Inner Harbor Navigation Canal Lake Borgne Surge Barrier Project

LOCATION:

New Orleans, Louisiana USA

SUBMITTING FIRM:

Tetra Tech

FIDIC MEMBER:

American Council of Engineering Companies (ACEC)

Project Description – *why the Inner Harbor Navigation Canal Lake Borgne Surge Barrier should receive an award*

PROJECT OVERVIEW

Nearly two miles long and 26 feet tall, the Inner Harbor Navigation Canal (IHNC) Lake Borgne Surge Barrier is the largest civil works design build project in the history of the U.S. Army Corps of Engineers and the largest surge barrier of its kind in the world. This massive project has moved the first line of defense against storm surge 12 miles away from the heart of the city of New Orleans and is the region's most critical defense against a recurrence of the devastation caused by Hurricane Katrina.

The project, located at the confluence of the Mississippi River Gulf Outlet (MRGO) and the Gulf Intracoastal Waterway (GIWW), consists of a concrete bypass barge gate and a buoyant sector gate (each 150 feet wide) at GIWW, a 56-foot-wide vertical lift gate at Bayou Bienvenue, floodwall tie-ins on the north and south ends, and complete closure of MRGO.

To meet the Corps' aggressive goal of achieving 100-year-level risk reduction by June 1, 2011, the project team designed and constructed the surge barrier simultaneously, an approach that drastically shortened the project delivery time but also created complicated technical challenges. The difficulties presented by the aggressive schedule, budget constraints, unstable soils, and the need to minimize environmental impact while maintaining navigability and public safety required original solutions developed through dedicated collaboration by all team members and stakeholders.

As a result of the team's outstanding project management, innovative design and accelerated construction efforts, the Corps announced the attainment of 100-year-level of risk reduction at the IHNC Lake Borgne Surge Barrier on May 24, 2011. Hailed as a model of Corps and industry partnership and a modern marvel of engineering, the project is a significant step in rebuilding a great city and restoring the trust of the people of southeast Louisiana.

INNOVATION, QUALITY AND PROFESSIONAL EXCELLENCE

The IHNC surge barrier is the largest surge barrier of its kind in the world and required a heightened level of originality and innovation to meet the budget, schedule, and stringent performance requirements set forth by the Corps. The project team worked tirelessly to develop, test, and implement innovative design techniques and solutions, including:

GIWW Sector Gate

The 42-foot-tall, hydraulically-operated, buoyant sector gate at GIWW weighs more than 675 tons per leaf and closes a 150-foot-wide navigation channel on the IHNC Surge Barrier wall. Most of the gate's weight is concentrated at the extreme of its 90-foot radius, where the heavy skin plate assembly is located along with a bridge designed to support an HS-10 truck. The long span requires a perimeter support to relieve the load on the supports at the monolith, which was achieved by providing buoyant tanks behind the skin plate. These tanks form a structural component of the gate in an effort to minimize gate weight and were designed in a modular manner to allow for fabrication in a separate facility prior to insertion into the gate structure.

Physical Modeling

The IHNC Surge Barrier was designed to resist loads originating from hurricane events and to protect the people and critical infrastructure of the greater New Orleans area from the effects of flooding. Because of the unique nature of the loads and the project's proximity to downtown New Orleans, extensive physical modeling was performed to confirm the efficacy of the barrier's performance. A floodwall model was

developed to verify that the overtopping rate was acceptable and to demonstrate the effectiveness of the plunge pool/energy dissipation basin. This model provided invaluable insight into the scour stone design and demonstrated the effectiveness of the braced pile wall.

To study the effects of wave forces on the gate reflecting off land-based T-walls and approach walls, a large basin model was created for the area in the GIWW, where the sector gate is located. Two models were used. The first, a simplified model, determined gate forces from a reverse head condition. Understanding forces generated on the gate while opened in a controlled manner were important for sizing much of the gates' structure and mechanical equipment. A second, more detailed model was developed and placed in the basin model for studying the effect of the hurricane-induced waves. Both mass and stiffness of the design were modeled to determine hydro-elastic effects such as gate vibration, wave slamming, and wave downfall.

Accurately Predicting Channel Characteristics and Vessel Behavior

Because the presence of the surge barrier wall across Lake Borgne was expected to change the characteristics of the channel flow and the manner in which large commercial vessels and recreational craft would navigate the area, it was extremely important to accurately predict both conditions. In order to do so, the project team constructed a fully-operational model of the GIWW channel, the bypass gate, sector gate, a barge, and associated guide walls. Remote control models of vessels were also constructed and used to navigate the channel under a variety of conditions (simulated by wind generators and wind machines) to determine their reaction while navigating the gates.

In providing physical evidence of what would otherwise have only been shown through theoretical hydraulic analysis, the models allowed the Corps to achieve "buy-in" from the project stakeholders that would ultimately own, operate, and utilize the IHNC gates.

Ultimately, the use of advanced modeling provided important technical information and demonstrated that the project would result in a safe and efficient navigation channel. It also served as a means to include input from end users and provided a training tool for the navigation industry.

Results

100-year-level risk reduction was attained on May 24th 2011, surpassing the Corps' aggressive goal for completion by the 2011 hurricane season. This result was the direct consequence of a very positive working relationship between the design team and USACE.

The design team formed close, collaborative relationships with the Southeast Flood Protection Authority-East, the State of Louisiana Coastal Protection and Restoration Authority. As costs started to grow, the design team participated closely with the Corps' Value Engineering Tiger Team review. Significant cost-saving options were developed for approach wall redesign, as well as the decision to change from a vertical axis sector gate at Bayou Bienvenue to a vertical lift gate.

The design team also worked closely with Corps headquarters staff to develop a waiver to the deflection standard in Corps Guidance for Floodwalls. The standard as currently written did not account for the flexibility and performance capabilities of a braced floodwall of this type. As designed, the wall is an economical solution that surpassed the performance requirements.

PRINCIPLES OF TRANSPARENCY AND INTEGRITY

Many residents lost not only their homes and livelihoods, but family members and friends, to the floodwaters of Hurricane Katrina and hold the federal government, particularly the USACE, responsible for the disaster. The proposal to build a surge barrier rather than raise and strengthen 30 miles of levees and floodwalls along the IHNC system was not well-received. The people of southeast Louisiana did not understand why no work had occurred on "their" levees and floodwalls when so much time had lapsed since Hurricane Katrina. Construction at the surge barrier site was out in open water and not readily visible to the public, leaving many convinced that nothing was being done.

To alleviate this anxiety, the project team embarked on an aggressive community relations and media campaign. More than 250 tours of the surge barrier site have occurred since construction began in May 2009, with upwards of 3,000 visitors participating. Having the opportunity to see the massive scope of the project has restored many residents' sense of security, while media exposure has helped to inform local, national, and international audiences.

The Lake Borgne Surge Barrier is a central feature of the Hurricane Storm Damage Risk Reduction System (HSDRRS) for the region's most vulnerable areas. Because the Corps has built a risk reduction system using the best science, technology, and engineering available, New Orleans is now better protected than at any time in its history.

SUSTAINABILITY AND RESPECT FOR THE ENVIRONMENT

Environmental, social, and economic sustainability were of major concern throughout the design and construction of the IHNC Surge Barrier. The project team investigated various alternatives in compliance with the National Environmental Policy Act (NEPA) and incorporated systems and techniques to help minimize environmental impact while providing additional social and economic benefits to the area.

Environmental Sustainability

- Material dredged during excavation associated with the project was deposited for beneficial use, creating conditions well-suited for the establishment of future marsh habitat.
- A structural surge barrier wall was used in lieu of a geo-textile levee, effectively minimizing the project's footprint by approximately 300 feet.
- Potential impact to threatened and endangered species as a result of the construction of the IHNC Surge Barrier was minimal; procedures for preventing disturbance to the manatee in particular were employed during construction.
- A 12-foot-wide roadway was built across the top of the surge barrier wall rather than at the marsh level, minimizing loss of wetlands.
- Fish ramps were installed to allow the fish's vertical movement through the GIWW gate structure.
- The project will result in an increasing freshwater, brackish system better suited to the production of oysters and other aquatic resources.

Social and Economic Sustainability

- Based on a review of data, the project had no adverse impact on cultural resources, a finding with which Native American tribes concurred.
- Beneficial indirect and cumulative impacts include enhanced protection of socioeconomic resources as a result of enhancement of the HSDRRS, potential long-term employment opportunities, and subsequent increases in income levels in Orleans and St. Bernard parishes.
- The HSDRRS will provide the levels of protection necessary for certification in the National Flood Insurance Program, providing a positive economic impact for the entire New Orleans area.