Ben C. Gerwick, Inc.

NEWS

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Cover Picture
IHNC Lock replacement

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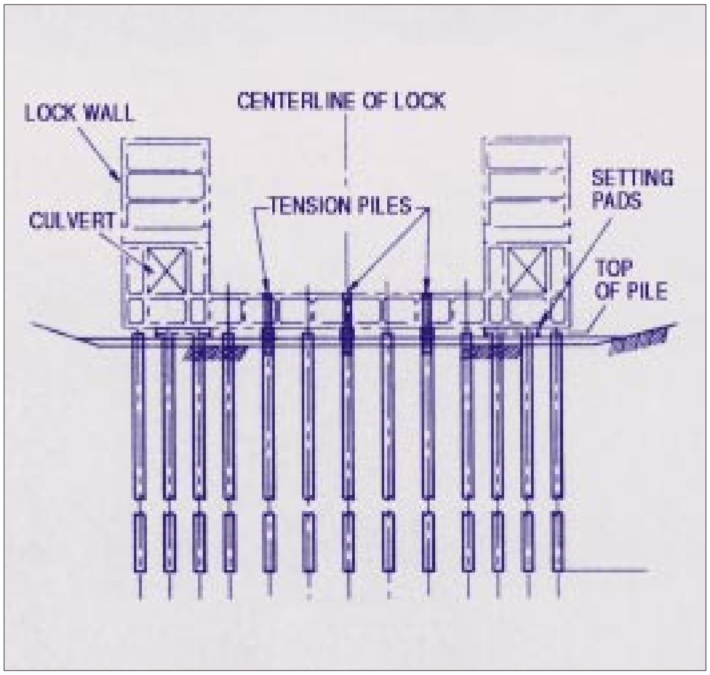

Cross-sectional view of the lock.

The United States Army Corps of Engineers-New Orleans District has recently completed a feasibility study for the innovative construction of a concrete float-in lock for the Inner Harbor Navigation Canal (IHNC) Lock replacement project. The replacement lock will be located about 0.5 miles north of the existing lock on the canal. The innovative float-in concept was selected in order to address the space restrictions imposed by construction within an urban site of historic buildings, while permitting continuous navigation within the canal, and to also reduce costs. The new lock will be located within the City of New Orleans and will connect the Mississippi River with major navigation routes and the Port of New Orleans. Ben C. Gerwick, Inc., served in a review role in the Corps' feasibility study.

The Corps is considering two lock configurations: a recommended 1,200 ft. by 110 ft. by 36 ft. ship lock and a baseline 900 ft. by 110 ft. by 22 ft. barge lock. Both options are pile supported and will use an innovative U-framed float-in concrete hull. Local sponsors will pay the difference between the baseline barge lock and the more expensive recommended ship lock.

The sequencing of construction would generally be as follows:

- The canal will be widened to provide a temporary bypass navigation channel and temporary vessel impact protection structures will be built.
- A graving site will be constructed on the waterways system within a few miles of the site.
- Float-in precast concrete segments approximately 400 ft. long will be partially completed within the graving dock.
- Each float-in segment will be floated to a staging area where the segments will be moored and the upper portion of the lock walls will be completed.
- The installation site will be prepared by dredging, installing piles and preparing set-down pads.
- Each segment will then be moved to the final installation site and ballasted to the bottom. Tremie concrete will be placed to join the structure and the pile foundation.
- The new lock will be tied into the levees, the bypass channel backfilled, and the existing lock removed.

The Corps is currently awaiting approval from public hearings before engineering of the selected innovative construction plan begins.

Dale E. Berner

Venice Fishing Pier, Los Angeles

Repair and Upgrading Project

The Venice Pier in Southern California near the Marina Del Rey yacht harbor has suffered severe concrete deterioration. It has been closed to the public since 1991. However, it has been resurrected several times to serve as a movie set for nearby Hollywood. Now work has begun to repair and rebuild the pier for the benefit of the local Venice Beach community.

Ben C. Gerwick, Inc., teamed up with Cash & Associates to develop construction methods, determine the existing structural capacity, and design the new structural system. The inspection and testing program revealed that the prestressed concrete piles were in good condition and that the 600 feet of concrete deck at the shoreside was severely deteriorated. In this area, the deck will be removed and a new deck built on the existing piles.

South side of existing pier.

The design of the new deck section required special detailing at the tops of the piles. In the longitudinal direction the pier acts like a moment frame with varying lengths of vertical columns. If all the piles were rigidly connected to the deck, the short stiff piles near shore would resist most of the seismic load. To provide a more uniform load distribution, the first two piles were detailed to act like pin connections in the longitudinal direction while still maintaining a moment connection transversely.

The construction concept, developed by Ben C. Gerwick, Inc., permitted the contractor to support launching beams on the existing piles so the precast deck segments could be lined up and pushed out over the water. The concept eliminated the required use of an expensive construction trestle, which allowed more contractors to bid on the project. However, the launching concept was not utilized because the contractor who was awarded the job used a trestle system from a nearby pier reconstruction project in Redondo Beach. That project was reported in the March 1994 edition of the Ben C. Gerwick, Inc. News.

The durability of the new pier deck is a primary concern because sections of the existing pier deteriorated in a relatively short time. Both the new and existing decks are made of precast, lightweight concrete. The new deck will be post-tensioned and have additional refinements that include: providing more concrete cover over the reinforcing, adding fly ash to the concrete mix, limiting the water cement ratio to 0.38, increasing the curing time to fourteen days and requiring the contractor to use the water curing method. These measures will help produce a dense, crack free, and durable concrete.

Stephen P. Hardy and Yu-Yi Hsu

View showing the first part of the temporary trestle.
View of heavy-lift crane moving precast element.

COWI Group Development Project

Concrete Technology

As a result of a May 1995 COWI Group Management Conference, COWI, Ben C. Gerwick, Inc.'s parent company, launched its first Group Development Project. This project will increase the technical competitiveness and enhance the international reputation of the COWI Group in concrete technology.

The Group Project has four guiding objectives:

1) obtain quality results for the professionals within the COWI Group;

2) achieve visible activities in the concrete field;

3) share worldwide knowledge and experience;

4) establish a lasting network among the professionals of the COWI group.

The project team consists of representatives from COWI (Denmark), Ben C. Gerwick, Inc. (U.S.), BaUm (Germany), COWI Almoayed Gulf (Bahrain), Hjellnes COWI (Norway), MIILJO-KEMI (Denmark) and Saudi COWIconsult & Partner (Saudi Arabia.)

The project steering committee established the following three tasks for the first phase of the project:

1) Develop a worldwide professional network to provide the COWI Group with on-line information services, including relevant experience, case histories, material information, codes and standards in various regions, and COWI's technical guidelines.
2) Produce model concrete specifications for concrete works, surface protection, and repair works. These specifications will be based on various Codes of Practices and Standards such as ASTM, BS, DIN and Eurocode.

3) Establish a catalogue of selected concrete repair and maintenance techniques, including case studies.

Ben C. Gerwick, Inc., has actively participated in the project and is the leader of Task 3 "Concrete Repair and Maintenance."

Over 20 different repair techniques and relevant project experiences will be available to all COWI Group members by May 1997. The Group Project members plan to complete the first phase of the project in late 1997.

Ben C. Gerwick, Inc., is a leading consultant in the field of concrete technology. The Group Development effort will increase our technical strength and consulting ability in the global market.

Sam Yao

Placement of high quality underwater concrete leaving the marine life undisturbed.

Olmsted Dam on the Ohio River

Construction Method Study

The Olmsted Dam on the Ohio River will be located approximately 16 miles upstream of the confluence with the Mississippi River. It will consist of an 800 ft. long tainter gate section, a 1,400 ft. navigable pass, two boat abutment sections, a fixed weir section, and upstream and downstream scour projection. The Olmsted Dam and its two 1,200 ft. long locks, will eventually replace both Locks and Dam Nos. 52 and 53, and will thereby bring significant benefits to the Ohio River navigation system. Olmsted's locks are currently under construction within a conventional cellular sheet-pile cofferdam, while construction on the dam portion of the project is expected to begin sometime during, or after, the year 2002.

The Olmsted Dam is a challenge to engineer for several reasons, including: a) its proximity to the New Madrid fault system, which could impose an 8.4 Richter Scale seismic event on the structure, b) the river elevation typically will vary by approximately 30 ft. in a given year, and can vary by as much as 60 ft. in a hundred year period, c) the river discharge can exceed 950,000 cfs, and river velocities are controlled not only by river discharge but also by the uncontrolled downstream pool elevation, d) geotechnically, the site has several challenges including liquefiable soils, artesian water pressures and scour problems.

The design of the Olmsted Dam is currently in the optimization study phase. The Sverdrup/Gerwick Joint Venture, in partnership with the United States Army Corps of Engineers, is examining a variety of construction options, including:

1. The use of a catamaran crane barge to lift-in 2,000 ton precast concrete shells onto a prepared bottom with pre-driven piles. Tremie concrete would then be used to integrate the shells with the piles to form a continuous dam and stilling basin. The Corps selected this option as the designated "In-the-Wet" construction alternative, after reviewing other innovative construction options including: a) float-in technology, b) braced cofferdam technology, and c) lift-in 800 ton precast concrete shells.

2. Three stages of cellular cofferdams for conventional "In-the-Dry" construction. The first stage would be built near the Kentucky shore to minimize disruption of barge traffic in the main channel near the Illinois shore. The second stage would be built near the locks on the Illinois shore in order to minimize scour impact on the lock. Finally, the third stage would be built mid-river and would tie into each of the previously-built dam sections.

3. The construction of a portion of the dam within a cellular cofferdam and a portion of the dam by the "In-the-Wet" method.

The Joint Venture is also examining various conceptual design alternatives including:

1. Different pile types ranging from HP 14 x 117 piles to 8 ft. dia. concrete filled pipe piles, with various degrees of head fixity ranging from pinned to fully fixed. Pile type has a major influence on the seismic performance of the structure due to stiffness and the consequent period of response. Selection of the final pile type is contingent upon a more refined subsequent analysis.

2. Various factors affecting the Tainter Gate section have also been examined including: a) gate radius, b) trunnion elevation, c) gate lifting mechanism (either cable hoist or hydraulic cylinder), and d) different tainter gate bay widths (50 ft. and 110 ft.).

3. Several connection details between the dam components and also between the dam and the locks which have a significant impact on the seismic performance and functionality of the dam.

The Joint Venture's goal is to reduce the Government's estimated construction cost range of $300 to $325 million by at least 15%.

Dale E. Berner

Catamaran crane barge.

Posey - Webster Street Tubes, Oakland

Seismic Retrofit Design

Ben C. Gerwick, Inc., is working with Parsons Brinckerhoff on the seismic retrofit design of two immersed tube tunnels in the San Francisco Bay area for the California DOT (Caltrans). The Webster Street and Posey Tubes connect the cities of Oakland and Alameda, passing in parallel under the Alameda Channel. Although the two tubes suffered little damage during the 1989 Loma Prieta earthquake, concerns with future earthquakes along the nearby Hayward and San Andreas Faults have prompted Caltrans to proceed with seismic analysis and retrofit design of the tubes.

The Posey Tube was constructed in the 1920s and the Webster Tube was constructed in the early 1960s by a Ben C. Gerwick, Inc., construction joint venture. Each tunnel, including approaches, is approximately 4,500 feet long and carries two lanes of traffic. Both tunnels are historically unique. The Posey was the fifth immersed tube tunnel ever built, and at the time was the largest in the world. It was also the first immersed roadway tunnel built without a steel shell. Of the 25 immersed tunnels in the U.S., the Posey and Webster Street Tubes remain the only two built without steel shells. Both tunnels are built of reinforced concrete with a bituminous coating to ensure water tightness. At the lowest crossing point under the Alameda Channel, the Posey and the Webster Tubes are 68 feet and 71 feet below sea level, respectively.

The project scope is the seismic analysis and retrofit design of both tunnels. Since they are not considered lifeline facilities, a "Minimum Performance" criterion has been adopted. The retrofit objective is to ensure sufficient structural integrity for tunnel evacuation of the public and workers following an earthquake.

Alameda entrance to the Posey St. Tube.

The dynamic analysis indicated that the fixed tube joints would create large destructive moments and longitudinal forces in the tunnel during the design earthquake. The analysis also showed that these forces would be substantially reduced by releasing the joints. The retrofit design will create a hinge connection while maintaining water tightness and retaining shear capacity to prevent transverse displacements.

Dynamic analysis also identified potential for liquefaction of the backfill around the immersed tube segments which would lead to possible floatation of the tubes during an earthquake. The designed retrofit measure for the Webster Street Tube is to densify the backfill and improve drainage by using stone columns placed along both sides of the immersed section of the tunnel. The solution selected for the Posey Tube is to densify the soil and to cut off flow and pressure buildup under the tunnel by using a jet-grout curtain along each side of the tunnel.

The third area highlighted by the dynamic analysis was the potential failure of the piles under the tremie platforms supporting three tube segments. The platforms had been designed to provide support for the tunnels over areas of deep Bay mud. The free field displacements developed from the dynamic analysis using SHAKE 91 and SASSI computer models showed relative displacements between the tunnel and the pile supported tremie platforms which would cause the support piles to fail. The selected retrofit solution will utilize a cluster of jet grout columns to support each end of the tunnel segments.

Ben C. Gerwick, Inc.'s, role in the project included:

- Participation of Ben C. Gerwick on the Technical Advisory Committee.
- Supply of historical information on construction of Webster Tube.
- Survivability analysis of the piles under the tremie platforms and portal buildings.
- Preparation of plans, specifications and estimate for jet grout support columns at the tremie platforms.
- Preparation of plans, specifications and estimate for new support system for existing Posey ceiling slab.
- Perform constructability evaluation of tunnel joint retrofit design.
- Design of isolation joints for the ramp connection to the Alameda portal buildings.
- Develop preliminary construction schedule for the entire retrofit.

Robert B. Bittner and Patrick E. Durnal

Gerwick Information Technology

Communication and Knowledge Sharing

Building on Internet-based standards, Ben C. Gerwick, Inc., is developing technologies for improving information sharing both internally and externally with Clients, Joint Venture Partners, Sub-Consultants and Contractors.

We are implementing Information Technology (IT) solutions to address the following three areas.

1) Internet: We have developed a Web Site (http:\\www.gerwick.com\) accessible by the general public. Included in this site are all past Gerwick News articles, highlighting projects over the last 10 years.

2) Intranet: Accessible only to employees, this site acts as a basis for building and distributing internal company knowledge. It includes searchable databases for past projects and archived information.

   This has been implemented using a number of technologies, including a information framework accessible by a standard web browser, newsgroups for information sharing and distribution and a relational database for information archiving.

3) Extranet: currently in the planning phase, we are developing technologies for communicating with project partners beyond just e-mail.

   Access to this information will be limited on a project-by-project basis to Clients and Partners. It will include the facilities to post information such as design manuals, specifications and drawings and to post questions and answers.

   The goal of this project is to develop an electronic filing cabinet of the project and enable rapid and accurate information distribution and retrieval. It will be based on standard Internet technologies for easy access by all project participants.

Matthew Dry

Ben C. Gerwick, Inc. Web Site (www.gerwick.com)

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Ben C. Gerwick

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Ben C. Gerwick

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