HEAVY MOVABLE STRUCTURES, INC.
THIRTEENTH BIENNIAL SYMPOSIUM

October 25-28, 2010

"Out with the Old, In with the New"

Reconstruction of the Ben Sawyer Bridge

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The Team

PCL Civil Constructors, Inc. (PCL), assembled a proven Team to provide Design-Build services to the South Carolina Department of Transportation (SCDOT) for the Ben Sawyer Bridge Reconstruction. The PCL staff proposed for this project is considered industry experts in both movable bridge and bridge replacement projects and lead the Design-Build team. The Design Team consisted of the lead designer Hardesty and Hanover, LLP (H&H), who have over 120 years of design experience in movable and fixed bridges and Florence and Hutcheson, Inc. (F&H), with over 20 years of experience with SCDOT. F&H supported H&H and PCL with permitting, civil, geotechnical, utility, and MOT design services. Civic Communications, a local Charleston, South Carolina Public Relations firm, managed community relations and public information distribution. The Team also included key subcontractors and suppliers who were critical to the success of this project; many of these have long-standing relationships with PCL and H&H on numerous past movable bridge projects and bridge rehabilitation/replacement projects.

Project

Delivery and Approach

Our overall design and approach to the Ben Sawyer Replacement Project took into account the following key criteria:

- Maintaining Similar Aesthetic Appearance
- Maintaining Existing Profile
- On-going Active Community Relations
- Adherence to Schedule and Closure Requirements
- Innovative and Environmentally Sensitive Construction Plan

Bridge Design

This Project consisted of the replacement of the existing superstructure, which is comprised of 12 approach spans and a swing span over the Atlantic Intracoastal Waterway. The bridge design incorporates aesthetic features similar to the existing structure with the same vertical profile. The new bridge superstructure was designed in accordance with the requirements of the RFP, Technical Specifications, Special Provisions, SCDOT Bridge Design Memorandums, SCDOT Design Guidelines, and AASHTO LRFD Code in the listed order of authority.

To minimize the dead load of the replacement superstructure since the new bridge is supported on the existing substructure, new steel components (ASTM A790 GR50) and lightweight concrete (115 lbs/ft3) was utilized for the new roadway deck including the swing span. High strength ASTM A325 TC bolts was specified for all field and shop bolted connections to provide a riveted connection appearance.
A substructure foundation analysis of the timber pile system was accomplished to ensure adequacy with the LRFD code.

Seismic Design

Seismic design of the bridge was performed in accordance with the Technical Specifications provided in the RFP, and followed all applicable codes. A 3-D Model of the bridge, from abutment to abutment, was created using SAP2000 software and was analyzed using the seismic input loading specified in the technical specifications.
This included a Response Spectrum Analysis (RSA) as well as a Time History.

Isolation Bearing Rendering - Figure 1

Approach Roadway

The approach roadway was widened for approximately 400 linear feet from the end of each bridge abutment. The SCDOT pavement section provided in the RFP and SCDOT Standard pavement markings was utilized. The existing bridge tender parking area was repaved in the existing location. Transitions from the existing multi-use path was constructed to allow bicyclists and pedestrians ingress and egress to the new bridge sidewalk. Guardrail was added at the end of each bridge quadrant.

Approach Slabs

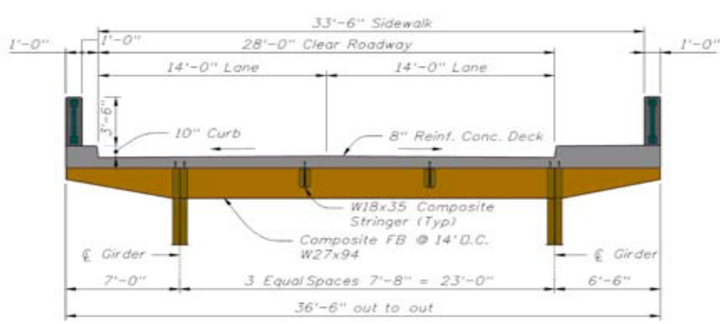
The existing approach slabs were replaced with new, widened approach slabs designed and constructed in accordance with SCDOT standard drawings, modified for the new bridge typical section. Abutment backwall modifications were necessary to facilitate construction of the new approach slabs. Replacement slabs match existing cross slopes with an asphalt overlay.

Substructure Repairs & Modifications

- **Approach Span Modifications** – Removed existing rocker bearings and replaced with new isolation bearings with steel shim packs to account for the height differential.
- **Pivot Pier Modifications** – Replaced existing center pivot bearing, provide a new track with new balance wheels and racks .
- **Rest pier modifications-** Furnished and installed a new span lock assembly, new end lifts, and hurricane tie-downs.
  Provide new center rollers, an innovation which will replace the existing wedge supports without the need for actuation machinery.
- **Crack Injection and Spall Repair-** 600 LF of crack injection and 10 CF of spall repairs was accomplished on the pivot pier.

Approach Spans

The approach span superstructure consists of three span continuous units supported by isolation bearings mounted on the existing concrete piers. The replacement spans utilize welded plate girders, rolled steel floorbeams and rolled steel stringers similar to the existing approach framing (see Figure 2) except the stringers frame into the floorbeams in lieu of framing on top to prevent cracking of the stringer web flange area as exhibited on the old bridge.

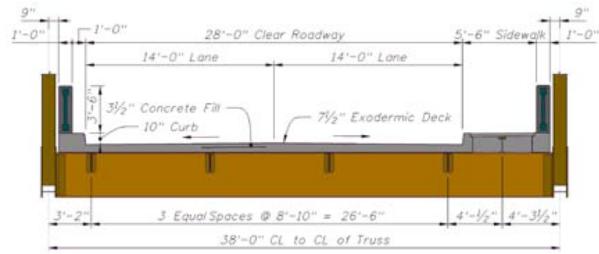


Approach Span Typical Section - Figure 2

The steel framing members are composite with an 8" reinforced concrete deck and Evazote roadway joints were used to prevent the deterioration of the stringers and floorbeams.

Swing Span

The swing span was analyzed per AASHTO requirements, as a 2-span continuous structure in the closed position, and a cantilevered structure for dead load in the open position to determine maximum stresses in addition to the erection stresses. A SAP 3D structural analysis model of the truss was created to assist in determining maximum loads for each component of the truss.

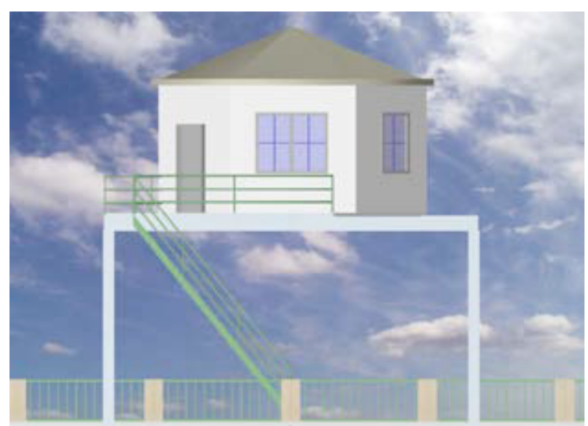


Swing Span Typical Section - Figure 3

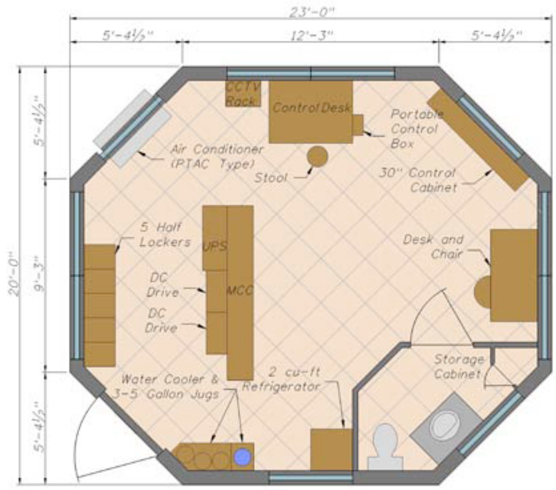
The swing span superstructure is a center-pivot modified Pratt through truss and matches the appearance of the original swing span, with the exception of the roadway widening and addition of the new sidewalk. The operator's house is located above the roadway, inside the truss sway bracing. The elevation of the bottom and top chords match the elevation of the existing chords to ensure the existing appearance and navigational clearance of the channel is maintained. New steel components match the existing as closely as practical utilizing current steel design and fabrication techniques. An exodermic deck system utilizing lightweight concrete and steel grating minimize span weight and economize the deck. Grinding of the swing span deck was completed to meet ridability requirements, and the deck was also grooved to improve roadway skid resistance. The sidewalk consists of aluminum grating panels and the steel railing system is similar in appearance to the existing bridge (see Figure 3).

Control House

The control house is located above the roadway, interior of the trusses inside the sway bracing. The control house is octagonal, similar to the existing, enlarged slightly to maximize view corridors and to meet necessary additional space requirements for the electrical equipment (as per NEC code) and the bathroom, which is now located inside the control house. A steel grating platform is located at the control house level which is accessed via a staircase from the roadway level. Figures 4a and 4b show the proposed elevation view along with a preliminary floor plan of the control house.



Control House Elevation - Figure 4a



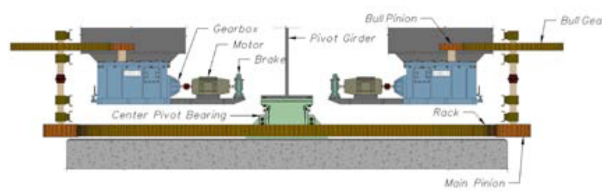
Control House Floorplan Layout - Figure 4b

Mechanical Systems

The mechanical systems of the swing span are categorized as follows: 1) span drive machinery, 2) span support machinery and 3) span lock machinery. All mechanical systems and components was designed, fabricated, and erected as per the requirements of AASHTO LRFD Movable Highway Bridge Design Specifications, 2nd Edition. PCL, H&H, and Steward Machine utilized our past experiences to assist in designing the preliminary details of the mechanical components.

1) Span Drive Machinery

Two independent drives, each capable of operating the swing span in the event of motor failure provides a redundant system (see Figure 5).
An extended input shaft at each right angle gearbox is accessible through the roadway deck. In the event of a power failure or loss of both motors, a capstand T-bar was provided which will engage the extended shafts for manual rotation of the span.



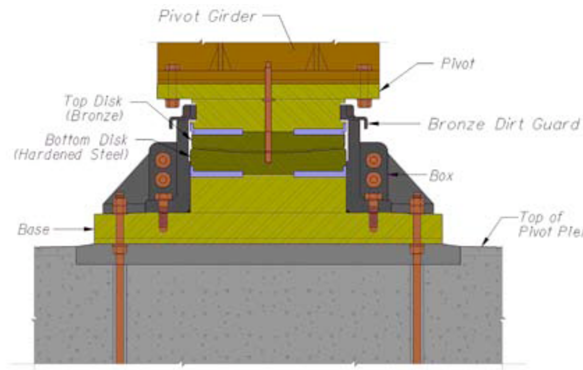
Span Drive Machinery - Figure 5

2) Span Support Machinery

The span support machinery consists of the following components: a) center pivot bearing, b) end eccentric lifters (in lieu of end wedges), c) center rollers (in place of center wedges), d) balance wheels.

a) Center Pivot Bearing

The center pivot assembly is shown in Figure 6. The pivot assembly was designed for lateral loads induced by the swing span during a seismic event (approximately 320 kips). Our swing span design provided a center pivot bearing capable of withstanding transverse seismic loads.



Center Pivot Bearing - Figure 6

b) End Lifters

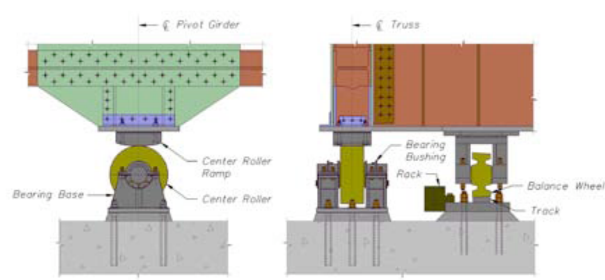
The end lifters, were used in lieu of an end wedge system to minimize weight on the span, and easier access for maintenance. The eccentric rollers driven by an electric motor and worm drive gear box are mounted to the end floorbeam for easy access. The eccentric rollers partially removes the dead load deflection out of the swing span in the open position in order to meet the approach roadway deck elevation when the span is in the closed position.

c) Center Rollers

Two center rollers are provided at the pivot pier (see Figure 8). The function of the center rollers is to resist vehicular live load and impact. The primary benefit of using center rollers in lieu of center wedges as per the Technical Specification is the elimination of actuation
machinery. This innovation has the advantage of no associated actuation machinery or electrical equipment required. The only routine maintenance associated with this type of live load support is lubrication of the bearings.

d) Balance Wheels

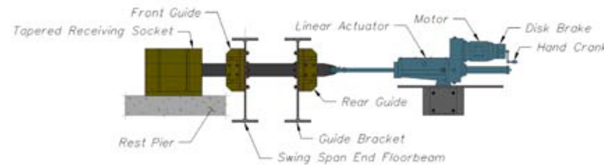
As per AASHTO specification, eight balance wheels were provided to counter overturning moments induced by wind loads during operation (see Figure 7). A combination of shims at the connection with the superstructure and wheel bearings provided the proper clearance at installation and allow for future adjustments.



Center Rollers & Balance Wheels - Figure 7

3) Span Lock Machinery

Figure 8 shows the proposed new span lock machinery. The function of the span lock machinery is to hold the swing span in the closed position and center the span when closing. Span lock machinery is at each end of the swing span.



Span Lock Machinery - Figure 8

Span Balance

Swing spans have an advantage over the other two major movable bridge types, bascule and vertical lift, in that they are structurally symmetrical about the axis of rotation. This symmetry provides balance without the use of a large counterweight as required by bascule or vertical lift bridges. Although swing spans are inherently balanced there can be some small imbalance both longitudinally and transversely caused by machinery, electrical equipment, roadway asymmetry, and specialized structural components. Minor balancing was required to compensate for longitudinal and transverse imbalance.

Fender System

In order for the new wider swing span to remain inside the protection of the new fender system in the open position, the fender system was slightly realigned to the west. The existing 94 foot clear navigable channel was be maintained by locating the new north rest pier fender piles adjacent, but outboard of the rest pier tremie.

Electrical/Control System

PCL, H&H, EHM and Edwards Electric have worked together to offer a state of the art electrical/ control system. Our collaborative design effort has created an economical, simple, and fully automated control system, which services the bridge with minimal maintenance. The information below provides a brief description of our proposed design. The replacement electrical system consists of multiple subsystems as follows: power distribution system, control system, traffic control system. All of these systems conform to the relevant standards including AASHTO, the National Electrical Code (NEC), NFPA 110 (Standard for Emergency and Standby Power Systems), NFPA 780 (Standard for the Installation of Lightning Protection Systems), and any State and Local requirements. Representatives of the maintaining agency receive manuals and training in the operation and maintenance of the new system.

Power Distribution System

The power distribution system includes a new service point and emergency generator, specialty submarine and flexible cable systems, a surge suppression system, a motor control center (MCC), two load-sharing 10hp Fencer AC drive motor systems, twelve ancillary drive systems (including gates, locks, lifters, and brakes), a lighting transformer, an non-interruptible power supply (UPS), and two lighting panels. The full submarine cable system provided distributes generator power to the Sullivan's Island end traffic control equipment, eliminating the need for a second back-up generator system to operate the span safely.

The motor control center (MCC) located in the control house is fed by the incoming service via submarine and flexible cables. Behind the MCC are two Fencor HMS-AC drive units sized to power the 10 hp AC drive motors (see operator’s house layout) which is set up to share the load under normal operation. In the event that one motor or drive fails, the operational drive and motor can rotate the span independently at reduced speed.

Control System

The proposed control system consists of a PLC, a main control desk with an Allen-Bradley PanelView 1250 Plus touch screen interface and keyed bypass switches, and relay backup control system, limit switches, position transmitter.

The touchscreen interface was programmed in such a way as to provide rich graphic feedback and control of the bridge systems according to SCDOT specifications.
An Allen-Bradley PLC connected to the PanelView 1250 Plus provides safety interlocking and automation functions. Limit switches, a position transmitter,
provides redundant feedback to the PLC for span operation.

Traffic Control System

The proposed vehicular and navigation traffic control systems is similar to the existing. The existing flashing warning lights on the approaches were reused.
New traffic signals and mast arm assemblies are provided and mounted to the approach spans. Warning gates stop oncoming traffic on both approaches
along with barrier gates to prevent vehicles from proceeding through the warning gates. Navigation lighting was provided according to US Coast Guard and
SCDOT Standards & Specifications.

Bridge Construction

Approach Spans

Method

Use of temporary support bents with trestle access was used to expedite removal and replacement of the approach spans during the 11-day bridge closure. New
approach spans was pre-fabricated directly west of the existing structure on temporary bents (see Figure 9). The north and south approach spans were constructed concurrently in order to meet the schedule constraints and closure requirements. During the 11-day closure, the existing approach spans was shifted east to temporary bents spaced identically to the existing concrete piers, and the new spans was shifted east onto the existing concrete piers.

Access Trestle /Temporary Bents

After the designed erosion control was in place, and the embankments cleared and grubbed, the east and west access trestle and temporary bents were installed simultaneously using top down construction methods. Installation commenced at the abutment and progressed toward the rest pier as each trestle section was completed. This cycle continued until the complete access trestle and all temporary approach bents were installed at each quadrant.

Structural Steel Erection

Prior to shipment, all components was shop primed and intermediate coated in accordance with the approved paint system submittal, in accordance with SCDOT Standard Specification, Section 710.

Construction Access Layout - Figure 9

Each three span continuous unit (2 each side) was erected independently. The north and south approaches were constructed simultaneously beginning at the abutment and progressing toward the rest piers. The main girders were erected on grillages supported on grillages on the temporary bent header beams. This enabled the load from the new approach spans to be transferred to rollers upon completion. A temporary jacking beam was connected to the underside of the main girders to facilitate jacking and load transfer upon completion of erection.

Deck and Sidewalk Construction

Mathews Bridge Deck Pour - Figure 10

Each three span continuous approach deck was placed in two separate nighttime pours. As each three span continuous approach was erected (east and west), the concrete deck crew commenced construction of the stay-in-place deck forms, followed by installation of rebar, and replacement of concrete. A Bidwell was used to ensure a superior finish that meets SCDOT ridability standards. The final deck surface was grooved. The sidewalk and curb was placed with a secondary pour after construction of the bridge deck.

Traffic Controls

Installation of the traffic control system began after the approach spans were constructed. This work included installation of conduit and wiring along the bridge approach spans, which connect to a junction box at each bridge abutment and a submarine terminal cabinet at each rest pier. Pre-installation of conduit and wiring allowed expeditious startup of the traffic control system during the critical closure period. This facilitated and ensured that the closure time was minimized.

Painting

Painting of structural steel was completed after the approach spans have been constructed. A QP2 certified subcontractor was used to final coat the structural steel in accordance with SCDOT Standard Specification 710.4.2. Access will be provided via a platform system mounted to the flanges of the steel. A closed containment system was designed and submitted for approval in accordance with SCDOT Standards. The painting operations for the approach spans and the swing span was performed prior to the closure with scheduled touch up afterwards. This minimized impacts once the new bridge was commissioned and open to traffic.

Span Replacement

The new and existing approach spans was shifted in four separate operations; the four existing continuous three span units and the four new continuous three span units were shifted in unison with each other.

Span Demolition

Upon completion of the approach span replacement, demolition began on the existing approach spans. After the bridge railing and traffic controls were removed, the concrete deck was sawcut into sections and removed by crane and hauled to a concrete recycling facility. Once the concrete deck was removed, the steel was cut, removed in manageable pieces, and shipped to a local steel recycling facility.

2.2.2 Swing Span Construction

Method

The new swing span, including the structural steel, control house, mechanical, electrical and exodermic deck grating was erected off-site at the Port of Charleston terminal. The close proximity of this terminal to the Ben Sawyer Bridge significantly reduces the risk associated with a long distance float-in. All swing span components was delivered to this location for erection, including 1) structural steel, 2) control house materials, 3) mechanical/electrical system, and 4) deck grating.

Shop Erection

Upon approval of shop drawings and submittals, the span was shop fabricated and assembled (see Figure 13). The structural steel was shop primed and intermediate coated prior to erection in accordance with the approved paint system. The span was supported by temporary bents, which was designed to ensure the structure is not overstressed during shop erection.

Steel Truss Shop Fabrication - Figure 13

Components were temporarily bolted to minimize alignment issues during final erection of the span. PCL and H&H coordinated with the Team QC Manager to make sure all parties understand the progress of the work and address any concerns throughout shop erection.

Onsite Pre-closure Work

Prior to the bridge closure, crews prepped the onsite mechanical and electrical components for replacement of the swing span. This work included 1) replacing a segment of the existing track/adding a new rack, and 2) installing the submarine cables.

Electric Work and Control Construction

Shop drawings, logic control programming and shop witness testing is a proven approach that minimizes on-site startup problems.. Integrated shop drawings and coordinated project planning facilitated the installation of the electric work and the controls on this project.
Electrical work including conduit, wiring, submarine cable installation, terminal cabinets, control house wiring and service wiring was completed in advance of the closure. Limit switch and gate simulations was performed prior to the float in, which ensured there are no start-up challenges during the 7-day closure. After installation of the new swing span, the span
mounted terminal cabinet was connected to the terminal cabinet on the center pivot pier with flexible cables, and startup was initiated immediately with minimal troubleshooting due to the pre-installation testing previously completed.

Float-in Procedure

An engineered floating scheme was used to transfer the swing span and ensure that all temporary supports are properly positioned. The PCL Project Manager coordinated all aspects of the swing span construction, the floating procedures and the transfer of the existing and new swing spans.

Following completion of erection of the swing span, the span and associated falsework was transferred to a 50’x180’ barge to float to site and place on temporary bents. The transfer was engineered to ensure the span is not overstressed during the move. To transfer the 700 Ton swing span to the barge, hydraulic pulling system and Hillman Rollers was utilized.

After the swing span has been transferred, and prior to the bridge closure, the span was floated to temporary bents adjacent to the swing span. The temporary bents was at the final span elevation. To lift the span from the barge to the header beam supports, a jacking system connected to the temporary bents was utilized.

A two-barge falsework system was utilized to remove the existing and place the new swing span. The shoring towers located on the barges was at an elevation that allows the system to float under the span at low tide and lift the span at high tide. Prior to the bridge closure, the new swing span was placed on the two-barge falsework system.

After the existing swing span was removed, crews began work on the rest pier and pivot pier modifications. Concrete modifications was required at the center pivot bearing as the new bearing is larger than the existing. Also, the of track/rack overlapped with the existing, and therefore could not be replaced until the closure, was installed with the span. The new span lock receivers was set on the rest piers, but not permanently mounted until the new swing span was set. This ensured proper alignment of the guide and receiver was achieved.

Upon completion of the required center pivot pier and rest pier modifications, the new span was installed. The installation process was completed in reverse of the removal process. Once the new span was set, the rack segments were aligned with the south new pinion and anchored, after which the span was manually rotated to the open position to allow marine traffic to pass through the channel.

After installation of the new swing span, the existing span was set on the temporary bents adjacent to the bridge. This process followed the same procedures utilized to set the new swing span. After the bridge closure, the existing span was transferred, demolished and recycled.

Construction Schedule

The award date for this project was October 1st, 2008. Our team carefully analyzed the constraints to construction activities based on the needs of the SCDOT. Based on the October 2008 contract award date, our proposed contract duration from award through final acceptance is 540 days (18 months). We sequenced the project to provide a flexible schedule that
meets the concerns of the traveling public. The detailed project schedule, was specifically tailored to accommodate the 10-day bridge closure.

- Phase I: Pre-Construction Activities ~ 5 Mo
- Phase II: Temporary Works Construction ~ 5 Mo
- Phase III: Approach Span/Swing Span Construction ~ 5 Mo
- Phase IV: 10-Day Bridge Closure
- Phase V: Demolition/Demobilization ~ 6 Mo

Phase I – Pre-Construction Activities commenced prior to the anticipated Notice to Proceed date of October 1, 2008 (pre-award on figure below). This allowed the project Team to accelerate the permitting, design, and procurement phase of the project. Phase I, which took approximately eight months (3 months of pre-award), and included intermittent design reviews between the project Team and SCDOT to ensure the design requirements are met. Public information meetings were also held during this phase to allow the public to address any concerns with the design and construction of the new superstructure.

Phase II – Temporary Works Construction began in March, 2009. This phase included the installation of the access trestle and temporary falsework. Crews worked on the east and west approaches simultaneously in order to accelerate the temporary works construction. This phase of construction took 5 months.

Phase III – Approach Span/Swing Span Construction took approximately 2 months after Phase II begins (May 2009). Separate crews constructed the east and west approach spans simultaneously while a third crew erected the swing span off site at the Port of Charleston. This phase included all preparation work required prior to the replacement of the superstructure and was completed by October, 2009.

Phase IV – 10 Day Closure occurred in February, 2009. Upon closure of the bridge, the superstructure replacement commenced with four separate operations: 1) north & south approach replacement, 2) swing span replacement, 3) approach slab replacement, 4) approach roadway widening. The project Team submitted a detailed 10 day, shift by shift breakdown of each construction activity to be completed during the closure.

Phase V – Demolition/Demobilization commenced after the replacement of the superstructure. The approach spans were demolished from the north temporary falsework and the swing span was demolished at Salmon's Dredging's facility. Upon completion of the superstructure demo, crews began removing the access trestle and temporary falsework. This work was completed by March of 2010, upon which the project Team has demobilize from site.

Community Relations Plan

The design and construction of the Ben Sawyer Bridge attracted great interest from the local residents of Mt. Pleasant and Sullivan's Island along with marine traffic utilizing the Intracoastal Waterway. The PCL Team recognized SCDOT's need to deliver a modern swing span bridge which maintained its historic integrity. Our team understood the value of experience and professionalism in public information and community outreach. For this reason, we teamed with Civic Communications, Inc, a local DBE public relations firm, to assist with community relations.

Commitment to the public is more than continuous communication; it begins with internal action and personal commitments at all levels. The Public Rela
tions Manager and Public Information Specialists was an active team member working not just to represent the design/build team, but to serve the SCDOT as a sincere partner for public relations. They attended regularly scheduled team and partnering meetings to receive project updates and to disseminate public interests and concerns with the Project Team.

Our Community Relations Plan committed to serving local residents, their related community organizations, and the public leaders in an effective manner and exemplified effective partnering between our team and the SCDOT. Public involvement and community relations services for the rehabilitation of the Ben Sawyer Bridge included information sharing and outreach through written materials as well as personal contacts. To ensure information was accurate and provided in a timely manner, the source of all information provided was background information and schedules provided by the design/build team members.

Beyond being available to address one-on-one outreach as necessitated by specific public concerns, information was shared with interested communities and their leaders on a daily basis with the creation of a project web page on the SCDOT website. On this site, community members received updates, follow project progress, receive traffic announcements, and be given the opportunity to provide feedback. In addition to the information above, our plan also included:

- A construction community forum to allow persons to ask questions regarding the construction process.

- Detour announcements for vehicular and marine traffic - sent as necessary at least 48 hours in advance.

• Leadership updates was provided as necessary, via paper and e-mail to area politicians, media, and interested community organizations.

• Flyers to address specific issues or concerns that may arise over the schedule of the project.

• Speakers and presentation materials were made available to the SCDOT, as needed for public presentations

Utility Coordination

Based on field observations and discussions with the local utility companies, the utility conflicts for this project were expected to be minimal. The only significant conflict with a public utility was with SCE&G’s electrical lines at the ends of the bridge. The first pole at each bridge end was relocated to facilitate construction access. These poles were located at the point where the electric lines split into a buried line under the channel and to an aerial line spanning above the channel. The relocation plan included moving this spliced transition to the adjacent pole east and west of the current location, which was outside of the anticipated construction limits.

Environmental/Permitting/Erosion Control

Our Team’s proposed construction method complied with the current permits based on the following requirements:

• The bridge was constructed on the existing alignment with no shift in right-of-way.

• No temporary or permanent fill was used in critical areas during construction activities.

• Access trestle mitigated construction impacts to critical areas by allowing daily tidal inundation in the construction area.

• As required, marsh areas impacted by the access trestle was returned to original contours, re-vegetated, and monitored after construction.

• Construction of the new swing span was completed off-site, thus reducing the impacts to wetland areas.

Any additional agency coordination and/or permit acquisition began immediately upon Notice-to-Proceed, in order for construction to commence on schedule. Our Team continuously coordinated with SCDOT, FHWA, permitting, and resource agencies throughout the duration of the project. To ensure construction proceeds in accordance with the approved permits, bi-weekly environmental commitment/compliance reviews were completed, which were in addition to the sediment and erosion control inspections. During these inspections, all permit conditions and NEPA commitments were reviewed. In addition, we propose intermittent interagency meetings to discuss schedules, questions, concerns, etc. with one or two of these meetings including field reviews with the regulatory agencies. These interagency meetings ensured the agencies have firsthand knowledge of the site and could respond to any public concerns or questions.

An erosion and sediment control plan was developed based on the bridge access plan. The erosion and sediment control plan was implemented Best Manage ment Practices as needed to minimize the impact to the environment. Based on the location of the project, the plan was submitted to the Town of Sullivan's Island, City of Isle of Palms, and the South Carolina Department of Health and Environmental Control Office of Coastal and Resource Management (OCRM) for approval. Throughout the project, PCL worked with local inspectors, OCRM, and the SCDOT to ensure the sediment and erosion control procedures were maintained ensuring limited impacts to environmentally sensitive areas.

2.7 Maintenance of Traffic

The bridge remained open to two lanes of vehicular traffic at all times during construction, with the exception of permitted nighttime lane closures, in accordance with the constraints set forth in the RFP, and the total bridge closure period.

Lane closure schedules was coordinated with public officials from Sullivan's Island to ensure minimal impact to emergency response. During the total bridge closure period, traffic was detoured to the Isle of Palms Connector. A significant public awareness campaign was conducted to ensure the public was made aware of the bridge closure. This campaign included coordination with public officials, contacting local media, and advanced notice signing along the project corridor and detour route. Particular attention was given to the public officials and citizens of Sullivan's Island, so that they could coordinate an alternate emergency response plan with neighboring Isle of Palms.

Marine Traffic Coordination

PCL has a great working relationship with the US Coast Guard (USCG) due to their extensive work experience along the Intracoastal Waterway. They considered the USCG part of the project Team and coordinated construction planning with them early in the project to ensure required closures of the navigable channel did not interrupt marine traffic. This coordination included continuously submitting construction sequence plans, mooring plans, and the project CPM schedule to the USCG for review and comment. Marine traffic was maintained throughout construction except for the minimal time required to complete construction activities which required occupation of the navigable channel. Our team contacted the USCG, it was determined that a navigation closure of 2-3 days could be coordinated with marine traffic. PCL submitted an application for a Marine Event Permit 120 days prior to the scheduled marine traffic interruptions. Following approval of the permit, the USCG issued a Notice to Mariners to alert the public of approved channel restrictions.-