HEAVY MOVABLE STRUCTURES, INC. ELEVENTH BIENNIAL SYMPOSIUM

November 6-9, 2006

Temporary Bridge Construction with an Acrow Lift Span Michael D. Yeager, P.E. URS Construction Services

DOUBLETREE UNIVERSAL STUDIOS ORLANDO, FLORIDA

Background

Project Location

The Bridge of Lions, with its Mediterraneanstyle architecture, is an integral part of the City the bridge is prominent in nearly every skyline rendering or photograph of St. Augustine. The nearly 80-year-old bridge showcases 23 pairs of arches, tile-roofed octagonal towers and marble lion statues guarding the west end.

Ponce de Leon, who discovered the North American continent on March 27, 1513, claimed the land for Spain and named it La Florida, Land of Flowers. It wasn't until an expedition led by Don Pedro Menendez arrived in August 1565 that the City of St. Augustine was named and came under the full control of Spain. St. Augustine is the nation's oldest continuously occupied European settlement. It is older than the colony at Jamestown by 42 years and older than Plymouth Rock by 55 years.

In the early years, St. Augustine served primarily as a military outpost. Considered a threat to other nations, it had been raided and burned by the English three times by the early 1700s. It changed hands between the Spanish and English through the centuries until Spain entered into a treaty with the expanding United States of America in 1821, and Florida became a U.S. territory.



It wasn't until Henry Flagler arrived in 1885 that the town became the resort destination it is

today. He constructed two grand hotels, the Alcazar and his ultimate: the Ponce de Leon. These hotels accommodated wealthy travelers with lodging and leisure. Flagler's Florida East Coast Railroad was the transportation link between New York and St. Augustine.



In 1887 and again in 1914, fires destroyed many of the historic buildings of St. Augustine. Preservation efforts are ongoing to restore many Spanish colonial structures to their original appearance. Historic St. Augustine has become the center of colonial Spanish culture and an important destination for travelers. The rehabilitation of the Bridge of Lions will be a crown jewel in the ongoing efforts to restore this beautiful city.

History of the Bridge

In addition to its most vital economic engine, historic tourism, St. Augustine also boasts artificial and natural attractions that draw visitors worldwide to this quaint area, linked to the north end of Anastasia Island only by the Bridge of Lions. Ripley's Believe it or Not, Potter's Wax Museum, and several art galleries cater to modern commercial tourism on the main land, less than a mile west of the bridge. On either side of the bridge, thrill seekers find helicopter tours and parasailing opportunities. The beaches, scenic cruises, the Alligator Farm and Anastasia State Park attract nature enthusiasts and vacationers on the island side of the bridge. In addition to the attractions, thousands of unique shops and restaurants dot downtown St. Augustine and Anastasia Island. Currently, a temporary bridge maintains this

essential transportation connection during the Bridge of Lions Rehabilitation Project.



Prior to the construction of what is known as the Bridge of Lions, an old wooden toll bridge with a swing span built in 1895 served as the only access to Anastasia Island from downtown St. Augustine. After major renovations in 1904, the wood bridge accommodated an electric trolley line. A congested group of horse-drawn carriages, coaches, electric cable trolleys, horseback riders, pedestrians and early automobile traffic was sometimes forced to wait as much as 30 minutes when the old draw opened for marine traffic. In 1918, the U.S. Engineers Corps, a division of the war department, requested construction of a modern concrete bridge with a lifting draw to better accommodate marine traffic. This request, combined with an increase in automobile traffic and a desire to remove an "eyesore," resulted in construction beginning in 1925 to build a modern bridge that would complement the City's existing architecture. The present Bridge of Lions opened to traffic in 1927, connecting the historic downtown business district with Anastasia Island. The rolling lift bascule drawbridge opens to allow passage of commercial and recreational marine traffic.



The American Society of Civil Engineers recognized the Bridge of Lions as one of the most significant bridges in Florida in 1976. In 1982, the bridge was listed on the National Register of Historic Places, and in 1997, the National Trust for Historic Preservation placed the bridge on its America's 11 Most Endangered Historic Places List.

The traffic environment has changed significantly since the 1927 opening of the Bridge of Lions. Decades of salt water corrosion and the burden of carrying millions of cars across its spans have substantially deteriorated the bridge. During the 1970s, more than \$2.2 million in mechanical and structural repairs were made on the bridge, temporarily improving its safety and reliability. Some of the deteriorated structural components were replaced, however, somewhat altering the appearance of the bridge. During the 1980s, landscape renovations in the parks adjacent to the west end of the bridge further changed the original appearance.

Not only has the Bridge of Lions provided a vital transportation and economic link over the Matanzas River for decades, but it is also a designated emergency evacuation route for Anastasia Island. It is crucial for fire and rescue units. The bridge is considered historically important on a local, state and nation level and is a symbol of the City of St. Augustine for both residents and tourists.

After decades of discussion and debate regarding the safety and functionality of the Bridge of Lions and whether to replace it or rehabilitate it, the Florida Department of Transportation (FDOT) announced in October 2003 that the Record of Decision had been received from the Federal Highway Administration (FHWA) to rehabilitate the bridge.

The National Trust for Historic Preservation and local groups, particularly the highly-involved

Save Our Bridge Inc., declared the decision a victory. They viewed the decision as precedentsetting, proving to other agencies across the nation that preservation is a viable option to consider when roadway updates become necessary.

In 1924, plans for the Bridge of Lions were finalized by world-renowned bridge designer John Edwin Greiner and his company. His plan for the bridge featured the then-new technology of a rolling lift bascule mechanism to operate the drawbridge.

Project Team

In 2003, when FDOT, District 2 made the rehabilitation plans available in their search for an engineering firm to oversee the project, URS Construction Services, a division of the URS Corporation, was hired based on previous work the team successfully completed on several other moveable bridges. Incidentally, URS Corporation had merged with Greiner's engineering firm in 1996, thus resulting in another historic aspect in the Bridge of Lions rehabilitation.

The Bridge of Lions Rehabilitation, including the temporary bridge design was lead by Reynolds, Smith and & Hills with Lichtenstein Consulting Engineers designing the movable portions of the project. One challenge during design was to provide for the rehabilitation of a sensitive historic site while accommodating for modern safety needs.

Tidewater Skanska, based in Virginia Beach, was awarded the \$76.8 million construction contract. Tidewater brought several employees to the project who had just successfully completed a major bridge project in South Carolina. Since its founding in 1932, Tidewater Skanska has worked on several projects with other state DOT's, the U.S. Navy, the ACoE, and port authorities along the Atlantic Coast. The Acrow Corporation system was chosen for the vertical lift span on the temporary bridge. One attractive feature of the Acrow vertical lift span design is the ability to reuse the modular steel parts.

The Project

Temporary Bridge

The plans indicated a Mabey type vertical lift span with a 175 foot horizontal span to provide a 125 foot channel and a vertical clearance of 65 feet. The substructure was designed and detailed similarly to the traditional design/bid/build contract. The vertical lift span was designed to 30% completion, typical of a design/build contract. The successful contractor was to select the most efficient structure available in terms of costs and constructability and time. Our contractors selected an Acrow bridge. That temporary bridge is the focus of this paper.

The Big Change

During the design phase, a standard height of 65 feet was chosen for the vertical lift span. This was not done in a vacuum. There were two public information "Open House" meeting and the U.S.C.G. sent out 1,400 post cards soliciting comments on the new vertical lift span as part of the permitting process. No one commented at either of the two open house meetings and the U.S.C.G. received one unrelated comment. However, once this information was reveled to the community during the project open house and other initial project meetings, the marine industry and associated businesses were very vocal with their concerns.

Shrimp businesses in St. Augustine would be unable to move most of their boats beneath the span, completely shutting down the livelihood of the owners and workers. Because the shrimp boats would be unable to pass beneath a 65 foot high span, the processing plants where the shrimp businesses sell their products would also be shut down. Not increasing the height of the vertical lift span would virtually ruin the shrimp and sea food industry in St. Augustine.

Furthermore, several marinas and yacht servicing businesses in the area expressed serious concern about the lack of access for larger sailboats. St. Augustine is the only deep water port in the area, and eliminating business from more than 30 percent of the pleasure crafts that come through the area would severely economically damage the marine industry. As a deepwater port, St. Augustine is also sought as a shelter in storms and has a major yacht towing company that can only operate because it is a deepwater port. Eliminating access to larger marine craft could endanger boaters who would then have to travel several more miles to reach safe harbor, or would have to wait several more hours for emergency towing services when necessary.

Discussions were held and data was gathered before the Florida Department of Transportation provided additional funding and direction to the contractor to increase the height of the vertical lift span to 80 feet. Raising the span to an 80foot height came as the result of data gathered on average mast heights and an agreement among the marine community that the additional 15 feet would be sufficient to continue business operations with significantly less impact.

Other Challenges

In addition to the costly and time-consuming change of raising the vertical lift span, the project team faced other challenges. The community, once fiercely debating over the decision to replace or rehabilitate the Bridge of Lions, had become complacent once the decision was made. Public information efforts combined with associations with City officials, neighborhood coordinators and contacts, and

several other community organizations helped bring the project to the forefront of the community's minds. This was important for ensuring the community was informed of roadway changes, noise issues and other potential project impacts to the surrounding area. Public information efforts included a project open house, a website, public presentations, and several publications including brochures and newsletters. In addition, a Community Awareness Team was created with involvement from neighborhood leaders, business leaders and other respected opinion leaders in the community. The tourism industry was also heavily involved in project activities and in distributing project information due to the impact this project would have on historic tourism, the economic lifeblood of St. Augustine.

Project Impacts from the Height Change

Once the towers were constructed for the span, the gantry had to be set using extremely steady barges and cranes that could accommodate the immense 95,000 pound weight, and lift it in the air, shifting it into position when it reached the top of the towers. However, lifting the gantry was the final step in a litany of issues even prior to the gantry's arrival at the project site. Assembled in Pennsylvania, the gantry had to be transported down to St. Augustine. The weight of the gantry combined with an additional 60,000 pounds, the weight of the truck that could carry the gantry, required several special permits from various states and highway operations between Pennsylvania and Florida. Unfortunately, some permitting agencies were reluctant to allow passage, and the gantry finally had to be separated into three smaller units to be transported. In our attempt to save time by having the gantry and sheave cassettes preassembled we actually lost time.



The temporary bridge of lions, at the permanent bridge closing, May 26, 2006.

Finishing Early

Despite issues with the height of the vertical lift span and transporting the gantry, the temporary bridge was completed and opened on May 18, 2006, days ahead of the million-dollar bonus deadline. The project team cooperated very effectively to achieve the major milestone. Lines of communications were kept open between members of the project team, as well as communication with local government agencies and the public.

Construction began in February 2005 on a temporary bridge with a vertical lift span located adjacent to the Bridge of Lions on the north side. The temporary bridge was completed and opened for traffic early on the morning of May 18, 2006. A crowd of locals and visitors gathered at a Closing Ceremony held for the Bridge of Lions on May 26, 2006, which concluded with the final raising of the draw just prior to beginning rehabilitation work.

Construction Sequence Photographs



Figure 1 Pile installation. The pile template was designed to serve as the form system support.



Figure 4 Concrete Counterweight blocks



Figure 2 A completed pier with form work inplace for pedestal construction.



Figure 5 First delivery of Acrow panel parts.



Figure 3 Beginning of tower erection.



Figure 6 Cross-Head beam during erection.



Figure 7 Control House apon arrival at the project.



Figure 10 Control House after rehabilitation.



Figure 8 Equipment Pallet.



Figure 11 Roadway during erection.



Figure 9 Setting the roadway into position.



Figure 12 The first lift.