**Editorial**

**THERE’S A LOT GOING ON!**

As reflected in the copy and photos in this edition of Segments, activity in the segmental bridge industry continues to grow dramatically! Two of the largest bridge projects undertaken to date in the U.S. – the San Francisco Oakland East Bay Skyway Bridge and the Woodrow Wilson Bridge Replacement are progressing well, each with applications of segmental concrete bridge construction technology that might not have been considered ten years ago. The Hoover Dam Bypass Bridge, scheduled for completion in June 2008, will incorporate the world’s fourth longest concrete arch span built in one of the most challenging and scenic locations in the world. These landmark projects are only the tip of the iceberg: the Benicia-Martinez Bridge in California may be the largest U.S. bridge constructed to date incorporating lightweight aggregates; New Jersey’s first precast segmental bridge (the Victory Bridge), with a record 440 ft. match-cast span was completed in record time – the 3,975 ft. northbound structure was erected in nine months; the Seattle Sound Transit Light Rail Project represents the first use of precast segmental construction in the State of Washington with 4.2 miles of elevated guideway and the bids were 10 percent under the Engineer’s estimate; the Susquehanna River Bridge, the first significant use of precast segmental construction in Pennsylvania is now being constructed for the Pennsylvania Turnpike Commission.

ASBI is working hard to keep pace with the industry. The new Construction Practices Handbook for Segmental Concrete Bridges will be the basis of seminars in Denver and Newark in August, co-sponsored by the U.S. Department of Transportation, Federal Highways Administration. The enclosed program for the 2005 ASBI convention November 6 – 8 in Washington, D.C. incorporates a world view of what is going on in the segmental industry. Come join us in the Nation’s Capitol!
2004 ASBI Convention
The 2004 ASBI Convention was held November 7-9 at the Grand Hyatt Tampa Bay. Attendance at the convention was 321. Five 2004 ASBI Leadership Awards were presented to the following individuals at the convention awards luncheon:

R. CRAIG FINLEY, JR., Finley Engineering Group, Inc.
For Outstanding Contributions to the Segmental Concrete Bridge Industry as ASBI President for 2003-2004

JEAN-PHILIPPE FUZIER, Freyssinet International
For Outstanding Career Contributions to Construction Technology for Segmental and Cable-Stayed Concrete Bridges

DAVID GOODYEAR, T.Y. Lin International
For Outstanding Contributions in Design of the First Cast-in-Place Segmental Concrete Arch Bridges in the United States

WILLIAM N. NICKAS, Florida Department of Transportation
For Outstanding National Leadership In Advancement of Design and Construction Technology for Segmental Concrete Bridges

ANDREA SCHOKKER, Penn State University
For Major Contributions to the Development and Implementation of Improved Grouting Technology for Segmental Concrete Bridges

Award recipients are shown in Fig. 1 with ASBI President for 2005-2006 Paul Liles. The Awards Luncheon presentation Fig. 2 was given by Michele Virlogeux, Consulting Engineer and Designer, Bonnelles, France on “Extremely Slender Concrete Cable-Stayed Bridges”.

The 2004 convention bridge tour to the Lee Roy Selmon Crosstown Expressway was arranged by representatives of Figg Engineering Group and PCL Civil Constructors, Inc.

2005 ASBI Bridge Award of Excellence Competition
The Call for Entries for the 2005 ASBI Bridge Award of Excellence Competition is posted on the ASBI website www.asbi-assoc.org under the “2005 Call for Entries” icon. The 2005 Competition will again be conducted in cooperation with the Concrete Products Magazine. Concrete segmental or cable-stayed bridges which are opened to the public or dedicated between January 1, 2003 and August 1, 2005, and which are located with the 50 United States are eligible for the 2005 program.

Bridge Categories
Bridge entries shall fall under one of the following categories:

- Long Span and Cable-Stayed Bridges (spans of 400’ or greater)
- Urban Bridges (within city limits)
- Mass Transit or Rail Bridges
- Bridges over Water
- Rural Bridges and Viaducts

The Awards Jury will not be required to select a winner from each bridge category, and may, if warranted, select two bridges from the same category, for an ASBI Bridge Award of Excellence.

Who May Enter
The Bridge Owner, the Engineer of Record, the Contractor, or any

New ASBI Member
We are very pleased to welcome Atkinson Construction as a new ASBI Organizational Member. The addresses and contact persons are as follows:

ATKINSON CONSTRUCTION
11001 W. 120th Avenue, Suite 310
Broomfield, CO 80021
(303) 410-2540
FAX: (303) 410-9705
website: www.atkn.com
e-mail: scott.lynn@atkn.com
Scott S. Lynn, President and CEO
ASBI Organizational (Corporate) Member may submit award entries. All entries must have the owner’s written permission to submit the entry. An ASBI Organizational Member that participated in the project in some way must be listed in the project submission.

Deadline
The ASBI office must receive all entries by August 1, 2005

Entry Form
A PDF file is located on the ASBI website at www.asbi-assoc.org, select the “2005 Call for Entries” icon.

2005 – 2006 ASBI Grouting Certification Training
The 2005 ASBI Grouting Certification Training was held April 4 – 5 at the J.J. Pickle Research Campus at the University of Texas at Austin. The training was co-sponsored by the Texas DOT. A view of the large specimen grouting demonstrations is presented in Fig. 3. Fig. 4 shows bleed water in the inclined tendon test with water-cement grout (left) and no bleed water in the specimen on the right using prepackaged grout. The training session exam is shown in Fig. 5. The 2005 training session was attended by 155 engineers and construction personnel. A total of 892 engineers and construction personnel have participated in this training over the past 5 years.

The 2006 ASBI Grouting Certification Training will again be held at the J.J. Pickle Research Campus April 24 – 25.

Construction Practices Handbook for Segmental Concrete Bridges – Construction Practices Seminars
The “Construction Practices Handbook for Segmental Concrete Bridges” developed by the ASBI Construction Practices Committee was published in April. Construction practices Seminars based on the handbook will be held in Denver, Colorado on August 15 – 16, 2005 and Newark, New Jersey on August 29-20, 2005. The seminars are co-sponsored by the U.S. Department of Transportation - Federal Highway Administration and ASBI.

Announcements of the availability of the Construction Practices Handbook and details of the Construction Practices Seminars were distributed to the ASBI Newsletter list in April. Additional copies are available on line at www.asbi-assoc.org or on request to the ASBI office asbi@earthlink.net.

2005 ASBI Convention
A copy of the program and registration information is enclosed for the 2005 ASBI Convention to be held November 7-8 at the Hyatt Regency on Capitol Hill in Washington, D.C. The convention will feature a
water and land tour of the Woodrow Wilson Bridge replacement project as well as presentation of the 2005 Bridge Awards of Excellence. We look forward to seeing many of you at the convention.

Craig Finley Opens Finley Engineering Group

R. Craig Finley (Fig. 7), a prominent figure in the bridge engineering and construction industry for more than two decades, announces the creation of Finley Engineering Group (FEG), a new bridge engineering and consulting company dedicated to providing high-level expertise to all aspects and phases of major bridge construction projects throughout the United States.

Finley was previously with Parsons Corporation, the sixth-largest design company in the U.S., where he served as senior vice president in charge of the Bridge & Tunnel Division. He joined Parsons in 2001 when it acquired Finley McNary Engineering, Inc., the company he co-founded in 1989.

“I learned a lot at Parsons,” says Finley. “I met some great people and worked on some very good projects. But with my own smaller company, I’m able to lend my experience and expertise more directly to bridge projects. That’s where my heart is.”

Finley says FEG’s niche is providing a link between engineering and construction on major bridge projects. “I see the company as an engineering ‘special forces’ group that can work either side of the fence,” he says.

“Our strength is that we understand both sides: we don’t see a line between design and construction.”

Sidney Lanier Bridge Receives Honor Award

The Consulting Engineers and Land Surveyors of California (CELSOC) selected the Sidney Lanier Bridge to receive an Honor Award for their 2005 Engineering Excellence Awards competition. Every year CELSOC reviews many projects to select those that deserve special recognition for their complexity, technical value to the engineering profession and contribution to the community.

The Sidney Lanier bridge was built by a joint venture of Condotte America, Inc. and GLF Corporation. The project will now go on to compete at the national level in the ACEC Engineering Excellence Awards Competition.

The new Sidney Lanier Bridge (Fig. 6) replaces a 43-year-old lift-span bridge that was deemed a navigational hazard by the U.S. Coast Guard. The new bridge’s key features include two traffic lanes in each direction, a main span of 1,250 feet, 185-foot vertical clearance and a 400-foot wide navigational channel – which provide smoother traveling, time savings and increased safety. Other community benefits...
include projected increased revenues of $464 million annually to the Port of Brunswick along with the creation of over 1,100 new jobs by 2010.

The new landmark structure is the tallest and largest bridge in the state of Georgia. Built from water level, the design and construction team was challenged to use innovative techniques to construct the islands, towers, support trusses and bridge deck. Additional complexities included seismic, aerodynamic, and environmental considerations.

**Sixth International Bridge Engineering Conference**

Reliability, Security, and Sustainability in Bridge Engineering is the theme for the Sixth International Bridge Engineering Conference (6th IBEC), to be held at The Westin Copley Place Boston in Boston, Massachusetts, July 17-20, 2005. This conference, which is being organized by the Transportation Research Board (TRB) and sponsored by the Federal Highway Administration (FHWA), will bring attendees up to date on the latest bridge research results and other practical technical information for planning, design, construction, maintenance, repair, rehabilitation, replacement, management, and security and safety of highway, railroad, and pedestrian bridges.

This conference provides you the opportunity to learn about the latest bridge technology advancements from around the world and to network with the individuals most knowledgeable about these technologies! The preliminary program includes topics related to LRFD research and practice, prefabricated bridges and accelerated construction, innovative materials and methods, durability, health monitoring, seismic design, extreme events, aesthetics, and more. For additional details, including online registration, please refer to the conference home page at: [http://www.trb.org/Conferences/IBEC](http://www.trb.org/Conferences/IBEC).

**Temporary Tendon Protection Against Corrosion**

For many years, temporary tendon corrosion protection when tendons were ungrouted for extended time periods due to cold weather was provided by Vapor Phase Inhibiting Powder (VPI Powder) blown into ducts by compressed air. This practice was abandoned about 8 years ago due to possible health hazards related to use of the powder. A non-toxic (no health hazard) bio-degradable VpCI Powder is now available from Cortec Corporation for temporary tendon corrosion protection. This powder is considered easier to apply than the oils now in use, and it has only a small effect on bond between strand and concrete. Information on VpCI Powder may be obtained as follows:

**Cortec Corporation**

4119 White Bear Parkway, St. Paul, MN 55110 USA
Phone (651) 429-1100, fax (651) 429-1122
Toll Free (800) 4-Cortec
E-mail info@cortecvci.com
www.CortecVpCI.com

**Publication on the Works of Eugene Freyssinet**

“Eugene Freyssinet, A Revolution in the Art of Construction” was published in 2004 by Association Eugene Freyssinet. The hard-bound publication includes 160 pages and 160 illustrations of the works of Eugene Freyssinet as well as works of his successors. The book may be obtained for 45 Euros plus mailing charges from Presses de l’Ecole nationale des ponts et chaussées – 28, rue des Saints-Pères 75343 Paris cedex 7
Tél 01 44 58 27 40
Fax 01 44 58 27 44.

Jean Muller (1925 - 2005)

Jean Muller was a bridge designer and inventor renowned for his designs of unique and attractive bridges throughout the world. He has been recognized by numerous professional organizations for his outstanding achievements, innovations, and contributions in the field of bridge engineering.

After receiving his Master’s Degree in Civil Engineering from the “Ecole Centrale des Arts et Manufactures” in Paris in 1947, Jean Muller started his professional career under the direct supervision of Eugene Freyssinet, the inventor of modern prestressed concrete. He worked on several large projects including three prestressed concrete arch bridges in Caracas, Venezuela.

From 1951 to 1955 he was Chief Engineer for the Freyssinet Company in New York. His work included engineering assignments associated with the development of prestressed concrete in the United States, such as precast concrete floating pier construction for the U.S. Navy, and numerous bridges and buildings. During this period he designed the first segmental beam bridge in New York State.

From 1955 to 1975 he worked as Technical Director for the Campenon Bernard construction company in Paris. He worked on various large prestressed concrete projects including dams, nuclear...
reactor pressure and containment vessels, and long span bridges. He developed the original concept of precast segmental construction using glued match-marking joints used for the Choisy Le Roy Bridge in 1962. In 1979, he designed the Brotonne Bridge over the Seine River in Normandy. This was the first concrete cable-stayed bridge with a single plane of stays, and the main span of 1,050 ft was the longest in the world for a concrete box girder.

From 1978 to 1988 he was Chairman of the Board and Technical Director of Figg and Muller Engineers, in Tallahassee, Florida. He supervised the design of a number of innovative structures produced by the firm. The Long Key Bridge and Seven Mile Bridge in the Florida Keys were the first precast segmental bridges erected by the span-by-span erection method with external tendons, the Sunshine Skyway Bridge 1,200 ft cable-stayed span was the longest in America for a concrete bridge at the time of construction.

From 1986 to 1999 he was Technical Director of Jean Muller International with offices in the USA, France, and Thailand. Some of the most notable bridges designed and built during this period include the H3 Windward Viaduct in Hawaii; the Second Stage Expressway and Bang Na Expressway in Bangkok, Thailand; the East Fork White River Bridge in Columbus, Ohio; and the Confederation Bridge in Canada. He also developed new designs for steel – concrete composite structures in Europe. After 1999, he worked as a special consultant for various projects in Europe and the USA.

Robert F. Wellner, 1928 - 2005

A well-known and highly regarded engineer in the bridge industry, Bob Wellner, passed away suddenly on February 9, 2005. Bob was a Senior Vice President at FIGG Engineering Group. Born in St. Clair, Pennsylvania on July 28, 1928, he was a graduate of St. Clair High School and the University of South Carolina with a B.S. in Civil Engineering.

Between 1954 and 1983, Bob was employed at Bethlehem Steel and retired as the Manager of Construction Marketing. After retiring, Bob began a second career by joining FIGG where he was involved in such major bridges as the Clark Bridge over the Mississippi River at Alton, Illinois; the Chesapeake & Delaware Canal Bridge near St. Georges, Delaware; Tennessee; Sagadahoc Bridge connecting Bath & Woolwich, Maine; and bridges for the Pennsylvania Turnpike Commission over the Susquehanna River and the Allegheny River.

Bob was a member of the American Society of Civil Engineers (ASCE) and served as President of the Lehigh Valley Section in 1972. As a member of the American Road & Transportation Builders Association (ARTBA), he served on the Board of Directors in the Planning & Design Division till 2004. In 2002 he received Honorary Lifetime Membership in the American Segmental Bridge Institute (ASBI).

Gerald (Jerry) L. Engelhart, 1926 - 2004

Gerald (Jerry) L. Engelhart, aged 78, died on Wednesday, August 18, 2004. Mr. Engelhart was a native of Anna-Jonesboro, Illinois and a longtime resident of Baton Rouge, LA. He was nationally known as an expert in deep water caisson construction for major river bridges. His career started in 1949 when he graduated with a BS in Civil Engineering from the University of Illinois. Upon graduating second in his class, he received the I.O. Baker Award from the University.

Over the next 50 years he participated in the construction of major bridges all across the country from the Theodore Roosevelt Bridge in Washington, DC to the proposed Tacoma Narrows Bridge in Washington State. However the bulk of his career was spent on the Mississippi River where was involved in the construction of 10 bridge crossings from Cape Girardeau, MO to New Orleans, LA. Jerry served on the ASBI Board of Directors and the Executive Committee. He was an Honorary Member of ASBI.
San Francisco-Oakland Bay Bridge Skyway

Construction on the Skyway section of the new San Francisco Oakland Bay Bridge is 65% complete and is scheduled for completion in January of 2007. The contract includes the construction of twin 26-meter wide (85.3 feet) precast segmental bridges across the Oakland Bay at a total length of 4200 meters (13,776 feet). Onsite, foundation work is nearing completion while pier and pier table operations are rapidly progressing. Segment erection operations commenced this past summer and about half of the segments for the eastbound bridge are in place.

Precast operations in the Stockton yard (Fig. 8) are continuing production in all four precast beds. The 2 critical longline beds are each producing a segment every three days. To date 60% of the 452 segments are cast. Segment production is scheduled to be completed in July 2006.

Pier construction is complete at 21 of the 28 pier locations (Fig. 9). Pier work is scheduled to be completed this October.

Currently, segment erection work is complete at 7 of the 28 cantilevers with 125 of 452 segments in place. Segments are erected in cantilever with 2 pair of Self Launching Erection Devices (SLED’s) (Fig. 10). Segment weight ranges from 500 to 800 tons. Segments are being loaded on a barge at the Stockton precast yard and ferried 70 miles to the jobsite. The last segment is scheduled to be erected in July of 2006.

Project Major Participants:
Owner: California Department of Transportation
Designer: T.Y. Lin International
Contractor: Kiewit/Flatiron/Manson, a Joint Venture
Construction Engineer: Parsons
Post-Tensioning & Segment Erection Equipment Supplier: SDI
Casting Bed Supplier: DEAL
Benicia-Martinez Bridge, California

Superstructure construction is well on its way on San Francisco’s new Benicia-Martinez Bridge across the Carquinez Strait (Figs. 11 and 12). The bridge superstructure is being constructed as a cast-in-place segmental, with a typical span length of 160 meters. The 82 foot wide deck will span a total length of 8,800 feet.

Project Status as of April 1, 2005 was as follows:

- Project is 60% complete.
- The foundation work is nearing completion with all the CIDH shafts cast.
- Column work is complete at 8 of 16 locations.
- 3 of 11 Pier Tables are complete.
- 3 of 4 traveler pairs are erected and casting segments.
- 23 of 335 segments have been cast.

The project is on schedule to be completed in September 2007.

Project Major Participants:
Owner: California Department of Transportation
Designer: T.Y. Lin International

Contractor: Kiewit
Post-tensioning Supplier: SDI
Traveler Supplier: VSL

Wakota Bridge Update, Minnesota

Construction of the Wakota Bridge continued through the Minnesota winter with completion of the westbound Interstate 494 bridge scheduled for November of 2005. The Wakota Bridge spans the Mississippi River between South St. Paul and Newport, Minnesota. The project consists of two parallel segmental box girder bridges each 1,879’ long and up to 98’ in width. The main spans are 466’ long and the box girder is a twin cell configuration (Fig. 13).

The contractor, Lunda Construction Company, enclosed the form travelers and heated the segments through the curing phase to maintain the concrete surface temperatures at contract requirements (Fig. 14).

Embedded thermal sensors in the thinnest section of the top flange monitor concrete temperatures, which are used to estimate compressive strength using the maturity method. This data, combined with field cured cylinder compressive strength, is used to confirm the specified strength for post-tensioning. Corrosion inhibitor is used on the tendons placed during the winter to allow stressing to take place while permitting the grouting to take place in the spring during warmer weather. The cast in place segmental box girder construction
continue through the winter with one of the three segmental cantilever units now complete and the remaining two anticipated for completion in spring of 2005. Construction progressed at an average rate of 7 – 16.4-foot long segments per month during a winter with above average temperatures and below average snowfall, but several days with high temperatures near 0° Fahrenheit temporarily halted operations. After completion of the cantilever units, the Span 1 cast in place unit, and closure of Spans 2, 3, and 4, a 2” low slump concrete overlay will be added to the deck surface. Removal of the in-place tied arch bridge and construction of the new eastbound bridge will begin in December of 2005. When complete, the twin bridges will relieve a chronic congestion problem for Twin Cities commuters by increasing the roadway width at the bridge from two lanes to five lanes in each direction.

**Victory Bridge - New Jersey**

The final precast concrete segment in New Jersey Department of Transportation’s new Victory Bridge, designed by FIGG, was erected on Monday, April 11, 2005 (Fig. 15), bringing total erection time for the second of 3,971’ twin bridges to nine months. The southbound bridge opened to traffic in June, 2004, just 15 months after George Harms Construction Company received notice to proceed. After the first half of the bridge opened, two-way traffic was shifted onto the bridge and the existing bridge demolished so that the northbound portion of the bridge could be constructed in the same alignment. Traffic on Route 35 will move more freely by eliminating the swing span bridge that opened an average of 1,100 times a year. The new bridge features a United States record for the 440’ fully match cast, precast concrete segmental main span. The long main span was desirable in order to remove a pier from the middle of the busy Raritan River shipping channel. Both the 440’ main span and the side spans of 330’ were erected in balanced cantilever, while the 20 approach spans on each half of the bridge were erected span-by-span. Main span pier segments are 21’ deep and weigh 128 tons. By casting them in halves, the same erection equipment could be used for both pier and typical segments.

New Jersey’s first precast concrete segmental bridge utilizes many time and cost saving features, including precast piers, as tall as 100’, that could be erected in a single day, and the use of an integral wearing surface.

The new bridge (Fig. 16) is rededicated to New Jersey residents who served in World War I and has four memorial obelisks at the abutments, creating gateways at the entrances to the bridge. Two of the obelisks carry refurbished bronze plaques from the original bridge, while the other two showcase newly created bronze plaques for the new Victory Bridge. Aesthetic highway light fixtures are supported by concrete pilasters, which also carry bronze plaques designed to honor various military groups that served in the first World War, creating a linear library on the pedestrian walkway.

The bridge will be honored with the 2005 Grand Award, presented by the New Jersey Concrete & Aggregate Association and the New Jersey Chapter of the American Concrete Institute on May 12. It is anticipated that traffic will be on the bridge by summer 2005.

**Four Bears Bridge - North Dakota**

After the planned winter shut down, Fru-Con Construction Corporation resumed segment erection operations on March 28, 2005 of the Four Bears Bridge in North Dakota. Work on the water increased as the tugboats broke...
up on the ice on Lake Sakakawea. This 4,500’ precast concrete segmental bridge on Fort Berthold Indian Reservation was designed by FIGG for the North Dakota Department of Transportation. Segment casting had continued through the winter and, with the return of warmer weather, has increased to an average of five segments per week.

Precasting is on schedule for completion in May of 2005. The bridge’s 316’ typical spans are being erected in balanced cantilever (Figs. 17 and 18), with work currently on pier 7. It is anticipated that the new bridge will open to traffic late in fall of 2005, with the demolition of the existing bridge occurring in 2006 prior to the “Reunion at the Home of Sakakawea” national event in August, a part of the bicentennial commemoration of the Lewis & Clark exploration.

**Penobscot River Cable-Stayed Crossing - Maine**

In early April, Cianbro/Reed & Reed construction crews have completed the third and final lifts for each of the pylon diaphragms at the Penobscot River Crossing near Bucksport, Maine (Figs. 19 and 20). The main span and back span extensions are under construction to build the 1160’ concrete cable-stayed main span. This unique bridge was designed by FIGG for the Maine Department of Transportation.

The twin legs of the western pylon, pictured here, will house the elevator which will provide public access to the glass observatory on top of the pylon. Anticipated completion is fall of 2006.

**Hoover Dam Bypass Bids, Boulder City, Nevada**

Bids received for construction of the Hoover Dam Bypass Bridge on Sept 16, 2004 were as follows:
At 1090 ft. the concrete arch span (Fig. 21) will be 4th longest concrete arch in the world when completed. The present segmental columns range up to nearly 300 ft. in height. The bridge deck is about 880 ft. above the Colorado River. The bridge is scheduled for completion in June 2008. A joint bridge design group of TY Lin International and HDR was led by the Olympia office of TY Lin International for development of the bridge type study and final bridge design.

**SR 125 Otay River Bridge, California**

The Otay River Bridge (Fig. 22) is a precast segmental balanced cantilever structure currently under construction in San Diego County, California. The bridge consists of twin box girders, each with a total length of 1012m (3320’). Typical spans are 90.5m (297’), and consist of 28 precast segments. The pier tables and columns are cast in place, with columns reaching as high as 50m (164’). The bridge is located in a moderate to high seismic zone, and is designed according to Caltrans seismic standards.

The bridge is part of the SR125 South toll road, which is the first privately financed toll road in San Diego County, and is being built as a design build project. Design work on the bridge is largely complete, and construction has begun. The majority of the foundations are complete (Fig. 23), with 102 of the 124 six-foot diameter CIDH piles in place. Column construction has begun, and segment precasting is scheduled to begin in May.

The precast segments will be erected with an overhead gantry. The gantry is capable of sliding from one alignment to the other in order to erect both alignments on the same pass, reducing the number of launching stages required.

*Project Owner:* California Transportation Ventures

*Contractor:* Otay River Constructors, a joint venture of Washington Group International and Fluor.

*Gantry Supplier:* Rizzani de Eccher

*Designers:* International Bridge Technologies, Inc.

Washington Infrastructure Services International
Seattle Sound Transit Light Rail Project, Tukwila Elevated Segment

The final major contract of the Seattle Sound Transit Light Rail Project was recently awarded to PCL Civil Constructors, Inc. with a bid that came in 10% under the Engineer’s Estimate. The contract consists of 4.95 miles of twin track light rail line, including 4.2 miles of elevated precast segmental guideway.

The first precast segmental project for the state of Washington, the majority of the elevated line consists of simple spans with a typical length of 120’ and will be erected using span-by-span construction. The 7’ deep box-girder utilized a new cross-sectional shape with a minimized bottom slab and tendons that are both external and internal to the section. To enhance the visual appearance, the pier segment diaphragm shape was incorporated with the columns to create continuity between the two elements (Fig. 24).

In addition, several special structures were needed including four longspans with main spans ranging from 216’ to a maximum length of 350’ for the Duwamish River crossing. All four longspans used a standardized box-girder shape and bottom soffit profile to economize construction and casting cells. These structures will be built using balanced cantilever construction with precast segments.

Another feature of the project was its design for large seismic loading with a stiff ground coefficient of 0.77g. The project criteria also included evaluation of a twin level earthquake to ensure both that the train will remain in service after a lower level earthquake event, and resist the larger event without collapse.

Construction of the project is anticipated to be complete by early 2008.

Participants:
Owner: Sound Transit
Prime Consultant: Hatch-Mott MacDonald
Elevated Structure Lead Consultant: International Bridge Technologies, Inc.
Prime Contractor: PCL Civil Constructors, Inc.
Contractor Engineer: T.Y. Lin/DGES
Truss Supplier: Rizzani/DEAL

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Pennsylvania Turnpike Gets First Concrete Segmental Bridge

The Pennsylvania Turnpike Commission received bids for replacement of the Susquehanna River Bridge in Harrisburg, Pennsylvania on October 6, 2004. The new Susquehanna River Bridge, designed by FIGG, will be the first precast concrete segmental vehicular bridge in the Commonwealth. The bids for the bridge and related roadway work were as follows:

Joint venture of Edward Kreamer & Sons and G.A. & F.C. Wagman $82,423,426
AMEC $89,618,159
Trumbull $98,917,522
Flatiron $99,999,584
Granite $111,388,722

The bridge is comprised of twin 5,910' long by 57' wide concrete box girder structures with typical spans of 150' (Fig. 25). Each will carry three lanes of traffic on a new alignment that is offset north of the existing bridge. The new bridge will span over a number of railway lines and local state roads. Box pier designs include precast and cast-in-place options.

Esplanade Riel Cable-Stayed Pedestrian Bridge, Winnipeg

The Esplanade Riel is a slender, cable-stayed concrete pedestrian bridge that crosses the Red River between The Forks and St. Boniface in Winnipeg. It is paired with, and parallel to, the newly constructed Provencher Boulevard road bridge. The bridge superstructure (Fig. 26) consists of two unequal spans and a semi-circular plaza at the base of a single pylon. The pylon is a steel-clad, concrete tower that supports both spans and a plaza at its base. The semi-circular plaza cantilevers off the southern edge of the deck and will be utilized for an enclosed restaurant.

The concrete deck was cast in place, on false work on the shorter west back span, and on a lightweight advancing form-traveler, on the longer main east span. The entire structure was post-tensioned throughout. Dywidag Systems International (DSI) supplied and installed cable-stays, and post-tensioning for the project. DSI also provided the special form traveler for construction of the east span.

The bridge, provides Winnipeg with a spectacular new skyline and a unique “meeting-place” for the communities on each side of the river.
Virginia Approach Spans
Woodrow Wilson Bridge Project

Virginia Approach Constructors (VAC), a joint venture of Granite Construction and Corman Construction companies, are building the Virginia Approach Spans of the new Woodrow Wilson Bridge. This project includes precasting and erecting 430 pier segments plus erecting 96 precast tie-beams to complete 24 “V-Piers” for the new Outer and Inner Loop bridges. Precasting the pier segments is performed at the project site with two long-line casting beds (one of the casting beds is shown in Fig. 27). Erection is performed using conventional crawler cranes equipped with special rigging for hoisting and rotating the segments (Figs. 28 and 29). Each V-Pier arm consists of three precast “knuckle” segments, four “flared” segments, and up to an additional six “typical” segments. Due to the varying geometry of the V-Pier arms, no two segments within a pier arm are alike. To date,
VAC has completed precasting and erection of all Outer Loop segments and tie-beams and, is preparing to resume precast operations for the Inner Loop segments. A completed pier with tie-beams is place is shown in Fig. 30.

Condition Assessment of Tendon Anchorages from the I-90/4th Avenue On-Ramp Bridge

FHWA/WSDOT/WSU TRAC Project
Transportation Center (TRAC)
Department of Civil & Environmental Engineering
Washington State University (WSU)

WSU Investigator: David G. Pollock, Associate Professor
WSDOT Project Manager: Bijan Khaleghi, Concrete Specialist

The east-bound I-90/4th Avenue on-ramp bridge in Seattle, WA was constructed in 1991. In 2003, as part of the Washington State Department of Transportation (WSDOT) Intermodal Improvement Project, a portion of the I-90/4th Avenue on-ramp bridge was demolished and replaced with a re-routed entry ramp for east-bound traffic entering Interstate 90 (I-90). The bridge demolition provided a unique opportunity to assess the condition of post-tensioned tendon anchorages from the prestressed concrete box girders following twelve years of service. The objective of this study was to inspect tendon anchorage specimens from the demolition of the I-90/4th Avenue on-ramp bridge for the presence of corrosion or voids due to poor grout consolidation.

Demolition of the I-90/4th Avenue on-ramp bridge was conducted in two phases during 2003. The first demolition phase occurred during late May and early June, and involved demolition of the highest 2.5 spans of the bridge (from the hinge at Pier 7 to the negative-moment tendon anchorages near Pier 4). Demolition of the remaining 3.5 spans occurred in November 2003, following construction of a new re-routed on-ramp bridge.

Fourteen longitudinal tendon anchorages were visually inspected for evidence of tendon corrosion or voids associated with poor grout consolidation. Thirteen of the anchorages were sawn transversely using a bandsaw to reveal the internal condition of the grout and tendons. No evidence of corrosion or voids was found in thirteen of the fourteen anchorages. A typical tendon anchorage with no corrosion or voids is shown in Fig. 31. It should be noted that many of the tendon anchorages included a large void located at the grout port (as shown in Fig. 32), and...
small voids (typically 0.1 in. thick) were occasionally observed adjacent to the inner surface of the anchorage housing. However, there was no evidence of corrosion at the grout ports or in the small voids where a proper grout mix was used.

Limited corrosion associated with a void in the grout was observed in one tendon anchorage (Tendon Anchorage #8, Fig. 33). The poor grout consolidation and consequent void corrosion appear to have been caused by penetration of concrete into the anchorage at the duct-to-anchorage joint during the construction process. In particular, it is apparent that a standard concrete mix including coarse aggregate (gravel) partially filled the tendon anchorage. This resulted in poor consolidation in the small space between the anchorage housing and adjacent tendons, which led to corrosion of the inner surface of the housing. In order to assess the extent of the void and corrosion, both pieces (from the original transverse cut) of Tendon Anchorage #8 were cut open (longitudinally) with a bandsaw through the largest portion of the void (Fig. 34). The maximum thickness of the void was slightly over 0.5 in., and the void extended approximately 1.5 in. along the anchorage housing length and approximately 2 in. around the inner circumference of the housing.

Based on the results of this study of a 12 year old prestressed concrete box girder bridge in Seattle, WA, it appears that the use of appropriate grout mixes and proper grouting procedures provide adequate grout consolidation within tendon anchorages. Properly consolidated grout appears to adequately protect high strength steel prestressing tendons from corrosion. It is also apparent that improper grout mixes and/or grouting procedures can lead to poorly consolidated grout, voids where moisture can collect, and subsequent corrosion of steel components of the prestressing system. In order to prevent failures associated with corrosion in prestressed concrete bridges, it is critical to maintain proper quality control of grouting procedures during the construction process.

Figure 33 – A sizable void and associated corrosion inside Tendon Anchorage #8.

Figure 34 – Improper grout and sizable void at duct end of Tendon Anchorage #8.