Appendix C
Lock Hydraulic System Model and Prototype Study Data

C-1. Introduction

The availability of data from CE hydraulic model and prototype investigations of navigation lock filling/emptying systems, as summarized in Table C-1, is given in Table 1 of Item P5. This information was obtained from a detailed review of 81 reports on model and prototype studies (1937 to 1984) by STP, BHL, and WES. Those reports are listed in Appendix A. The organization and use of Table 1, Item P5, are described in the following paragraphs.

C-2. Design and Operational Variables

A list of 251 hydraulic design and operational variables or significant features of navigation locks was derived from a review of such items in several kinds of filling/emptying systems used in CE locks. This list is organized in an upstream-to-downstream order and has a numbering sequence for easier manipulation in a digital computer. The major divisions of the list include:

11000 INTAKE SYSTEM

12000 FILLING VALVE SYSTEM

13000 CULVERT-CHAMBER MANIFOLD

14000 LOCK CHAMBER

15000 EMPTYING VALVE SYSTEM

16000 OUTLET SYSTEM

A listing of operational variables is included with each major division in Table C-1 rather than in a separate division in order to group more closely the aspects of the lock operation with their related design features. The 22 "NOTED ITEMS" lines include special items peculiar to the specific projects and are identified in the notes at the end of Table C-1.

Table C-1
Lock Hydraulic System Model and Prototype Study Data

PAGE SEQUENCE FOR TABLE 1

DESIGN AND OPERATIONAL VARIABLES	TEST REPORT COLUMN NUMBERS			
	01 TO 20	21 TO 45	46 TO 65	66 TO 90
11000 TO 11275	1	2	3	4
11300 TO 12290	5	6	7	8
12300 TO 13236	9	10	11	12
13240 TO 14180	13	14	15	16
14200 TO 15290	17	18	19	20
15300 TO 16260	21	22	23	24
16300 TO 16460 AND "NOTED ITEMS"	25	26	27	28
	FACING PAGES		FACING PAGES	

1. Select DESIGN and/or OPERATIONAL variable(s) of interest and note line number(s) (1100 to 16460).

2. Trace selected line(s) across appropriate tables and note which REPORTS (columns) contain TYPES OF DATA (T, O, Q, etc.) of interest.

3. See Appendix A for full titles of REPORTS.

C-3. Test Reports

Each column heading in Table C-1 includes a very brief identification of the project and a brief notation of the report number (full title in Appendix A). The reports are listed in chronological order of the report dates.

The STP Report No. 46 contains six separate studies and is listed in six separate columns in Table C-1. This gives an apparent total of 86 reports. All the reports are available on loan from the WES Technical Library.

C-4. Types of Data in Reports

The types of lock performance data available in each report and pertaining specifically or generally to the various design and operational features investigated are indicated by the following letter symbols in Table C-1:

T = time, curves, and/or tabulation of lock chamber filling and/or emptying, or actual valve motion in a few tests

O = overfill or overempty in lock chamber

Q = culvert system discharge, or lock chamber rate-of-rise or rate-of-fall

H = hawser force on tow in lock chamber, or in approach in a few tests

D = tow displacement, unrestrained by hawsers

V = local velocities in ports, approach channel, etc.

C = surface currents, including vortices at intakes

B = boils, or surface turbulence

W = waves, or water-surface profiles in a few tests

S = surges or oscillations

I = internal flow pattern or flow distribution

Z = local average piezometric pressures

P = local transient or fluctuating pressures

L = pressure losses or differences

F = mechanical forces or torque

A = vibration

X = other data, usually air vent discharge. See last line of NOTED ITEMS at end of Table C-1

C-5. Comments

The following comments result from observations during the compilation of Table C-1 and may be of interest and/or assistance to users searching for available test data pertinent to their design problems.

a. Consideration of both the design and operational variables of the feature under investigation, both more general and more specific identification of the variables, and related items or systems in Table C-1 may aid in finding data that might otherwise be missed.

b. The listing of operational variables at "division level" in Table C-1 and the compilation process may have resulted in some inappropriate entries of types of data relative to the design variables. This would most likely occur where a report table or illustration includes several kinds of design and operational variables.

c. Culvert roof pressures just downstream from a valve were considered pertinent to, and listed under, 12230 (15230) FILLING (EMPTYING) VALVE SYSTEM, FLOW PASSAGE, ROOF EL, although a different variable may have been the primary consideration.

d. Surface currents at the intakes are listed under 11150 INTAKE SYSTEM, APPROACH, VORTEX CONTROL, although the vortex control may have been by valve operation or other feature rather than modification of the intake system.

e. Variable 14000 LOCK CHAMBER was given data references for nearly every citation involving lock chamber filling and emptying times and/or rates, hawser forces, surges, etc. Although there may not have been any design variations within the chamber, it is a location of primary interest for most aspects of lock operation.

C-6. Detailed Test Data Listings

Individual test report listings of the data locations within the reports are given in Item P5. An example list is given in Table C-2. The LINE NO'S correspond to those 251 numbers assigned to the design and operation variables. The TYPE OF DATA symbols correspond to those given in paragraph C-4 above. The FORMAT symbols are:

T = numbered table

P = numbered photograph

D = numbered drawings (plates)

F = numbered figures (covers all illustrations in STP reports)

W = test paragraph (or page if unnumbered paragraphs) containing information not indicated by the tables, photographs, drawings, or figures.

The LOCATION IN REPORT numbers and letters are those of the pertinent tables, photographs, drawings, figures, and/or paragraphs in that particular report.

C-7. Instruction

In addition to the indicated tables, photographs, drawings, and/or figures having data pertinent to a specific design and/or operational variable, the user should refer to those parts of the text where these data items are discussed. The comment in subparagraph C-5*b* above also applies to the detailed data listings. Also,

Table C-2
An Example of the Detailed Data Listing

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SORTED DATA FILE NO E01SP019
DATE 10/15/85
PROJECT: PICKWICK
DETAIL:
REPORT:  STP 19
MISC:
ENTRIES  275

 LINE    TYPE OF
 NO.     DATA     FORMAT   LOCATION IN REPORT
11200      I        F      10,11,12,16
11240      I        F      10,11,12,16
11300      T        F      18
           Q        F      19,20
           Z        F      18,41,44,45,46,47
           L        F      19,20
11450      T        F      18
           Q        F      19,20
           I        F      10,11
           Z        F      18
           L        F      19,20
12110      S        F      29
           I        F      21,22,23,24,26,26,27,28,30,31
                           32
           Z        F      30,31,32
12200      D        U      24
           S        F      29
           I        F      21,22,23,24,26,26,27,28,30,31
                           32
                    U      24
           Z        F      30,31,32
12230      T        F      72
           D        U      24
           I        U      24
12270      S        F      29
           I        F      30,31,32
           Z        F      30,31,32
12280      I        F      30,31,32
           Z        F      30,31,32
12330      T        F      72
           D        U      24
           S        F      29
           I        U      24
12350      I        F      21,22,23,24,26,26,27,28
12370      I        F      30,31,32
           Z        F      30,31,32
13100      Q        F      54,55
           U        F      54,55
           Z        F      41,42,43,44,45,46,47,48,49
13170      I        F      36,37,38
13200      D        U      19
           I        F      58,59,60,65,66,67,68,69
           Z        F      41,42,43,44,45,46,47,48,49
13240      Q        F      52,54,55,63,75
           U        F      51,54,55
           I        F      50,51,56,57,58,59,60,65,66,67
                           68,69,75,76,77
           L        F      63,75
13241      I        F      69
13265      Q        F      54,55
           U        F      54,55
13330      I        F      37
13340      Q        F      54,55
           U        F      54,55
13350      Q        F      52,54,55
           U        F      54,55
           I        F      65,66,67,68
           Z        F      41,42,43,44,45,46,47,48,49
13370      I        F      36,37,38
14000      T        F      70,71,72
           Q        F      70
           D        F      74
                    U      19,24,25
           C        F      73
           I        U      24
           Z        F      41,42,43,44,45,46,47,48,49
14212      D        F      74
                    U      19,24,25
           I        U      24
14230      D        U      25
14240      T        F      71,72
           D        U      24
           I        U      24
15100      B        U      26
           I        U      27
15110      I        F      33,34
           Z        F      33,34
15200      I        F      33,34
           Z        F      33,34
15270      I        F      33,34
           Z        F      33,34
15280      C        F      87
           B        F      85,86,87
           I        F      33,34,82,84,88
           Z        F      33,34
15360      I        F      33,34
           Z        F      33,34
16200      I        F      79,80,81,82,83,84
                    U      27
16230      C        F      87
           B        F      85,86,87
                    U      26
           I        F      79,80,81,82,83,84,88
16231      I        F      79,80
16241      I        F      88
16252      I        F      80,81,82
16440      I        F      83,84
16460      C        F      87
           B        F      85,86,87
           I        F      82,84,88
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variations in design and/or operational variables from table to table, photograph to photograph, etc., rather than in individual tables, photographs, etc., are covered by listings of all the related data item location numbers. The user should compare variables from item to item as well as in a single item.

C-8. Coverage

A total of 24,635 location citations was derived from a total of 2,816 single- or combined-item references (tables, photographs, drawings, figures, text) in the 86 reports (81 publications).

C-9. Project Data Listings

Listings of available dimensional and other descriptive data pertinent to the project designs investigated in the model tests also are given in Item P5. An example list is given in Table C-3. Entries of "XXXXX" indicate subheadings; entries of "X" indicate confirmed nonapplicable items; and blanks indicate unavailable information. A definition list for the abbreviations is included in Item P5.

Table C-3
An Example of Project Data File Number (PLEGEND)

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00001 PROJECT DATA FILE NUMBER (PLEGEND)
00002 DATE 02/14/86
10000 GENERAL INFORMATION
10100   PROJECT IDENTIFICATION
10110     PROJECT
10120     DETAIL
10130     REPORT
10200   WATERWAY
10210     NAME
10220     MILE
10230     PORT-DOCK NUMBER
10300   PROJECT DIMENSIONS
10310     DESIGN LIFT
10320     MAX. LIFT
10330     MIN. LIFT
10340     USABLE LENGTH
10350     CLEAR WIDTH
10400   PROTOTYPE SYSTEM
10410     INTAKE
10420     VALVES
10430     FILL/EMPTY
10440     OUTLET
10450     LOCK GATES
10460     EMERG. CLOSURE
10500   MODEL STUDY
10510     TITLE (SHORT)
10520     AUTHOR
10530     LABORATORY
10540     WES LIBRARY NO.
10550     REPORT DATE
10560     TEST COMPL. DATE
10570     SCALE
10580     SCOPE
10590     NOTED ITEMS
11000 INTAKE SYSTEM
11100   APPROACH
11110     CHANNEL TYPE
11120     CHANNEL LENGTH
11130     GUIDE-GUARD WALLS
11140     DEBRIS CONTROL
11150     VORTEX CONTROL
11160     TRASH RACK
11170     NOTED ITEMS
11200   MANIFOLD
11210     TYPE
11220     LOCATION
11230     DESIGN SUBMERGENCE
11240     PORTS
11241       NUMBER
11242       ARRANGEMENT
11243       SHAPE
11244       NOTED ITEMS
11250     PORT FACE
11251       WIDTH
11252       HEIGHT
11253       TOTAL AREA
11254       T. AREA/CULV. AREA
11260     PORT INTAKE
11261       WIDTH
11262       HEIGHT
11263       TOTAL AREA
11264       T. AREA/CULV. AREA
11270     PORT THROAT
11271       WIDTH
11272       HEIGHT
11273       TOTAL AREA
11274       T. AREA/CULV. AREA
11275       T. WIDTH/CULV. WIDTH
11300   TRANSITION CONDUIT
11310     LENGTH
11320     SHAPE
11330     UPSTR SIZE (WXH)
11340     DNSTR SIZE (WXH)
11350     SLOPE
11360     BENDS
11370     NOTED ITEMS
11400   OPERATION
11410     TYPE
11420     VALVES USED
11430     VALVE SCHEDULE
11440     INITIAL POOL EL
11450     INITIAL CHAMBER EL
11460     NOTED ITEMS
12000 FILLING VALVE SYSTEM
12100   VALVE
12110     TYPE
12120     SIZE (WXH)
12130     RADIUS
12140     TRUNNION EL
12150     HOIST
12160     VENTS
12170     NOTED ITEMS
12200   FLOW PASSAGE
12210     SHAPE
12220     SIZE (WXH)
12230     ROOF EL
12240     INVERT EL
12250     CONTRACTION
12260     EXPANSION
12270     WELL
12280     BULKHEAD SLOTS
12290     NOTED ITEMS
12300   OPERATION
12310     TYPE
12320     VALVES USED
12330     VALVE SCHEDULE
12340     INITIAL POOL EL
12350     INITIAL CHAMBER EL
12360     VENTS
12370     BULKHEAD SLOTS
12380     NOTED ITEMS
13000 CULVERT-CHAMBER MANIFOLD
13100   CULVERT
13110     LENGTH
13120     SHAPE
13130     SIZE (WXH)
13140     AREA
13150     TRANSITIONS
13160     BENDS
13170     NOTED ITEMS
13200   MANIFOLD
13210     TYPE
13220     BRANCH LATS, LONGS
13221       NUMBER
13222       ARRANGEMENT
13223       LENGTH
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