FALL 2016

CHAMBERLIN
Roofing & Waterproofing

NEWSLETTER

Decision Time: Re-Roof or Re-Cover?

The completed torch-applied roofing system for a leading environmental agency's headquarters in Austin, TX.

A lead environmental agency for the state of Texas recently faced roofing issues at their headquarters in Austin, TX. The facility was built in 1992 and is comprised of seven buildings. The existing standing seam roof on one of the buildings was starting to fail. The metal panels were coming apart, rust spots were emerging and the HVAC units needed to be upgraded. With a long history of remedial roofing projects, as well as substantial metal roofing experience, Chamberlin Roofing & Waterproofing was selected by General Contractor Kiewit Building Group to complete the roofing scope for this project.

Weighing The Pros and Cons

Deciding between a new roof or to re-cover the existing roof is the first decision a building owner must consider. A re-cover is the installation of a new roofing system over an existing roof. It is the quickest and least expensive option. There is a reduction in debris to manage, minimal noise and less of a risk for the owner because the roof is not being torn off the building and exposing it to potential water damage. When a roof is removed, there are safety and health factors to consider - will the debris become a safety nuisance? Will there be asbestos in the roof? However, working on an existing roof comes with its own challenges. As with most roofs, a variety of roof equipment is already installed, creating obstacles to be worked around.

A re-roof is the complete removal and replacement of an existing roofing system. With a re-roof, the roof

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GUEST COLUMN:

By Diego Romero and Al Bustamante, Walker Restoration Consultants

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Facade Restoration Using Photogrammetry

INTRODUCTION

The historic Lancaster Houston Hotel, located in Houston, TX, is a twelve-story structure built in 1926 (Fig.1). Originally known as "The Auditorium Hotel," the Lancaster was designated a Recorded Texas Historic Landmark by the Texas Historical Commission (THC) in 1984.

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deck can be thoroughly inspected for any underlying issues and corrected prior to new roof installation. However, it is more expensive because more labor is involved with tearing off the existing roof. The construction can also potentially disrupt day-to-day business due to the demo process.

Wiss, Janey, Elstner Associates, Inc. (WJE) was hired to conduct a roof survey to weigh the options and determine if the structure would also be able to support the extra weight of another roof. With confirmation that it would, a re-cover was decided on, as it was the most cost-effective choice and woud also mitigate business disruption.

The design for the roof re-cover was not your ordinary design. Because of the existing roof equipment – 52 HVAC units, four satellite dishes and 15 plume exhaust fans – the roofing crew needed to work meticulously to detail in the curbs. The roof insulation also had to be chamfered to fit inside the existing metal panel profile.

The Scope

Chamberlin installed 25,000 square feet of torch-applied modified roofing system and flashed the new HVAC rooftop units. To ensure the HVAC curb units were watertight, Chamberlin installed a self-adhered vapor barrier flashing to the existing standing seam roof.

First, chamfered insulation was mechanically attached through a metal panel to steel purlins. Once attached, another layer of ISO was installed with a urethane adhesive. Then, a gypsum-fiber roof board was installed with a urethane adhesive to act as a cover board and thermal barrier. The SBS base sheet was applied directly to the cover board, then the cap sheet was torched to the base sheet. On the vertical walls, Chamberlin torched the base and cap flashing to the plywood and installed a termination bar at the top of flashing. The cap sheet was embedded with ceramic granules to give the roof the required Solar Reflectance Index (SRI) value. The crew then fabricated and installed stainless steel sheet metal counter-flashings and copings. Stainless steel was the best choice for this project because it is very durable and holds up well against weather.

Safety is #1

The importance of safety is critical for each project Chamberlin undertakes. To begin, parapet clamps were installed on the low parapet walls on

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Chamberlin had to work around the extensive existing rooftop equipment.

Parapet clamps were used as one fall protection method while the base sheet and cap sheet were being installed.

(PHOTOGRAMMETRY Continued from pg. 1)

Figure 1: *Overall view of the Lancaster Hotel in foreground.*

CONDITION ASSESSMENT

Exterior wall evaluations were performed in phases for several years and different types of distress conditions were identified. The most significant deterioration occurred on the top level of the structure on the south and west elevations. Typical observations included cracks at the spiral columns and mortar joints, localized surface spalling of cast stone trim and spandrel panels (Fig. 2) and missing ornamental cast stone spiral columns and brackets.

Based on our conclusions, we recommended sealing facade cracks greater than 0.012 inches (0.3 mm) in width, repairing localized cast stone and masonry spalls in the facade and removing deteriorated cast stone units to replace them in kind. The cast stone replacement encompassed a total of 28 column and bracket units and 14 spandrel panels. The focus of this article is on the spandrel panel cast stone replacement.

RESTORATION PLAN

Original construction documents were not available for this building, which made the cast stone replacement even more difficult. Without any details, our only option was to make a mold out of the physical cast stone ornaments. We proposed two methods to the contractor to create the molds. First, the conventional approach which required vertical access to the facade, removal of a spandrel panel, column and bracket in good condition and, finally, manufacturing the molds. This method, although tried and true, is costly and comes with the inherent risk of damaging the delicate cast stone features. The second method proposed was to use 3D scanning and modeling technology to create a three-dimensional model of the architectural features and use the model to create a negative mold or a master copy. This method removes the risk of damaging a cast stone piece in good condition.

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the east, west and south sides of the roof to extend the height above 39 inches for fall protection on those elevations. The north wall on the gutter side had no parapet wall. In lieu of a warning flag line, which is comprised of a rope and flags hanging 34" tall, Chamberlin went a step further and created a safety guardrail system built of 2X4s standing over 39" tall and installed it 10 feet from the leading edge. This acted as a safe guard for not only Chamberlin employees, but also other trades and authorized individuals accessing the area.

Since the roof did not have existing tiebacks, butterfly anchorage points were installed on the north side for the crewmembers to tie off to while working outside the guardrail. These are hinged, temporary anchor points that are mechanically fastened to the roof and are capable of withstanding 5,000 pounds.

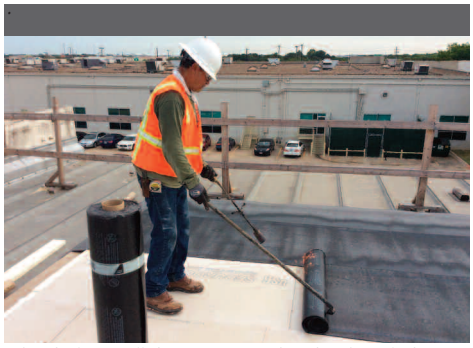
The roofing crew utilized Personal Fall Arrest Systems (PFAS) with yo-yos. The yo-yo is a self-retracting lifeline that allows for increased mobility and less restricted movement compared to a traditional lanyard. These allowed the crewmembers to install along the entire north side of the roof without having to move their butterfly anchors along with them. Doing so would have been labor intensive since each anchor is bolted to the roof with 16 screws. Also, another method of fall protection would have had to been employed while the butterfly anchor was unhooked from the roof. Additionally, if a fall were to occur, a yo-yo limits the free fall distance, catching almost immediately with its quick-activating brake system.

Once the gutter and edge of roof work was finished, the guardrail was removed in order to complete the installation of the roofing system and replaced with safety flagging installed six feet from the leading edge. The project was completed safely and efficiently with no incidents.

Rain, Rain Go Away

With record breaking rainfall in May and the wettest August since 2001, construction was periodically on hold. There was an aggressive schedule from the beginning, by the owner's request, so working overtime and on Saturdays became the routine to stay on schedule because of the rain days. Keeping the lines of communication open and coordinating with the owner, consultant, manufacturer and general contractor were crucial to staying on schedule. Chamberlin finished their scope of work on time, remedying the roof issues and leaving the building watertight. ■

A guardrail system was built on the north side of the roof where there was no parapet wall.



Chamberlin installed 25,000 square feet of torch-applied roofing system.

The HVAC units were flashed to keep the building watertight.

(PHOTOGRAMMETRY Continued from pg. 2)

Given that the contractor had already mobilized on site, a combination of both methods was selected to manage risk and costs. This involved manufacturing traditional molds out of physical spiral column and bracket samples (due to their small size) and creating non-traditional molds from 3D models for the delicate 60 x 22 inch (1524 x 559 mm) spandrel panels. We evaluated different methods to create the 3D model and determined that photogrammetry was the most cost-effective and practical method.

Photogrammetry is the science of making measurements from photographs. In short, computer algorithms attempt to identify points in common between a set of photographs and plot them in a three-dimensional space (i.e. a point cloud). Once the point cloud is created, a mesh which connects all the individual points with flat planes can be generated using traditional modeling software. A 3D mesh allows an engineer to manipulate its dimensions and shapes, analyze the object for stresses and strains, 3D print the model or use a computer numerically controlled

Figure 2: *Cracked and spalled cast stone at facade spandrel panels.*

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(PHOTOGRAMMETRY Continued from pg. 3)

(CNC) mill to create our shape. The main advantages of photogrammetry include this method being extremely portable and only requiring a camera, a trained photographer and a computer modeler.

DEVELOPING THE 3D MODELS

The general procedure was as follows: While on the suspended scaffold, hundreds of photographs were taken of the spandrel panels, columns and brackets using indicator targets in the objects so the photogrammetry software is able to recognize similarities between photographs. The photographs were then manually sorted to delete photographs that were either blurry or not part of the data set needed. Once sorted, the photographs were uploaded to a commercially available photogrammetry software package to process the point cloud. Once processed, the point cloud was imported to a free and open-source 3D modeling software in order to create a solid surface mesh that connects all of the points in the point cloud (Fig. 3). The time it takes to process a mesh is highly dependent on the complexity of the geometry and the density of the point cloud. For reference, the decorative spandrel took approximately three hours to generate the point cloud, one hour to mesh and three hours to edit the model and complete the final touches.

As a trial, we used 3D printing to determine if the models were detailed enough for full scale production. A partial model of the spiral column and capital was generated, edited and printed using a MakerBot 3D printer and biodegradable thermoplastic aliphatic polyester filament, commonly known as PLA. The result was a miniature version of the column with all its surface defects and details (Fig. 4). Pleased with the results, it was time to move forward with the full scale replica of the spandrel panel.

DESIGN OF CAST STONE SPANDREL PANELS

Matching the existing features of the existing spandrel panels required using cast stone as our final product. Cast stone, as defined by the Cast Stone Institute, is a refined architectural concrete building unit manufactured to simulate natural cut stone. The materials and processes used in the manufacturing of the stone depend on the required appearance and physical properties. Our specifications required producing cast stone with a minimum 28-day compressive strength of 6,500 psi (44.8 MPa), a 28-day absorption rate

Figure 3: 3D model of spandrel panel developed with photogrammetry.

Figure 4: Left - Existing decorative column, Middle - 3D model of column, Right - 3D print of model.

ranging between 6% to 8% and shrinkage not to exceed 0.065%. Additionally, the cast stone was to be reinforced using either non-corrosive reinforcement or welded wire fabric with a minimum reinforcement of 0.25% of cross sectional area.

Figure 5: New cast stone spandrel panel installed.

The existing cast stone spandrel panels are supported by a steel shelf angle connected to the building frame with post-installed anchors and are laterally supported by corrugated metal ties. For the replacement panels, we utilized the same steel shelf angle to support the gravity loads and secured each panel with four new stainless steel post-installed chemical anchors to resist lateral wind loads. The chemical anchors were detailed to be installed at an angle of 15 degrees from the horizontal plane to provide a mechanical interlock between the anchor and the cast stone spandrel.

FABRICATING THE SPANDREL PANELS

The method used to create the molds was CNC low-density foam to form the shape, create a rubber mold and then use cast stone to create the spandrel. This method offers relatively low costs, ability for the contractor to cast their own units and the improved durability provided by cast stone over polyurethane-coated high density foam.

A StereoLithography (STL) file was exported and sent to the manufacturer. This file format is widely used for rapid prototyping, 3D printing and computer-aided manufacturing. Using a three axis CNC machine, a foam master copy of the spandrel panel was milled and sanded. The final master copy coated with polyurethane was delivered to the project site ready for the mold-making process.

Molds made of liquid urethane were fabricated from the master copy. The cast stone panels were fabricated at a plant using the master copy, delivered to the site and installed (Fig.5).

CONCLUSION

The distressed spandrel panels were successfully replaced with new cast stone panels that closely match the shape, size, texture and color of the original cast stone panels maintaining the historic significance of the building. Based on this project experience, we are confident that photogrammetry can be implemented in any project requiring replacement of ornate or historical building features without the risk of damaging the existing conditions of the facade and at the same time reducing design and construction costs. ■

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Al Bustamante is the Director of Restoration for Walker Restoration Consultants in Houston, TX, and a licensed Professional Engineer. He earned his master's degree in civil engineering from the University of Illinois. He has over 15 years of experience as a restoration consultant in a variety of structural, architectural and material distress related projects. He is a past president of the Houston chapter of the Structural Engineers Association of Texas (SEAoT), American Concrete Institute (ACI) and the American Institute of Steel Construction (AISC). 281.280.0068 Al.Bustamante@walkerrestoration.com

Walking the Walk: Chamberlin Awarded for Excellence & Safety

Chamberlin achieved Associated Builders and Contractors (ABC) STEP Diamond status for the second consecutive year.

Chamberlin has recently been honored with several awards for outstanding workmanship and safety on the job. We are proud of our team and recognize that training, hard work and a dedication to delivering more to our clients makes for successful projects.

Chamberlin received an Associated General Contractors (AGC) Texas Building Branch Outstanding Construction Award for four different projects:

- **Parkland Hospital Skybridge – Dallas, TX**
- **Austin Bergstrom International Airport Consolidated Rental Car Facility – Austin, TX**
- **Clinical Services Wing – Galveston, TX**
- **Love Field Modernization Program – Dallas, TX**

This awards program recognizes outstanding construction projects built by AGC members. Projects are evaluated on difficulty in construction, unusual construction techniques, final appearance and quality of the finished product, timeliness of completion and safety.

Associated Builders and Contractors, Inc. (ABC) believes world-class safety programs have three main components: a commitment from company leadership to embrace safety as the core value upon which decisions are made, a top-to-bottom safety culture that empowers all employees to create the safest work environment possible and systems and processes that focus on how to prevent a hazard or incident from occurring.

Their Safety Training Evaluation Process (STEP) helps companies assess and improve their safety programs. Chamberlin Roofing & Waterproofing achieved STEP Diamond status, the highest STEP level, in 2016 for the second consecutive year. Chamberlin will continue to keep safety as a top priority on every job they undertake to get their workforce home safely each night. ■

TEXO The Construction Association hosts the Distinguished Building Awards which embody the skill, commitment and passion that TEXO members have for construction.

This year Chamberlin Roofing & Waterproofing won first place in the Other Specialty Contractor category for their roofing installation on the Love Field Modernization Program in Dallas, TX. Chamberlin installed 450,000 square feet of torch-applied, two-ply modified bitumen roofing for the airport's renovation and expansion. The projects are judged based on difficulty in construction, innovative construction techniques, final appearance and timeliness of completion. ■

Dallas Love Field Airport

Kirby Towers in Houston, TX

The Associated General Contractors of America (AGC) Houston Chapter's Awards for Project Excellence (APEX) program honors firms for their excellence in construction, their valuable contributions to the community and their demonstrated commitment to skill, integrity and responsibility. Chamberlin is the proud recipient of an APEX award for their roofing and waterproofing work on the Kirby Towers Renovation in Houston's Greenway Plaza district. Their scope included restoring the concrete eyebrows that extend from both buildings on each elevation. ■

PROJECTS IN PROGRESS

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One Dallas - Dallas, TX
New Construction Waterproofing
Contract Amount: $625,000 (approx.)
Owner: One Uptown
Architect: Humphreys and Partners Architects, LP
General Contractor: Hunt Construction Group, Inc.
Scope of Work: Concrete curing, temporary waterproofing, hot-fluid applied waterproofing, sheet waterproofing, cementitious and reactive waterproofing, traffic coating, spray-applied air barrier, firestopping, joint sealants, site and paving sealants
Project Description: Luxury apartment homes

Shops at Clear Fork – Fort Worth, TX
New Construction Waterproofing
Contract Amount: $1,100,000 (approx.)
Owner: Simon Property Group
Architect: Nelson Partners
General Contractor: The Beck Group
Scope of Work: Hot fluid rubberized asphalt waterproofing, sheet waterproofing, traffic coating, thermal insulation, spray-applied air barrier, sheet metal flashing and trim, flexible flashing, firestopping, joint sealants, site and paving sealants
Project Description: Upscale mixed-use development

SAIA CONRAC – San Antonio, TX
New Construction Roofing & Waterproofing
Contract Amount: $2,600,000 (approx.)
Owner: San Antonio International Airport
Architect: TranSystems Corporation, Inc.
General Contractor: Turner Construction Company
Scope of Work: Exterior metal soffit panels and escalator soffit panels, insulation, cold fluid-applied waterproofing, water repellent, traffic coating, expansion joints, joint sealants and air barrier
Project Description: Rental car and public parking facility

Rice Office Building – Houston, TX
New Construction Waterproofing
Contract Amount: $550,000 (approx.)
Owner: The City of Houston
Architect: Kieran Timberlake
General Contractor: JE Dunn Construction
Scope of Work: Elevator pit waterproofing, sheet metal flashing, water repellent, site sealants, air barrier, traffic coating, fire sealants and expansion joints
Project Description: Office building with attached seven-level parking garage on Rice University campus

3M Innovative Center – Austin, TX
Remedial Waterproofing
Contract Amount: $200,000 (approx.)
Owner: 3M
General Contractor: Craftcorps, Inc.
Scope of Work: Window washing, water repellent and joint sealants
Project Description: Waterproofing repair on visitor building

St. Martha Catholic Church – Houston, TX
Remedial Waterproofing
Contract Amount: $150,000 (approx.)
Owner: Archdiocese of Galveston-Houston
Consultant: French Engineering
General Contractor: Chamberlin Roofing & Waterproofing
Scope of Work: Cleaning and power washing limestone, brick and precast surfaces
Project Description: Church campus exterior cleaning

Carrollton Police Headquarters – Carrollton, TX
New Construction Waterproofing
Contract Amount: $600,000 (approx.)
Owner: City of Carrollton
Architect: Perkins+Will
General Contractor: Turner Construction Company
Scope of Work: Formed metal fabrications, wood blocking, cap wall and curb flashing, thermoplastic membrane roofing, sheet metal coping, gravel guard, counter flashing, sheet waterproofing, air barrier, cavity insulation, joint sealants, flashing and site sealants
Project Description: New addition to Carrollton Police Headquarters

1600 West Loop South – Houston, TX
New Construction Waterproofing
Contract Amount: $3,000,000 (approx.)
Owner: Landry's Corporation
Architect: Gensler
General Contractor: Tellespen
Scope of Work: Below-grade waterproofing, traffic coating, weather barrier, joint sealants, site sealants, water repellents, fluid-applied waterproofing and expansion joints
Project Description: A 10-acre site with a 240-room luxury hotel, boutique office space, parking garage and convention center

The Driskill – Austin, TX
Remedial Waterproofing
Contract Amount: $900,000 (approx.)
Owner: Hyatt Hotels Corporation
Consultant: Building Consultants, Ltd.
General Contractor: Chamberlin Roofing & Waterproofing
Scope of Work: Concrete demolition, concrete installation, framing, sheet metal flashing and trim, balcony waterproofing and plastering
Project Description: Balcony repairs on historic hotel

SPEC's Wine, Spirits & Finer Foods – Dallas, TX
Remedial Roofing
Contract Amount: $200,000 (approx.)
Owner: Spec's Liquor
General Contractor: Embarcadero Advisors
Scope of Work: Removal of existing roof system and installation of TPO single-ply roofing system and sheet metal
Project Description: Retail store and deli

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