# Zero/Six

BEYOND THE EXTERIOR

February 2017

## "THE WASHBOARD EFFECT" OF TORCHED APPLIED ROOFING MEMBRANES

(SEE PAGE 4)


ZERO/SIX CONSULTING, LLC
Z6
ENVELOPE ARCHITECTURE

# CONTENT




Figure 1: Washboarding observed on a Torch Applied Roof Membrane.

WORDS: MR. ZACHARY JOHNSON, ASSISTANT PROJECT MANAGER

# LESSONS LEARNED IN THE FIELD:
# "THE WASHBOARD EFFECT"
## OF TORCHED APPLIED ROOFING MEMBRANES

THE ORIGIN OF A ROOF'S FAILURE OFFERS VITAL INSIGHT INTO REFINING INSTALLATION PRACTICES THAT PROLONG THE LIFE AND PERFORMANCE OF ROOF SYSTEMS.

Throughout the career of an experienced roof observer, you will inevitably run across roof deficiencies and installation errors. These ultimately lead to premature aging or premature roof failure. The roof is a costly component of the building envelope with its integrity being a large factor in the efficiency of the facility. Unlike many other building envelope component, roofs are susceptible to severe weathering, expansion, contraction, and abuse, which can result in additional roof system degradation. The origin of a roof's failure offers vital insight into refining installation practices that can prolong the life and performance of roof systems. With the latest technological advances in the roofing industry, we have come a long way from the 90 pound granulated roll roofing system utilized in historic building construction. Today manufacturers offer warranties upwards of 30 years and with the correct installation and proper roof asset maintenance program, this can easily be achieved. The procedures implemented during the roof system installation such as manufacturer's training and published guidelines are imperative tools designed to aid installers. During install, companies should ensure specifications, building codes, regulations and ordinances are adhered to and followed by hiring a roof observer or third-party consultant.

Recently, consultants and roof observers alike have observed an anomaly with torch applied modified asphalt membranes and hot mop applications that is being termed "the washboard effect" **(Figure 1).** The term originated through observing ridge patterns seen at certain hours of the day. The ridge patterns are more visually prominent when the angle of the sun casts a shadow observable between each protrusion. The ridge patterns can be in localized areas, or in severe cases, throughout the entire torch-applied built-up membrane installation.

Built-up roof systems are composed of: layer(s) of insulation adhered with adhesive or mechanically fastened, a cover board adhered or mechanically fastened, and 2 to 3 layers of asphalt membrane bonded by utilizing a hot mop or propane torch. The washboard appearance is caused by two factors: an uneven distribution of heat at the torch applied membrane and inconsistent pulling or kicking of the membrane roll during installation.

The torch flame is directed to a localized area at the face of the membrane roll while stationary, the face of the roll begins to soften, and with excess heat will liquefy, creating a pool of modified asphalt in front of the roll **(Figure 2)**. The membrane roll is then pulled or rolled forward over the pool of modified asphalt that is cooling quickly upon contact with the roof substrate thus creating a small hump or ridge beneath the membrane. When this application method is repeated, you begin to observe a ridge pattern anomaly in the roof membrane.



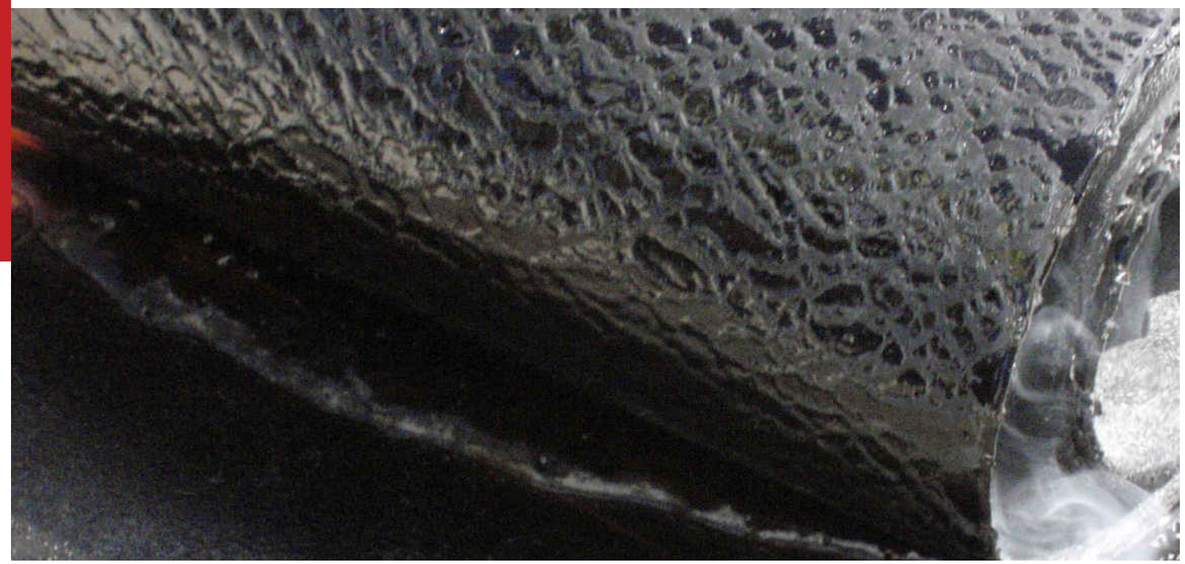


Figure 2: Modified Asphalt pool at Roll Base from Excess Heat during Application.


Figure 3: Uneven Distribution of Modified Asphalt beneath Membrane.

TODAY MANUFACTURERS OFFER WARRANTIES UPWARDS OF 30 YEARS AND WITH THE CORRECT INSTALLATION & PROPER ROOF ASSET MAINTENANCE PROGRAM, THIS CAN BE EASILY ACHIEVED.

Figure 4: Uneven Distribution of Heat Apparent during Forensic Analysis.

Examination of a roof sample containing the ridge pattern anomaly revealed small humps in the membrane which are apparent with a straight object positioned across the ridges. The modified asphalt bond is unevenly distributed beneath the membrane due to improper torch application and excess heat **(Figure 3)**. The point of application temperature the membrane is exposed to during installation is critical.

An experienced torch applicator applies a consistent "L" shaped distribution of heat to the face of the roll and partially up the seam. This is done in conjunction with smoothly pulling or pushing the roll as typically specified per the manufacturer's instruction. During a forensic evaluation of the anomaly, evidence of uneven distribution of heat at the point of application is apparent from the burn pattern on the gypsum cover board layer after membrane removal **(Figure 4)**.

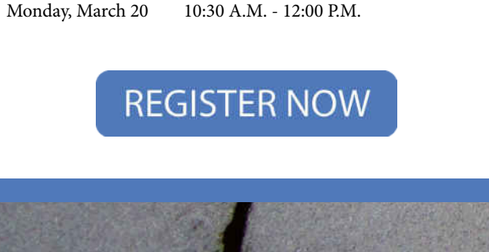
In addition to the aesthetics of the roof system, building owners should be concerned the effect it has on the longevity of the roof system. Overtime, the prominent humps of the washboarding generate an increase in granule loss at their ridges. These increase pattern ridges of the cap sheet layer will lead to a reduction in the roof membranes ultraviolet (UV) resistance. When the unprotected, modified asphalt is exposed to UV rays it will begin to rapidly degrade and alligator, ultimately leading to premature roof membrane failure.

The occurrence of the washboard effect or ridge pattern anomaly is dependent on the quality of the roof membrane installer. The roofing industry needs to recognize the damaging effects to the longevity of a roof system created by an inexperienced installer. Educating the torch applicators thoroughly and providing adequate hands-on training is needed to ensure installers are informed on the proper roof application techniques and procedures.

As the industry continues to evolve there will be ever-changing variables and challenges with roofing materials that the installer must adequately adjust to during the application process. We are a technology-driven society fueled by the latest products and trends. Installers must thoroughly understand the newest roofing products, materials and procedures implemented by the manufacturers to stay ahead in the industry. It is the responsibility of the employers and manufacturers alike to provide continuing education workshops to keep installers on the cutting-edge of the roofing industry and ensure the future success of their roof systems. Much like the roofing industry, the construction science field will need to continue to evolve, exploring new methods of proper building envelope system applications and techniques so the industry can optimize performance of the entire building envelope.

Figure 5: During proper heat application of torch applied membrane, the roll can be rolled back and "stringers" of modified asphalt can be observed. This is an indicator of adequate heat at the point of application.

## SPEAKING ENGAGEMENT




**OPTIMIZING THE BUILDING ENVELOPE WITH A BIM-BASED FRAMEWORK**

When it comes to optimizing the building envelope, Bill Coltzer Jr., AIA and Christian Ozbun, NCARB bring the know-how, the know-what, and the know-why!

Please join us at the **RCI 32nd International Convention and Trade Show** at the Anaheim Convention Center in Anaheim, CA from March 16-21 as we present how creating a BIM-based framework to coordinate drawings for a 432,671 square foot higher education facility helped identify issues that would have been costly to remedy once all of the pieces came together on-site.

We'll also be exhibiting at **Booth #339**, so stop by, say hello and learn a little more about Zero/Six from our building envelope experts!

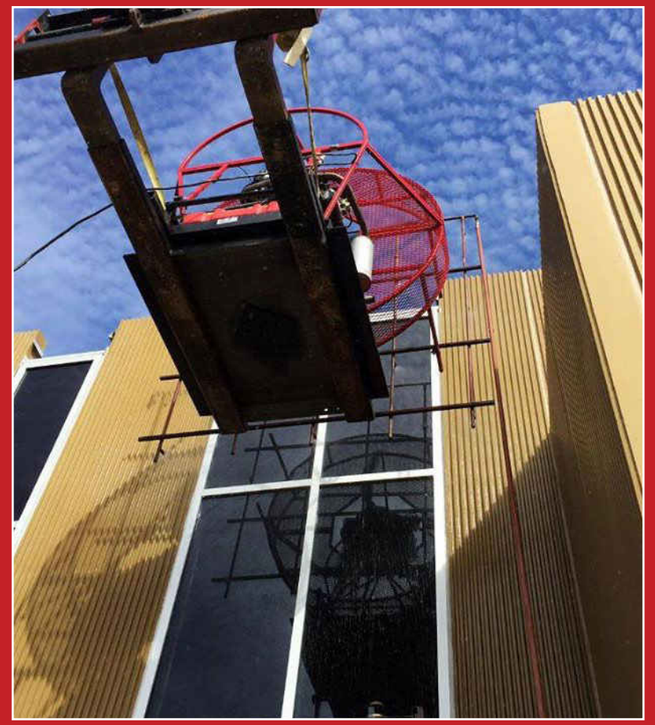
**SPEAKING SCHEDULE**

Monday, March 20 8:45 - 10:15 A.M.

Monday, March 20 10:30 A.M. - 12:00 P.M.

REGISTER NOW

# ZERO/SIX OUT&ABOUT



## ▲ Performance Testing with Z6 Commissioning

A little mobile, wind-driven rain performance testing in the sunshine from our dynamic fan "Alicia" for the City of Schertz Recreational Center! #blownaway

## ISO Accredited Testing ▲

The Z6 Commissioning team performing #ISOaccredited chamber testing for WHCI International in the Rio Grande Valley #ANAB

## ▲ SMPS San Antonio Event

We had a great time networking & learning about Texas A&M University-San Antonio's plans for the future! Thank you SMPS San Antonio Chapter for the warm welcome and opportunity to meet other #AEC professionals in San Antonio!

## ▲ South Main Baptist Church Below Grade Waterproofing

Personnel escavating along basement wall 11' deep for the installation of below grade waterproofing along the west elevation of South Main Baptist Church.

## ▲ Going New Heights

The Zero/Six team geared up to do a little steeple work on Moody Methodist Church in Galveston!

## ◀ Facility Asset Management

SBS modified bitumen base ply being torched to cover board at the City of Houston HFD Fire Station.

## ◀ Texas A&M University Quality Control

Kelly Mitchell performing on-site QA/QC at Texas A&M University's Corps Dorm Phase 2 renovation in College Station, TX. #QualityControl


Photo Info : The Z6 Commissioning (Z6) Stucco Mock-up at the Z6 Accredited Laboratory in Galveston, Texas.

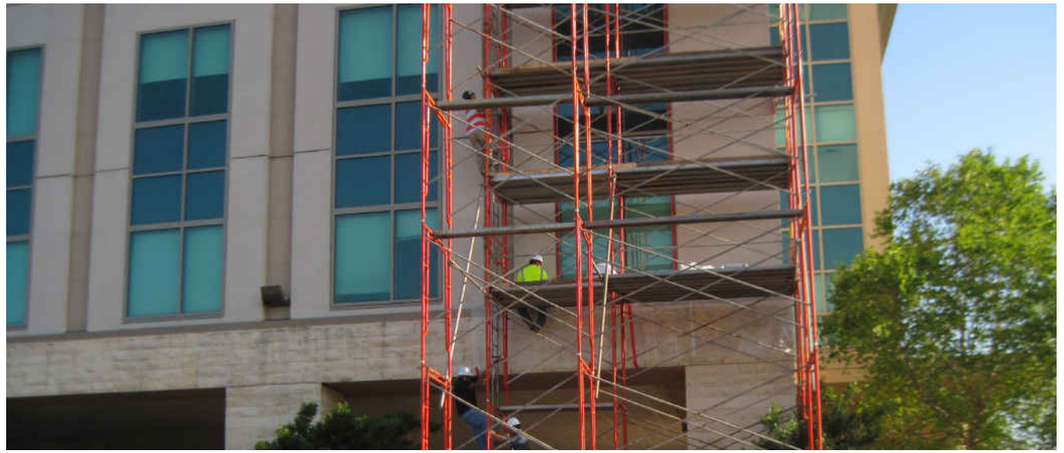
WORDS: MR. TIM ROGAN PHOTOS: MR. TIM ROGAN

# STRATEGIC PARTNER SPOTLIGHT: HOUSTON LATH & PLASTER

WE BOTH OFFER SERVICES TO HELP WITH CONSTRUCTION-RELATED PROBLEMS AND OFTEN TIMES, IT'S JUST LACK OF MAINTENANCE THAT DEGRADES A STRUCTURE.



Photo Info : Building Investigation.



Zero/Six is proud to work with some of the best companies in the AEC industry to ensure optimal building performance for our clients. This month, we're featuring long-time strategic partner Houston Lath and Plaster. Together with Z6 Commissioning, we're conducting testing on a 40' wide x 32' tall stucco mock-up that is garnering national attention and will likely impact future codes related to stucco installations.

**ABOUT HOUSTON LATH AND PLASTER**

Houston Lath and Plaster (HL&P) was formed in 1998 by Tim Rogan and his wife. Tim brings over 36 years experience in the industry, 20 of which he was a journeyman lather and foreman. HL&P participate in public offerings through the bid process, including both new & remodels of city projects, select school districts, medical facilities, and both state and federal projects. They also specialize in restoration and renovation projects of historic buildings and older structures that were assembled with interior plaster, including The Historic Strand District in Galveston, Rice University, Liberty County Court House, and many campuses in the Houston Independent School District.

In recent years, HL&P has downsized and evolved into a smaller, leaner company focusing on special projects such as remedial work and are moving toward forensics as they creep up on retirement. Today, they operate with a small core and increase manpower when the need arises.

"There is a void to fill in that area and the construction market is cost-driven to where the margin is getting slimmer," said Tim Rogan.

**HOW DOES HL&P SUPPORT ZERO/SIX AS A STRATEGIC PARTNER?**

I think we have a common belief - build better. Building codes and standards are minimum requirements and to build to those requirements one should expect minimum performance for the building. We both offer services to help with construction-related problems and often times, it's just lack of maintenance that degrades a structure.

**DESCRIBE THE PERFORMANCE TESTING YOU ARE CONDUCTING WITH ZERO/SIX.**

The stucco industry is torn between two lovers. Many stucco contractors love to run metal lath continuous behind control joints because it's the way we've always done it. On the other hand, many in the AEC industry love to have it separated to allow for movement of the joint during the initial stucco cure, with 60% of stucco movement occurring during the initial cure. So we, together with some sponsors who are committed to our industry, have assembled a 1500 square foot structural mock-up. We have identical panels, one has continuous lath and the opposite hand has cut lath.

Photo Info : Water Damaged Column.

All control joints are wired to the lath, as they should be. This allows them to flex with the lath and stucco during cure and thermal variation because they are not pinned to the structure.

**Bill Coltzer Jr., AIA:** While some observations are what was to be expected, others are pretty enlightening. The final report is some ways off, but we can share with you that, based on the results to date, the "to cut lath or not cut lath at joints" debate will have to be fueled by something other than cracking. Stay tuned...

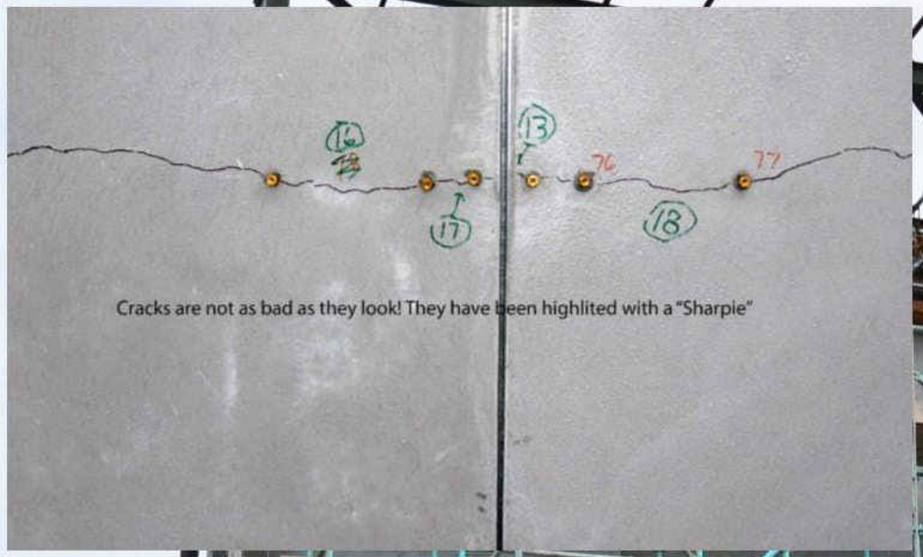
**FAVORITE PROJECT YOU HAVE WORKED ON?**

One project that stands out is the Mi Tienda (HEB store) on Little York @ 59. I was working for a rancher from South Texas that was also a contractor. It was a remodel of an old building and as it progressed some hidden conditions came to light. It was a big job on a fast track. He and I stood in front of the building and I told him how much more it would cost for the remedy - it was over 50K. I turned to him and said, "McCoy you know how long it will take to follow contract procedures and paperwork?" He took off his sunglasses and looked me in the eye and said "Rogan, we need to start right away and you'll get paid every dime. My handshake and my word are my contract and if I don't stand behind them I'm not worth dirt." He was an honorable man that paid his bills to all his subs, regardless if he had been funded by the owner.

**WHAT DO YOU ENVISION FOR THE FUTURE OF CONSTRUCTION IN HOUSTON?**

I envision an evolution of building materials and assemblies that are not sensitive to this climate. It's impossible to "keep the outside out" on all jobs because of details and craftsmanship. To some extent it's already happened. When I started, we didn't even use galvanized studs in an exterior wall assembly. I believe the city engineers will finally realize that building to the minimum standards is simply not good enough. There are plenty of structures standing today that won't be here in 50 years because water and humidity will take its toll on them.

Photo Info : Tommy Bahamas Exterior Insulation and Finish System (EIFS) Underway.




COMPROMISING QUALITY IS NOT AN OPTION AT HOUSTON LATH AND PLASTER, CLICK HERE TO LEARN MORE ABOUT THEIR SERVICES.

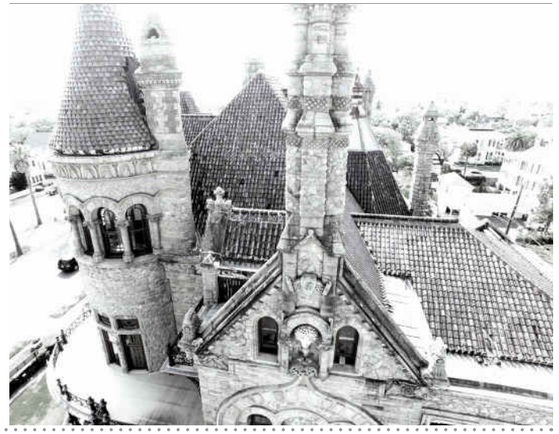
CONNECT WITH US & STAY UP-TO-DATE ON OUR LATEST STUCCO MOCK-UP FINDINGS!

# PROJECTPORTFOLIO

## COMMUNITY CHURCHES AND HISTORICAL PRESERVATION PROJECTS

### BISHOP'S PALACE

Construction of Bishop's Palace began in 1887 and completed in 1893. The ornate Victorian-style house, located in Galveston, is made all of stone and was sturdy enough to withstand the great hurricane of 1900. Zero/Six conducted an unmanned aircraft systems (UAS) survey to obtain aerial photography to facilitate planning for repairs and maintenance on the historical building.



**Owner:** Galveston Historical Foundation
**Client:** RB Hash
**Year Build:** 1887 - 1893
**Project Scale:** 19,082 SF
**Project Type:** Forensic
**Architect:** Nicholas J. Clayton
**Location:** Galveston, Texas
**Scope of Work:** Drone Survey

### JACK K. WILLIAMS ADMINISTRATION BUILDING

Built in 1932 to house the university's administrative offices, the Jack K. Williams Building continues to house many offices and agencies related to the Texas A&M University System. The design of the building is based on a classical revival style that includes fourteen ionic columns with images of cadets and a young woman cast into the capitols of the columns.

Zero/Six first visited the Jack K. Williams Building in April of 2014 while the building was in the midst of a major renovation that was predominately an effort focused on the interior spaces. At that time, water infiltration associated with rain events had been observed in several areas within the building. Since the 2014 site visit, there have been repairs to the exterior building envelope in an effort to eliminate water infiltration experienced within the building. Although these repairs seem to have improved the building's overall performance with regard to water resistance, water infiltration continues to be experienced in some areas.

Zero/Six determined that the exterior building envelope issues experienced at the Jack K. Williams Administration Building were the result of an aging, and as a result deteriorating, exterior building envelope that depends on masonry mass walls for protection from the elements.

**Owner:** Texas A&M University
**Client:** SSC Services
**Year Built:** 1932
**Project Scale:** 68,000 SF
**Project Type:** Renovation & Forensic
**Location:** College Station, Texas
**Scope of Work:** Building envelope analysis, infrared investigation, remediation, construction document review (100% SD and 50% CD), and investigative water testing.



### KEILLER BUILDING

Construction documents called for the application of a waterproofing system below grade, Zero/Six was commissioned to further comment on the viability of the proposed scope. The scope entailed excavations of the building perimeter, including demolition of adjacent sidewalks and stairways, and installation of a sheet applied waterproofing membrane.

Zero/Six performed a forensic investigation, including water testing with a horizontal spray rack meant to stimulate a heavy rain at grade and below. Data loggers were randomly placed within the building (Level 1) to monitor humidity levels. After review of testing and inspection data, Zero/Six assisted in preparation of a scope of work and provided on-site quality control inspections while the construction team implemented the below grade modifications.

**Owner/Client:** The University of Texas Medical Branch
**Year Built:** 1925
**Project Scale:** 48,000 SF
**Project Type:** Renovation & Forensic
**Architect:** Herbert Miller Greene
**Contractor:** Hammonds Construction
**Location:** Galveston, Texas
**Scope of Work:** Peer review of construction documents, on-site QA/QC and reporting, performance testing, and commissioning of the building envelope.

### ASHBEL SMITH "OLD RED"

Built on Galveston Island in 1891, the Ashbel Smith Building, also known as Old Red, is a Romanesque Revival building comprised of red brick and standstone. Old Red was the first University of Texas Medical Branch facility and was registered as a Texas Historical Landmark in 1969 and renovated in 1985. In 2008, Old Red was flooded with six feet of water by Hurricane Ike. Zero/Six conducted a forensic study and investigation to remediate issues experienced after the hurricane.



**Owner/Client:** The University of Texas Medical Branch
**Year Built:** 1891
**Project Type:** Renovation & Forensic
**Architect:** Nicholas J. Clayton
**Contractor:** Hammonds Construction
**Location:** Galveston, Texas
**Scope of Work:** Forensic study, peer review of construction documents, construction administration, on-site Q/QC and reporting, and inspection services for exterior envelope work, such as flood protection wall repairs, window repair/replacement and roof repair/replacement.

### MARY STAR OF THE SEA

In 2015, Zero/Six observed completion of structural renovation for Mary Star of the Sea in Jamaica Beach, Texas and provided full architectural services relating to the exterior envelope and structural repairs of the church.

**Owner/Client:** Holy Family Parish of Galveston and Bolivar
**Year Built:** 1980
**Project Type:** Renovation
**Location:** Galveston, Texas
**Scope of Work:** Design, forensic study, and on-site QA/QC and reporting.

**SACRED HEART**

Architecturally speaking, a building that is designed and constructed to be a "50-year building" is considered the gold standard in today's world. That is not to say that we only expect the building to perform for fifty years, but it would suggest that survival focused renovations and increased maintenance can be expected; especially in a harsh Gulf Coast environment.

The solid masonry mass walls of Sacred Heart Church place it in a category best described as a multi-hundred year building. Buildings constructed similarly can be expected to survive literally hundreds of years if they can be protected from outside influences (i.e. earthquake, hurricanes, tornadoes, etc.) and water infiltration. Zero/Six conducted a forensic study and evaluated the exterior envelope to address water infiltration issues within the building.

| | |
|---|---|
| **Owner/Client:** | Holy Family Parish of Galveston and Bolivar |
| **Year Built:** | 1904 |
| **Project Type:** | Renovation & Restoration |
| **Location:** | Galveston, Texas |
| **Scope of Work:** | Forensic study and exterior envelope evaluation. |

**MOODY MEMORIAL FIRST UNITED METHODIST CHURCH**

Moody Memorial First United Methodist Church, a 50-year-old church on Galveston Island required an exterior renovation to a ten-year-old addition. The original project was to include stained glass window protection, precast concrete panel repair, re-roofing and re-glazing of windows. The project was underway, but incomplete when hit by Hurricane Ike in 2008. The project then continued with both hurricane recovery efforts as well as the ongoing original renovation project. Among the storm related items added to the scope of work was the replacement of all copper standing seam roof panels and the related code upgrade to the wood deck. All work was completed without interrupting church function, which had increased due to programs required for storm recovery and/or relocated due to the storm. Zero/Six is currently providing facility asset management services and exterior renovations for Moody to optimize the building's roof and entire building envelope.

| | |
|---|---|
| **Owner/Client** | Moody Memorial First United Methodist Church |
| **Year Built:** | 1847 |
| **Project Scale:** | $4,200,00.00 |
| **Project Type:** | Renovation & Restoration |
| **Location:** | Galveston, Texas |
| **Scope of Work:** | Forensic study, construction administration, construction management (at risk), on-site QA/QC and reporting, facility asset management, and commissioning of the building envelope, including air/water infiltration testing per ASTM E1105 and E783 and roof uplift testing per ASTM E907. |




**SOUTH MAIN BAPTIST CHURCH**

What is currently known as South Main Baptist Church (SMBC) was founded as Tuam Baptist Church in 1903. The church moved to the Romanesque Sanctuary Building located at 4100 Main Street upon the building's completion in 1930 and was renamed at that time. From a period spanning from 1934 to 1939 the church also served as home to the University of Houston.

Since erection in 1930, the church has undergone a few addition projects, including a newer entry way on the Southeast corner of the building was installed sometime within the last decade.

Zero/Six Consulting was commissioned in August of 2015 to perform a forensic study of the Sanctuary's exterior building envelope (walls, windows, doors and roof) and provide an assessment report outlining the existing conditions, systems' remaining life expectancy, and recommendation and prioritization for required remedial work. The exterior building envelope of SMBC consists of masonry mass walls, wood casement windows, a large clay tile roof, and smaller sections of low sloped mod bit roofs; the report has been broken down accordingly. While there is evidence of maintenance, water infiltration is still occurring in the Sanctuary on a regular basis. Zero/Six conducted a forensic assessment and site survey of the building envelope, providing recommendations to remediate all issues occurring on the SMBC campus.

| | |
|---|---|
| **Owner/Client:** | South Main Baptist Church |
| **Year Built:** | 1930 |
| **Project Type:** | Renovation & Forensic |
| **Architect:** | Hedrick and Gottlieb |
| **Location:** | Houston, Texas |
| **Scope of Work:** | Forensic study, construction administration, site survey investigation, on-site QA/QC and reporting, roofing, waterproofing and wall restoration monitoring. |

# Insane in the Membrane:

WORDS: MR. AARON SHAFFNER, RRO, ENVELOPE SPECIALIST

## How altering the way we specify reinforcements can yield insanely better results.

THE ADDITION OF A FEW KEY WORDS TO THE SPECIFICATION, LIKE "COMPOSITE," "WOVEN MAT," OR "SCRIM REINFORCEMENT," CAN IMPROVE THE LONGEVITY AND PERFORMANCE LEVEL OF THE ROOF SYSTEM BY 20-40% BEYOND THE ASTM STANDARDS.

Specifying types of polymer modified bitumen (MB) membrane reinforcement can play a large role in the performance and life of a roof system. There are multiple factors to consider before specifying a type of roof membrane, such as geographical location. In Texas, we have extreme heat and hurricane force winds which can shorten the lifespan of the roof. The addition of a few key words to the specification, like "composite," "woven mat," or "scrim reinforcement," can improve the longevity and performance level of the roof system by 20-40% beyond the ASTM standards.

The American Society for Testing and Materials (ASTM) is the organization that sets the standards to define the specific types of reinforcement materials. ASTM's standards should be viewed as having the minimal code requirements for construction. These standards create a foundation for the roof system, but don't provide the upgrades that can provide enhanced durability and or extended life cycle expectancy. ASTM relies on qualified members from around the world to develop the standards, but the organization does not have an in-house testing facility or technical research center for material testing, so it uses accredited facilities like the Z6 Commissioning laboratory to help develop them. These standards provide dimensional tolerances, physical properties, performance requirements and material appearance requirements. The MB roof system standards are drafted and reviewed by industry professionals and manufacturer's representatives for approval, then published if a two-thirds consensus is achieved. There are five typical ASTM standards used to define the structural performance characteristics of a styrene butadiene styrene (SBS) or atactic polypropylene (APP) MB membrane. There are three commonly used polymer modified roofing material standards for SBS by ASTM. These standards define reinforcement types using glass fiber (ASTM 6163), polyester (ASTM 6164), or combination (ASTM 6162). There are two standards which define reinforcements for APP polyester (ASTM 6222) or combination of polyester and glass fiber (ASTM 6223). These standards are further defined with type classifications I, II, and III, differentiated by increasing weights and area of sheet per unit. The grade of the unit is distinguished with a granule-surface (G) or smooth surfaced (S) materials. An example of ASTM D6162, Type



| Reinforcement Types | Elongation (Load/Strain) | Tensile Strength | Tear Strength | Heat Resistance | Abuse Resistance | Memory | Weathering Properties |
|---|---|---|---|---|---|---|---|
| Non-Woven Glass Fiber | Poor | Good | Poor | Good | Fair | Strong | Good |
| Woven Glass fiber | Poor | Good/Excellent | Good | Good | Good | Moderate | Good |
| Glass Fiber Scrim | Poor | Excellent | Excellent | Good | Good/Excellent | Moderate | Good |
| Woven Polyester | Poor | Good | Good | Poor | Good | Moderate | Poor |
| Non-Woven Polyester | Excellent | Poor | Poor | Poor | Fair | Weak | Poor |
| Combination/Laminated Mats | Good | Excellent | Excellent | Good | Good/Excellent | Strong | Good |

Figure 1: Assessment of Performance Criteria for Polymer Modified Bitumen Membranes

I or II, Grade S in the specification reads, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements." There are no additional distinctions defined in these standards to specify a type of fabric used for reinforcements. The words scrim or non-woven (i.e. mat) are left out of the standards. SBS is a plastomer with elasticity characteristics that have consistent properties throughout a wide temperature range. The SBS will stay flexible even in cold temperatures below 32° F. SBS has a melting point of 210° F which allows a variety of application methods. SBS membranes can be cold applied, hot mopped, or propane torch applied. APP MBs tend to be stronger and stiffer and will provide greater resistance to high temperatures. APP MBs are typically only applied via propane torching with a melting point of 300°F or through cold applied polymer modified adhesives. Specifying a scrim or composite in either APP or SBS will lead to a superior product line for just about any manufacturer.

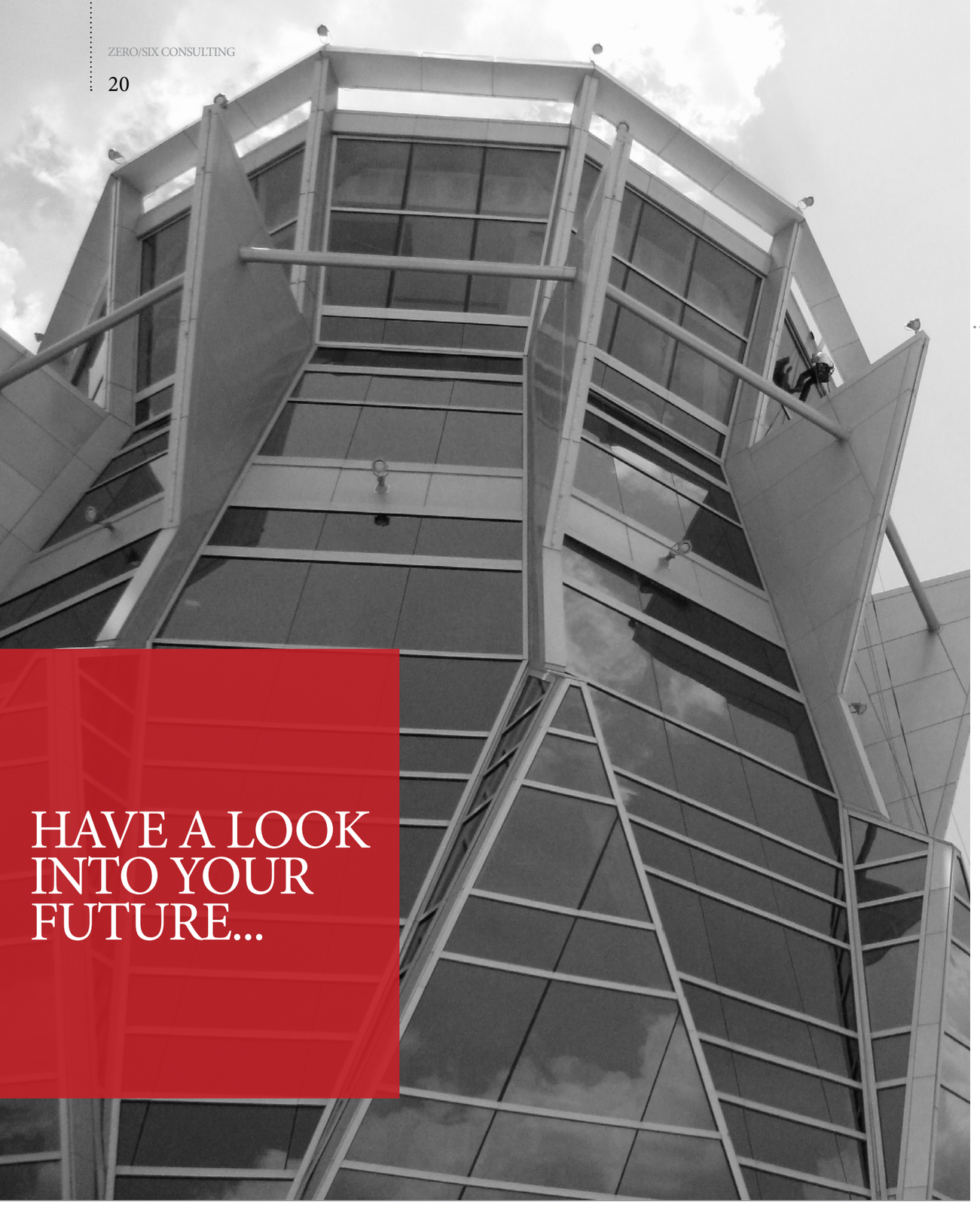
The performance criteria to consider when choosing a membrane combination are watertight laps, blister resistance, resistance to splitting, delamination resistance, shrinkage resistance and durability. Reinforcing materials of the MBs will serve as carrier for the polymers and will work as a structural element to bridge substrate joints. The combinations of materials will then increase tensile strength, puncture resistance, and provide increased fire protection. There are two main types of reinforcement fabrics – scrims and fabric mats. Scrims are fabrics woven together in both machine and cross machine directions and are used in high-performance membranes, providing a greater tensile and tear strength than minimum ASTM standards. Fabric mats are non-woven (unless specified as "woven mat") comprised of randomly distributed fibers which are dependent on binders achieved through chemical adhesives, thermally, or mechanically. They typically have an overlapping arrangement and have less resistance to tensile and tear strength. Composites or laminates include both scrim and mats which are chemically or mechanically bonded. Composites will typically combine characteristics for superior tensile strength and puncture resistance. Glass fibers are more dimensionally stable and more heat resistant than polyester fibers. Glass fibers will not breakdown with ultraviolet (UV) exposure but polyester will. Polyester, however, has greater resistance to puncture, strain energy, and flexibility. Since polyester and fiber glass are complementary, the best approach is a two ply membrane minimum incorporating both materials (**Figure 1**).

The placement and type of reinforcements can have a significant effect on weathering characteristics of the finished roof membranes. Studies* have shown that the use of polyester mats, due to their dimensional instability, in cap membrane of both APP and SBS can accelerate the natural weathering causing cracking and crazing, which is a network of fine cracks on the surface of the material. The best performing systems have an inner ply and cap membranes to incorporate both a scrim and a mat. Failures can occur with systems using only scrims due to excessive dimensional instability which can lead to failures with the membrane splitting. The use of only non-woven mats can cause a less dimensionally stable reinforcement that can eventually result in stress to the seams due to shrinkage.

In the harsh environment of the Texas coastal region, there is little room to accept only the minimum criteria where every manufacturer meets the benchmark. Relying only on the standards can be short-sighted which tends to damage the health of the modified bitumen industry. This is evident due to the fact that so many roof systems are compromised by water infiltration, cutting their lifespans short before the warranty is over. Referencing reinforcement fabric type combinations in the specifications can provide a healthy boost in performance and durability for the roof system.

**LEARN MORE ABOUT ZERO/SIX'S FACILITY ASSET MANAGEMENT PROGRAM HERE.**

**Source: Baxter, Richard and Tim Keamney, "Weathering Characteristics of Polymer Modified Asphalt Roofing Membrane," Third International Symposium on Roofing Technology (NRCA, 1991), pp 453-458.*



HAVE A LOOK INTO YOUR FUTURE...

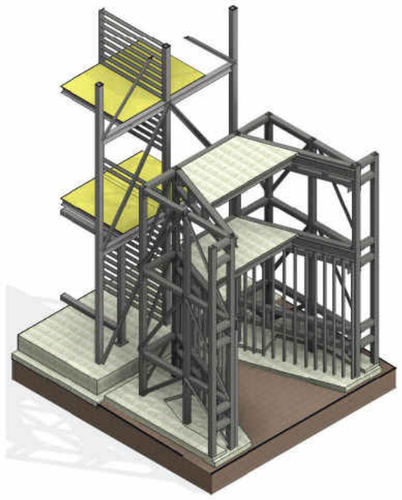


# JOIN OUR ZERO/SIX TEAM

Zero/Six is on the cutting edge of building envelope science - we do this by hiring and fostering the leading talent in our field. As a designer you'll be responsible for helping ensure the production of the highest performing building envelope designs the construction industry has to offer. At ZSC, you will grow technically and professionally in a specialized field of Architecture. The primary responsibility of a Senior Designer/3D Specialist is to collaborate daily with Senior Architects and Project Managers.

## CURRENT OPPORTUNITIES

**SENIOR DESIGNER / 3D SPECIALIST– GALVESTON, TX**



**PRIMARY RESPONSIBILITIES**

- Produce design and construction documents, as directed.
- CAD, BIM and Revit as assigned.
- Work to achieve Client's goals.
- Communicate an understanding of task assignments and expectations.
- Explore alternate design approaches as directed by Project Architect/Design Architect.
- Undertake job related research assignments, as directed.
- Gain an understanding of building systems, codes, and construction methods.
- Attend meetings as required.
- Promote a collaborative team atmosphere.
- Other duties as assigned.

**ADDITIONAL RESPONSIBILITIES**

- Participate in business development efforts.
- Duties as assigned.
- Meet task and project deadlines.

**MINIMUM REQUIREMENTS AND KEY COMPETENCIES**

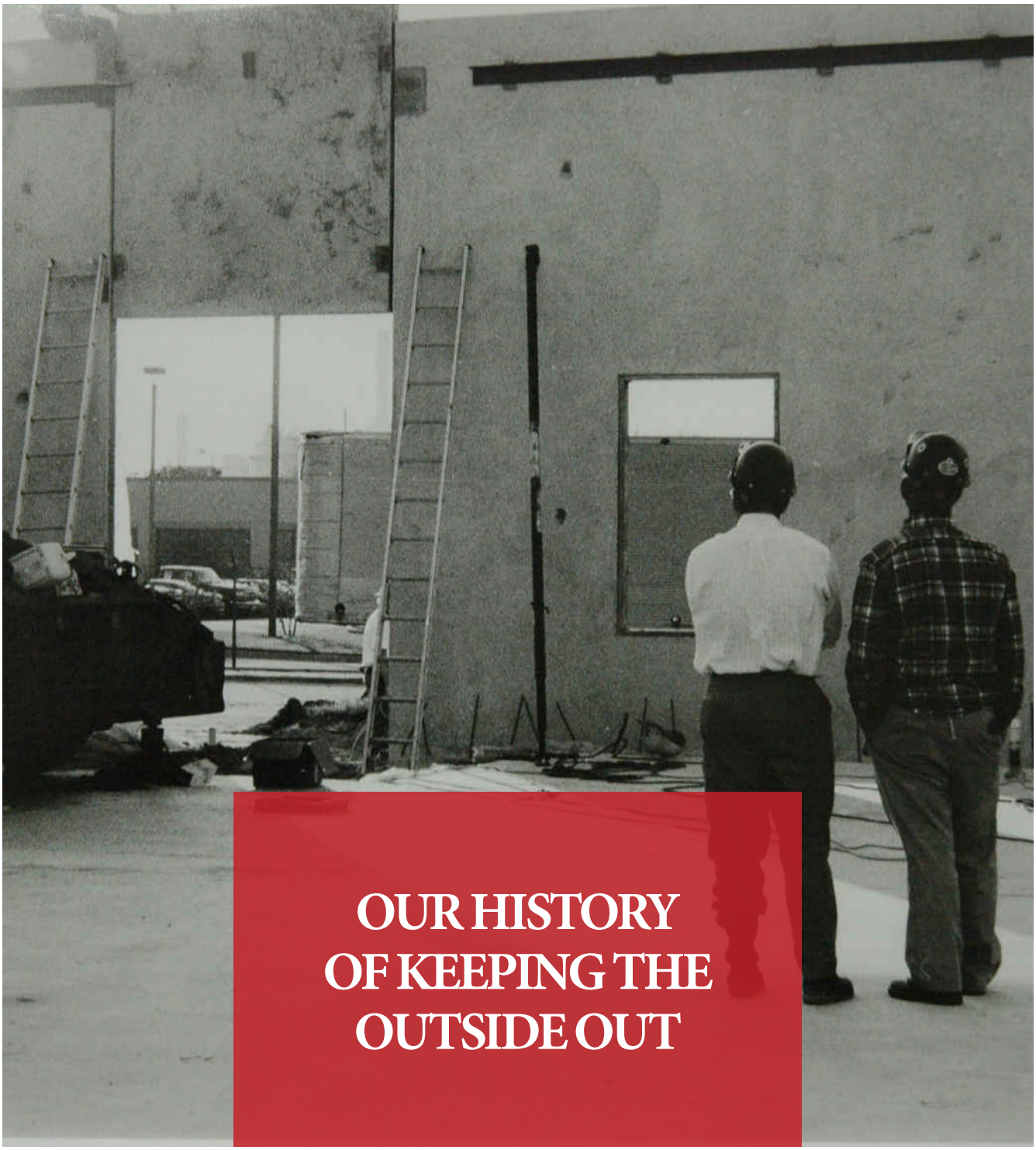
- Bachelor's Degree in Architecture, Civil Engineering, Architectural Engineering or Construction Sci-ence preferred.
- An Associate Degree in Construction Technology, Drafting Technology or Computer-Aided Design and Drafting with experience will be considered.
- Meticulous attention to detail.
- Excellent problem solving skills.
- Current knowledge of drafting standards.
- Proficiency in drafting software (Revit and BIM).
- Work requires professional written and verbal communication and interpersonal skills.
- Ability to travel on occasion to project work sites to provide CAD support in the field, or for data retrieval and verification.
- Team player with professional appearance and behavior.

**WORKING CONDITIONS**

Work will be performed at 1027 Tremont Street, Galveston, Texas.

**Zero/Six Consulting, LLC. is an Equal Opportunity Employer**

**APPLY NOW**



# OUR HISTORY OF KEEPING THE OUTSIDE OUT

## Thank you for reading our newsletter!

For more information, visit www.z6consulting.com!