LAKE WALES, FLORIDA, USA

BOK TOWER RESTORATION

Two Decades of Durability Through ICCP

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PROJECT

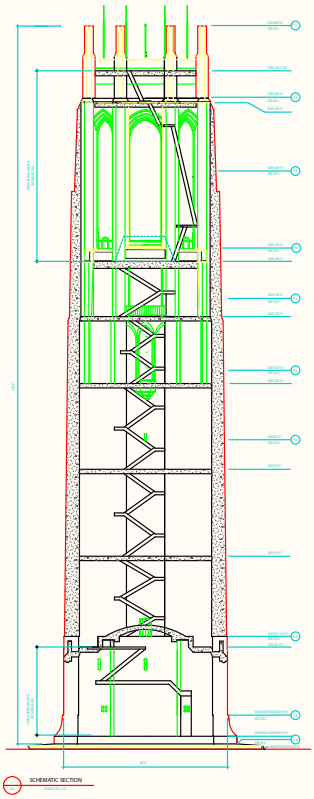
ABSTRACT

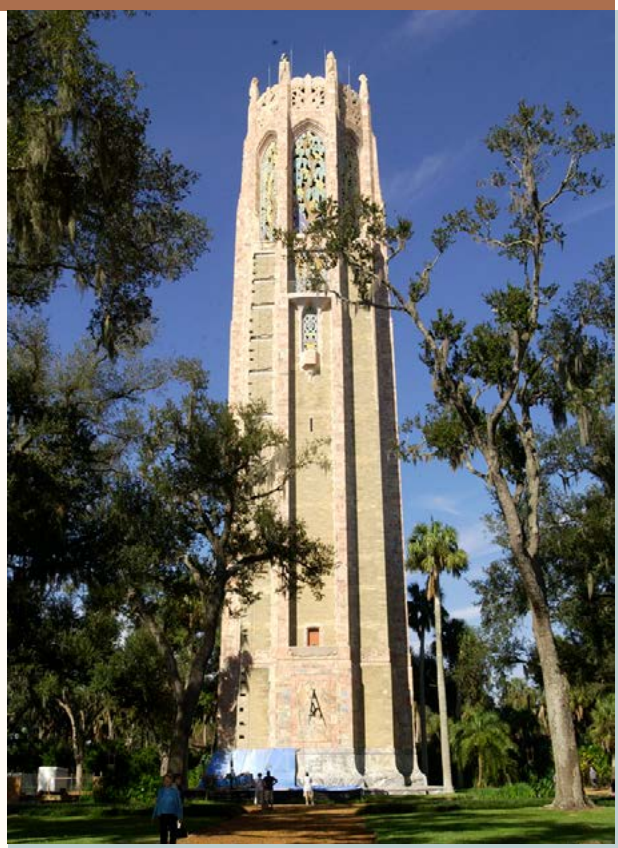
The Bok Tower restoration project, originally honored with the ICRI Award of Excellence in the Historic Category in 2007, is now presented for the Longevity category in 2025.

A LEGACY OF LONGEVITY

Set within its tranquil garden sanctuary, Bok Tower continues to stand strong, preserved through a thoughtful and lasting restoration effort. The project addressed severe masonry-encased structural steel frame corrosion through the application of an impressed current cathodic protection (ICCP) system.

After 13 years of operation, a comprehensive 2020 evaluation confirmed the system's continued effectiveness, with subsequent annual monitoring demonstrating an ongoing commitment to the structure's long-term health. This project exemplifies foresight in design, state-of-the-art repair execution, and dedicated asset stewardship, ensuring the sustained preservation and functionality of Bok Tower for generations to come.





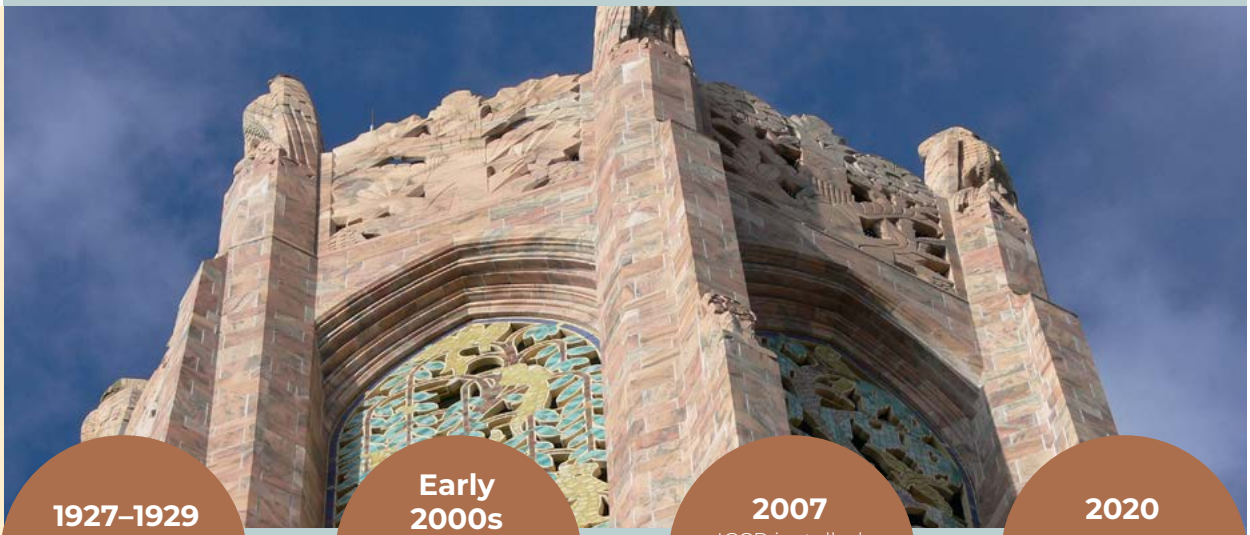
PROJECT BACKGROUND
AND ORIGINAL DETERIORATION

Bok Tower, an iconic landmark nestled in Lake Wales, Florida, popular with locals and tourists alike, stands as a testament to architectural grandeur and visionary engineering.

HISTORY

Built between 1927 and 1929, this striking 205-foot-tall tower spans seven floors and houses a 60-bell carillon, whose music echoes throughout the surrounding botanical gardens. The tower's distinctive Gothic Revival architecture features a masonry-encased steel frame clad in coquina brick, accented with intricate marble detailing and decorative tile panels. Native to Florida, coquina is a porous limestone made of compacted shell fragments and sand, valued for its regional character and distinctive texture.

Serving as the focal point of the 250-acre Bok Tower Gardens sanctuary, the tower continues to be a cherished public attraction. Its profound historical and architectural significance is underscored by its listing on the National Register of Historic Places in 1972 and subsequent designation as a National Historic Landmark in 1993.



1927–1929
Construction of Bok Tower

Early 2000s
Masonry deterioration observed

2007
ICCP installed as part of major restoration

2020
Evaluation showed sustained, effective preservation

Corrosion of structural steel damages surrounding masonry

Reference electrode for ICCP performance monitoring

CRITICAL CHALLENGE

By the early 2000s, this historic edifice faced a critical challenge: significant deterioration of its coquina brick facade, particularly in areas around the spandrel beams. This damage was a direct consequence of corrosion of the underlying structural steel. Often termed “Regent Street Disease,” due to its prevalence on Regent Street in London, United Kingdom, this type of deterioration is typical of early steel-framed, masonry-clad construction. As corrosion develops within the structural steel, typically embedded behind unreinforced masonry infill, it produces expansive forces that overstress the surrounding cladding. The result is distinctive cracking and displacement, frequently observed as horizontal and vertical cracking along beam and column lines. In Bok Tower, moisture ingress through the naturally porous coquina brick and openings at the tower’s summit, compounded by cavities formed during earlier repairs in the 1970s, created an environment conducive to accelerated steel corrosion.

The resulting expansion of the corroding steel caused the masonry to crack, bow, and in some instances, completely fail, posing a dangerous condition of falling debris. The primary areas of concern were the top plates of the spandrel beams and the intersections of columns and beams, with secondary consideration given to the entire perimeter of the spandrel beams.

LONG-TERM PROTECTION

In addressing similar corrosion challenges in historic masonry-clad structures, ICCP systems have been widely adopted since the 1990s. These systems offer long-term corrosion protection for embedded steel without the need for extensive material removal. Given their proven effectiveness, ICCP was selected as a central component of the restoration strategy at Bok Tower.

2006–2007

HISTORIC REPAIR & PRESERVATION PROJECT

Building on this proven approach, a comprehensive restoration effort was carried out at Bok Tower from late 2006 to early 2007. This project combined selective removal and reconstruction of deteriorated coquina masonry with the installation of a discrete anode ICCP system. Designed to deliver a minimum of 25 years of protection, the system offered a long-term solution that minimized aesthetic disruption while addressing the damaging corrosion process. Together, these interventions helped secure the tower's stability and visual character for future generations.

Installation of the ICCP anodes

UNIQUENESS AND USE OF STATE-OF-THE-ART METHODS

The Bok Tower restoration was groundbreaking as it marked the first fully cathodically protected steel frame building in the Americas. The application of an ICCP system to a masonry-encased steel frame, especially one of such historic and architectural significance, was a pioneering endeavor. The discrete anode system, constructed using a conductive ceramic material and used successfully to address Regent Street Disease in the United Kingdom, was specifically chosen due to the tower's complex geometry and the imperative to preserve its ornate exterior. This system allowed for the installation of anodes from inside the tower, minimizing disruption to the delicate facade.

Furthermore, the ICCP system incorporated a power supply and control system that was considered advanced at the time. This sophisticated capability minimized the need for extensive cabling and reduced installation complexity.

Inspection and repair of coquina masonry

MATERIALS AND AESTHETICS

Preserving both the integrity and appearance of Bok Tower required careful material selection and execution. The original coquina brick was meticulously documented through field measurements and photographs to ensure precise reinstallation. Replacement brick was sourced to match the original in size, pattern, and texture, with special attention given to corner detailing.

The structural steel, if exposed during repairs, was cleaned and coated with a protective cementitious material before being re-encased in mortar. Discrete anodes were placed at variable depths above and below the beam to ensure 360-degree protection, and their installation from the interior avoided any visual impact to the tower's intricate exterior masonry and marble features. Together, these measures ensured long-term durability while maintaining the landmark's historic aesthetic.

FUNCTIONALITY

The primary functionality of the repair was to halt the active corrosion of the structural steel and prevent its recurrence, thereby restoring the structural integrity of the tower. This was achieved by addressing the root cause of the deterioration, moisture ingress and subsequent corrosion, and implementing a robust protection system. Thorough testing, including pre-commissioning, commissioning, and final start-up of the ICCP system, ensured its optimal performance. The system was designed to polarize the steel sufficiently to maintain a controllable, non-corroding condition for at least 25 years. This proactive approach ensured the tower's continued functionality as a safe and stable historic structure.

Running wire through conduit

VALUE ENGINEERING

Significant value engineering was achieved through the strategic decision to install the ICCP system from the interior of the tower. This approach provided easier access for installation, significantly reducing costs associated with exterior scaffolding and complex facade work. Additionally, resizing the anodes to a smaller diameter during the design phase decreased the size of the holes required for drilling, further contributing to cost savings and minimizing intervention on the historic fabric. These choices optimized the project's budget while maintaining the highest standards of preservation and protection.

DEMONSTRATING LONGEVITY

2020 EVALUATION AND ONGOING MONITORING

The true measure of a concrete repair project's success in the Longevity category lies in its sustained performance over time. The Bok Tower project stands as a prime example of such enduring success.

EVALUATION

In 2020, 13 years after the initial restoration, a specialized consultant with extensive experience in cathodic protection was engaged to conduct a comprehensive evaluation of the ICCP system. This critical assessment confirmed that the cathodic protection system remained operational and highly effective. The evaluation revealed that despite the failure of two cathode connections to the steel frame, the system's robust and redundant design ensured continuous protection across the tower. These minor connection issues did not compromise the overall efficacy of the corrosion mitigation, and plans were made for their repair at a later, more opportune time. This finding is a powerful testament to the foresight in the original design, which incorporated redundancy to guarantee long-term performance even in the face of minor component failures.

ICCP power supply and monitoring system

MONITORING

Building upon this successful 2020 evaluation, the owner demonstrated an ongoing commitment to the tower's preservation by establishing an annual monitoring contract with the same specialized firm. This proactive program involves regular data collection by onsite personnel, which is then carefully reviewed by the cathodic protection firm. A yearly report is subsequently produced, detailing the system's performance and providing expert recommendations. The most recent monitoring report indicates that 95% of the monitored locations continue to meet the stringent cathodic protection criteria established by industry standards. Minor masonry cracking under one slot window was also noted for future investigation, demonstrating a thorough and continuous assessment approach.

This consistent, data-driven monitoring ensures that any potential issues are identified and addressed promptly, maximizing the system's lifespan and the tower's structural health.

CONCLUSION

The Bok Tower Restoration project is an exemplary candidate for the ICRI Longevity Award. Its initial 2006-2007 repair was a pioneering effort, employing state-of-the-art ICCP technology to address severe steel corrosion in a historic, masonry-encased structure. The project demonstrated uniqueness, careful design and material selection, restored functionality, and meticulous aesthetic preservation.

SUSTAINED PRESERVATION

Crucially, the project's sustained success over nearly two decades, as validated by the 2020 evaluation and ongoing annual monitoring, demonstrates its long-term effectiveness. The continued operational status of the cathodic protection system, coupled with a proactive maintenance and assessment program, ensures the enduring preservation of Bok Tower. This project stands as a powerful illustration of how innovative engineering, combined with dedicated stewardship, can extend the life of critical infrastructure and safeguard invaluable historic landmarks for future generations. It embodies the very essence of longevity in concrete and masonry repair.