



# COOPER RIVER BRIDGE UPDATE

## The Cable-Stay Bridge

THREE YEARS SINCE ITS NOTICE TO PROCEED WAS SIGNED, THE CONSTRUCTION OF THE NEW COOPER RIVER BRIDGE'S MAINSPAN BEGINS TO EXTEND FROM ITS DIAMOND TOWERS.

Now that the new Cooper River Bridge's diamond towers have been completed, construction crews are turning their focus on the installation of the cables and bridge deck of North America's longest cable-stayed span.

When it is completed, the new Cooper River Bridge will span 1,546 feet between the eastern and western diamond towers. The new bridge will be twenty feet longer than the Alex Fraser (Annacis Island) Bridge in Vancouver, British Columbia, and will become the new record holder for the longest cable-stay span in North America. The longest cable-stay span in the world is the Tatara Bridge in Japan at 2,919 feet.

The completed diamond towers extend 572.5 feet in the air. They are now the tallest concrete structures in the state. Each tower was constructed with almost 22,000 cubic yards of concrete and 3,700 tons of reinforcing steel.

To put the towers into perspective, their combined concrete could easily construct a five-foot wide (4 inches thick) sidewalk from Patriot's Point, across the new bridge, and up to the SCDOT office in Columbia - roughly 120 miles. The reinforcing steel in both of the towers is the weight of almost 900 African elephants - averaging 16,500 pounds a piece. The mainspan deck will be constructed 186 feet above the mean high tide mark in the Cooper River to provide a shipping clearance

of 36 feet more than the existing bridges.

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*Above: Concrete was placed for the parapet wall at the top of the western tower on May 18th marking the completion of this tower. Construction for the eastern tower was completed five days later.*

### Girder by girder,

the bridge deck extends from Charleston and Mount Pleasant towards the mainspan. ■

*For more information, see "Girders" on page 2.*



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# GIRDERS

**W**hile the bridge's mainspan is held in place by the cables extending from the two diamond towers, the rest of the bridge deck is being built upon steel and concrete girders.

## **anatomy of a bridge**

Drilled shafts extend deep into the ground and support the columns. The columns, some of which are reinforced by horizontal struts, support the pier caps.

Steel or concrete girders, depending upon the span they must cross and the geometry of the bridge deck they support, connect the pier caps. Step by step the new Cooper River Bridge is taking shape.

## **a year's progress**

The first girders arrived in March of 2003. By the end of June 2004, almost 80% of all of the bridge's girders have been set, including the entire span of steel and concrete girders from Meeting Street out across Drum Island.

## **the interchanges**

Curved steel girders for the four-level Charleston Interchange rise up over Meeting Street and I-26.

Just beyond temporary barrier walls, small steel girders are in place for new



*Above: With more and more girders in place, the Mount Pleasant Interchange takes shape. Pictured here are the girders for the Johnnie Dodds Boulevard (US 17) and the Coleman Boulevard ramps off of the new bridge.*

lanes being added to I-26 and US 17 (the Crosstown Connector) which will accommodate new on- and off-ramps as well as new merge lanes.

In Mount Pleasant, the steel girders define the split between the bridge's four northbound lanes and its four southbound lanes.

## **prefabricated girders**

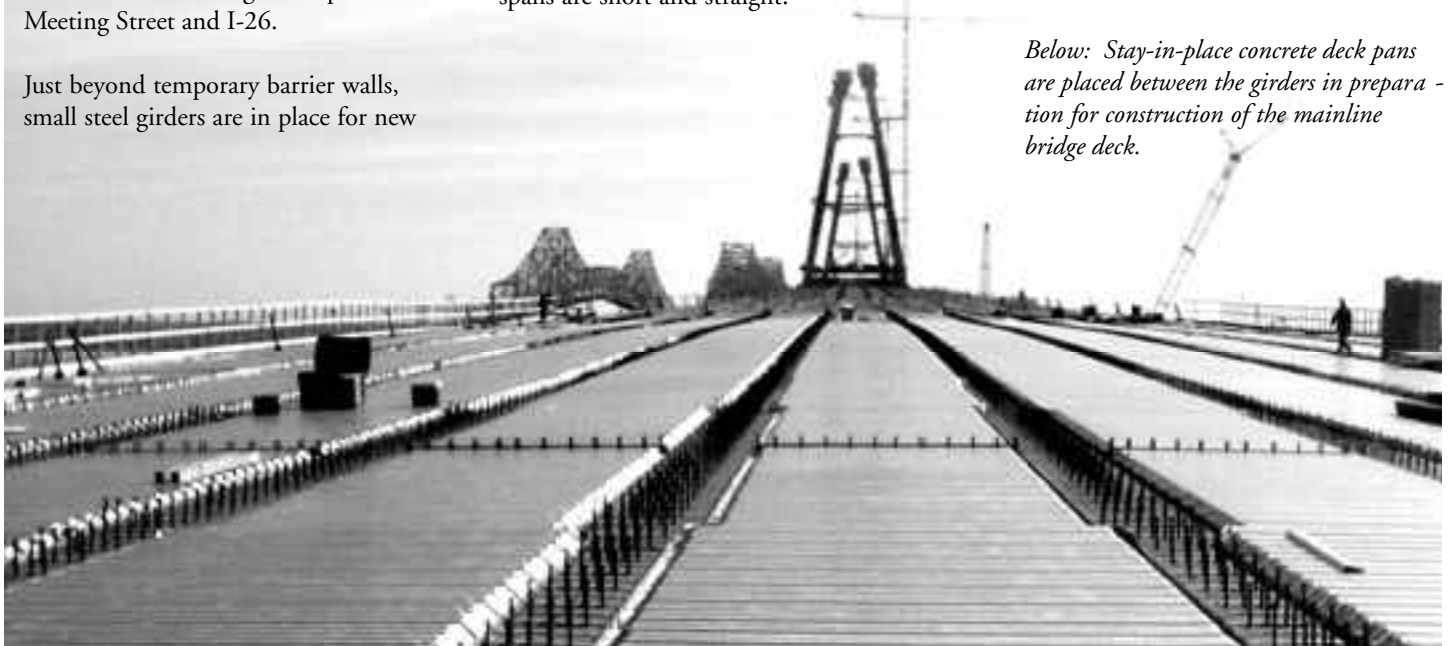
Prefabricated concrete girders are heavy, but are perfect for constructing the bridge deck and interchange ramps when the spans are short and straight.

Most of the concrete girders are already in place for the Charleston Interchange, and concrete girders have begun to be placed for the ramps in Mt. Pleasant. It is anticipated that the concrete girders for the Wingo Way on-ramp, the Coleman Boulevard on- and off-ramps, and the Johnnie Dodds (US 17) on- and off-ramps will be completed in August of 2004.

## **bridge deck construction**

Once the girders are in place, silver colored stay-in-place metal deck pans are set between the girders, reinforcing steel is tied between the girders, and concrete is spread out to form the bridge deck.

To place the concrete across the eight lanes of mainline bridge deck, crews are utilizing one of the the longest concrete-paving screeds ever manufactured. The construction of the bridge deck is anticipated to take a little more than 18 months from when it began in September of 2003. ❖



*Below: Stay-in-place concrete deck pans are placed between the girders in preparation for construction of the mainline bridge deck.*

## The Cable Stay Bridge

Continued from page 1

The white cables that can be seen extending from the towers are actually white high density polyethylene (hdpe) pipes. The bridge's cables will vary from eight to twelve inches in diameter as each pipe is threaded with 37 to 91 cable strands. The number of strands along with the diameter of the pipe depends upon the position of the cable and the weight of the load it must support.

Before the tower cranes lift the cables into place, pieces of the white hdpe pipe are welded together and are laid out on a barge with a single master strand strung through the pipes. Then, the tower crane lifts the cable pipe and master strand for crews to anchor one end of the cable into the tower legs and the other end into a roadbed anchor. After the master strand is anchored, it will take about two days to thread the rest of the cables through the pipe and into the anchorages.

When all of the cable strands are in place, they are properly tensioned and the telescopic pieces of the pipe are extended to their final length.

The anchor boxes in the tower legs are set within the concrete and steel of the hollow tower legs. Work elevators within the tower legs provide access to anchor the cables and then to inspect and maintain them over the 100 year life of the

bridge. The setting of these anchor boxes must be very accurate to insure the proper geometry for the bridge. Surveyors were careful to measure the placement of the stay pipes and the anchor boxes at night before the heat from the sun or afternoon winds have caused any expansion or movement of the towers.

The anchorages on the edge of the bridge's roadbed are called "shark fins" because of the way that they stick up on the steel edge girders. The roadbed anchors are 6 feet tall and weigh three tons each. On the ocean side of the bridge, pedestrians and bicyclists will be able look at the cable anchorages on one side of their path and out across the Charleston harbor on the other side.

The first cables provide support for the pier table, which floats six feet above the crossbeam on each tower. Once the four cables were hung at each corner of the pier table, construction began to extend out from the towers section by section. Derrick cranes, on either side of the bridge deck, lift girders and beams from barges below and add them to the existing span. With each new set of girders bolted into place, cables are placed to support the weight that the span will ultimately carry.

Balance is the key to placing the cables and constructing the mainspan. Crews will balance the added weight of each new set of girders, cables and deck panels that extend out across the Cooper River channel with another set of girders, cables and deck panels that extend back to the approaches. With two cables and forty-seven feet of bridge deck in each segment, cables and bridge deck will be added until the mainspan is connected with the Charleston and Mount Pleasant approaches. Once the backspan connections have been made, crews will close the midspan connection between the two towers.



*Above: After the master cable is anchored, it takes a couple of days to thread the rest of the steel cable strands through the pipe and into the anchorages.*

It is estimated to require approximately twelve months for the sixty-four cables to be hung from each tower. Once the cables are in place and the new bridge is opened in 2005, the cables will be lit with low-level lights at night. ❖



*Above: The anchorage systems on the bridge deck and up in the towers hold the cable strands in the proper tension to support the bridge deck and its service load.*



*Above: Cable construction begins with the anchoring of a single master strand strung through a white, high-density polyethylene pipe. Once this master strand (as seen here behind the rope) has been anchored up on the tower and down on the bridge deck, the rest of the necessary cable strands are fed through the pipe and into the anchors.*

**Lights** on the cables will be dimmed during the sea turtle nesting season. ▢

# Milestones

❖ The notice to proceed was signed between the SCDOT and Palmetto Bridge Constructors on July 14, 2001. Palmetto Bridge Constructors (PBC) was given 60 months to complete the bridge and all its ramps. Assuming an uneventful hurricane season this summer and fall, **the bridge is anticipated to be completed by early summer 2005**, roughly a year ahead of schedule.

❖ **The first cables were set for the western tower on leap year day, February 29th, 2004.**

In four months, 40 of the bridge's 128 cables were in place.



❖ **More than 300 presentations have been given** to schools, community groups, and professional organizations interested in learning more about the bridge project.

❖ **Two box girders were set over I-26** to carry lanes of traffic on and off of the bridge. The one for the on-ramp from I-26 onto the new bridge was erected in September of 2003, and the one for the ramp from the new bridge over to US17 (the Crosstown Connector) was erected a month later. Curved steel I-beam girders were set across these box girders in late spring of 2004.



*Photo provided by Larry Workman.*

❖ **The new Romney Street exit ramp** from I-26 Westbound was opened to traffic on May 19, 2004.



❖ **The third class of high school students has entered the FHWA and SCDOT's Summer Transportation Institute** at Trident

Technology College. The eight week program offers scholarships for students living in the Charleston neighborhoods impacted by the bridge construction to learn the about the transportation industry through coursework and field trips.



❖ **Bridge deck construction began** with the first segment of bridge deck poured in September of 2003. By July of 2004, 113 of the approximately 245 bridge deck spans were completed within the bridge's interchanges and high level approaches. (The screed designed to spread and finish the concrete for mainline bridge deck is the largest screed ever manufactured by Bidwell Industries).



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