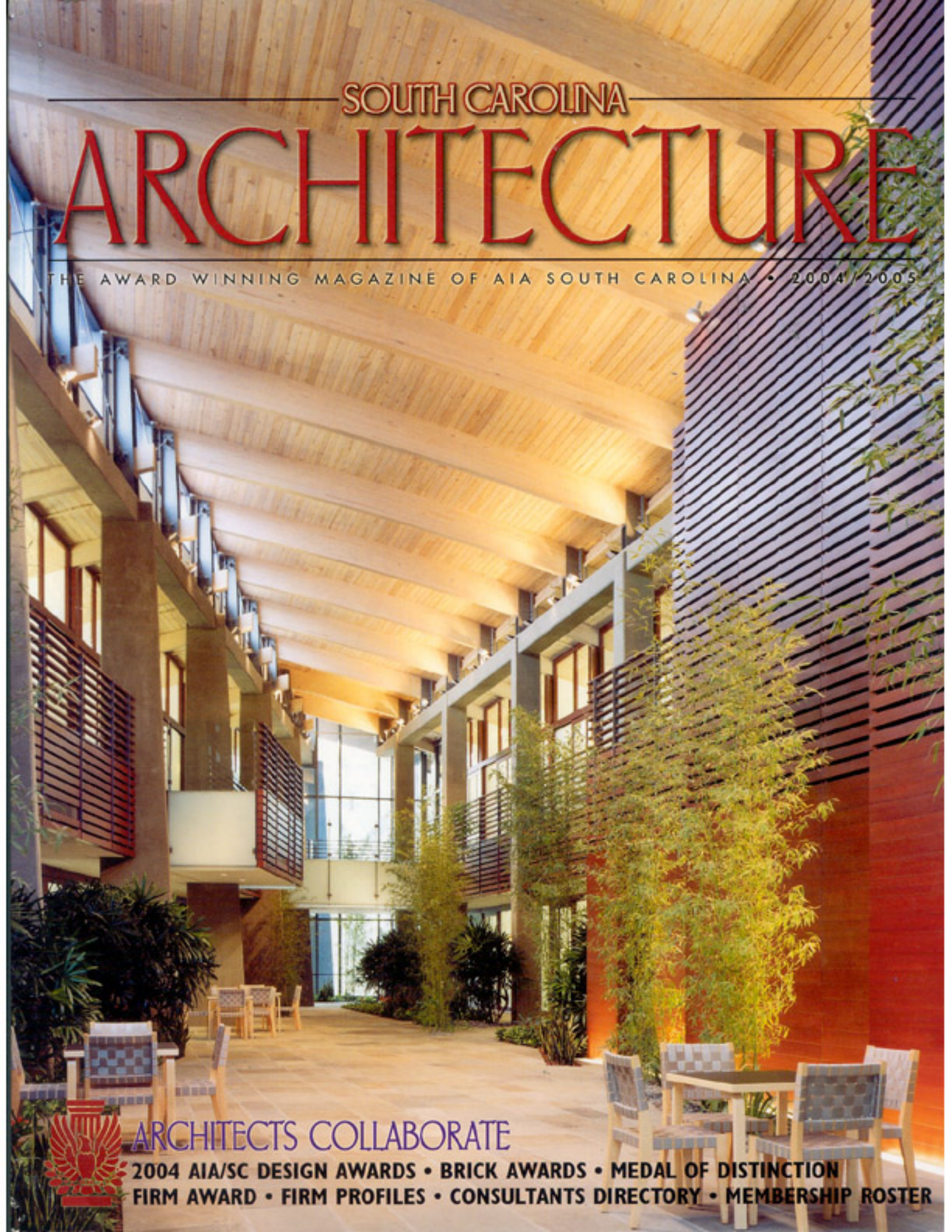


SOUTH CAROLINA ARCHITECTURE

THE AWARD WINNING MAGAZINE OF AIA SOUTH CAROLINA • 2004/2005

ARCHITECTS COLLABORATE

2004 AIA/SC DESIGN AWARDS • BRICK AWARDS • MEDAL OF DISTINCTION
FIRM AWARD • FIRM PROFILES • CONSULTANTS DIRECTORY • MEMBERSHIP ROSTER

ARCHITECTS & ENGINEERS PUSH THE ENVELOPE

BY MARTI M. HOWITZ, AIA, NCARB, LEED

This is big. No question. Under construction right here in Charleston, South Carolina, is the largest cable-stayed bridge in North America. With a $644 million dollar construction budget, this is the biggest project the South Carolina Department of Transportation (SCDOT) has ever undertaken. The Arthur Ravenel, Jr., Bridge replaces the two older bridges over the Cooper River that link Charleston to the Mount Pleasant community to the north on US 17. Ground was broken in 2001 and the bridge is scheduled to carry traffic in the summer of 2005.

The bridge design provides an example of how architects and engineers collaborate on projects, pushing each other to create, in this case with the new bridge, a timeless gateway to an historic American city. Architect Donald MacDonald, FAIA of San Francisco, California, collaborated with Parsons Brinkerhoff Quade and Douglas of New York and their project engineer, Mike Abrahams, on the design.

The new bridge is a Design-Build Project, the winning proposal led by Palmetto Bridge Contractors (a partnership established between Tidewater/Skanska USA Inc. and HBG Constructors Inc./Flatiron Structures Company). Palmetto provided construction services with design services by Parsons Brinkerhoff Quade and Douglas. In part, the job was won through the collaboration of the engineers and the architect, MacDonald, who produced renderings showcasing the design and selling the design-build team. A requirement of the Design-Build proposal was the inclusion of an architect, thereby, demonstrating that the aesthetics of this contemporary structure in an historic region were critical.

Features of the bridge include allowing some of the world's biggest ships to pass under the roadway which floats 200 feet above the river. The towers are 575 feet tall and each leg of the towers has elevators for access and maintenance. Eight lanes of car traffic, pedestrians and bicycles are all accommodated and treated to breathtaking views.

According to MacDonald, "The process of designing a bridge is a process of making big decisions," and many of the big decisions were made before the actual design team was selected. SCDOT began the design process by proposing a number of alternative bridge designs and presenting them to the public at public input sessions. Charles Dwyer, a civil engineer and Project Manager for SCDOT, describes the alternatives given at the public hearing: "from numerous basic cable stay bridge designs including an A-shape, H-shape and diamond shape." The public selected the diamond shape, evok-

This design model of the bridge shows the overall proportion of bridge enhanced by the architect through the tapering each of the tower's legs. Also shown is the addition of cheek walls suggested by the architect in order to visually stabilize the base of the towers.

Photo Credit: SCDOT

The viaduct connector to the bridge connecting Charleston to Mount Pleasant to the north

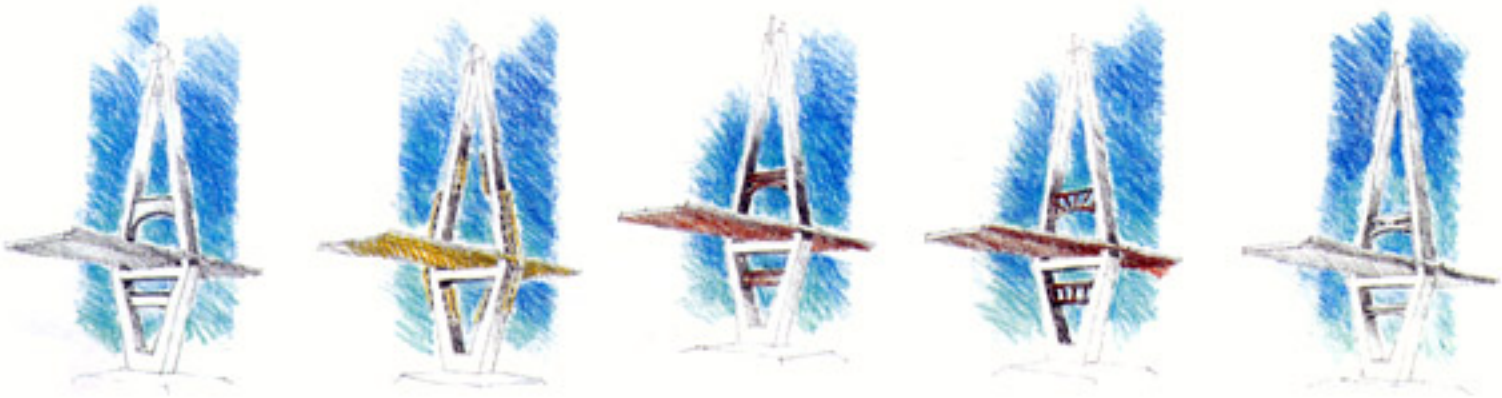
ing symbolism of sails on the harbor and Charleston's history as a port city.

With the first big design gesture established, Project Engineer Abraham's role was to quantitatively define tower parameters to the architect. What would stand up to the traffic, through strong winds, hurricanes and 8.0 seismic events? Abrahams calculated the basic dimensions of the tower. MacDonald proposed the aesthetic refinements, establishing the collaborative pushing relationship of the design team.

MacDonald's first design push came from the fact that through his training as an architect, he understands the visual implications of the bridge's proportions to people on the ground and in their cars. Additionally, he considered the aesthetics of the bridge from the sea, the air and at night. Dimensions of the legs of the diamonds set by the engineer were refined into aesthetically pleasing proportions and details. MacDonald collaborated with and pushed the engineer by suggesting adding a taper to the legs of each tower. Ideally, MacDonald proposed tapering the legs in both directions to achieve an elegant design solution. The engineer pushed back at the architect for further refinement of the tower design, noting that tapering the towers in two directions would require difficult and, thus, expensive concrete forming techniques and reinforcing bar design. With cost input from the contractor and the realization that the double taper would be difficult and, therefore expensive, MacDonald refined the design by tapering the towers in one direction.

Macdonald further pushed the bridge's design and aesthetics by finishing off the top of the tower with a beveled shape. This design decision effectively terminates the top of the tower. The bevel also established a motif repeated throughout the bridge design.

In another aesthetic suggestion, MacDonald added reveals in the concrete to break up the scale of the towers, as well as add a regional aesthetic to the design. The reveals also recall the modular construction of historic stone buildings in Charleston such as the U.S. Customs House. The color of



Contextual Tower Study

the concrete material was determined by the architect, mimicking the grey and white limestone prevalent in historic Charleston.

Another collaborative detail of the bridge is the 128 cables supporting the span, whose number and strength was determined by the engineer. For protection from corrosion, the cables are covered in PVC pipe, deliberately colored white. McDonald understands that, visually, white cables accentuate the shadows. Additionally, the shape of the cable can be seen better in white and white emphasizes how the sun interacts with the bridge during the course of the day. Finally, white, again, evokes the historic colors of Charleston.

MacDonald is emphatic in his design philosophy that bridges represent the region, relating to the context of an area. Established engineering practices and principles followed by engineers may work in any locale but the architect in this case pushed the envelope and incorporated a regional aesthetic, making the bridge a timeless gateway to Charleston. Geometry and proportion are what make the design timeless. The detail makes the design regional and brings it down to human scale.

MacDonald also pushed the lighting engineer. A feature of the lighting is that the angle of the light poles matches the angle of the cables. The Ravenel Bridge will be subtly lit to provide a nighttime gateway to Charleston. It will not dominate the skyline at night.

Photo Credit: SCDOT

The true form of the diamond towers emerges from the construction process.

Photo Credit: SCDOT

Massive amounts of re-bar designed by the structural engineer will be concealed by the form of the concrete envisioned by the architect.

Photo Credit: SCDOT

Part of the Crew

Ideally, architects and engineers push each other but are flexible in their collaboration. Breaking traditional building architect roles, the Ravenel Bridge architect is hired as a consultant to the engineer. MacDonald notes that on such an enormous project, he is a subcontractor for engineering firms that are also enormous, with anywhere from 1000 to 2000 employees.

Regardless of the contractual relationship, or type of project, the collaborative relationship remains the same; architects and engineers collaborate and push each other to achieve better results in their designs. In this case, the architects and engineers collaborated to create a timeless gateway to the historic city of Charleston. It is a contemporary engineering marvel that has achieved success relating to the human scale and context of a historic city.

Marti Mitchell Howitz, AIA, NCARB, LEED AP received her Masters of Architecture from the University of Utah and is an Associate with Moseley Architects Florence, South Carolina Studio. Marti is currently project architect for several school and municipal projects throughout the state of South Carolina.