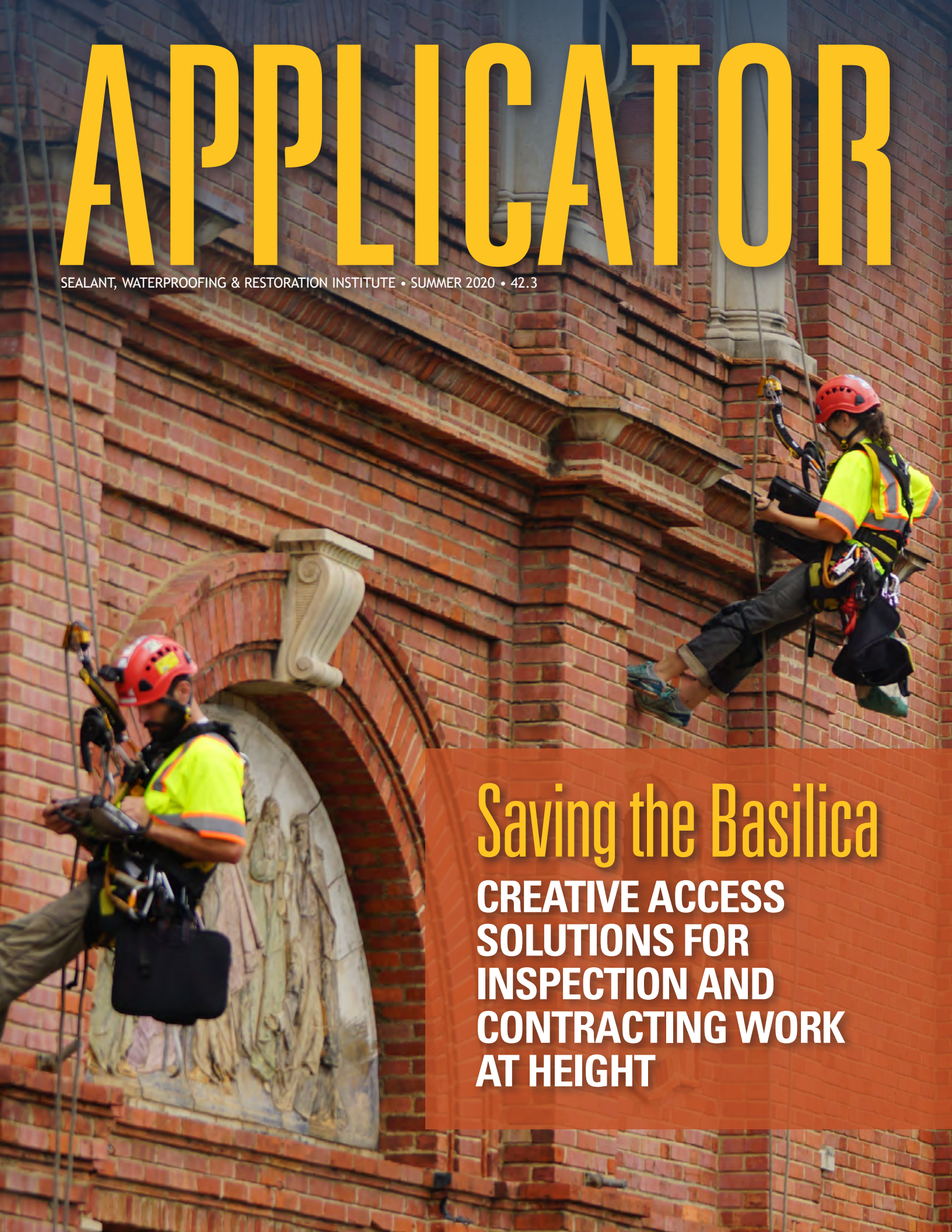


# APPLICATOR

SEALANT, WATERPROOFING & RESTORATION INSTITUTE • SUMMER 2020 • 42.3



## Saving the Basilica

**CREATIVE ACCESS  
SOLUTIONS FOR  
INSPECTION AND  
CONTRACTING WORK  
AT HEIGHT**



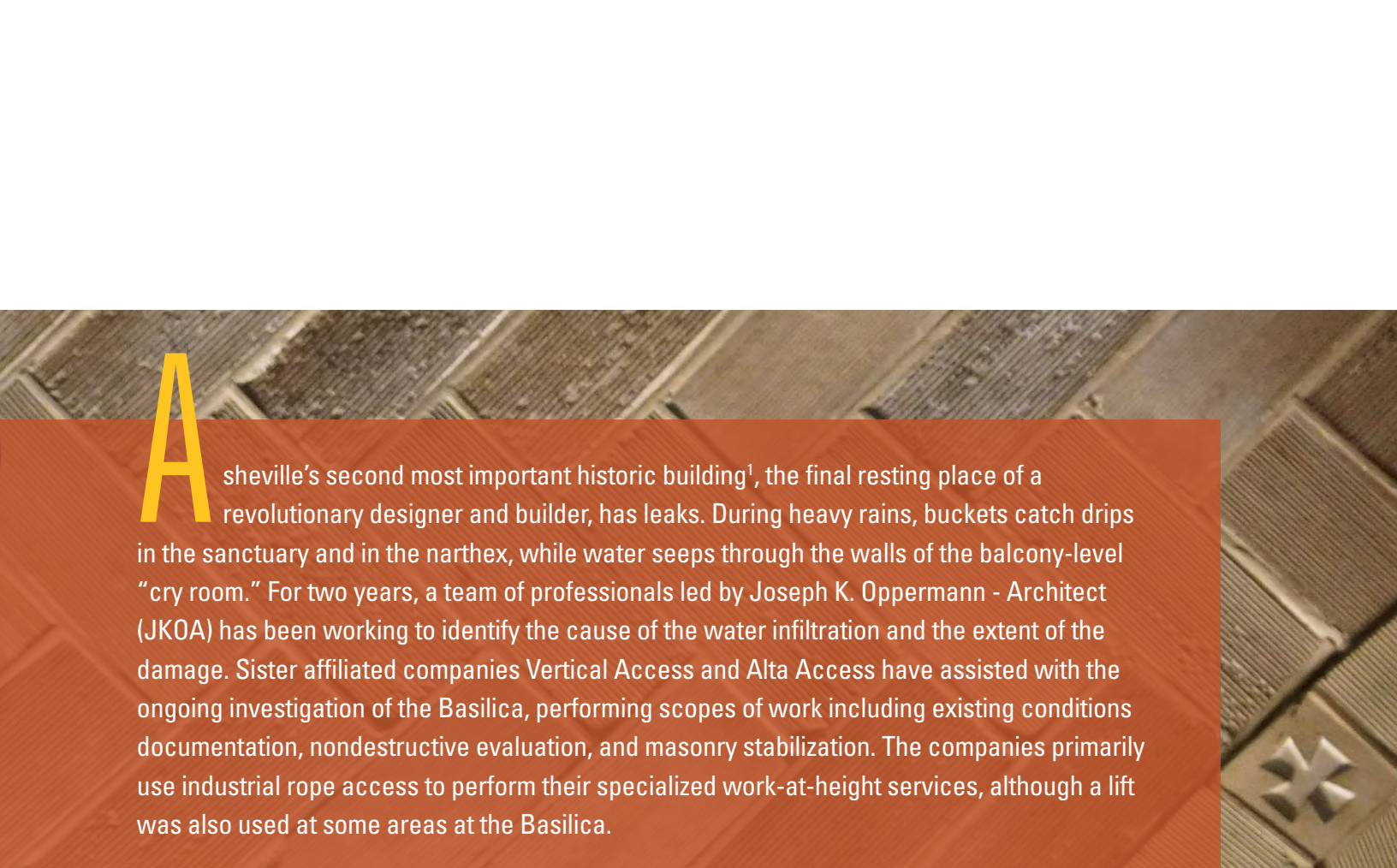
# Saving the Basilica

CREATIVE ACCESS SOLUTIONS FOR  
INSPECTION AND CONTRACTING  
WORK AT HEIGHT

BY KRISTEN OLSON AND  
KELLY STREETER, PE

The Basilica of St. Lawrence in Asheville, NC.  
(Photo by Vertical Access and Alta Access)





**A**sheville's second most important historic building<sup>1</sup>, the final resting place of a revolutionary designer and builder, has leaks. During heavy rains, buckets catch drips in the sanctuary and in the narthex, while water seeps through the walls of the balcony-level "cry room." For two years, a team of professionals led by Joseph K. Oppermann - Architect (JKOA) has been working to identify the cause of the water infiltration and the extent of the damage. Sister affiliated companies Vertical Access and Alta Access have assisted with the ongoing investigation of the Basilica, performing scopes of work including existing conditions documentation, nondestructive evaluation, and masonry stabilization. The companies primarily use industrial rope access to perform their specialized work-at-height services, although a lift was also used at some areas at the Basilica.

The National Register-listed Basilica of St. Lawrence<sup>2</sup> is a source of pride for its congregation and for the larger Asheville community. It is significant both for its importance to Asheville's Catholic community, and as the work and final resting place of Rafael Guastavino Moreno (1842-1908), a Spanish immigrant and innovator who transformed traditional Catalan tile building techniques in designing some of the most well-loved public spaces of the late 19th and early 20th centuries.

JKOA is preparing a Historic Structure Report, or HSR, for the building. Generally, an HSR is a detailed report combining in-depth archival research, documentation of existing conditions, schematic recommendations for repairs or treatments, maintenance plans, and draft cost estimates. As part of this process, JKOA retained Vertical Access (VA) in 2018 to assist with an interior and exterior condition survey. VA's inspection identified several potentially hazardous conditions at the exterior masonry, so in 2019 Alta Access was asked to help mitigate those conditions. VA has worked on dozens of Guastavino structures, and the team was excited to work on a building that is so significant to Guastavino's story.

#### **Affiliated companies specializing in work at height**

Vertical Access conducts interior and exterior inspections, nondestructive evaluation, and other services on buildings, monuments, bridges, and dams. Alta Access

is a specialty contractor working with clients to design, fabricate, and install access and fall protection solutions, install debris containment netting, make light masonry and sealant repairs, mitigate hazardous conditions, and perform other specialty construction in difficult-to-reach locations. Both companies use industrial rope access (IRA), a lightweight, fully redundant, two-rope rigging system that allows certified technicians to access difficult-to-reach areas of buildings and structures. The flexibility and adaptability of IRA makes it a quick-to-deploy, building- and landscaping-friendly, cost-effective alternative to personnel lifts, suspended scaffolds, and supported scaffolds. VA and Alta rope access technicians are third-party certified by the Society of Professional Rope Access Technicians (SPRAT).

#### **A Spanish Renaissance church in North Carolina**

The Basilica of St. Lawrence was designed in 1903 by Spanish architect Rafael Guastavino (1842-1908), who had immigrated to the United States in 1881, bringing along his young son, Rafael Guastavino Esposito (1872-1950), and the Catalan building tradition of thin tile domes and vaults. Guastavino Sr. established the Guastavino Fireproof Construction Company, providing designs and, eventually, materials to construct incredibly strong, lightweight domes and vaults built of layers of thin clay tile. His namesake tile arch system was patented in 1892. Guastavino domes and vaulted

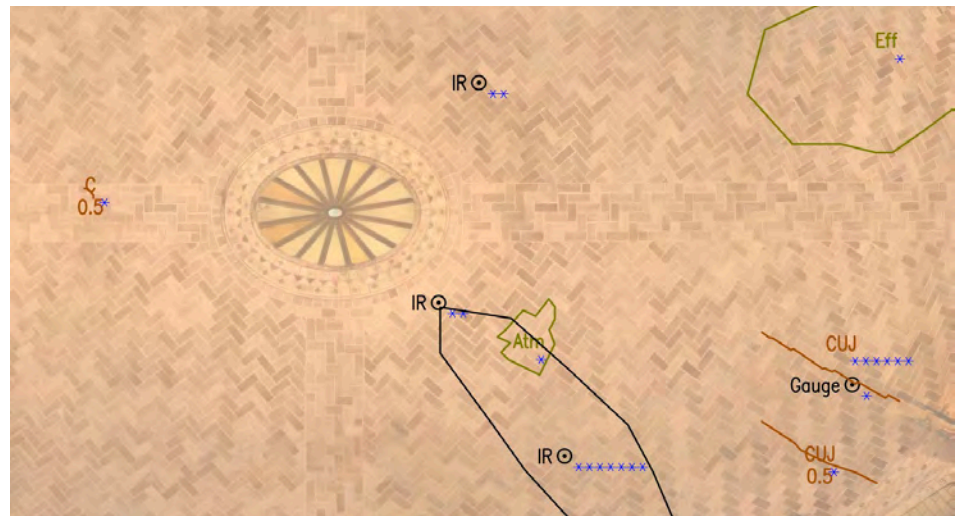


ceilings are found in hundreds of historically- and architecturally-significant buildings from around the turn of the 20th century, including Grand Central Terminal, the Boston Public Library, and the Cathedral Church of St. John the Divine.

The elder Guastavino first visited Asheville in 1894 to work on the Biltmore estate. Liking the area, he bought land and built his summer home Rhododendron in nearby Black Mountain. Guastavino became involved with Asheville's Catholic community and donated his design services to the parish when it outgrew an earlier wood church on the same property as the current structure. Construction began on the new St. Lawrence Church in 1905; Guastavino Sr. died in 1908 and his son took over management of the project until its completion in 1909. Guastavino Jr. designed the tile-covered door enclosing his father's tomb within one of the church's side chapels.

The Basilica is constructed of load-bearing masonry with minimal structural steel elements, instead relying on the strength and geometry of Guastavino's patented

method. The building is rectangular in plan, capped by an elliptical dome roof. Exterior walls are of brick with limestone trim and terra cotta copings and finials. At the south façade the pedimented entrance to the narthex is flanked by a pair of square-plan towers, each capped with a copper-clad dome and cross. The main dome roof is also clad in sheet copper. Interior walls are of brick or ceramic tile, with polychrome glazed tile and mosaics in the side chapels.



**Reflected ceiling plan showing conditions documented using TPAS. Annotations indicate the locations of cracked tile units ("C"), crack systems through units and joints ("CUJ"), efflorescence ("Eff"), atmospheric soiling ("Atm"), infrared imagery ("IR"), and a crack gauge. The blue asterisks are hyperlinks to photographs associated with each annotation.**



**Technicians Mike Russell and Kristen Olson inspect and document the main façade using rope access. (Photo by John Cosmas)**

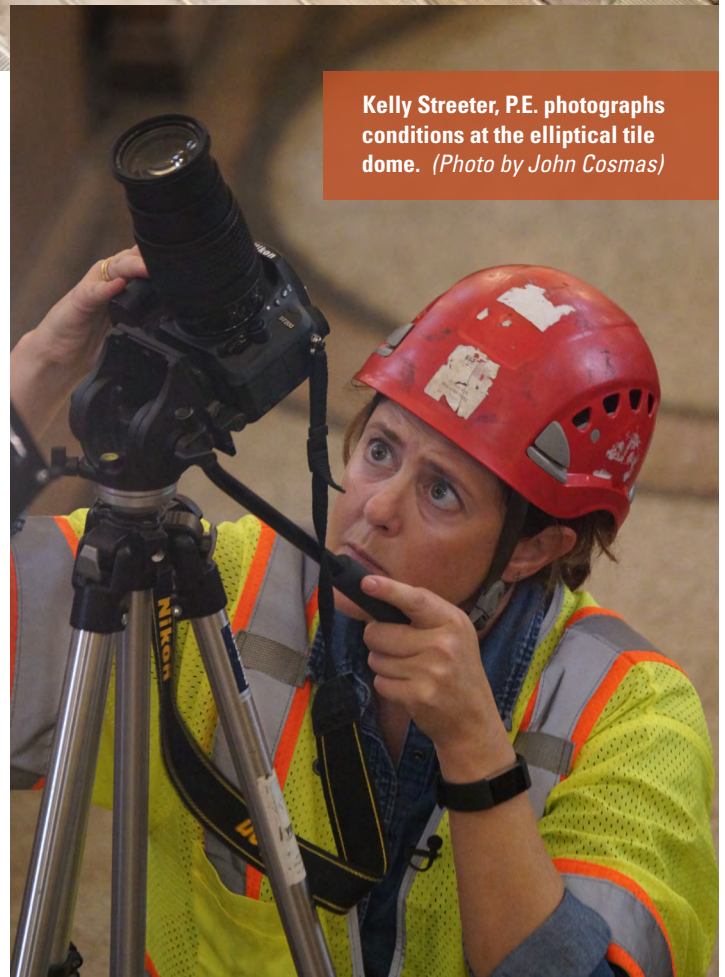




### Investigation and documentation

Vertical Access was retained by Joseph K. Oppermann – Architect (JKOA) to perform an interior and exterior condition survey of the Basilica in 2018. JKOA has been working with the Basilica Preservation Fund and the Roman Catholic Diocese of Charlotte on a Historic Structure Report and restoration plan for the building. Of particular concern were localized areas of water infiltration and damage to the masonry materials.

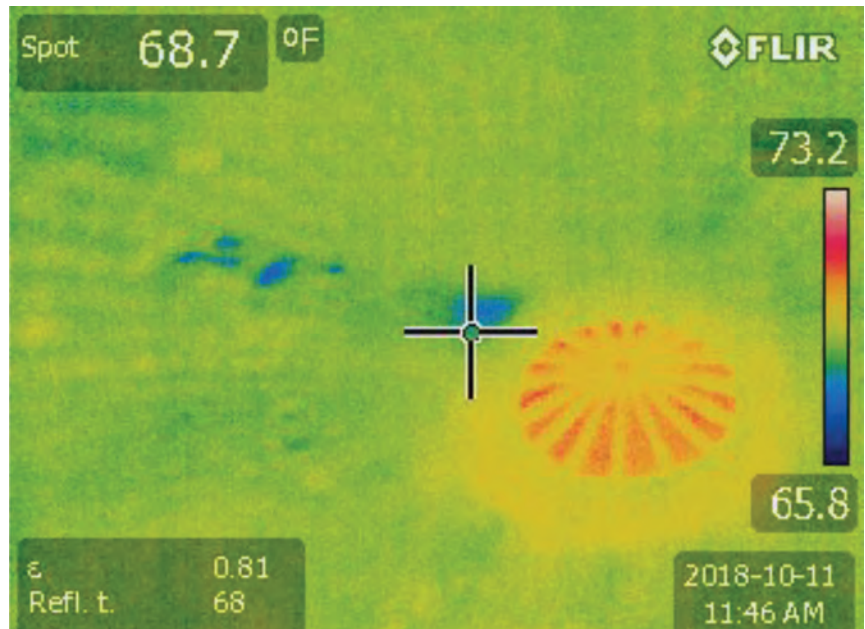
Prior to VA's field work, interior and exterior CAD (computer aided design) drawings were prepared based on a 3D model built from laser scan and photogrammetry data by Aaslestad Preservation Consulting. VA used the CAD drawings as backgrounds for their survey using TPAS®, the Tablet PC Annotation System. TPAS® was developed by Vertical Access as a direct-to-digital documentation platform integrating graphic and numerical data along with photo naming and photo linking capabilities, within AutoCAD. For the Basilica investigation, VA technicians documented conditions such as cracks and spalls in the exterior masonry and water infiltration and damage to the interior materials. While on site, VA created a photogrammetric orthomosaic of the elliptical dome ceiling and added it as an overlay to the existing AutoCAD drawing, allowing highly accurate placement of annotations in TPAS®.



Kelly Streeter, P.E. photographs conditions at the elliptical tile dome. (Photo by John Cosmas)



**“Although the elliptical main dome appears to be in overall good condition, VA identified moisture within the tile masonry based on the infrared imagery.”**



**Infrared image of the dome interior. Areas of likely water infiltration appear as a cooler area in blue; the skylight appears in orange.**

VA utilized a variety of access methods and investigative techniques to document both interior and exterior conditions. St. Lawrence is of a smaller scale than many parish churches, allowing most of the exterior to be observed with the aid of binoculars. Conditions at the towers, upper areas of the sanctuary walls, and at the dome copper cladding and skylight were documented in high-resolution video recorded by VA's unmanned aerial vehicle (UAV, or drone). Conditions observed in the UAV video were annotated on the digital drawings using TPAS®, with notes linked to still images taken from the video. Finally, the pedimented main façade was documented by VA technicians using TPAS® “on rope.” The 2018 survey did not include hands-on access to the exterior of the towers, due to the impracticality of accessing them from the interior.

At the interior, VA used binoculars and zoom cameras to observe and document the condition of the walls, elliptical tile dome, and other vaulted Guastavino ceilings. Upper areas of the sanctuary walls, including the stained-glass windows, were inspected by UAV. Supplemental 1000-watt theatrical lighting was used to illuminate ceilings and the upper portions of walls.

VA's site work coincided with several days of wet weather, allowing direct observation of water infiltration at the interior where wet areas of masonry are plainly visible. VA also used a FLIR E60 infrared camera to obtain images of the interior walls and ceilings showing thermal patterns due to moisture. Although the elliptical main dome appears to be in overall good condition, VA identified moisture within the tile masonry based on the infrared imagery. The initial survey findings suggest that undersized roof drains are the main cause of localized deterioration, and that the brick and tile masonry systems are otherwise in serviceable condition.

### **Repairs and temporary mitigation**

After reviewing VA's survey findings, JKOA asked Alta Access to help mitigate potentially unsafe exterior conditions by removing loose masonry and installing netting, as an alternative to prolonged closure of the building's main entrance and the erection of costly overhead protection at walkways. Based on the findings of the 2018 survey and working closely with the architect, Alta designed debris containment netting for six areas of masonry. As part of the same mobilization, Vertical Access returned to update the survey condition report to reflect the stabilization measures and to include any new information discovered during a hands-on inspection of the towers.

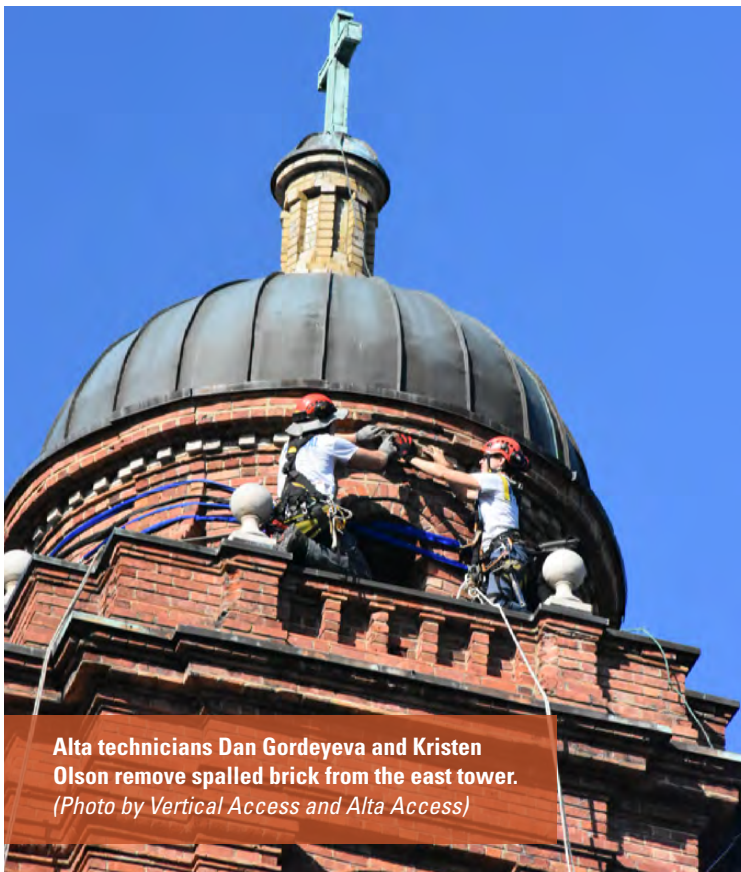
VA and Alta used a 120-foot articulating boom lift to establish encirclement anchors at the tower cupolas for industrial rope access, allowing technicians to ascend ropes and move around all four faces of each tower. Rope access was also used to achieve work positioning and fall protection for stabilization work at the northwest corner and along the west parapet. Additional stabilization work was performed from the lift basket on the south and east façades.

Alta technicians removed damaged portions of three terra cotta finials. Discrete areas of loose brick masonry were removed by hand at the towers and east façade, while larger areas of deteriorating and unstable masonry were mitigated by the installation of debris containment netting. Three netting samples were installed in easy-to-access locations representing a variety of exposures, while a fourth control sample was left with the building manager for future evaluation of the netting performance in different weathering conditions.





**A damaged terra cotta finial is rigged to prepare it for removal by Alta Access.**  
(Photo by Vertical Access and Alta Access)



**Alta technicians Dan Gordeyeva and Kristen Olson remove spalled brick from the east tower.**  
(Photo by Vertical Access and Alta Access)

One of the most critical areas was the pediment over the main entrance to the church, which required field cutting the net to fit over the statue of St. Lawrence. Cracks at the skyward-facing surfaces of the pediment were repaired with mortar prior to the netting installation.

Although his designs are based on traditional, unreinforced masonry construction, Guastavino Sr. often included steel tension rings in his larger domes, and they are shown on the original design drawings for large domes including those at the Cathedral Church of St. John the Divine (New York City) and St. Francis de Sales Church (Philadelphia). Likewise, Guastavino's design drawings for St. Lawrence called for a "7-inch plate" around the lower perimeter of the elliptical dome. Alta was asked to open probes in the exterior brick masonry at two locations so that John Matteo of 1200 AE and Tom Whitmore of Christman could observe the condition of the steel. Specialized access wasn't necessary for the probe openings, since portions of the outer elliptical wall can be comfortably reached from lower roofs.

#### **What's next for the Basilica of St. Lawrence**

With netting in place, parishioners and tourists alike can continue to use and enjoy the historic Basilica of St. Lawrence while the Basilica Preservation Fund





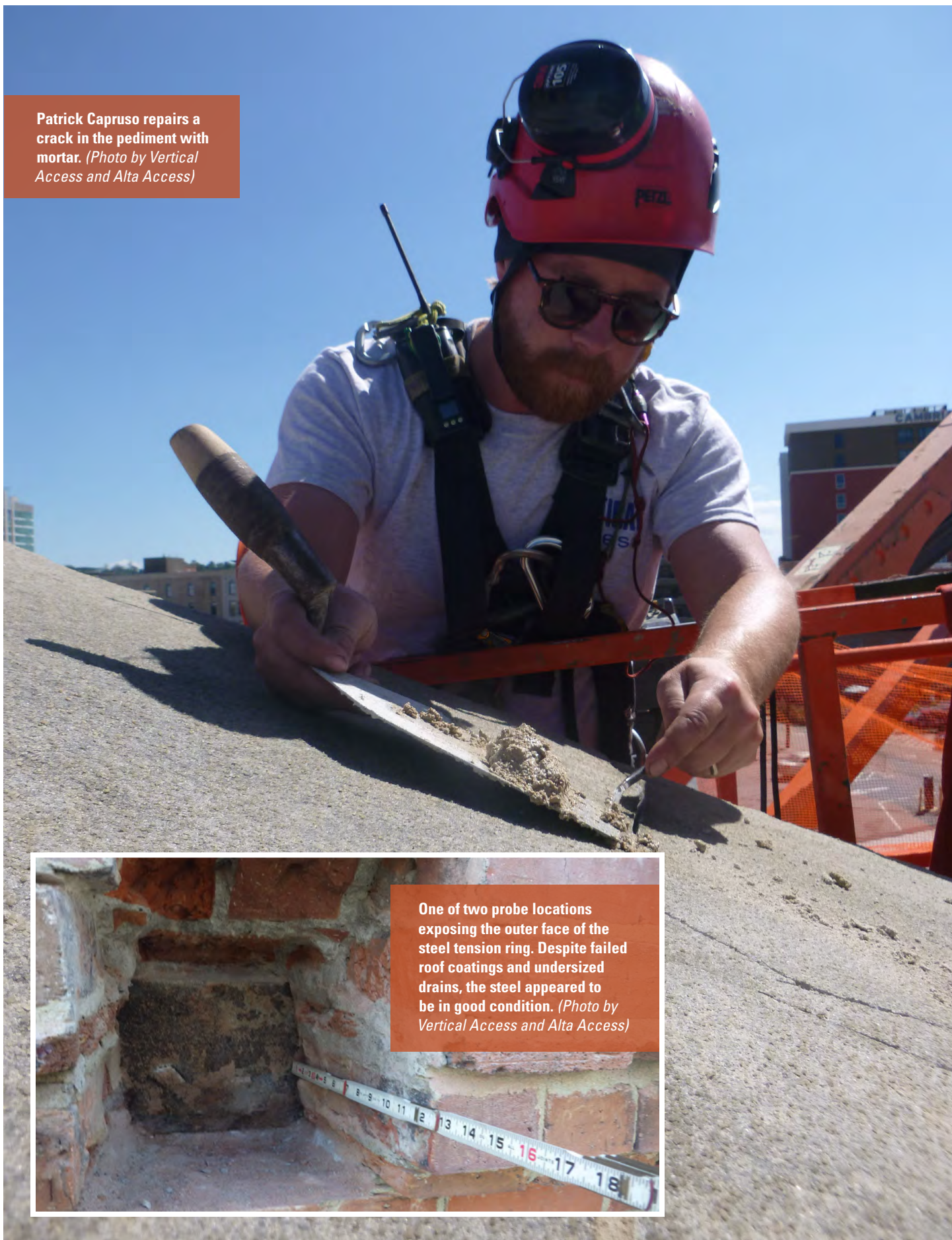
**Alta Access technician Dan Gordeyeva** installs debris containment netting around a damaged cornice on the east tower.  
*(Photo by Vertical Access and Alta Access)*



**Alta Access technicians Patrick Capruso** and **Mike Russell** lower a panel of netting over the statue of Saint Lawrence.  
*(Photo by Vertical Access and Alta Access)*



**Patrick Capruso repairs a crack in the pediment with mortar. (Photo by Vertical Access and Alta Access)**



**One of two probe locations exposing the outer face of the steel tension ring. Despite failed roof coatings and undersized drains, the steel appeared to be in good condition. (Photo by Vertical Access and Alta Access)**







Netting and removal of loose masonry will allow the Basilica to keep the main entrance open to building visitors while raising funds for necessary repairs.

(Photo by Vertical Access and Alta Access)

and the Roman Catholic Diocese of Charlotte work with JKOA on a restoration plan and identify funding sources. Meanwhile, Guastavino fans both young and old will enjoy the newly-published children's book *Immigrant Architect: Rafael Guastavino and the American Dream*, written by Vertical Access' Kent Diebolt and Berta de Miguel Alcalá with illustrations by Virginia Lorente.

#### About the Authors

**Kristen Olson** is a former Architectural Historian and Field Technician at Vertical Access, LLC, and is currently a Project Architectural Historian with Environmental Design & Research, Landscape Architecture, Engineering, & Environmental Services, D.P.C., in Syracuse, NY. Kristen has over 10 years' experience investigating and evaluating historic structures. She has written and presented about industrial rope access and unmanned aerial vehicles for a variety of audiences including SWR Institute and the Association for Preservation Technology. Kristen can be reached at [kolson@edrdpc.com](mailto:kolson@edrdpc.com).

**Kelly Streeter, PE**, is a partner of Vertical Access, LLC (VA), which provides specialized building inspections and condition reports for architects, engineers, and conservators utilizing efficient, lightweight rigging systems. Kelly holds a BS in Structural Engineering from Cornell University and a MS in Structural Engineering with a concentration on nondestructive evaluation from the University of Colorado. She has practiced as a structural engineer prior to joining VA, and has a specialty in historic building materials and nondestructive evaluation. Kelly is a registered PE in several states and a certified SPRAT (Society of Rope Access Technicians) Level III Supervisor. Kelly is based in Guilford, CT, but can be found on-rope at height anywhere in the country. You can reach her at [kelly@vertical-access.com](mailto:kelly@vertical-access.com).

- <sup>1</sup> *The Basilica of St. Lawrence is considered to be second only to the Biltmore for its architectural and historical significance.*
- <sup>2</sup> *In 1993, Pope John Paul II designated the former St. Lawrence Church as a minor basilica, and it is now officially named the Minor Basilica of Saint Lawrence the Deacon & Martyr.*