Olmsted Lock and Dam
Upper and Lower Approach Walls

Olmsted Dam, Illinois

Owner: USACE, Louisville District

Description: The Louisville District is constructing a new lock and dam on the Ohio River at Olmsted. INCA Engineers, Inc., A Tetra Tech Company (INCA) was responsible for preliminary and final design of the new lock approach walls, which will guide barge traffic and other marine vessels into and out of the new twin lock chambers in a more efficient manner. The approach walls are a component of the overall project design for the replacement of the two old locks at Dam No. 52 and Dam No. 53. The project will feature two 110-foot by 1,200-foot locks, a spillway section controlled by five tainter gates, a navigable pass, and a fixed weir section. Upon successful completion of the project, the waiting time in the locks will be decreased by half, while river traffic will be dramatically increased.

The original design for the upper and lower approach walls consisted of reinforced concrete beam members to form a guide surface. The beams were supported on concrete-filled sheet pile cells, founded on H-piles. An Alternatives Planning Study was performed to reduce concrete weight and satisfy seismic requirements; a weight reduction of 50% or greater was targeted. In the study report, INCA recommended the design of floating approach walls, laterally supported by drilled shafts. Because of significant river pool variations and flood conditions, floating structures provide for dramatic cost savings and significantly reduced operations and maintenance costs.

Special Features:

- In-the-wet construction
- In-the-wet drilled pier design
- Prestressed, post-tensioned concrete design
- Floating concrete structure
- Vessel impact and mooring loading
- Finite element analysis of concrete structures
- Seismic analysis
- Hydrodynamic analysis
- Frequency and stability calculations
- Heavy lift procedures
- Contractor mooring and anchorage to facilitate construction
- Electrical and lighting analysis and design
- Motorized cable reels
- Fiber-optics
- Engineering services during construction

INCA developed this innovative design concept and prepared the final plans, specifications, and cost estimates for 4,000-linear feet of post-tensioned concrete pontoon floating approach walls and 600 feet of fixed approach walls. In addition to the structural analysis and design, INCA was also responsible for providing electrical engineering, including power distribution, high-mast lighting, CCTV system, communication systems, pumping systems, and navigation lighting. The INCA design effort required 323 construction (MicroStation) drawings and 269 reference drawings. This included 25 drawings detailing complex construction procedures and tolerances, 199 drawings for floating pontoon structures, 55 drawings for fixed structures constructed in-the-wet, 27 drawings for electrical lighting and instrumentation, and 17 drawings for miscellaneous other features.

The design accounts for impacts with a 15-barge tow that carries 60 million pounds of cargo and redirects this traffic into the lock chambers. Because the facilities are located in Seismic Zone III, the anchor pylons and nose piers required seismic analysis, including pseudostatic, response spectrum, ground motion determination, and time history.

A sophisticated analytical effort was also directed to evaluate pontoon/pylon dynamic interaction during seismic and impact events. These structures are not directly coupled, but have significant interaction during dynamic events. SASSI analysis software was used for the soil/structure interaction analysis of the drilled shaft supported structure.