Eneref Institute

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CLIMATE CHANGE DRIVES NEW WINDOW SPECS FOR **CHARLESTON LIBRARY**

ENEREF INSTITUTE EXAMINES THE WINDOW SPECIFICATION DECISIONS FOR THE OLDEST US PUBLIC LIBRARY

The city of Charleston successfully balances historical community preservation with building codes and safety. Recently, however, globally intensifying weather events encouraged the Board of Architectural Review to tilt the scales towards safety for the renovation of the city's renowned library.

"The Charleston Library Society is the second-oldest circulating library in America, established in 1748,

THE WINDOWS WERE DEFINITELY THE MOST INTERESTING PART OF THE RENOVATION PROJECT.

JASON GREGORIE | *Applied Building Sciences*

when we were still a colony of King George," explained Anne Cleveland, Executive Director of the Charleston Library Society. The Society's valuable documents include personal letters from George Washington, as well as John Paul Jones' plans for the first US Navy. Most prized is a rare 1669 handwritten South Carolina constitution by John Locke — "a template for what became the American Constitution," noted Cleveland, who is also a historian.

HURRICANE'S IMPACT

Before Hurricane Hugo, Charleston, SC was a small traditional southern city. It was the extensive city-wide renovations after Hugo that inspired a group of local residents to assure that Charleston maintained its authenticity and charm, firmly establishing the authority of the Board of Architectural Review.

"When Hurricane Hugo hit in 1989, it put a whole lot of insurance companies out of business. Everybody got new roofs, new paint jobs," said Anne Cleveland. "That's when real estate values grew, and tourists just started pouring in."

Today's century-old library facility is one of two Beaux-Arts buildings in Charleston — a 19th-century French neoclassical design incorporating modern materials such as iron and glass. To avoid unsightly gutters when originally built, the designers hid the gutter drains inside the walls, which caused leaks nearly a century later as rainfall has increased because of global warming. The library maintenance crew naturally assumed the leaks were from the roof until a structural engineer, hired to examine the problem, discovered that the walls and windows needed to be replaced. The complete overhaul of the building afforded the engineers an opportunity to reimagine the library's construction and fortify the building for a future of severe weather events.

FLOODING NOW WORSE

"We're in a hurricane-prone region," said Jason Gregorie, the structural engineer with Applied Building Sciences. "One of the things I'm most proud of, is that not only are the new windows a perfect historical match, but they are code-upgraded to meet wind resistance for structural impact."

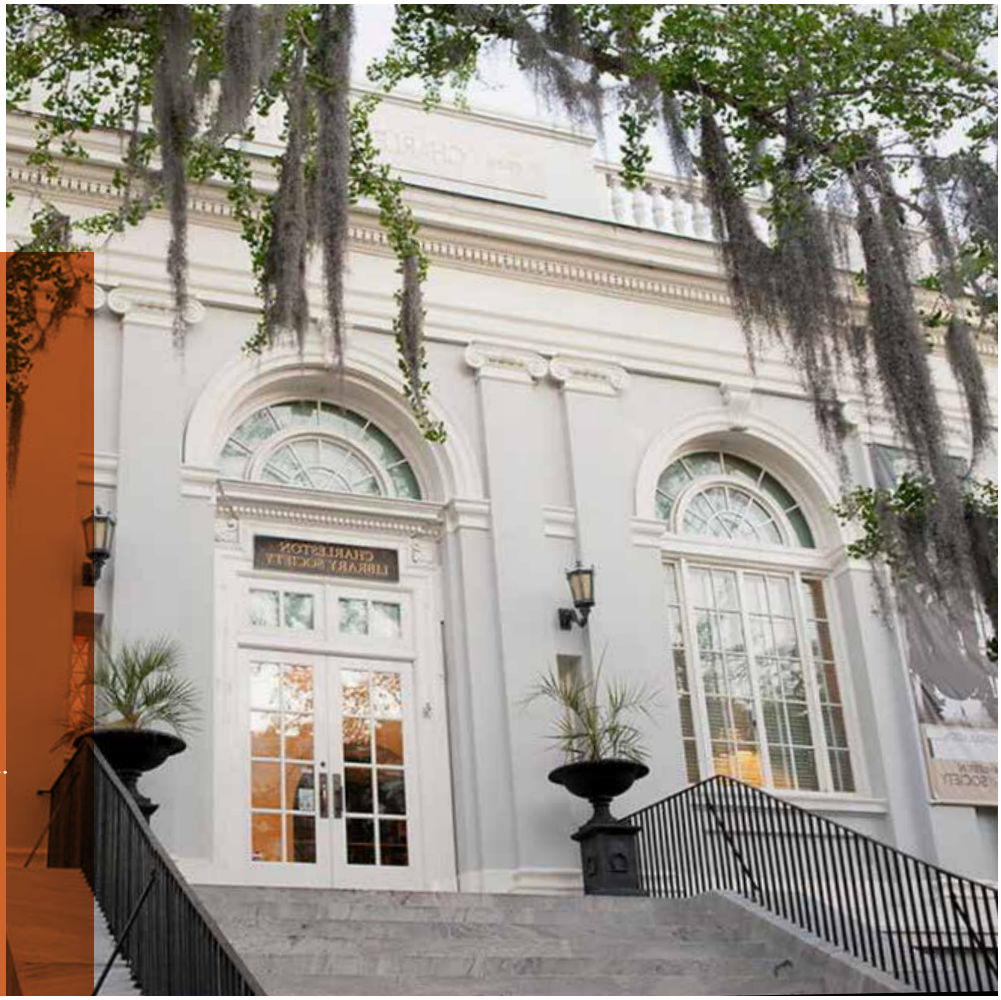
The weather in Charleston is rapidly changing, with more hurricanes than in the recent past, according to Executive Director Anne Cleveland. "We worry about flooding in ways we didn't when we moved here 37 years ago. Then, we had five or six days when certain streets flooded. And now, it's probably 30 to 40 days per year," she said. "We've had storms that completely flooded the city far worse than Hurricane Hugo." Windows that don't meet building codes are especially vulnerable to such weather events. All building renovations in Charleston must be approved by the Board.

PRESERVATION

"They're persnickety. If they say it has to be replicated exactly, they mean exactly,"

ENEREF INSTITUTE ACKNOWLEDGES THE CONTRIBUTION OF

Anne Cleveland, Executive Director, Charleston Library Society; Bud Hay, President, Palmetto Craftsmen; Glenn Keyes FAIA, Principal, Glenn Keyes Architects; Jason Gregorie, Structural Engineer, Applied Building Sciences; Darren DeNett, Sales Director, Hope's Windows



PALLADIAN-STYLE WINDOWS

The eight steel-reinforced, hurricane-resistant, UV-protective windows are designed for impact, with two sheets of glass laminated together.

said Anne Cleveland.

Engineer Jason Gregorie concurred. "They wanted an exact match of the windows. We're talking plus or minus a sixteenth of an inch on a highly decorative window."

The Board of Architectural Review is made up of architects and preservationists with an eye for detail. "The Board is smart enough to realize that we can't go out and buy old Black Cyprus or Heart of Pine, but I don't think any of us knew at the beginning that BAR would be that critical over identical detail. I mean identical," said Bud Hay, President of Palmetto Craftsmen, the general contractor overseeing the library renovation.

Recreating the original windows was "a laborious process," said Cleveland, "but they look beautiful now."

APPROVAL PROCESS

Window fabrication could not begin without BAR's approval, a back-and-forth process between engineer Jason Gregorie and the city architect, which ran over an entire year. Before the design team even supplied physical mock-ups of the new windows for approval, BAR examined details, such as the window's corners and arches, to assure the new windows would look exactly like the originals.

However, a conflict between the window design team and the city's review board further held up the project's timeline. Whereas BAR looked primarily for historical preservation, the design team prioritized the structural integrity of the windows.

"Sometimes preservation is not synonymous with structural code compliance," said Gregorie. "But eventually BAR came around, and in this case, I think we were able to balance the two."

To win over the board, Anne Cleveland solicited the help of renowned architect Glenn Keyes to argue their case. “We prevailed when we convinced the board that using these old windows is not going to protect our building or the incredible contents from hurricanes and disasters,” she said.

Glenn Keyes identified the primary stumbling block as this: “The Board of Architectural Review does not routinely like wholesale replacement of historic windows.”

ORIGINAL WINDOWS

The Charleston Library Society’s original windows were manufactured by Hope’s Windows, Inc., not long after the company’s founding in 1912. Hope’s has since grown into the leading steel window and door manufacturer in the US, and the company is still based in Jamestown, NY, where it was originally established. As such, Hope’s Windows was naturally chosen to supply the replacement windows for the library renovation.

“Hope’s was the first name that came to mind for all-metal windows,” said Bud Hay, President of Palmetto Craftsmen.

According to engineer Jason Gregorie, “A lot of companies can do a historical or preservation match, but only Hope’s could also create a code-compliant, impact-rated product. That was what we needed.”

The library’s original design was of large Palladian-style windows, echoing 16th-century architect Andrea Palladio, the influential building designer of Europe’s High Renaissance. Eight large Palladian windows surround the library’s main reading room. Measuring a tall 13 feet by 8 feet, the original windows were steel-framed, single-pane glass with wood and copper decorations, likely hand-bent to achieve their crisp angles.

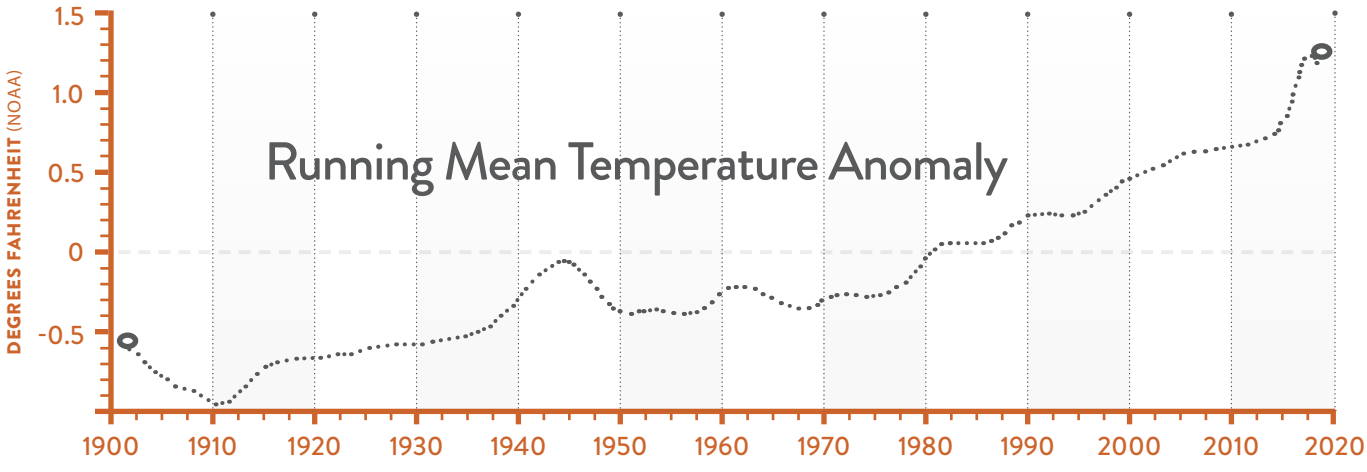
UPGRADED FOR IMPACT

Extensive planning went into the new profiles to mirror the old windows and meet the stringent requirements of the hurricane-prone geographic location. Using a FARO LiDAR scanner, Jason Gregorie captured a photorealistic 3D scan of the window profiles to glean the exact design and measurements, which he used to create a computer drawing and model. Using the computer drawings, he created a 3D-printed physical replica of the windows, which the library’s team showed the Board for final approval. Once approved, CAD drawings of the windows were then sent to Hope’s to begin fabrication.

“In my opinion, the windows were definitely the most interesting part of the renovation

ANNUAL GLOBAL TEMPERATURE

DIFFERENCE FROM AVERAGE TEMPERATURE



A POSITIVE ANOMALY INDICATES THE OBSERVED TEMPERATURE WAS WARMER THAN BASELINE (1971-2000 baseline period)

CHARLESTON LIBRARY SOCIETY

The Charleston Library Society is the second-oldest circulating library in America, established in 1748.

project," said Gregorie. "The windows are very robust — really the cat's meow."

The eight steel-reinforced, hurricane-resistant, UV-protective windows are designed for impact, with two sheets of glass laminated together. The final windows measured 1.25 inches thick, made using hot-rolled steel frames from Hope's proprietary dies. The steel profile adds rigidity. The entire process — from planning and design to fabrication — took several years.

"I visited Hope's plant and personally examined all the pieces before they were shipped down to Charleston because if something was off just a little bit, it would have either not fit or could have been rejected by the BAR," said Gregorie. "They were all good. I don't recall there being any hiccups."

Once installed, for a final quality control, Gregorie performed water penetration and negative pressure testing of the windows, according to AAMA and ASTM building code specifications.

ABOVE-CODE NEEDED NOW

While the Charleston Library Society is the second oldest in the US, it is the oldest public library now that the Ben Franklin Library in Philadelphia is no longer circulating books. And the current oldest, the Newport RI Redwood Library, established just months before the Charleston library in 1747, was chartered as and remains a subscription library society.

"The Charleston Library is in a very prominent location," said Bud Hay, President of Palmetto Craftsmen, the general contractor. "They have chamber music concerts and readings from famous authors. It's great."

Today, the library is well prepared to safeguard its irreplaceable texts from a future of extreme weather events, and the city of Charleston benefits from the library's unique character.

"We protected the library for another hundred, two hundred years," explained Hay. Such forward thinking is urgently needed. Eneref Institute encourages other municipalities to follow Charleston's lead in "above-code" construction and strong enforcement of mandatory building codes.

LEAD BY EXAMPLE.

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