

CEWES-HR-N (CELMN-ED-HD/23 Jul 93) (1110-2-1150a) 1st End Mr. Wilson/
Mr. Hewlett/lm/601 634-2813/4164
SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

DA, Waterways Experiment Station, Corps of Engineers, 3909 Halls Ferry Road,
Vicksburg, MS 39180-6199 **9 SEP 1993**

FOR Commander, U.S. Army Engineer District, New Orleans, ATTN: CELMN-ED-HD,
P.O. Box 60267, New Orleans, LA 70160-0267

1. Enclosed is a memorandum for record (encl 2) covering the information requested. The following table presents the cost estimates and elapsed time for the proposed studies.

- a. Navigation physical model studies (assuming two entrance plans):
- | | | |
|--------------------|-----------|------------|
| (1) Tows | \$205,000 | 8 months * |
| (2) Tows and ships | \$240,000 | 10 months |
- b. Navigation computer simulation study (assuming one approach plan):
- | | | |
|--------------------|-----------|----------|
| (1) Tows | \$190,000 | 6 months |
| (2) Tows and ships | \$235,000 | 7 months |
- c. Field data collection (performed concurrently with the simulator study)
- | | | |
|--|----------|----------|
| | \$60,000 | 2 months |
|--|----------|----------|
- d. Lock filling and emptying model:
- | | | |
|--|-----------|-----------|
| (1) 110 ft by 900-ft non-standard barge lock | \$700,000 | 14 months |
| (2) 110-ft by 1,200-ft non-standard barge lock | \$730,000 | 15 months |
| (3) 110-ft by 900-ft ship lock | \$820,000 | 16 months |
| (4) 110-ft by 1200-ft ship lock | \$850,000 | 17 months |

* The times given above include the time to completion of tests and availability of model test results. Draft reports would be available three months following completion of testing.

2. When seeking approval for this study, please comply with paragraph 8.b of ER 110-2-1403, dated 21 January 1985, that defines the procedure for approval of hydraulic and hydrology studies and provide us a copy of the appropriate approval memorandum with your funding document or authority to proceed.

3. We understand that these studies are under consideration for the U.S. Army Engineer Waterways Experiment Station (WES) to perform beginning in about FY 96. In order for us to perform the studies, we must be authorized the necessary FTE. To assist us in obtaining necessary FTE allocation, it is

CEWES-HR-N

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

requested that you take action to have this work entered into the Headquarters, U.S. Army Corps of Engineers FORCON manpower accounting system when updates for future FY'S are requested. For this study to be considered by the Programs Division of Civil Works Directorate as justification for the necessary FTE authorization, it must be substantiated and validated by a submission from your office.

4. If you have any questions, please contact Mr. Chris Hewlett or Mr. Don Wilson at (601) 634-4164 or -2813, respectively.

2 Encls
wd encl 1
Added 1 encl
2. as


ROBERT W. WHALIN, PhD, PE
Director



DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

CEWES-HR-N (1110-2-1150a)

31 August 1993

MEMORANDUM FOR RECORD

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

1. References.

a. CELMN-ED-HD memorandum of 23 July 1993, subject as above.

b. Telephone conversation between Mr. Charles Shadie, U.S. Army Engineer District, New Orleans (LMN) and Dr. Larry Daggett, U.S. Army Engineer Waterways Experiment Station (WES) on 10 August 1993, subject as above.

c. CELMN-ED-HD memorandum for record dated 8 July 1993, subject: IHNC Model Studies - Future Needs.

d. Telephone conversation between Mr. Charles Shadie, LMN, and Mr. Chris Hewlett, WES, on 18 August 1993, subject as above.

e. CEWES-HR-N 1st end dated 6 March 1990, subject: Model Study Cost.

f. Design drawing, General Plan, Lock and Channel, Industrial Canal Lock Replacement, Plate 1, LMN.

2. The following time and cost estimates were requested in reference 1a. We understand the estimates will be incorporated into the Inner Harbor Navigation Canal (IHNC) Lock Replacement Study - Feasibility Report and the model studies will be initiated about three years in the future. Additional time was required to obtain plan drawings from LMN and additional information on the project, therefore, a request to extend the response date to 31 August 1993 was made and granted (reference 1b). References 1c and 1d indicate that at the present time the proposed design configuration of the IHNC lock has not been specified. Design ship and tow configurations are therefore not certain. This proposal is predicated on the assumption that economic evaluation by the New Orleans District will result in a recommended lock for the National Economic Development (NED) Feasibility Study plan.

3. We recommend taking advantage of the physical model (located at WES) of the river entrance to the canal to test and design the entrance and approach conditions to the river side of the lock. In our earlier investigation (reference 1e), we learned that complex current patterns exist at the intersection of the Mississippi River Gulf-Outlet (MRGO) and the IHNC. Since this lock design moves the lock even nearer the intersection than the previous design, it is recommended that the approach on the lake side of the lock be analyzed using a maneuvering simulation model. Since physical space restrictions limit testing the construction sequences in the physical

HYDRAULICS
LABORATORY

GEOTECHNICAL
LABORATORY

STRUCTURES
LABORATORY

ENVIRONMENTAL
LABORATORY

COASTAL ENGINEERING
RESEARCH CENTER

INFORMATION
TECHNOLOGY LABORATORY

CEWES-HR-N

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

model, these sequences will be tested with the simulation model. The estimates for the physical model navigation study and the navigation computer simulation study are based on studying the design tow in the lock recommended by the Feasibility Study. If a ship lock is recommended as the locally preferred plan, incremental time and costs are included for study of a design ship as well as a tow. In other words, it is assumed that only one size lock will be studied, but it could require investigation of two designs (one for a tow and one for a ship).

4. Navigation Physical Model Study. An undistorted, 1:120-scale, fixed-bed navigation model, which reproduces 4.1 miles of the Mississippi River and the entrance to the IHNC is available to conduct tests on the Mississippi River side of the proposed lock. The model can be used to conduct tow and ship navigation tests to aid in the design of the river entrance to the lock canal. Preparation of the model for operation and revision of the model to include the IHNC up to the southern lock approach of the proposed lock will require four months and cost \$100,000. The revision of the model requires an extension of the IHNC portion of the model which will cross an existing model currently maintained in an inactive status for the Vicksburg District (LMK). Therefore, this portion of the estimate is contingent on permission to cross the LMK model. The lock and dam that the LMK model represents is currently under construction and may be completed by the time the IHNC model is required. Collection of current direction, velocity, and tow track data and an evaluation of navigation conditions with the proposed design and three river flows will require about two months and cost \$35,000. Collection of ship track data and an evaluation of navigation conditions for ships with the proposed design and three river flows will require about one month and cost \$15,000. If the design ship is not one of our existing models, construction of a scale ship model will cost approximately \$5,000 and the work will be performed concurrently with revision of the navigation physical model. Testing additional canal entrance plans for a tow lock will require about two months and cost \$35,000 each. Additional testing for a ship lock will require about one month and cost \$15,000 per entrance plan. If we assume two entrance plans would be tested with only tows, the total time required would be 8 months and the study would cost \$170,000 (one design tow). If ships are included in the test program the study will expand to 10 months and cost a total of \$205,000 (including the construction of one design ship). Preparation of a draft report will require \$20,000 and three months; publication of a final report will cost \$15,000 and require three months following receipt of review comments.

5. Navigation Computer Simulation Study. In conjunction with the navigation physical model, a computer simulation study is recommended. This simulation study will concentrate on the MRGO side of the lock while the navigation physical model will focus only on the Mississippi River side. The WES has reviewed the design as it stands and has identified five traffic scenarios which we recommend be tested in a numerical computer simulation study. These scenarios span both the construction and completed phases of the project:

CEWES-HR-N

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

a. During construction of the new lock facility, northbound traffic leaving the existing lock structure must detour to the bypass channel through the protection cells in front of the lock. Southbound traffic passing under the Florida Avenue Bridge must also immediately divert to the bypass lanes (reference 1f). These maneuvers and the possible resultant meeting/passing situation in the bypass lanes need to be tested on a ship simulator because there is a question as to the allowable tow size and required maneuvering room. Visibility may be restricted also. This scenario would be restricted to existing traffic because the existing lock would still be in place. This test could yield valuable information concerning tow size and operational restrictions that may be needed during the construction phase of the project.

b. Vessel approaches to the new lock from the Mississippi River side (south) should be simulated. This would probably involve simulations of both the design tow and ship (both presently undetermined). The horizontal clearance through the St. Claude Avenue and N. Claiborne Avenue Bridges in their final conditions are still unknown and could affect navigation safety during the lock approach (reference 1f). If ships are tested for this scenario, tug operations could be critical. This scenario would be the one area of overlap with the navigation physical model; however, the ship simulation tests would terminate before the vessels enter the lock chamber. These tests would allow comparison with the physical model test results using licensed local pilots in a real-time environment.

c. Vessel approaches to the new lock from the Mississippi River Gulf-Outlet (MRGO) side (north) should be simulated. These tests are recommended because (1) currents are complex in the area, (2) the design ship and tow will be larger than vessels now using the IHNC, and (3) the Florida Avenue Bridge is being moved closer to the proposed position of the new lock and guard wall. At present, there is no information as to the prospective horizontal clearance through the bridge piers. As in the preceding scenario, tugs could be required for simulations of single-screw ships, particularly when strong wind conditions are present. The tests will be to determine approach conditions and will stop before the vessels enter the lock chamber.

d. After completion of the new lock, the design of the required bypass channel during demolition of the old lock is unspecified. This may be critical only for a short time but could result in partial traffic restriction. It is recommended that simulation tests be conducted for this scenario.

e. After completion of the new lock structure, it is evident that ships moving into the basin on the western side of the channel (encl 1) between the new lock and the Florida Avenue Bridge will have a constricted entrance between the new lock guard wall and the new bridge piers and fenders. There is an indication that containerships (Ro-Ro) and general cargo vessels utilize this area as well as tows. Depending on the ship size, this may be a navigation concern and it is recommended that the maneuver to enter and exit this basin be tested on a simulator.

CEWES-HR-N

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

6. Development of simulation data bases (visual scene, currents, vessel, numerical models, etc.) will require 4 months to complete and cost \$100,000. At least six professional tow pilots are required to test the five scenarios listed in paragraph 5. Assuming that two pilots visit the simulator per week during each of three weeks over a four-week period, the basic testing with tows will take one month and cost \$33,000. If simulation tests with a design ship are needed, the testing will require an additional month and another \$33,000. After testing (either alternative), one month will be required to produce a preliminary results letter report with a cost of \$25,000. Development of ship numerical models (tow or ship) will cost approximately \$6,000 each. At this point without knowing the design vessels, the study cost estimate must include one existing condition design tow, one proposed condition design tow, one design ship for the proposed lock and one design ship for the entrance into the western basin (scenario 4e). Final publication of a WES technical report will cost an additional \$20,000. If only tow testing is required the computer simulation study will take six months for preliminary results and cost \$190,000 (including two vessel numerical models). With the addition of ship tests, the study will take seven months and cost \$235,000 (including four vessel numerical models).

7. Field Current Data Collection. Channel current data for the proposed computer simulation study will be obtained from a proposed field data collection effort and from the physical model. Because of the expected change in design vessels, it is considered important that the effect of currents on navigation in the area be investigated. Within the canal it is anticipated that currents will be negligible. However, currents will affect vessels outside the canal in the approaches including the approaches in the MRGO. The currents on the MRGO side of the lock are not expected to change because of project construction; therefore, field data from the existing condition are considered adequate for simulations of the proposed lock configurations. The field data will be gathered from the MRGO side of the lock only; currents on the Mississippi River side of the lock can be measured from the physical model. If the physical navigation model is not used, currents for the river entrance would have to be obtained with a numerical model; cost estimates are not included for this model.

8. Tide gages will be deployed at four locations within the study area on the MRGO side of the lock. One will be near the proposed location of the new lock, one at the Lake Pontchartrain entrance to Inner Harbor, one at the entrance to the Gulf Intracoastal Waterway northeast of the study area, and another farther down the MRGO toward the Gulf of Mexico. Current speed and direction measurements will be obtained for seven different transects ranging from the south side of the Florida Avenue Bridge to about a mile down the MRGO. One boat, with three persons on board, will operate along the proposed transects. Current speed and direction data will be collected using Acoustic Doppler Current Profile systems. Data are to be collected over a 25-hour period in conjunction with a spring tide interval and with each transect being traversed at least once per hour. The field data will be obtained concurrently with ship simulation data base development and cost \$60,000.

CEWES-HR-N

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

9. Lock Filling and Emptying Study. If the recommended plan for the filling and emptying system for the lock involves a non-standard design barge lock or a ship lock and barge, a physical model study of the filling and emptying system will be required (as stated in paragraph 4 of reference 1a). This model will be used to investigate the hydraulic characteristics of the filling and emptying system. Testing will consist of evaluating the performance of the lock intakes, optimizing conditions in the lock chamber during filling and emptying, recording filling and emptying times, measuring instantaneous and average pressures in the filling and emptying system, and evaluating flow conditions at the discharge outlets. The cost and time estimates are based on requiring approximately ten revisions to the basic filling and emptying system design. The four possible plans that will require filling and emptying studies are:

- a. 110-ft by 900-ft non-standard barge lock
- b. 110-ft by 1200-ft non-standard barge lock
- c. 110-ft by 900-ft ship lock
- d. 110-ft by 1200-ft ship lock.

The filling and emptying study will test only the one configuration chosen as the design lock. If the recommended plan is a ship lock, then the filling and emptying system must be designed to provide satisfactory hydraulic characteristics for both ships and barges. Thus, longer testing times will be required to arrive at a satisfactory design. Obviously, the larger locks will require additional time and cost for construction. A 1:25-scale model will be used for the study. Approximately 600 ft of approach and exit topography and the lock configuration with the filling and emptying system constructed in detail will be reproduced. No tow or ship entry or exit tests will be performed due to the limited approaches that can be constructed in the existing facilities. Estimates of time and cost to study each of the different plans are shown in the following table. Design and construction of two non-propulsive ship models are included in plans c and d.

<u>Plan</u>	<u>Design and Construction</u>		<u>Testing</u>		<u>Report</u>	<u>Total</u>	
	<u>Time</u> (months)	<u>Cost</u> (\$1000)	<u>Time</u> (months)	<u>Cost</u> (\$1000)	<u>Cost</u> (\$1000)	<u>Time</u> (months)	<u>Cost</u> (\$1000)
a.	6	350	8	320	30	14	700
b.	7	380	8	320	30	15	730
c.	6	390	10	400	30	16	820
d.	7	420	10	400	30	17	850

CEWES-HR-N

SUBJECT: Model Study Cost Estimates - IHNC New Ship Lock/Barge Lock

A draft of the report will be furnished for your review and comments about three months after completion of all tests. The report will be published about three months after your comments are received.

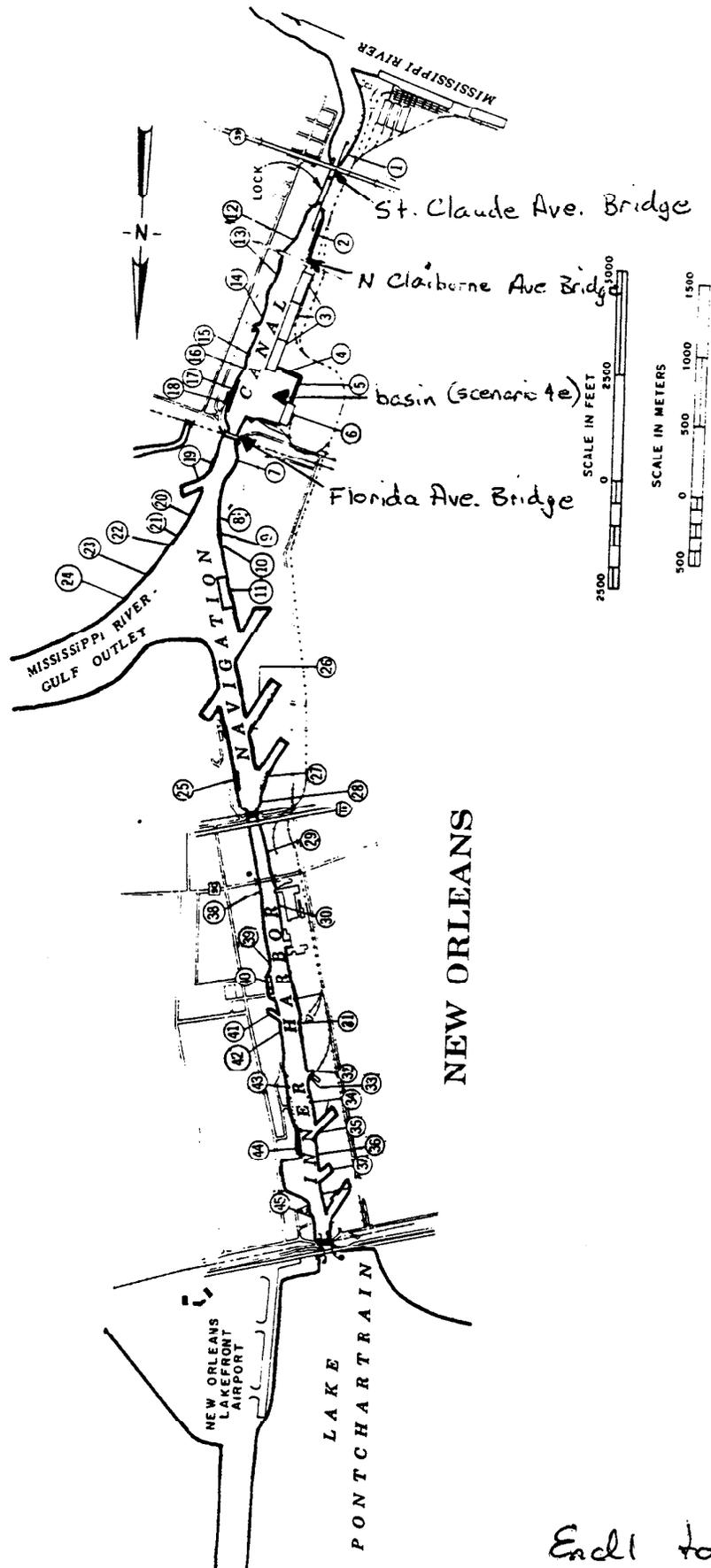
Encl



CHRIS HEWLETT
Research Hydraulic Engineer
Navigation Branch



DONALD C. WILSON
Research Hydraulic Engineer
Navigation Branch



End 1 to End 2