AD-A134 267 MISSISSIPPI RIVER: STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND D..(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT APR 76 1/1

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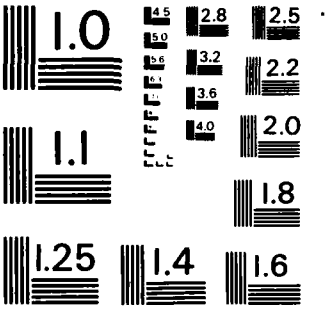

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INLAND WATERWAYS
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

It is recommended that both the landward lock, the riverward lock and the dam at Lock & Dam no. 1, Minneapolis, Minnesota be completely rehabilitated. Based on studies completed to the date of this report, more detailed studies are required to firmly establish cost estimates, environmental effects, and the construction scheduling necessary to insure the work can be completed in the proposed two year construction period without delaying navigation.

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DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER
STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1
MINNEAPOLIS, MINNESOTA

SUPPORTING DATA
FOR
APPENDIX H
MECHANICAL INVESTIGATIONS

TABLE OF CONTENTS

I. SUPPORTING COSTS

The cost figures below can be found summarized in Chapter X of Appendix H.

A. Itemized Miter Gate Repair Costs

1. Miter Gate Labor Costs (Item 1-A, Chapter X, of Appendix H)

a. Lower Gates

1951 Feb.-March Construction Labor Costs - $32,105

ENR Minneapolis Index for common labor:

1950 December	-	38
1974 March	-	180
1975 January (est.)	-	187

Present cost $= \frac{187}{38} \times 32{,}105 =$ $160,000 (2 sets)

Present cost = $160,000 x 1/2= $80,000 (1 set)

b. Upper Gates

Estimate that half of the cost determined for the lower gates is fixed and the other half of the cost is a function of the size of the gate.

Cost of 1 set = [0.50 + (0.50) (70,660/173,000)](80,000)=

= 40,000 + 16,300 = $56,000

Where: 70,660 is weight of upper gate in lbs.
173,000 is weight of lower gate in lbs.

c. Total

Total labor cost of combined upper and lower gate

repairs = 80,000 + 56,000 = $136,000.

2. Miter Gate Temporary Material Costs (Item 1-B)

a. Lower Gate

1950 December Material Costs - $13,550

ENR Minneapolis Index for construction material:

1950 December	- 83
1974 March	- 160
1975 January (est.)	175

Present cost = $\frac{175}{83}$ x $13,550 = $29,000, say $30,000
This cost is chosen as the cost of reparations to one set of leaves. Originally, the 1951 repair history gave the $13,550 cost as that for 2 sets of leaves. However, the lower gates were not repaired simultaneously as required by the current construction schedule but one at a time. Therefore, the cost of material for one set of lower miter gates is the adjusted 1951 cost of both sets of lower gates.

b. Upper Gate

Estimate 80% of lower miter gate costs for upper gates. Cost of 1 set = (0.80)(30,000) = $24,000.

c. Total

Total temporary material costs of combined upper and lower gate repairs = $24,000 + $30,000 = $54,000.

3. Miter Gate Equipment Rental Costs (Item 1-C)

a. Lower Gate

1950 Equipment Rental Costs - $5,400

ENR Minneapolis Index for construction costs:

1950 December	49
1974 March	- 170
1975 January (est.)	- 175

Present cost = $\frac{175}{49}$ x $5,400 = $19,300 (2 sets), say $20,000

Present cost = $20,000 x 1/2 = $10,000 (1 set)

b. Upper Gate

Estimate 50% of lower miter gate costs for upper gates.

Cost of 1 set = (0.50) x ($10,000) = $5,000.

c. Total

Total rental costs of combined upper and lower gate repairs = $10,000 + $5,000 = $15,000.

4. Lubrite Pintle Bushings (Item 1-D)

From Corps of Engineers Drawing No. M-L1-21/27. The existing pintle bushing weighs 174 lbs each. "Lubrite" bushing estimated January, 1975, cost per pound: $12.00/lb. Cost for each pintle bushing: ($12/lb) (174 lbs/ea.) = $2,088, say $2,100/ea.

5. Lubrite Anchorage Bar Bushings (Item 1-E)

From Corps of Engineers Drawing No. M-L1-20/31. The existing bronze bushing weighs 7.1 lbs. Use 8 lbs. Cost for each anchorage bar bushing = ($12/lb)(8 lbs/ea.) = $96/ea., say $100/ea.

6. Diagonal Extensions (Item 1-F)

Estimated weight of extension (see Plate H-3) = 160 lbs. Estimated cost per pound of structural steel, bars and threaded rod (incl. labor) = $1.75/lb. Cost per diagonal extension = (160 lb/ea.)($1.75/lb) = $280/each.

7. Diagonal Jacking Bracket (Item 1-G)

Estimated weight of jacking bracket = 175 lbs/ea. Estimated cost per pound of structural steel plate (including labor) = $2.00/lb.

Cost per bracket = (175 lbs/ea.)($2.00/lb) = $350/ea.

8. Timber Fenders (Item 1-H)

Each timber fender measures 8" x 10" x 30'. Estimated cost per foot of timber is $5/ft. Cost of each timber fender = ($5/ft)(30'/fender) = $150/each.

9. Painting (Item 1-I)

a. Upper gate surface area:

As per Corps of Engineers drawing 122 M-L1-21/25, total accessible surface area (estimated) = 4,500 sq.ft.ea.

b. Lower gate surface area:

By comparison lower to upper gate height $\frac{53'}{23'}$ = 2.3 to 1 ratio (both about 30' wide x 2'-6" thick). Surface area for lower gate is:

4,500 sq.ft. x 2.3 = 10,350 sq.ft.

Additional surface area for lower gates (Note the closer beam spacing at bottom of lower gate leaves) = 1,250 sq.ft.

Total accessible surface of lower gate leaf (estimated) = 11,600 sq.ft.ea.

c. Summary of surface area per lock

Total surface area= 2 x upper gates + 2 x lower gates= 2 x 4,500 (upper gate) + 2 x 11,600 (lower gate) = 32,200 sq.ft., say 33,000 sq.ft.

d. Cost estimate:

Sandblast upper and lower gates to bare metal. Paint per Corps of Engineers (Don Boneville by phone 10-30-74):

3 coats vinyl base - white, gray, white
3 mills total

3 coats vinyl aluminium
3 mills total

Estimated cost of sandblasting an irregular surface is $1.25/sq.ft.

Estimated cost of painting, six coats at $0.25 per coat per square foot is $1.50/sq.ft.

Total cost per square foot for sandblasting and painting = $1.25 + $1.50 = $2.75/sq.ft.

Estimated cost of scaffolding per sq.ft.: $1.00/sq.ft.

Combined cost per square foot for sandblasting, painting and scaffolding = $2.75 + $1.00 = $3.75/sq.ft.

e. Total cost of sandblasting, painting, and scaffolding = ($3.75/sq.ft.)(33,000 sq.ft./lock) = $124,000, say $125,000.

10. Reinforcing Embedded Gate Anchorages for Lower Miter Gates (Item 1-J)

Estimated Weight:	$1,500 lbs/lock
Estimated Cost:	$3.00/lbs (installed)
	$4,500/lock

11. Miter Gate Guides (Item 1-K)

Engineering Estimate: $3,000/gate

12. Allowances for Labor and Material for Straightening Gate Bottom and Rivet Replacement (Item 1-L)

Engineering estimate:

$5,000 for 2 upstream leaves

$15,000 for 2 downstream leaves

$20,000 total per lock

13. Miter Gate Bolt-Back System (Item 1-M)

Estimated Cost by Corps of Engineers: $750/lock

14. Ice Protection Plating (Item 1-N)

a. Lower Miter Gates

Estimated weight of aluminum plate per leaf = 996 lbs/leaf.

Cost per gate = (2 leaves)(996 lbs/leaf)($4.00/lb)

= $7,963, say $8,000.

Estimated volume of foam per leaf = 1280 ft^3/leaf.

Cost per gate = (2 leaves)(1280 ft^3/leaf)($3.40/$ft^3$)
= $8,700.

b. Total

Aluminum plate:	$8,000
Foam:	$8,700
Total estimated Cost	$16,700

B. Itemized Miter Gate Operator Costs

1. Cylinder Assembly (Item 2-A, Chapter X)

7" bore, 5" rod, 106" stroke similar to Parker Hannifin DD-NS-23 with gimbled mounting base:

Estimated weight	1500 lbs each
Estimated Cost/lb	2.65
Estimated Cost/Cylinder	$4,000 each

2. Hydraulic Pump Unit (Item 2-B)

a. Pump

Variable discharge 5% - 100%; 3100 cipm @ 1100 psi max. 1500 psi, Oilgear type DE with reservoir, motor base:

Estimated Cost	$3,500

b. Motor

15 hp, 1200 rpm:

Estimated Cost	750

c. Estimated additional miscellaneous materials cost: 750

d. Estimated total pump unit cost: $5,000

3. Limit Switch Assembly (Item 2-C)

Limitorque type rotary limit switch assy. $1,000 ea.

4. Latch (Item 2-D)

a. Assembly

Estimated weight 100 lbs
Estimated cost per pound $2.50
Estimated cost/assembly $250

b. Cylinder

2" stroke, 2" bore, 1500 psi similar to Carter Controls Model GNM:
Estimated cost/cylinder $100

c. Total Latch Assembly $350 ea.

5. Existing Operator Removal (Item 2-E)

$18/hr/man x 8 hr/day = $144/man/day Assume: 4 man crew, 8 days for installation. Estimated cost of one operator removal = (144)(4)(8) = $4,600/each operator.

6. Installation and Testing of New Operator (Item 2-F)

Assume:

$20/hr/man x 8 hr/day = $160/man-day

Assume 4 man crew, two weeks for installation. Estimated cost of installation of one operator = ($160)(4)(10) = $6,400/each operator.

C. Itemized Slide Valve Costs

1. Gate (Items 3-A, 4-A)

Estimated weight of gate - 7000 lbs/ea.
Estimated cost per pound - $2.00/lb
Estimated cost of gate = (7000 lbs)($2.00/lb)
= $14,000 each gate

2. Hoist Cylinders (Items 3-B, 4-B)

Hydraulic cylinder: 7" bore, 3" piston rod, 120" stroke, design pressure 1400 psi.
Estimated weight of cylinder - 1700 lbs/ea.
Estimated cost per pound - $2.65/lb
Estimated cost of cylinder = (1700 lbs)($2.65/lb)

= $4,500/cylinder

3. Hydraulic Pump Units (Items 3-C, 4-C)

Variable discharge 5%-100%; 3500 cipm @ 1700 psi max. 2000 psi, Oilgear type DE with reservoir, motor base:

Estimated Cost = $5,000 each.

4. Limit Switch Assembly (Items 3-D, 4-D)

Limitorque type rotary limit switch assembly - $1,000/each.

5. Motor (Items 3-E, 4-E)

(1) Motor 20 hp, 1200 rpm:

Estimated cost = $1,500/ea.

(2) Mounting base and miscellaneous equipment:

Estimated cost = $500/ea.

Total cost $2,000/ea.

6. Embedded Parts for Filling Valves (Item 3-F)

Estimated weights:

(1) Guides = (2 slots)(50 feet/slot)(24 lbs/foot)

= 2400 lbs

(2) Tracks = (2 slots)(20 feet/slot)(65 lbs/foot)

= 2600 lbs

(3) Sill plate = (10 feet)(36 lbs/foot) = 360 lbs

(4) Lintel plate = (10 feet)(50 lbs/foot) = 500 lbs

Total estimated weight of embedded parts = 5860 lbs

Say 6000 lbs/gate

Estimated cost per pound: $2.00/lb installed Estimated cost for filling valve embedded parts
= (6,000 lbs) x ($2.00/lb) = $12,000/slot

7. Embedded Parts for Emptying Valves (Item 4-F)

Estimated weights:

(1)	Guides	2,500 lbs
(2)	Slots	5,500 lbs
(3)	Sill	360 lbs
(4)	Lintel	500 lbs
Total estimated weight of embedded parts:		8,860 lbs
Say		9,000 lbs

Estimated cost per pound: $2.00/lb installed.
Estimated cost for emptying valve embedded parts
= (9,000 lbs) x ($2.00/lb) = $18,000/slot

D. Itemized Valve Bulkhead Costs

1. Bulkhead Assembly (Item 5)

Estimated weight of one section of one bulkhead:	725 lbs
Estimated weight of 4 sections:	2,900 lbs
Estimated weight of bolts & misc. parts:	100 lbs
Estimated weight for one bulkhead:	3,000 lbs

Estimated cost: $1.50/lb

Estimated cost per bulkhead = (3,000 lbs)($1.50/lb)
= $4,500 each

2. Valve Bulkhead Embedded Parts (Items 6-A, 6-B)

a. Upstream filling valve bulkhead slot (2 required per lock)

Sill beam: length 9.33 feet of W4x13 (13#/ft)	=	121 lbs
Side guide Ls; length 2H = 48' of 3x3x1/2 (9.4#/ft)	=	451 lbs
Roof seal Ls; length 9.33' of 3x3x1/2	=	87 lbs
Guide seating Ls; length $\frac{12+2}{2x2}$ = 14' of 3x3x1/2	=	132 lbs
Guide seating plates; 14 PL (1 1/2x4x1/2) ($490\#/ft^3$)	=	12 lbs
		803 lbs
	Say	800 lbs

Estimated Cost: $4.00/lb installed
800 lbs x $4.00/lb = $3,200/slot

b. All other slots (6 required per lock)

Sill beam; length 9.33 feet of W4x13	=	121 lbs
Side guide Ls; length 2H = 102' of 3x3x1/2	=	957 lbs
Roof seal Ls; length 9.33' of 3x3x1/2	=	87 lbs
Guide seating Ls; length $\frac{102.8}{4}$ = 30' of 3x3x1/2	=	283 lbs
Guide seating PL; 30 PL (1 1/2x4x1/2)	=	26 lbs
		1474 lbs
	Say	1500 lbs

Estimated cost: $4.00/lb installed
1,500 lbs x $4.00/lb = $6,000/each

F. Itemized Lock Bulkhead Costs

1. Bulkhead Sections (Item 7-A)

Estimated Weights:

Structural Steel	7510 lbs each
Low Alloy Structural Steel	4520 lbs each

Estimated total weight: 12,000/lbs/section

Estimated Cost: $2.00/lb

Cost for one section = (12,000 lbs/section)($2.00/lb)
= $24,000/section

2. Pickup Beam (Item 7-B)

Estimated beam and components weight: 4000 lbs/each
Estimated cost/lb: $2.00
Estimated cost of pickup beam = (4000 lbs/ea.)($2.00/lb)
= $8,000/each

3 Bulkhead Trucks (Item 7-C)

Estimated weight of one truck: 750 lbs
Estimated cost per pound of truck: $1.50/lb
Estimated cost of one truck = (750 lbs/ea.)($1.50/lb)
= $1.125/ea., say $1,150/ea.

4. Bulkhead Slot Embedded Parts (Item 8)
Note: Bulkhead slot materials taken from C of E Drawing No. 89 M-L STA-20/55L1. Upstream bulkhead slots (weights for 2 slots)

Item	Estimated Weight
L3x3x3/8	316
PL 2x1/4x12	150
PL 4x1/2	300
10WF 33	1533
PL 12x1/2	950
PL 2x1/4x12	95
PL 15x1/2	1430
	4774, say 4800 lbs

Downstream bulkhead slots (weights for 2 slots)

Item	Estimated Weight
L3x3x3/8	770
PL 2x1/4x12	363
PL 4x1/2	728
10WF33	3610
PL 12x1/2	2240
PL 2x1/4x12	211
PL 15x1/2	3160
	11,082, say 11,100 lbs
	15,900

Total estimated weight for 1 lock = 16,000

Estimated cost per pound: $2.50/lb installed

Cost of one lock = (16,000 lb/lock)(2.50/lb) =
= $40,000/lock

F. Itemized Mooring Provisions and Miscellaneous Mechanical Costs

1. Floating Mooring Bitt (Item 9-A)

a. Bitt

1959 Bid cost of identical bitt at St. Anthony Falls - $4,000.

Estimated material portion: $1,000
Estimated labor portion: $3,000

Material Cost Index:

December 1959 - 102
March 1974 - 160
Est. January 1975 - 170

January 1975 Material Cost = $\frac{170}{102}$ x 1000 = $1,700

Labor Cost Index:

December 1959 - 71
March 1974 - 175
Est. January 1975 - 180

January 1975 Labor Cost = $\frac{180}{71}$ x 3000 = $7,700

Total estimated cost of each floating mooring bitt = $9,400/ea.

b. Guide Sections

From El. 678.0 to El. 731.5 is 53.5 feet.

Number of 8'0" long sections required on each side = $\frac{53.5}{8}$ = 6.7

From C. of E. Dwg. No. 334 M-L STA-33/502. Weight of each guide section: 630 lbs/8'0" section

Total weight = 2 x 6.7 x 630 = 8,500 lbs

Weight of anchors (ea. 10 lbs), 4 per section =
13.4 x 4 x 10 = 536 lbs

Estimated weight, total = 8,500 + 536 = 9,036 lbs
Say 9,000 lbs
Estimated cost per pound = $2.00/lb installed
Estimated cost of embedded parts = ($2.00/lb)(9000 lbs)
=$18,000

c. Total Costs

Bitt	$9,400
Embedded Parts	18,000
TOTAL	$27,400/each floating mooring bitt installation

2. Traveling Mooring Bitt (Item 9-B)

a. Bitt

From C. of E. Dwg. No. 193 M-5A-33/13.

Weight of bitt:

Structural Steel	300 lbs
Steel Pipe	400 lbs

Estimated Costs:

Per pound of structural steel	$3.00
Per pound of steel pipe	$0.75

Estimated cost of travelling mooring bitt:
($3.00)(300)+($0.75)(400) = 900 + 300 = $1,200

b. Rail

Estimated length of rail = 310'
Estimated weight per yard rail = 175#/yd.
Estimated cost of rail per pound = $1.00 installed

$$\text{Cost of rail} = (310')\left(\frac{1 \text{ yard}}{3 \text{ feet}}\right)(175 \text{ lbs/yard})(\$1.00/\text{lb})$$

$$= \$18,100$$

c. Hardware

Estimated amount of manufactured mounting hardware is 700 lbs.
Estimated cost per pound of hardware is $1.50/lb.
Cost of hardware = (700 lbs)($1.50/lb) = $1,200.

d. Total

Total cost of one traveling mooring bitt:

Bitt	$1,200
Rail	$18,100
Hardware	$1,200
	$20,500/each

3. Check Posts (Item 9-C)

From C of E. Dwg. No. 92 M-L STA-20/561.1.
Weight of post: 315 lbs.
Weight of anchors: 60 lbs.
Estimated cost per pound: $0.70/lb.
Cost of post and anchors = (375)(.70) = $270/each
From C. of E. Dwg. No. 19 M-L-STA-20/561.1.
Chock weighs 150 lbs/ea.
Estimated cost per pound is $0.70/lb.
Cost of chock = (150 lbs)($0.70/lb) = $105/ea.

Total cost per set of post, anchors and chock=$375/ea.

4. Tow Haulage Unit (Item 9-D)

One hydraulic winch with 10,000 pound minimum pull, 100 feet per minute maximum line pull speed, clutch and brakes. Cost, including installation, profit and overhead: $15,500 ea.

One hydraulic power pack, 1700-2000 psig, 40 gallon per minute. Cost, including installation, profit and overhead: $5,000 ea.

One 60 hp electric motor. Cost, including installation, profit and overhead: $2,000 ea.

Estimated cost of base and storage tank: $2,000 ea.

Estimated weight of swivel chock taken from C. of E. Dwg. No. 231 M-L STA-33/1.1: 2000 lbs.

Estimated cost per pound, including labor and installation: $2.00/lb.

Estimated cost of one swivel chock =

(2000 lbs/ea)($2.00/lb) = $4,000 ea.

Estimated cost per foot of 1/2 inch galvanized steel rope: $2.00/foot

Cost of 250 feet = (250)(2.00) = $500

Total Estimated Cost $29,000 each

5. Revolving Jib Crane (Item 9-E)

Corps of Engineers Estimate $3,000 ea.

6. Boat Davits (Item 9-F)

Corps of Engineers Estimate $5,000 ea.

7. Portable Gantry Crane (Item 9-G)

Wallace Gantry Model 1-6010101	$1,629
Gantry accessories	883
4 ton hand-operated chain hoist with 56 ft lift	1310
TOTAL	$3,822
Say	$3,900

G. Itemized De-icing System Costs

1. Plans 1, 2, and 3

a. Valves and Piping (Item 10-A)

2 1/2 inch copper tube:	$6,200
2 inch copper tube:	8,300
1 inch copper tube:	6,200
6 inch copper pipe:	600
Assorted valves and nozzles	6,200
Total	$27,500
Say	$28,000

b. Air Compressor (Item 10-B)

One air-cooled air compressor, 100 cfm capacity and 100 psi discharge pressure each. One to be used for continuous de-icing while the other is in reserve and auxiliary tool use: $16,000

Note: All costs based on 1974 list prices, including an allowance for price increases, installation, profit and overhead.

2. Plan 4

a. Valves and Piping (Item 10-A)

Valves and piping for one lock (see Section 1a above)	$28,000
Additional piping necessary for second lock	$14,000
Total	$42,000

b. Air Compressor (Item 10-B)

Two air-cooled air compressors 100 CFM, 100 psi: $16,000/ea.

(2) x (16,000) = $32,000

H. Itemized Costs for Station Services

1. Fire Protection (Item 11-A)

a. Plans 1, 2, and 3

2 pumps with 30 hp motor delivering 500 gpm and 130 feet of head and pumphouses	$24,000
System comprised of various tubing, standpipes and strainers, valves, 2 1/2 inch firehoses and reels	$36,000
Electrical control equipment	$5,000
Total	$65,000

b. Plan 4

3 pumps with 30 hp motor delivering 500 gpm and 130 feet of head and pumphouses	$36,000
System comprised of various tubing, standpipes and strainers, valves, 2 1/2 inch firehoses and reels	$56,500
Electrical control equipment (includes controls from each hose cabinet)	$7,500
Total	$100,000

2. Sanitary Facilities (Item 11-B)

Lavatory, water closet, urinals, water heater, drinking fountain, and wash facilities	$2,500
Piping	$1,500
Force main, grinder pump and two lift stations (Est. from C. of E.)	$40,000
Total	$44,000

3. Heating, Ventilating and Air Conditioning (Item 11-C)

Estimated required air conditioning: 7 tons
Estimated air conditioning system cost: $2000

Estimated cost of unit = (7 tons)($2000/ton) = $14,000

Estimated heating and ventilating requirement: 5150 cu.ft. per minute

Estimated cost per cfm: $2.00 per cfm

Estimated cost of heating, ventilating, and air conditioning system=
(5150 cfm) ($2.00/cfm) = $10,300

Total cost for HV & AC $24,300

Say $25,000

I. Itemized Costs for Temporary River Lock Repairs

1. Remove and Replace Stoney Gates

$18/hr/man x 8 hr/day = $144/man/day

Estimate: 4 man crew, 12 days required

Estimated cost of 1 gate removed and replaced:
(144)(4)(12) = $6,900, say $7,000

2. Allowance for Stoney Gate Replacement Parts

Engineering Estimate: $10,000 each

3. Remove and Replace Miter Gate Operators

$18/hr/man x 8 hr/day = $144/man/day

Estimate: 4 man crew, 6 days required

(144)(6)(4) = $3,400 each

4. Allowance for Miter Gate Operator Replacement Parts

a. Labor to Rebuild Cylinder

Estimate: 55 man-hours at $18/hr

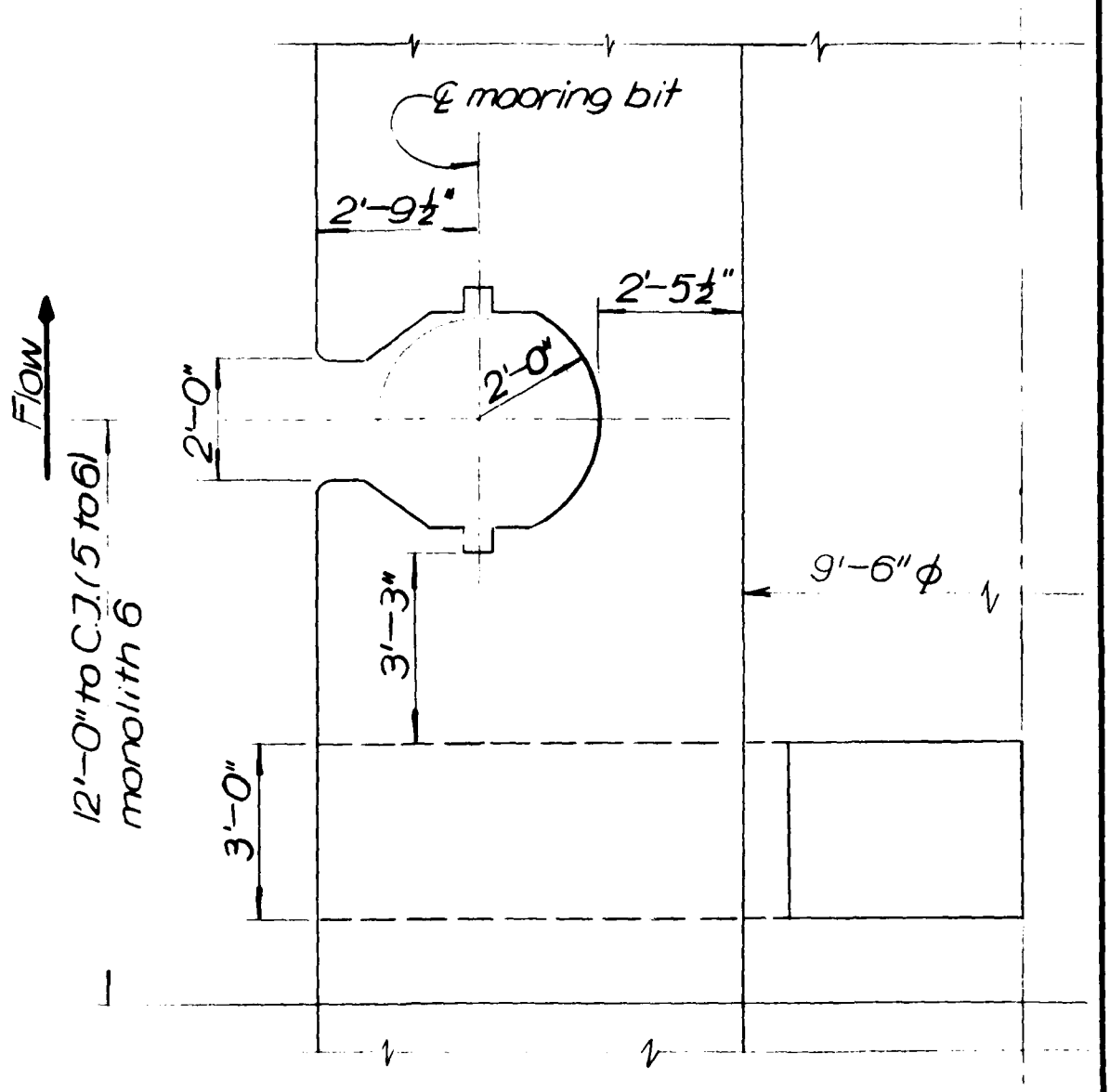
Total labor cost: (55)(18) =	$990

b. Parts for Rebuilding Cylinder

2 Packing rings per cylinder at $50/ea. =	$100
Piston ring (cast iron) (1/cylinder) (35 lbs/ea.)($2.00/lb)=	$70
Stuffing box pack rings (9/cylinder)($10/ea.)=	$90
Type I cast iron rollers (4/cylinder)(7 lbs/ea.)($2.00/lb)=	$60
Type II cast iron rollers (5/cylinder)(26 lbs/ea.)($2.00/lb)=	$260
Sector arm bushing (65 lbs/cylinder)($7.00/lb) =	$450
Thrust washer (65 lbs/cylinder)($7.00/lb) =	$450
Recondition 4-way valve =	$500
Total Replacement Parts	$2,975
Say	$3,000/ea.

II. FLOATING MOORING BITT SKETCHES

This chapter displays the floating mooring bitt-filling conduit and manifold interactions and clearances.



STUDY OF ALTERNATIVES FOR REHABILITATION

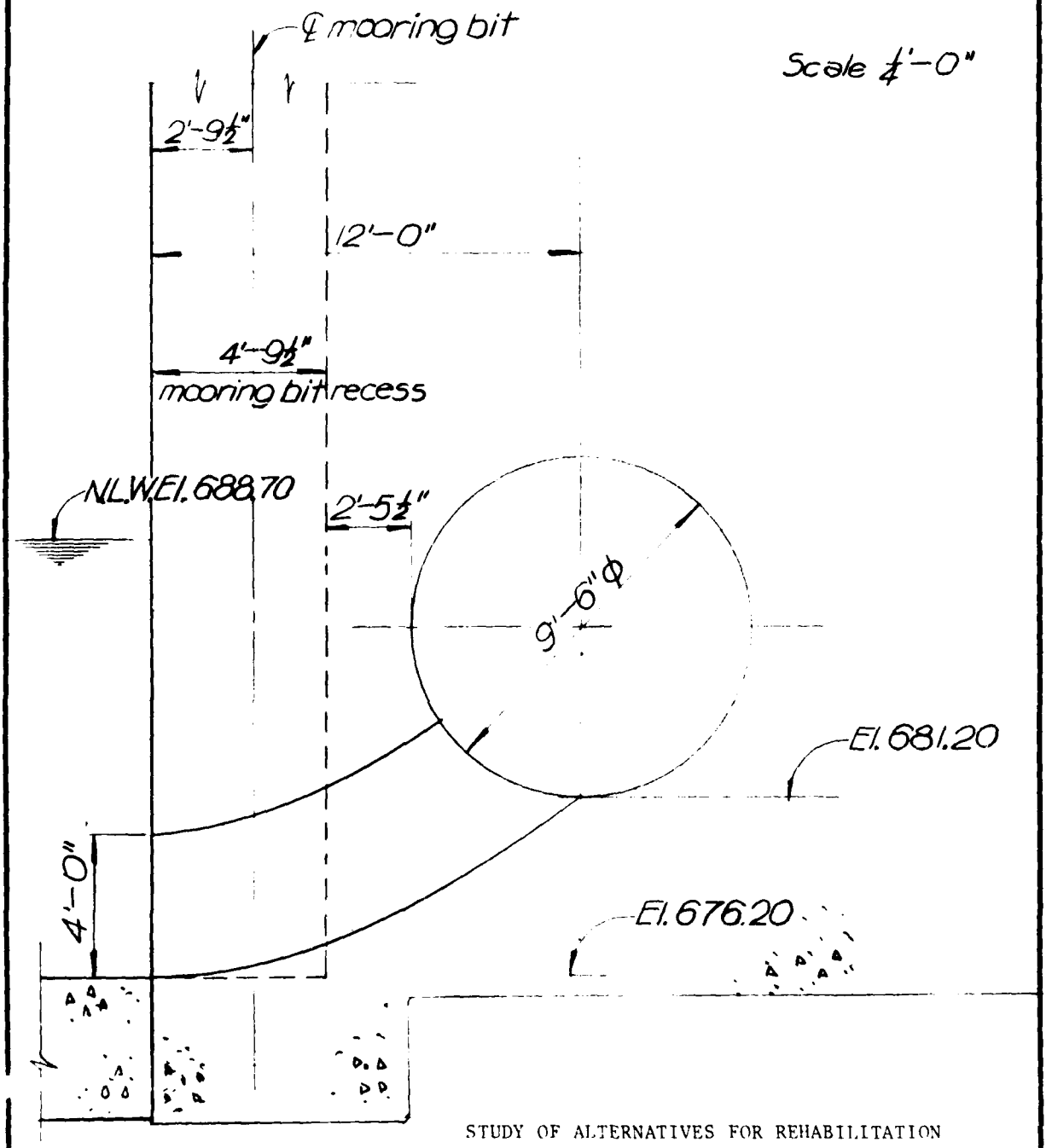
MISSISSIPPI RIVER LOCK & DAM NO. 1

MECHANICAL INVESTIGATIONS

FLOATING MOORING BITT CLEARANCES

ST. PAUL, MINN. DISTRICT

MARCH, 1975



STUDY OF ALTERNATIVES FOR REHABILITATION
MISSISSIPPI RIVER LOCK & DAM NO. 1
MECHANICAL INVESTIGATIONS
FLOATING MOORING BITT CLEARANCES
ST. PAUL, MINN. DISTRICT
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III. AIR COMPRESSOR SIZING

The size of the air compressor to be used in the lock de-icing system was determined for Plans 1, 2, and 3 using the following criteria:

A. Air Pressure: Nozzle discharge pressure will be static head + 2 psi.

B. Air Quantity: 2 cfm per nozzle.

C. Nozzle Size: 1/8".

D. Piping Material:
- Copper tubing
- Wrought copper and brass soldered fittings
- Brass valves
- Brass pipe and nipples at the control stations and air outlets, where screwed joints are required
- Pressure reducing valves will be provided at de-icing stations.

E. Air Quantity:

No. of nozzles:

-Miter gate recesses: 4 x 4	=	16
-Miter gate (upstream)	=	8
-Quoins 4 x 3	=	12
-Filling gate recesses 4 x 2	=	8
		44

44 nozzles x 2 cfm = 88 cfm

F. Air Pressure:

Upstream miter gate:

Top of lock	El. 733.0	(Norm. W.L.E.724.7)
Bottom of gate	El. 709.7	
	23.3 ft	

Downstream miter gate:

Max. water level	El. 688.7	
Bottom of gate	El. 675.7	
	13.0 ft	

Assume that filling gate slot nozzles will operate while channel is filled to normal upstream W.L. El. 724.7
Nozzle El. El. 692.0
32.7 ft

32 ft x .433 = 14 psi
+ 2 psi
16 psi

G. Air Tools: From Compressed Air Handbook:

Best operating pressure 90 psi; at 60 psi, efficiency is 50% lower.

10 - 1" air outlets will be provided.

H. Compressor: One air compressor, 100 cfm capacity and 100 psi discharge pressure, will be provided. (One air compressor is enough for de-icing (reduced pressure) or for tools, but not simultaneously.)

Ingersoll-Rand ESV, bore 7x5, maximum discharge pressure 125-100 psi, 108.7 cfm at 90 psi, packaged unit, continuous duty.

IV. SOURCES OF DATA AND INFORMATION

A. As-Built Drawings

1.	M-L1 40/36.1	Sluice gate operating machinery assembly.
2.	M-L1 40/37.1	Sluice gate operating machinery assembly, details.
3.	M-L1 40/37.1A	Sluice gate operating machinery assembly, modified intake trashracks.
4.	M-L1 40/38	Sluice gate operating machinery assembly, miscellaneous details.
5.	M-L1 40/39	Sluice gate operating machinery assembly, gate guides.
6.	M-L1 40/41	Sluice gate operating machinery assembly, replacement of top side of gate frame and bronze strip.
7.	M-L1 Sta 21/501	Upper miter gate, outline of leaf and recess.
8.	M-L1 27/1	Piping.
9.	M-L1 27/2	Piping.
10.	M-L1 20/78	Debris and ice removal, bubbler system.
11.		Lock and Dam 2, landward lock, fire protection facilities, profiles, sections and details.
12.		Lock and Dam 2, landward lock, fire protection facilities, layout plan.
13.		Lock and Dam 2, landward lock, fire protection facilities, pumphouse.

14.		Lock and Dam 2, landward lock, fire protection facilities, profiles, sections and details.
15.		Lock and Dam 2, landward lock, fire protection facilities, details.
16.	M-L Sta 20/121	Lock Masonry.
17.	M-L Sta 30/1.1	Steel bulkheads for tainter valves.
18.	M-L 5A - 33/5	Traveling mooring bitt.
19.	M-5A - 33/13	Revisions to traveling mooring bitt bearings.
20.	M-LG-33/4	Traveling Mooring bitt, rail, splice bars and clips.
21.	M-L5A-10/17	Traveling mooring bitt.
22.	M-L Sta-20/55L1	Lock bulkhead recesses.
23.	M-L Sta-22/502	Miter gate operating machinery.
24.	M-L Sta-22/503	Miter gate operating machinery.
25.	M-L Sta-22/504	Miter gate operating machinery.
26.	M-L Sta-22/501	Miter gate operating machinery.
27.	M-L Sta-22/509	Miter gate operating machinery.
28.	M-L Sta-20/561.1	Miter gate operating machinery.
29.	M-L Sta-33/1.1	Tow-haulage equipment, haulage units, cable guide details.
30.	M-L Sta-36/501	Air bubbler and de-icing systems.
31.	M-L Sta-36/502	Air bubbler and de-icing systems.
32.	M-L Sta-36/503	Air bubbler and de-icing systems.
33.	M-L Sta-36/504	Air bubbler and de-icing systems.

34.	M-L Sta-36/507	Air bubbler and de-icing systems.
35.	M-L Sta-58/501	Lock bulkhead.
36.	M-L Sta-58/502.1	Lock bulkhead details.
37.	M-L Sta-58/503	Lock bulkhead truck.
38.	M-L Sta-58/504	Lock bulkhead truck details.
39.	M-L Sta-33/501	Floating mooring bitt plan, elevation and section.
40.	M-L Sta-33/502	Floating mooring bitt, miscellaneous details.
41.	M-L Sta-29/601.1	Equipment location.
42.	M-LI-20/3	Handrailing - chocks.
43.	M-LI-20/35	Details of miscellaneous parts.
44.	M-LI-20/70	Operational plan - Dewatering two locks.
45.	M-LI-20/71	Lock rehabilitation - Operational plan.
46.	M-LI-20/72	Lock rehabilitation - Existing conditions plan and section.
47.	M-LI-24/1	Stoney gate valves, operating machinery assembly.
48.	M-LI-24/2	Stoney gate valves, operating machinery assembly.
49.	M-LI-24/3	Stoney gate valves, downstream elevation section.
50.	M-LI-24/4	Stoney gate valves, downstream elevation section.
51.	M-LI-24/5	Fixed metal - upper valves assembly.

52.	M-L1-24/6	Fixed metal - lower valves assembly.
53.	M-L1-24/9	Roller train - Valve stem.
54.	M-L1-24/10	Stoney gate valves - wall castings.
55.	M-L1-24/13	Cylinder plunger - plunger base - fastenings.
56.	M-L1-24/14	Valve seal - lintel castings.
57.	M-L1-24/15	Side water seals.
58.	M-L1-24/16	Shields - rubber strips.
59.	M-L1-24/21	Counterweight - Miscellaneous parts.
60.	M-L1-24/22	Control valve assembly.
61.	M-L1-24/23	Control valve cylinder - plunger - bushing.
62.	M-L1-24/30	Stoney gate valves operating house.
63.	M-L1-24/31	Valve house.
64.	M-L1-24/33	Upper valves - Operating machinery assembly.
65.	M-L1-24/34	Lower valves - Operating machinery assembly.
66.	M-L1-24/35	Downstream elevation section.
67.	M-L1-24/36	Upstream elevation section.
68.	M-L1-24/37	Assembly fixed metal lower valves.
69.	M-L1-24/38	Assembly fixed metal upper valves.
70.	M-L1-24/41	Roller train - valve stem.
71.	M-L1-24/42	Wall castings.
72.	M-L1-24/45	Cylinder - Plunger - plunger base.

73.	M-L1-24/46	Valve seal - Lintel castings.
74.	M-L1-24/47	Side water seals.
75.	M-L1-24/48	Shields - rubbing strips.
76.	M-L1-24/53	Counterweight - miscellaneous parts.
77.	M-L1-24/54	Control valve assembly.
78.	M-L1-24/55	Control valve cylinder plunger - bushing.
79.	M-L1-24/62	Stoney gate valves operating houses.
80.	M-L1-24/63	Stoney gate valve houses.
81.	M-L1-20/16	Lock gate anchorages.
82.	M-L1-20/17	Details gate anchorages.
83.	M-L1-20/18	Miter sill steel-bearing castings locations.
84.	M-L1-20/19	Miter sill steel-bearing castings, details.
85.	M-L1-20/30	Gate anchorage locations.
86.	M-L1-20/31	Gate anchorages - details.
87.	M-L1-20/32	Miter sill steel vertical bearing castings.
88.	M-L1-20/33	Miter sill steel-bearing castings - details,
89.	M-L1-20/84	Modification - upper gate anchorage.
90.	M-L1-21/0	Lock gates - stress sheet.
91.	M-L1-21/1	Reconstruction upper gates.
92.	M-L1-21/2	Lower gate - upper part.

93.	M-LI-21/3	Lower gate - lower part.
94.	M-LI-21/5	Upper pintle castings - miscellaneous parts.
95.	M-LI-21/6	Construction - 2nd lock - upper gates.
96.	M-LI-21/7	Lower gate - upper part.
97.	M-LI-21/8	Lower gate - lower part.
98.	M-LI-21/10	Upper pintle castings - miscellaneous parts.
99.	M-LI-21/11	Lock gates - stress sheet.
100.	M-LI-21/25	Test program metalized surfaces.
101.	M-LI-21/27.11	Miter gate pintle castings.
102.	M-LI-21/28.11	Miter gate anchorage bars - details.
103.	M-LI-21/29	Miter gate repair - jacking bracket.
104.	M-LI-21/30	Operating plan - repair pintle assembly - lower gate.
105.	M-LI-21/31	Repair pintle assembly - lower miter gate.
106.	M-LI-21/32	Miter gate diagonals.
107.	M-LI-21/34	Repair pintle assembly - lower miter gate.
108.	M-LI-21/36	Miter gate diagonals - general layout.
109.	M-LI-21/37	Diagonal connections - details.
[illegible]	M-LI-21/38	Miter gate - prestressing bracket.
111.	M-LI-21/39.1	Jacking brackets miter end - lower gate.
112.	M-LI-21/42	Miter gate anchorage bars - details.

113.	M-L1-22/1	Reconstruction - gate operating machinery assembly.
114	M-L1-22/2	Sector - sector arm.
115.	M-L1-22/3	Operating strut - miscellaneous machinery.
116.	M-L1-22/4	Operating machinery - cylinder - piston.
117.	M-L1-22/5	Cylinder base - sector base - miscellaneous.
118.	M-L1-22/6	Double 4-way valve - assembly - details.
119.	M-L1-22/7	Double 4-way valve - details.
120.	M-L1-22/9	Operating machinery assembly - 2nd lock.
121.	M-L1-22/10	Operating machinery - sector - sector arm.
122.	M-L1-22/11	Operating strut - miscellaneous parts.
123.	M-L1-22/12	Operating machinery - cylinder - piston.
124.	M-L1-22/13	Cylinder base - sector base.
125.	M-L1-22/14	Operating machinery - double 4-way valve.
126.	M-L1-22/15	Double 4-way valve - details.

B. Construction Photos

1. 113-1/0.9
   Black Cover
   Construction of original lock
   May 1907 - Jan. 1913
   28 pictures with periodic construction data and sketches.

2. Construction Photos
   Twin City Lock and Dam
   Oct. 1929 - Sept. 1930
   Black Cover
   Approx. 100 pictures.

3. Rehabilitation of Landward Lock
   133 photographs
   Dec. 16, 1959 - April 4, 1960.

4. Photographs of L/D No. 1 - Brown Cover
June 12, 1973 - Dec. 13, 1973
44 pictures (3 1/2 x 3 1/2).

C. Existing Criteria and Design Manuals

1. Mississippi River
St. Anthony Falls Project
Minneapolis, Minnesota
Design Memorandum No. 3
Upper Lock
Part UL-6 Structural Design

2. Mississippi River
St. Anthony Falls Project
Minneapolis, Minnesota
Design Memorandum No. 3
Upper Lock
Part UL-7 Mechanical Design

3. Manual EM 1110-2-2608 30 Mar. '62
"Engineering and Design"
Navigation Locks - Fire Protection Provisions.

D. Existing Reports and Observations

1. History
Pintle Repair, Diagonal Installation
and
Diagonal Prestressing
Lower Miter Gates Lock and Dam No. 1
1950-51.

E. Reconnaissance Field Trips

The project site was visited by the following engineering personnel of the contractor during the year 1974:

January 21-22	T. G. Szemere	Mechanical
May 13-14	R. L. Pfarr	Mechanical
November 8	R. L. Pfarr	Mechanical
November 8	B. J. Dainis	Mechanical