MISSISSIPPI RIVER - GULF OUTLET
NEW LOCK AND CONNECTING CHANNELS

EXECUTIVE SUMMARY

This Engineering Appendix provides detail designs and M-CACES cost estimates for the NED Plan 110 x 900 barge lock and the Recommended Plan 110 x 1200 shiplock.

The scope of work, as envisioned, at the start of Engineering Division's support for the Feasibility Study focused primarily on the New Lock, North of Claiborne Avenue Alternative. Engineering Division was tasked to provide engineering designs and costs for the various components of this alternative. A list of major components of this alternative follows with a general description of each component and summary narrative of engineering analysis performed.

LOCK

Engineering design effort focused on a pile-founded, precast, post-tensioned, float-in concrete lock with miter gates. Prior to the feasibility effort, a conventional cast-in-place lock design was considered and not adopted for further study due to excessive costs and right-of-way required for construction cofferdaming to maintain navigation for the full construction period. Analysis, designs and cost estimates were developed for four alternative lock sites, two barge locks and two ship lock sites. The chamber width is 110 feet for both barge and ship locks, with a uniform chamber floor and sill depth of 22 feet for the barge locks and 36-foot depth sill and 40-foot chamber floor depth for the ship locks, and a 900-foot and 1200-foot usable chamber length for both barge and ship locks. The preliminary design investigated a steel hull structure that was soil-founded. The calculated differential settlement that was acceptable for the steel hull was considered to be detrimental for the less ductile concrete structure. Therefore, the soil foundation was eliminated and a pile foundation designed.

Additional engineering investigations and cost estimates were conducted and developed during plan formulation. For project optimization purposes in the economic analysis, cost estimates were developed for four additional lock sizes. Quantity take-offs were made from the 110 x 900 x 22 foot barge lock to estimate costs for 110 x 900 x 18, 110 x 900 x 25/22 floor/sill and a 90 x 900 x 22 foot barge locks. Code of accounts cost estimates for the alternative plans, except the 90 x 1200 x22 foot barge lock, are presented in the cost estimate section of the Engineering Appendix. A cost estimate for a 90 x 1200 x 22 foot barge lock was developed more simplistically. To get the 90 x 1200 x 22 foot barge lock estimate, the 90 x 900 foot barge lock was increased by the same rate of increase that exists between the 110 x 900 and 110 x 1200 barge locks.

In support of the economic analysis, costs estimates were developed for several additional alternatives. These alternatives are described below. The engineering support for these estimates was minimal and to a lesser degree than those alternatives discussed above.

a. Rehabilitation. In lieu of a lock replacement, rehabilitation of the existing lock was considered. The design life for this alternative was estimated to be 50 years. Rehabilitation would provide a serviceable lock, but with lockages limited to the existing lock chamber capacity. The estimated cost, $21 million, is in addition to the normal O&M cost for the existing lock.

The lock elements that would be rehabilitated or replaced include four spare miter gate leaves, a spare set of miter gate machinery, a sump pump system, wall armor retrofitting, and replacing control houses and the original roofing of the Lockmaster's office. The river side timber guidewalls would be replaced with floating concrete guidewalls and fendering, and forebay and guidewall mooring dolphins would be replaced. Other work included rehabilitation of a water utility line through the existing lock, and selected electrical and mechanical system replacements. Structural repairs would be made to the concrete masonry in the miter gatebay machinery rooms.

An important element of this alternative to consider was the intermittent lock closures required to accomplish the rehabilitation work. It was estimated that nine 30-day closures would be needed within a five-year construction period.

b. Bridge only. In this alternative the St. Claude Bridge would be replaced. Lock replacement would not be considered for 50 years. The St. Claude bridge replacement is intended to benefit navigation by reducing the current delays in lock cycle time from the existing St. Claude bridge operation. The replacement bridge in this alternative would be a mid-level double bascule bridge providing a 40-foot vertical clearance and a 200-foot horizontal clearance. The cost estimate for this bridge was based on a low-level bridge design and cost developed by an A-E that also provided a 200-foot horizontal clearance. The A-E's cost was modified by adjusting their quantities from a low-level design to a mid-level design.

c. Phased construction. In this alternative the St. Claude Bridge would be replaced first assuming the replacement of the lock would be realized approximately 25 years later. This alternative would provide short-term benefits to navigation by reducing the current delays in lock cycle times from the existing St. Claude Bridge operation. The bridge in this plan is a mid-level vertical lift bridge providing a 300-foot horizontal clearance as opposed to the 200-foot clearance provided in the "Bridge only" alternative discussed above.

The 300-foot horizontal clearance is needed to facilitate future lock construction without closing the canal to navigation for extended periods of time. The cost estimate for the bridge component of this alternative was based on a bridge design and cost estimate developed by an A-E. In the economic analysis this bridge cost was combined with the cost estimates for the various lock sizes already developed.

CHANNELS

The design channel depth is (-)36 feet NGVD for the ship lock and (-)22 feet NGVD for the barge lock with channel bottom widths of 200 and 284 feet, respectively. Bottom widths transition to 150 feet at the Claiborne Avenue Bridge for both ship and barge locks, and to 180feet at the St. Claude Bridge, 150 feet for the ship lock, and 234 feet for the barge lock at the Florida Avenue Bridge. The channel transitions to 110 feet at the new lock for both barge and ship locks. Side slopes of 1 vertical on 3 horizontal were used. During construction at the new lock site and demolition of the existing lock, a system of by-pass channels was designed to keep navigation down time to an absolute minimum. The by-pass channel at the new lock site is to the east of the site and is a split level channel providing two 110-foot bottom width lanes of travel, one at (-)31 feet NGVD and the other at (-)22 feet NGVD. During demolition of the existing lock, a by-pass channel will be provided to the east with a (-)12-foot NGVD bottom elevation and an 85-foot bottom width.

LEVEES AND FLOODWALLS

The Mississippi River flood protection levees and Floodwalls must be extended from the existing lock north approximately 2500 feet on the east and west banks to tie into the southern end of the new lock. This MRL flood protection, dependent upon location, will consist of a combined earth/concrete topped I-wall or concrete T-wall sections. The MRL design grade at this location is 22.1 feet NGVD and will be replacing the existing hurricane protection which has a top elevation of 15 feet NGVD on the west bank and 14 feet NGVD on the east bank. Hurricane protection, a combined earth/concrete topped I-wall, will tie into the northern end of the new lock with a top elevation of 14 feet NGVD.

RELOCATIONS

Bridges. Three existing movable bridges are located on the Inner Harbor Navigation Canal between the Mississippi River and the Mississippi River Gulf Outlet: Florida Avenue (northernmost), Claiborne Avenue (LA Route 39) and St. Claude Avenue (LA Route 46) (southernmost).

a. Florida Avenue Bridge. The Florida Ave. bridge is not included in the Corps IHNC lock replacement project. Although this bridge is not part of the project, it is being assumed that the bridge is being replaced by others. Further details of this bridge are presented in the Appendix.

b. St. Claude Avenue Bridge. The existing St. Claude Ave. Bridge will be demolished and replaced by a low-level leaf doublebascule bridge with a 200-foot clear horizontal span at the water surface. During plan formulation both low and mid-level vertical lift type bridges were also considered, but were not adopted because of social impacts and slower operating times compared to the double leaf bascule bridge.

c. Claiborne Avenue Bridge. Because of its location north of the existing lock, the Claiborne Ave. Bridge is subjected to Lake Pontchartrain water levels; but with the proposed new lock location, it will be subjected to Mississippi River levels. To maintain Coast Guard mandated clearances when in the open position, the Claiborne Ave. Bridge superstructure will be replaced and the existing bridge piers retrofitted and reused. The replacement bridge is the same type as the existing bridge, a mid-level, vertical lift span bridge. The Claiborne bridge superstructure will be replaced with higher towers and a new movable span. New mechanical and electrical equipment will be installed.

UTILITIES

There are a number of utility relocations of varying types and sizes that traverse the canal or pass through the existing lock utility gallery. The project plan is to relocate these in three utility corridors, each containing one trench crossing the channel. These trenches are located south of St. Claude, north of Claiborne Ave. and south of Florida Ave. The trenches will be provided by the Government with utility owners performing relocations.

MITIGATION PLAN

Details and components of the mitigation plan are presented in the Mitigation Appendix A. Given the unique circumstances associated with this project, a shift in focus from the natural environment to the social environment requires a departure from traditional methods of environmental impact analysis and mitigation planning. The construction plan developed for the North of Claiborne Avenue site either eliminates or substantially reduces major project-related impacts in the areas of displacement of people, construction-related noise and traffic congestion. The various components of the mitigation plan and their costs are presented in code of accounts format in the cost estimate section of the appendix.

BOARD OF EXPERTS

The preliminary concept, the steel hull float-in, was rejected late in the report process. In order to meet the schedule, it was decided that the concrete float-in concept would be reviewed and revised concurrent with the design effort. The review was conducted by both an in-house Technical Review Team and a Board of Experts. The Board of Experts had the second responsibility of approving the lock structural concept. The Board was comprised of a representative from Headquarters Engineering Division, representatives from Division Engineering Division and two A/E firms experienced in the design and construction of precast concrete float-in structures. The Board members are:

Mr. Joe Hartman	CECW-ED
Mr. Terry Cox	CELMV-ET-ES
Mr. Tony Young	CELMV-ET-EG
Mr Saad Moustafa	Wiss, Janney, Elstner, Assoc., Inc.
Mr. Dale Berner	Ben Gerwick, Inc.

The vast experience of both A/E members was a vital ingredient in the accepted design. Their review and recommendations solidified this state of the art design. The CORPS members provided the expertise that assured final acceptance. The Board of Experts approved the structure at their last meeting, October 17, 1996.

FUTURE ENGINEERING & DESIGN

Upon approval of the Feasibility Report (Reevaluation Report), a series of design documents will be done. Several potential cost reduction items were discovered during preparation of the draft feasibility study. Some of the more considerable items include:

a. Removal of the backfill in the area outside of the chamber lock wall. Allow the riverside tie-in levee to act as both river and hurricane protection.

b. Revisions to the guidewall design.

c. Use of a sector gate, with an assisting filling and emptying system (i.e., ear-type sector gate, sector gates with sluice gates, around-the-gate culvert system) in lieu of miter gates.

d. Considering larger diameter piles in the foundation. Additionally, pile tests will be performed to minimize pile lengths.

e. Mechanical guidance system to hasten tow entrance and exit times.

Post-feasibility studies will focus on these issues as well as others that may result in reduced costs for the lock replacement. A CPM logic network of activities associated with producing design memorandums, plans and specifications, and construction is provided in the Project Management Plan (PMP). More details and resources associated with these efforts can also be found in the PMP. Engineering and design cost estimates are also provided in the cost estimate section of this appendix.