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Structures Inspection Unit

NEW ORLEANS TO VENICE, LOUISIANA

HURRICANE PROTECTION

REACH B-1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

PERIODIC INSPECTION REPORT NO. 1

SEPTEMBER 1975

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

Structures Inspection Unit

NEW ORLEANS TO VENICE, LOUISIANA

HURRICANE PROTECTION

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September 1975

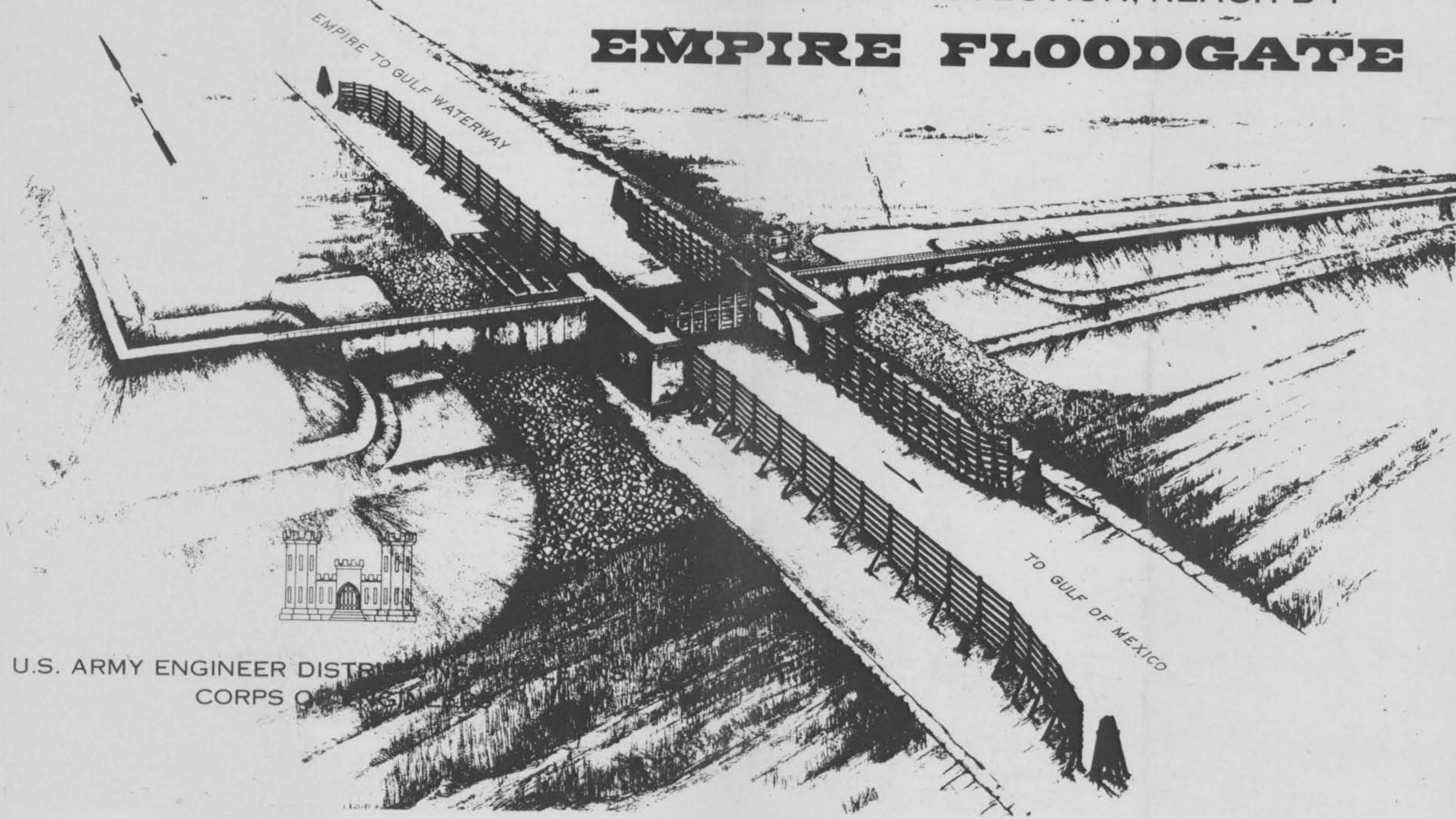
U.S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1

EMPIRE FLOODGATE



U.S. ARMY ENGINEER DISTR
CORPS OF

PHOTO TAKEN 2 MAY 1975

EMPIRE FLOODGATE

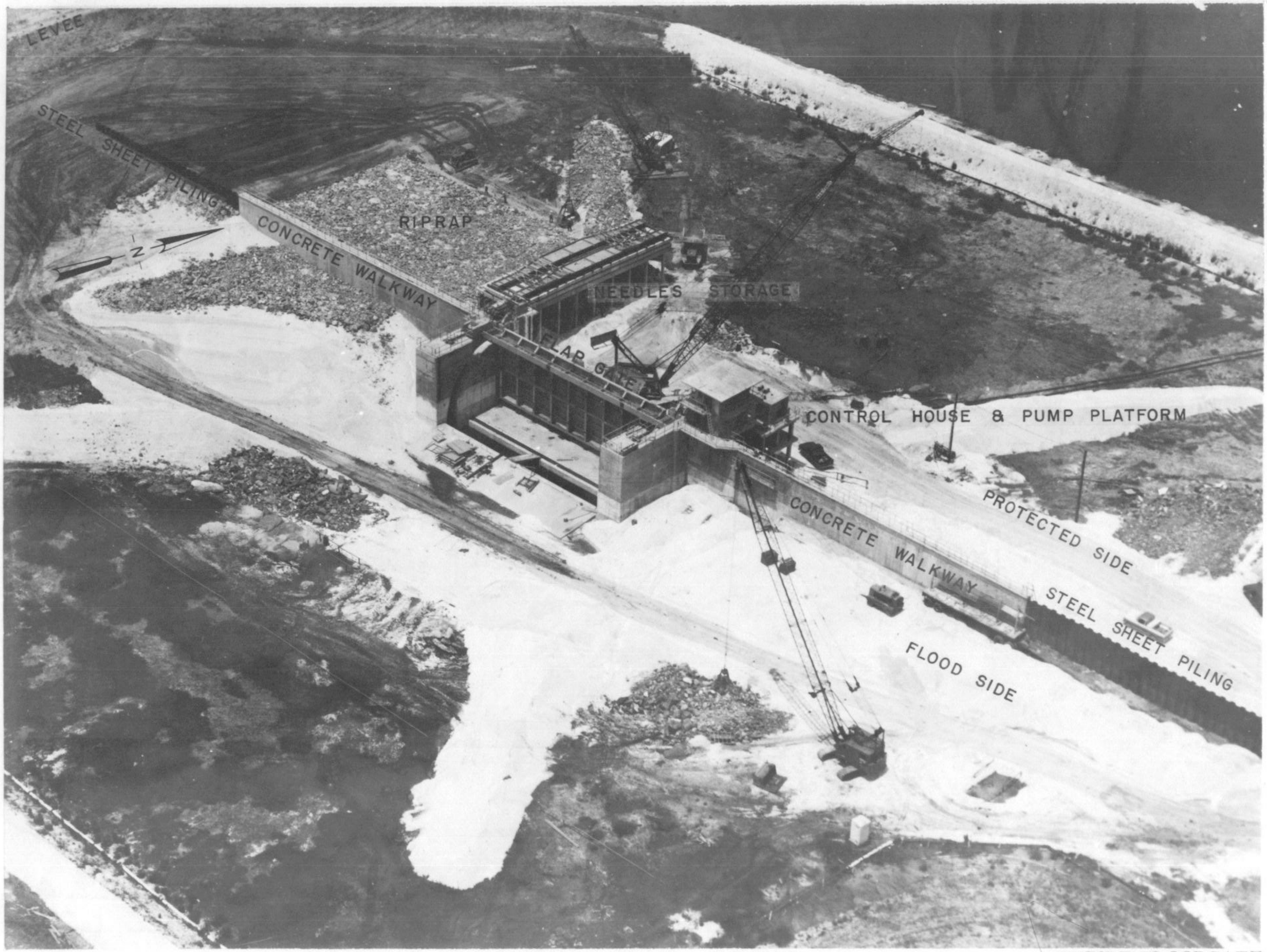


PHOTO TAKEN 2 MAY 1975

EMPIRE FLOODGATE

EMPIRE FLOODGATE

PERIODIC INSPECTION REPORT NO. 1

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APPENDIX A - ALLOWABLE STRESSES

SECTION I - INTRODUCTION

1-01 Authority. Authority for this report is contained in ER-1110-2-100, dated 26 February 1973, subject "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures."

1-02 Purpose and Scope. This report presents the results and conclusions of the initial field inspection of the Empire Floodgate structure conducted under the above referenced ER. The inspection was made before completion of construction and before the structure was flooded.

1-03 Datum Plane. All elevations in connection with the Empire Floodgate structure, unless otherwise specified, refer to feet, mean sea level.

SECTION II - PROJECT DESCRIPTION AND BACKGROUND

2-01 Project Authorization. The Empire Floodgate is a feature of the hurricane protection project, "New Orleans to Venice, La.," authorized by Public Law 874, 87th Congress, approved 23 October 1962, and which will provide hurricane protection in accordance with the recommendations of the Chief of Engineers in his report entitled "Mississippi River Delta at and below New Orleans, La.," and contained in House Document No. 550, 87th Congress, 2d Session. Improvements for prevention of hurricane tidal damages along the Mississippi River below New Orleans, Louisiana, in Reach B-1 between Tropical Bend and Fort Jackson are to be provided by raising the heights of the existing back levees and modifying the existing drainage facilities where necessary. See plate II-1.

2-02 Purpose of Structure. Upon completion of the raising of the levees in Reach B-1, Tropical Bend to Fort Jackson, in the project "New Orleans to Venice, La.," The Empire Floodgate will serve to protect the general area from hurricane tidal overflows and will allow water traffic to proceed normally along the waterway from Empire to the Gulf of Mexico. The Empire Floodgate will provide drainage for an area of about 365 acres inclosed by the hurricane protection levee, the levee along the Mississippi River, and the levees approximately parallel to the Mississippi River levee. See plate II-1.

2-03 Location. The floodgate structure is part of the hurricane protection levee system and is located at the hurricane protection levee base line station 101+80.89 in Plaquemines Parish, Louisiana, near Empire at the river end of the Empire to Gulf Waterway. The site is accessible by a temporary road from the structure to Louisiana Highway #23. See plates II-1 and II-2.

2-04 Local Interests. When construction of the structure is completed, the structure will be turned over to the Plaquemines Parish Commission Council, Pointe a la Hache, Louisiana, for maintenance and operation in accordance with the conditions of local cooperation, as specified by the authorizing law.

2-05 Description.

a. General. The Empire Floodgate structure consists of a reinforced concrete gate bay, supported on prestressed concrete piles, timber guide walls, pile supported inverted "T" reinforced concrete floodwalls, and uncapped steel sheet piling connecting the "T" floodwalls to the earthen levee on each side. The gate bay is 109 feet in length and has a channel width of 84 feet. The elevation of the tops of the gate and floodwalls is 15.0 feet, and top of sill is at -14.0 feet. The floodgate is operated by an electric motor-powered chain hoist and a freewheeling counterweight system. The floodgate is a bottom hinged single-leaf flap gate which, in the open position, will be stored in a recess in the base slab of the structure. See plates II-3 and II-4.

b. Foundation. The floodgate and "T"-type floodwalls are supported on 12-inch square prestressed concrete piling with lengths of 78 feet. The floodgate monolith has two rows of vertical piles and two batter pile groups, 2.5V to 1H and 2V to 1H. The "T"-type floodwalls have three batter pile groups, 2.5V to 1H, 2V to 1H, and 3V to 1H. Steel sheet (PMA-22) pile cutoff walls are beneath the floodgate and "T"-type floodwalls to provide protection against hazardous seepage. Tip elevations of the steel sheet pile cutoffs beneath the floodgate and "T"-type floodwall monolith T-1 is -40.00 feet. "T"-type floodwall monoliths T-2, T-3, and T-4 steel sheet pile cutoff tip elevations are -30.00, -23.00, and -23.00 feet respectively. The design of the prestressed piling was based upon actual pile tests. See plates II-4, II-5, and II-6.

c. Gate Bay. The gate bay was designed as a reinforced concrete "U" frame, 106 feet in length with a channel clearance of 84 feet as shown on plates II-7, II-8, and II-9. The top of the gate, the gate bay walls and the inverted "T" floodwalls, are at elevation 15.0 and top of sill is at elevation -14.0 feet.

d. Dewatering. Dewatering of the gate bay is accomplished with the gate in the closed position and by the use of needle dams consisting of vertical reinforced concrete needles supported at the bottom in a slot in the base slab and at the top by a single span steel needle girder having intermediate vertical supports to minimize bending and deflection due to the weight of the girder. See plates II-11 and II-16.

e. Floodgate. The Empire floodgate is fabricated structural steel, mounted on horizontal hinges at the bottom and operated by lifting chains connected to each end of a horizontal girder at the top. This horizontal girder spans the full width of the gate and supports vertical beams at the top. Each vertical beam is supported by a hinge at the bottom and horizontal ribs span between the vertical beams to support the skin plate. See plates II-12 and II-13.

f. Gate Operating Machinery. The operating machinery for the floodgate consists of two identical, opposite hand, sets of machinery located on the tops of the floodgate walls. Each set of machinery is comprised of a motor-powered chain hoist and a freewheeling counterweight system. Each chain hoist consists of an electric motor with rear mounted electric brake, a right angle speed reducer, a mechanical load brake, a parallel shaft speed reducer, a limit switch, and a synchro transmitter. A wildcat sheave is keyed to the extended output shaft of the parallel shaft speed reducer and engages the die lock chain attached to the gate. The synchro transmitter monitors the positions of the wildcats. Each counterweight system consists of approximately 40,000 lb. weight attached to the gate by the die lock chain passing over freewheeling wildcat sheaves. Other items of mechanical equipment are gate locking devices, gate shock absorbers, a diesel engine driven vertical water pump, which relieves the suction under the gate, and ratchet jacks used to dog-off the counterweights and relieve the tension on the chain when the gate is in the open position. See plates II-19 and II-20.

g. Electric Power. Commercial electric power is furnished for gate operation and interior lighting. An auxiliary diesel engine-generator rated at 30 kW, 0.8 PF, 480 volts, 3 phase, 60 Hz is available for emergencies. See plates II-19 and II-21.

h. Floodwalls. There are two types of floodwalls constructed between the gate bay and the adjacent levees. The inverted "T" type floodwall commences at the gate bay wall and extends approximately 150 feet toward the levee on each side of the structure. The inverted "T"-type floodwall consists of a pile-supported concrete base slab and stem, with a sheet-pile cutoff wall. The "T"-type floodwall is supported against settlement and overturning by battered, prestressed concrete piles.

The other type of floodwall is the "I"-type and it is still incomplete. The floodwall extending from the edge of the "T"-type floodwall to the levee on each side of the structure consists of uncapped PZ-32 steel sheet piling. After major settlement of the levee embankment has taken place, the sheet piling will be cut off above final grade and a new "I"-type reinforced concrete floodwall will be constructed over the cut sheet piling. See plates III-19, II-4, and II-5.

i. Timber Guide Walls and Fenders. A 300-foot long timber guide wall and a 100-foot long timber fender are located on each side of the gate structure. The guide wall is on the west side of the channel and the fender is on the east side. The tops of the guide wall and fender are at elevation +9.5. The guide walls and fenders consist of treated timber piles, vertical and batter. A 7-pile timber dolphin is located at the end of each guide wall and fender. See plates II-4, II-17, and II-18.

j. Breakwater. A breakwater with top elevation of +3.0 is located to the southwest of the structure, as shown on plate II-2. The breakwater will cause the larger hurricane waves in the wave spectrum approaching the structure from Adams Bay to break on the breakwater during the closing operation, thus limiting the incident wave heights to those equal in height to the smaller waves which approach directly along the channel alinement. The breakwater will provide a quieted area and a substantial reduction in wave loads on the gate machinery due to slammings during closing operations.

k. Access Road. The floodgate structure is presently accessible by a shell surface construction road located along the levee centerline on the east side of the structure. A permanent road, as shown on plates II-2 and III-1, will be constructed at a later date. Other access routes will be along the hurricane protection levee, when completed, and across the bridge at the Sunrise Pump Station.

l. Control House. A two-story control house constructed of reinforced concrete is located at the east end of the gate bay and above the east "T" floodwall. The second floor is at elevation 24.00 to enable the operator to view the operation of the gate over the sight obstruction of the gate machinery. The second floor houses the main switchboard and motor control center for the operation of the gate. The first floor is used to house the engine-generator and for storage. See plates II-10, II-19, and II-23.

m. Approach Channels. Upon completion of all construction and placement of the shell blanket, riprap, and shell backfill in the dry, the approach channels will be dredged to project depth by hydraulic dredge. The side slopes will then be shaped by dragline.

n. Pump. A two-story pump platform constructed of reinforced concrete is located on the north side of the control house as shown on plates II-3 and II-4. The first floor has reinforced concrete pipe supports, which are used to support the pump intake suction pipe. The pump and pump motor are located on the second floor. The pump is a vertical pump, 12,000 gallons per minute a TDH of 19.5 feet and a shut off head of approximately 50 feet. The pump motor is a Detroit Diesel engine with a minimum rating of 238 bhp at 2100 rpm and with all standard equipment, model No. 1064-7000. See plate II-22. The pump is used in connection with the raising of the flap gate from an open position. Water is pumped under the open flap gate in order to break the pressure seal and allow the flap gate to be raised.

o. Boat Dock. The boat dock is constructed of treated timbers on treated timber piles and is located on the north side of the pump platform. See plate II-18.

p. Cathodic Protection. Cathodic protection is provided for the floodgate and is designed to protect both sides. The sacrificial metal type cathodic protection system is used because the structure is unmanned and commercial power was not originally available at the structure site. See paragraph 3-05.

2-06 Gate Operating Criteria. The floodgate will be closed when rising tides, in advance of an approaching hurricane, exceeds elevation 5.0 on the landside of the structure. The floodgate will be kept closed until such time that the hurricane tides have receded and the stage on the landside is equal to or higher than the stage on the gulfside.

2-07 Subsurface Conditions. The subsurface at the project site is generally similar to that shown on the profile in the GDM. The foundation soils, as indicated by borings 1-SEU and 2-SE through 5-SE, consist predominately of Recent Backswamp Clays having soft to medium consistencies, and extending to depths of approximately 90 feet below the natural ground surface. The Recent Clays contain 3- to 5-foot thick layers of silts and sands at approximate elevations -20, -30, and -50. The 5- to 10-foot thick clay layer, extending from the ground surface, contains organic matter with some peat. See plates II-3, III-23, and III-24.

2-08 Instrumentation.

a. Settlement. Permanent settlement reference marks have been placed on the top of the gate bay structure and the floodwalls as shown on plate II-4. The initial elevation of each reference mark was determined when the structure was completed. Observations will be made quarterly for the first 2 years after completion of the structure and annually thereafter.

b. Scour Survey. Scour surveys will be made in the approach channels at each end of the structure at the same time the settlement measurements are made until it has been determined that the channel side slopes and bottom have become stabilized.

2-09 Index of Selected Construction Drawings.

Plate No.	Title	File No.	Dwg. No.
II-1	Location Map, Vicinity Map, and Index	H-4-26081	1
II-2	Site Plan	H-4-26081	2
II-3	Completed Plans	H-4-26081	5
II-4	Completed Sections	H-4-26081	6
II-5	Typical Sections	H-4-26081	7
II-6	Gate Bay & Floodwall Piling Layout	H-4-26081	11
II-7	Plan of Gate Bay Monolith	H-4-26081	12
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II-10	Control House Plan and Elevations	H-4-26081	24
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Plate No.	Title	File No.	Dwg. No.
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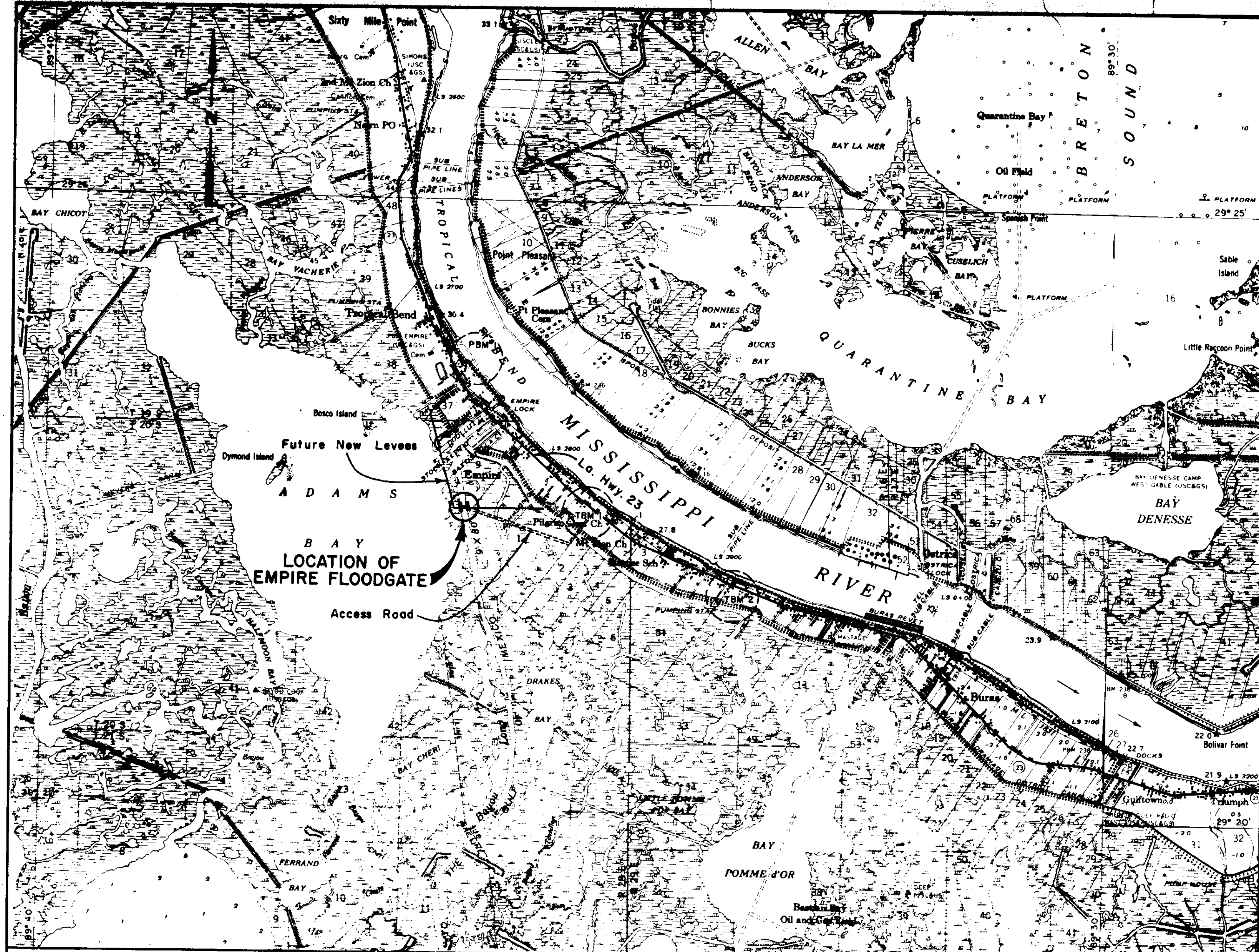
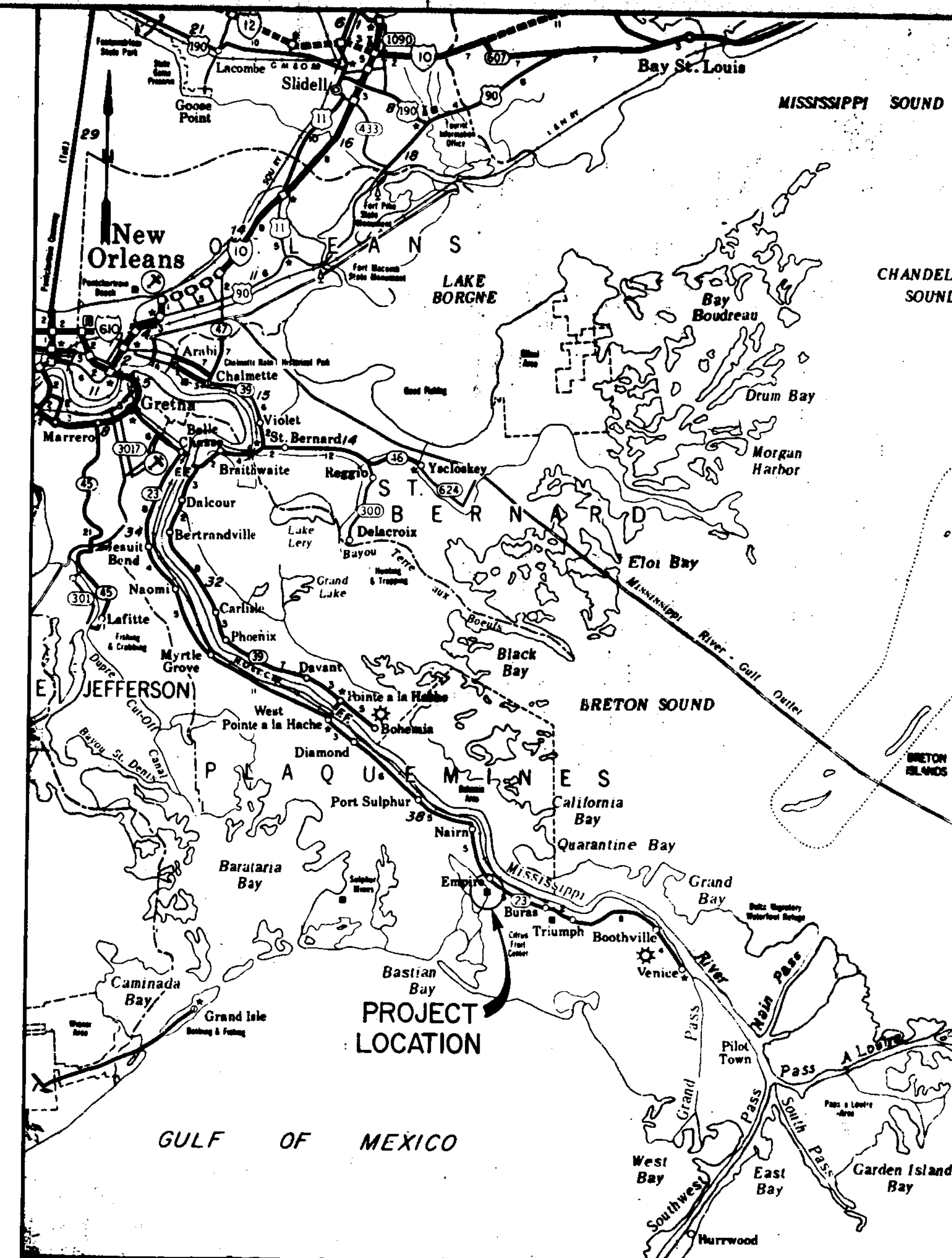
II-21	Engine Generator Layout	H-4-26081	52
II-22	Pumping Unit Layout	H-4-26081	53
II-23	Switchboard, Control Center and Desk	H-4-26081	57
II-24	Cathodic Protection	H-4-26081	61
II-25	Revised Chain Guide	H-4-26081	49B



LOCATION MAP

SCALE 1 : 31,680



VICINITY MAP

SCALE IN MILES

INDEX TO DRAWINGS

DWG.	TITLE
	GENERAL DRAWINGS
1	LOCATION MAP, VICINITY MAP, AND INDEX
2	SITE PLAN
3	SOIL BORINGS
4	SOIL BORING LEGEND
5	COMPLETED PLAN
6	COMPLETED SECTION
7	TYPICAL SECTIONS
8	INITIAL EXCAVATION
9	INITIAL EXCAVATION
10	STRUCTURE EXCAVATION AND SECURITY FENCE
	FLOODGATE STRUCTURE
11	[illegible] BAY AND FLOODWALL PILING LAYOUT
12	PLAN OF GATE BAY MONOLITH
13	SECTIONAL ELEVATION OF GATE BAY MONOLITH
14	TRANSVERSE SECTION OF GATE BAY MONOLITH
15	GATE BAY WALL REINFORCEMENT PLAN AT EL. 15.0
16	GATE BAY WALL REINFORCEMENT PLAN AND SECTIONS
16A	GATE BAY WALL REINFORCEMENT PLAN AND SECTION
17	GATE BAY WALL REINFORCEMENT SECTIONS
18	GATE BAY WALL REINFORCEMENT SECTIONS
19	GATE BAY SLAB REINFORCEMENT
20	GATE BAY SLAB REINFORCEMENT
20-A	GATE BAY SLAB REINFORCEMENT
21	FLOODWALL MASONRY AND REINFORCEMENT
22	FLOODWALL TRANSITION SECTIONS
23	EXPANSION JOINT DETAILS
24	CONTROL HOUSE PLAN AND ELEVATIONS
25	CONTROL HOUSE ELEVATIONS AND DETAILS
26	CONTROL HOUSE REINFORCEMENT
27	CONTROL HOUSE REINFORCEMENT
28	PUMP PLATFORM
29	PUMP PLATFORM
29A	PUMP PLATFORM - MISCELLANEOUS DETAILS
30	NEEDLES AND STORAGE RACK
31	MISCELLANEOUS EMBEDDED METALS
32	MISCELLANEOUS EMBEDDED METALS
33	EMBEDDED METAL - CORNER PROTECTION
34	LADDER AND STAFF GAGE DETAILS
35	HANDRAILING LAYOUT - SECTIONS AND DETAILS
	FLAP GATE
36	FLAP GATE - PLAN AND SECTIONS
37	FLAP GATE SECTION AND HINGE DETAILS
38	GATE SEAL DETAILS
39	HINGE LUBRICATION DETAILS
40	TRASH PLATE - PLAN AND SECTIONS
41	NEEDLE GIRDER - PLAN AND DETAILS
42	COUNTERWEIGHT CAGE SECTIONS AND DETAILS
	GUIDE WALL
43	TIMBER GUIDE WALL - PLAN AND SECTIONS
44	TIMBER DOCK AND DOLPHINS
	OPERATING MACHINERY
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47	MACHINERY BASE
48	MACHINERY HOUSING
49	MISCELLANEOUS DETAILS
50	CHAIN AND SHAFT DETAILS
51	LOCKING DEVICE AND SHOCK ABSORBER DETAILS
52	ENGINE GENERATOR LAYOUT
53	PUMPING UNIT LAYOUT
54	PUMPING UNIT DETAILS
	ELECTRICAL
55	SCHEMATIC WIRING DIAGRAM
56	CONTROL WIRING DIAGRAMS
57	SWITCHBOARD, CONTROL CENTER, AND DESK
58	CONDUIT LAYOUT
59	CONDUIT LAYOUT
60	LIGHTING AND DETAILS
61	CATHODIC PROTECTION

Note:
See dwg. 2 for tabulation of bench marks.

REVISION | DATE | DESCRIPTION | BY

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA

William C. Sommer
Jerome C. Baehr
William E. Lee Jr. LTC
For

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.
LOCATION MAP VICINITY MAP AND INDEX

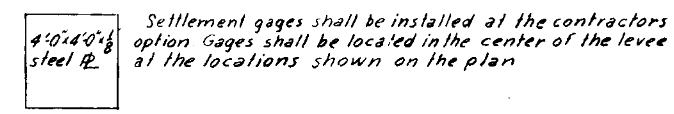
D.A.M. R.G.S. F.N.J. FEB. 1973

H-4-26081

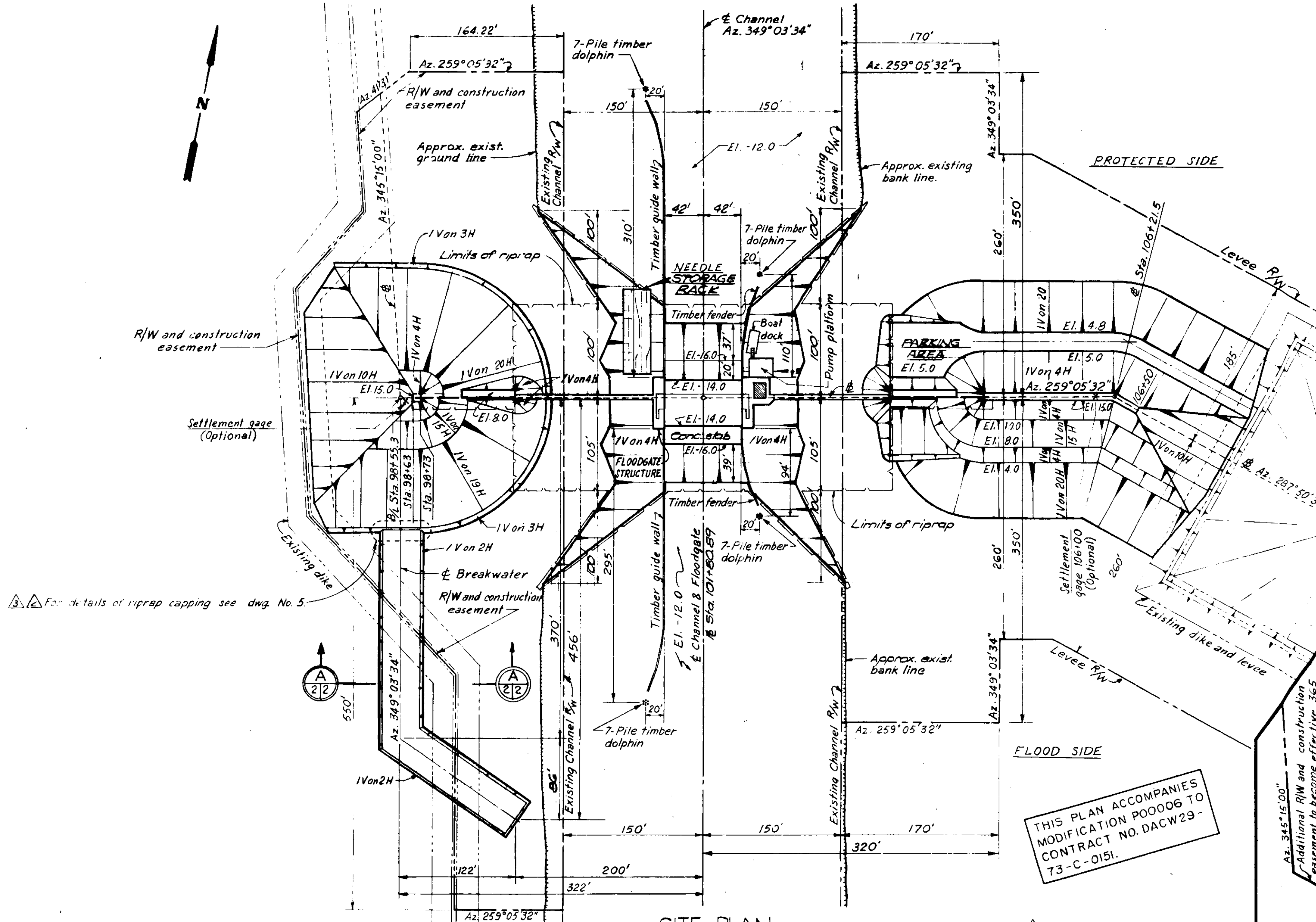
Jed S. Henderson, Jr. DACW29-73-B-0111

1 64

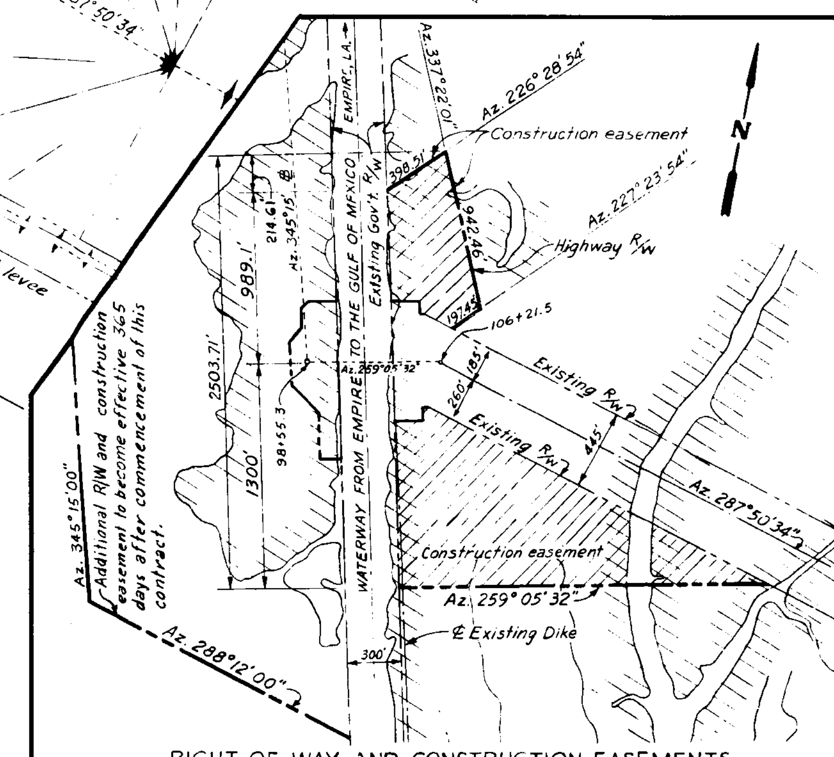
PLATE II-1



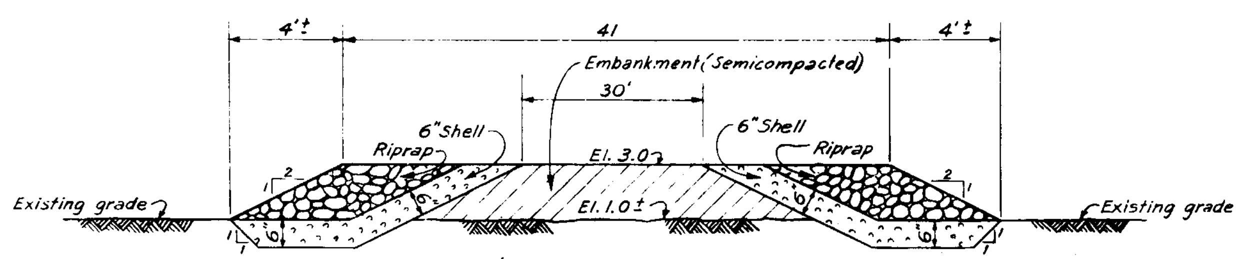
SETTLEMENT MEASUREMENT GAGE
(OPTIONAL)



SITE PLAN
Scale: 1"=50'



RIGHT-OF-WAY AND CONSTRUCTION EASEMENTS
500 0 500 1000
SCALE IN FEET



(Existing dike not shown)
SECTION A/2
Not to scale

⚠1

BENCH MARK		
B.M.	DESCRIPTION	ELEV.
K 195 EMPIRE	At Empire, set in the top of the northeast end of the northwest concrete abutment of the State Highway 23 drawbridge over the Doullut Canal at Empire, 21.4 feet northeast of the center of the highway, 4.3 feet northeast of the bridge operator's house, 0.8 foot southwest of the northeast end of the abutment and 1 foot below the level of the highway.	7.320 M.S.L.

Notes:
Elevations shown are in feet and refer to mean sea level.
For concrete general notes, see dwg. 13

REVISION	DATE	DESCRIPTION	BY
3	12-21-75	Mod. 6 deleted on this contract.	S.S.G.
2	10-23-75	Added note for riprap capping. Mod. 6.	E.N.J.
1	3-2-73	Added bench mark, amendment No. 1	R.G.S.

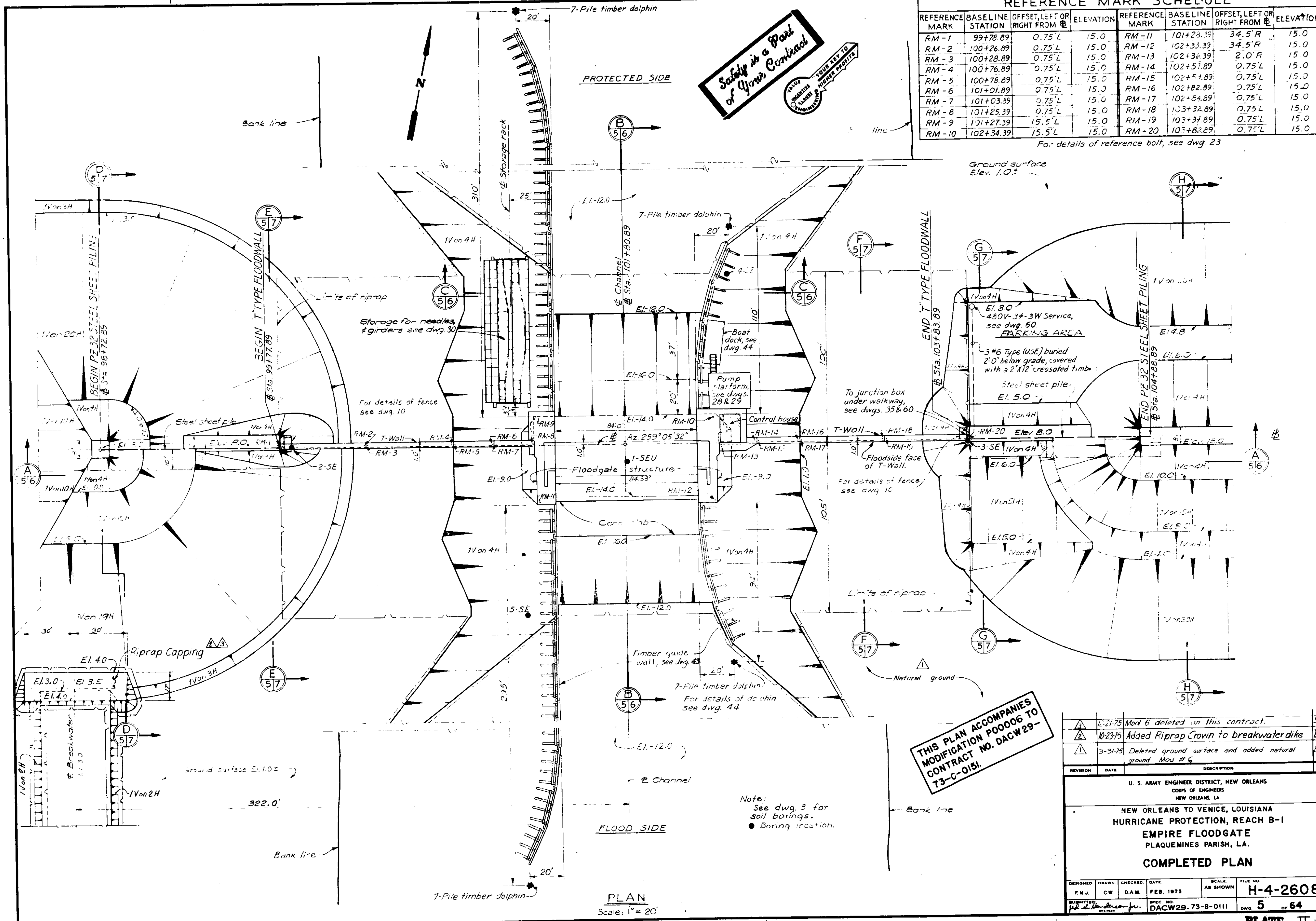
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

SITE PLAN

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.A.M.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature]			SPEC. NO. DACW29-73-B-0111		DWG. 2 OF 64

PLATE II-2



REFERENCE MARK SCHEDULE

REFERENCE MARK	BASELINE STATION	OFFSET, LEFT OR RIGHT FROM ℄	ELEVATION	REFERENCE MARK	BASELINE STATION	OFFSET, LEFT OR RIGHT FROM ℄	ELEVATION
RM-1	99+78.89	0.75'L	15.0	RM-11	101+28.39	34.5'R	15.0
RM-2	100+26.89	0.75'L	15.0	RM-12	102+33.39	34.5'R	15.0
RM-3	100+28.89	0.75'L	15.0	RM-13	102+36.39	2.0'R	15.0
RM-4	100+76.89	0.75'L	15.0	RM-14	102+57.89	0.75'L	15.0
RM-5	100+78.89	0.75'L	15.0	RM-15	102+59.89	0.75'L	15.0
RM-6	101+01.89	0.75'L	15.0	RM-16	102+82.89	0.75'L	15.0
RM-7	101+03.89	0.75'L	15.0	RM-17	102+84.89	0.75'L	15.0
RM-8	101+25.39	0.75'L	15.0	RM-18	103+32.89	0.75'L	15.0
RM-9	101+27.39	15.5'L	15.0	RM-19	103+34.89	0.75'L	15.0
RM-10	102+34.39	15.5'L	15.0	RM-20	103+82.89	0.75'L	15.0

For details of reference bolt, see dwg. 23

REVISION	DATE	DESCRIPTION	BY
3	12-21-75	Mod. 6 deleted on this contract.	S.S.G.
2	10-23-75	Added Riprap Crown to breakwater dike	E.N.J.
1	3-31-75	Deleted ground surface and added natural ground. Mod #6	B.L.C.

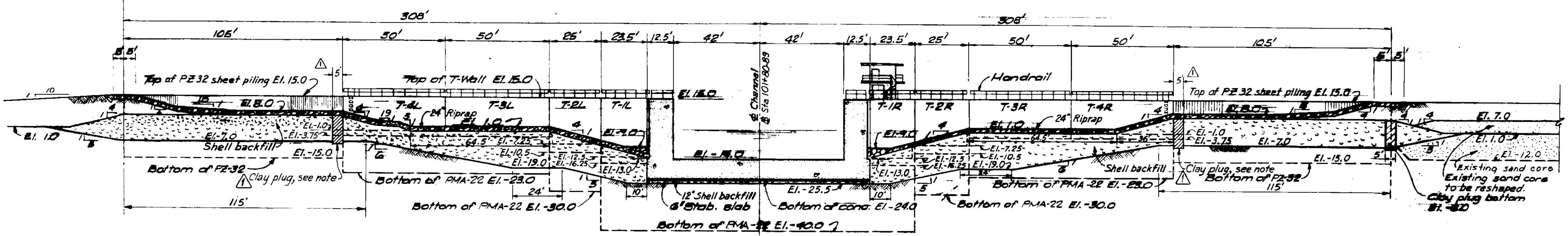
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

COMPLETED PLAN

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
F.N.J.	C.W.	D.A.M.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature] ENGINEER			SPEC. NO. DACW29-73-B-0111		DWG. 5 OF 64

West Side
New Orleans Side

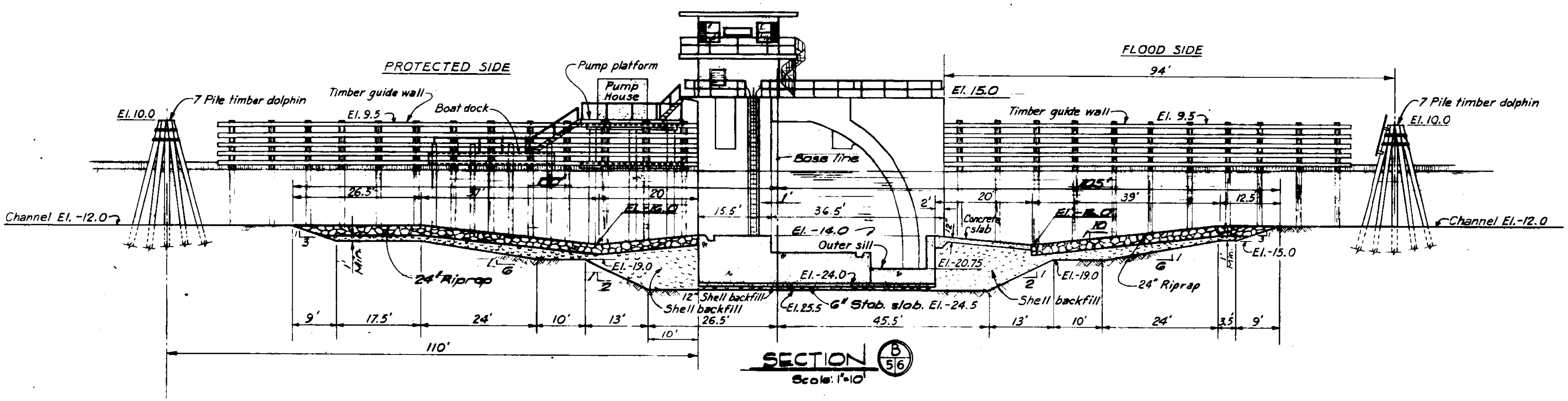


SECTION A (5/6)

Scale: 1"=20'

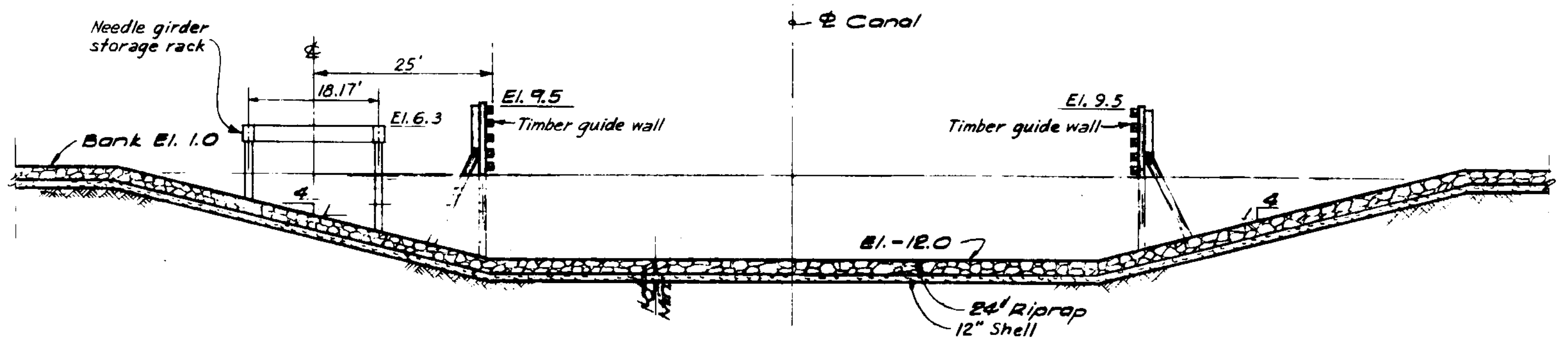
ELEVATION REF. FOR T-WALL BASE SLABS

T-1R & T-1L	El. -12.5 Top of base slab. El. -16.25 Bottom of base slab.
T-2R & T-2L	El. - 7.25 Top of base slab El. -10.25 Bottom of base slab.
T-3R & T-3L, T-4R & T-4L	El. - 1.0 Top of base slab. El. - 3.75 Bottom of base slab.



SECTION B (5/6)

Scale: 1"=10'



SECTION C (5/6)

Scale: 1"=10'

Note:
⚠ 5' Clay plug to extend to the sectional limits of the shell backfill. Bottom of clay plug to be 1' below bottom of excavation.

REVISION	DATE	DESCRIPTION	BY
⚠	3-2-73	Added clay plugs, amendment No. 1	R.G.S.

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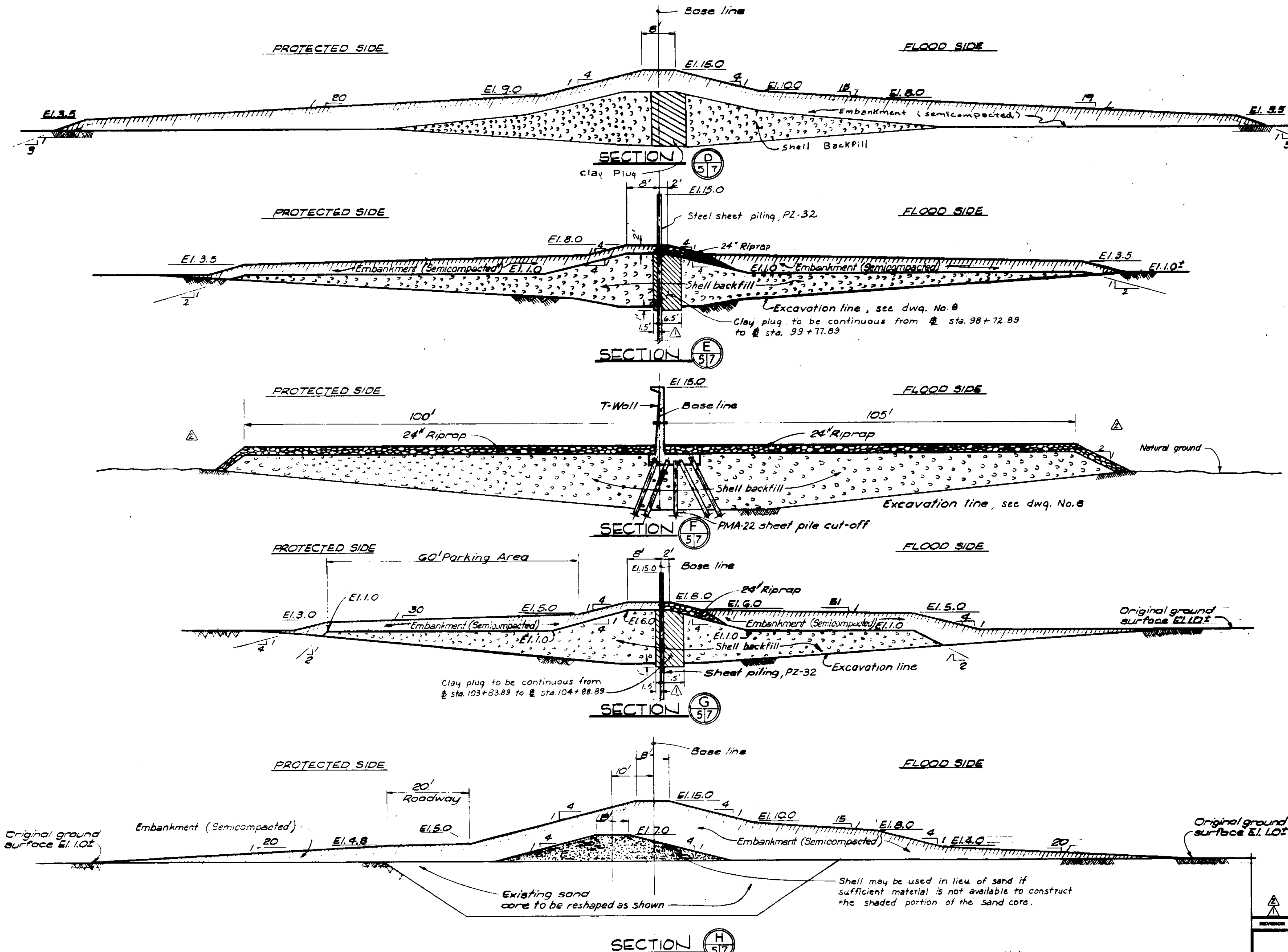
NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

COMPLETED SECTIONS

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
F.H.J.	P.W.	D.A.M.	FEB. 1973	AS SHOWN	H-4-26081

SPEC. NO. DACW29-73-B-0111 DWG. 6 of 64



Note:
For excavation, see dwgs. 8 & 9

TYPICAL CROSS SECTIONS

Scale: 1" = 10' - Horz. & Vert.

Revision	Date	Description	By
2	3-31-75	Revised section F. Mod. #	B.L.C.
1	3-2-73	Added dimensions, amendment No. 1	R.G.S.

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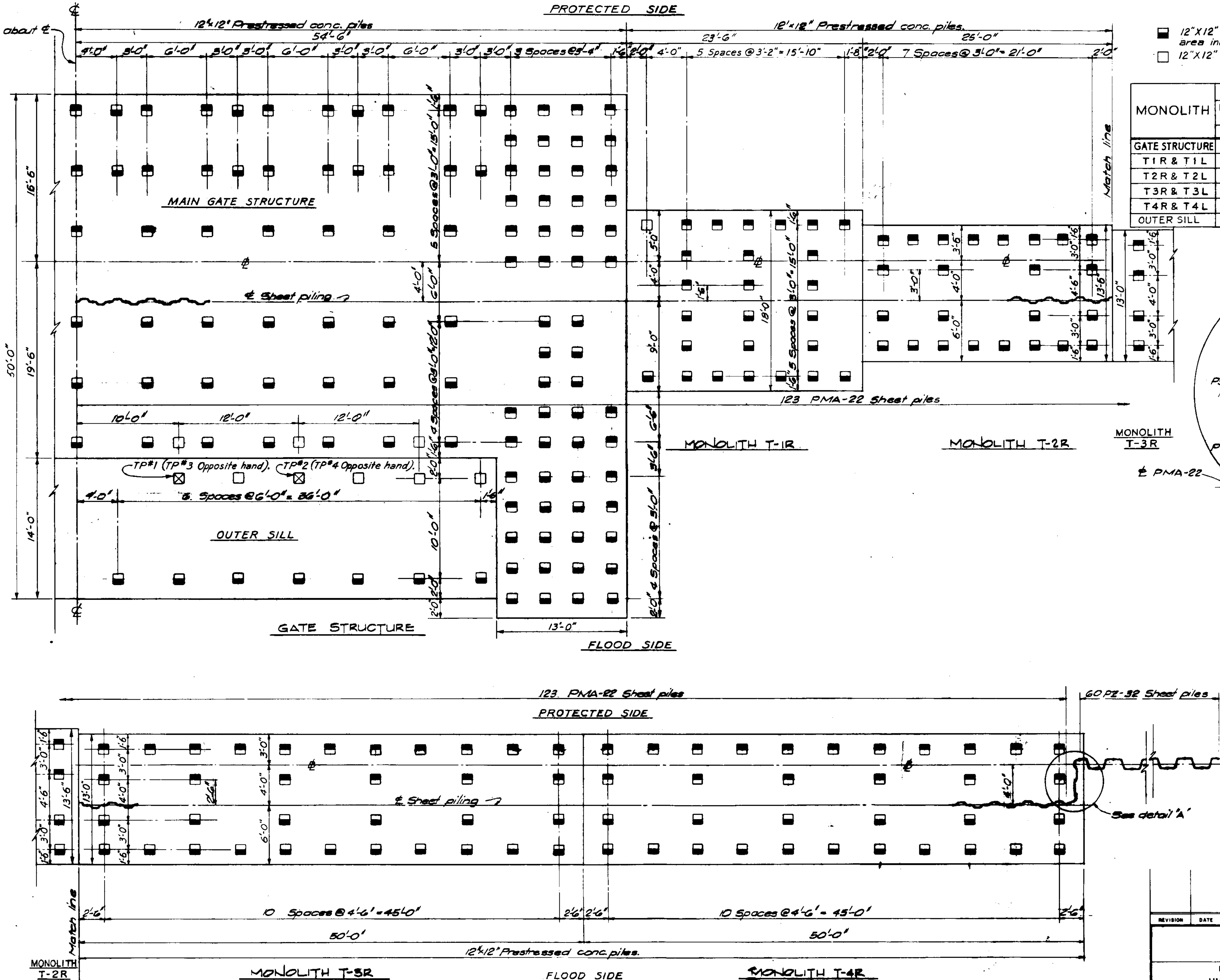
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

TYPICAL SECTIONS

Designed:	Drawn:	Checked:	Date:	Scale:	File No.
F.N.J.	C.W.	D.A.M.	FEB. 1973	AS SHOWN	H-4-26081
Submitted:			Spec. No. DACW29-73-B-0111		DWG. 7 of 64



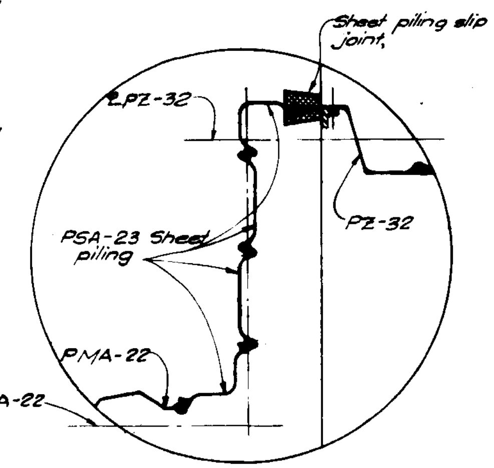
PILE LAYOUT

Scale: 1/8"=1'-0"

LEGEND

- ■ 12"X12" Prestressed concrete piles (shaded area indicates direction of batter). See chart below.
- □ 12"X12" Prestressed concrete piles (vertical)

MONOLITH	PILE BATTERS & LENGTHS			
	PILES BATTERED TOWARD THE PROTECTED SIDE		PILES BATTERED TOWARD THE FLOOD SIDE	
	BATTER	LENGTH	BATTER	LENGTH
GATE STRUCTURE	2.5 V on 1H	78 ft.	2V on 1 H	78 ft.
T1R & T1L	3V on 1H	78 ft.	3V on 1H	78 ft.
T2R & T2L	3V on 1H	78 ft.	3V on 1H	78 ft.
T3R & T3L	2.5V on 1H	78 ft.	2V on 1H	78 ft.
T4R & T4L	2.5V on 1H	78 ft.	2V on 1H	78 ft.
OUTER SILL	VERTICAL	78 ft.	3V on 1H	78 ft.



DETAIL "A"

Scale: 1"=1'-0"

TEST PILE SCHEDULE		
LOCATION	NUMBER	TIP EL.
AS INDICATED ON PILE PLAN	TP#1	① -70
"	TP#2	-75
"	TP#3	-80
"	TP#4	-85

☒ Test pile symbol.

① Indicates first pile to be tested

Note: PZ 32 sheet piles shall be coated with coal tar epoxy on both sides from elevation -3.0 to elevation 5.75.

REVISION	DATE	DESCRIPTION	BY

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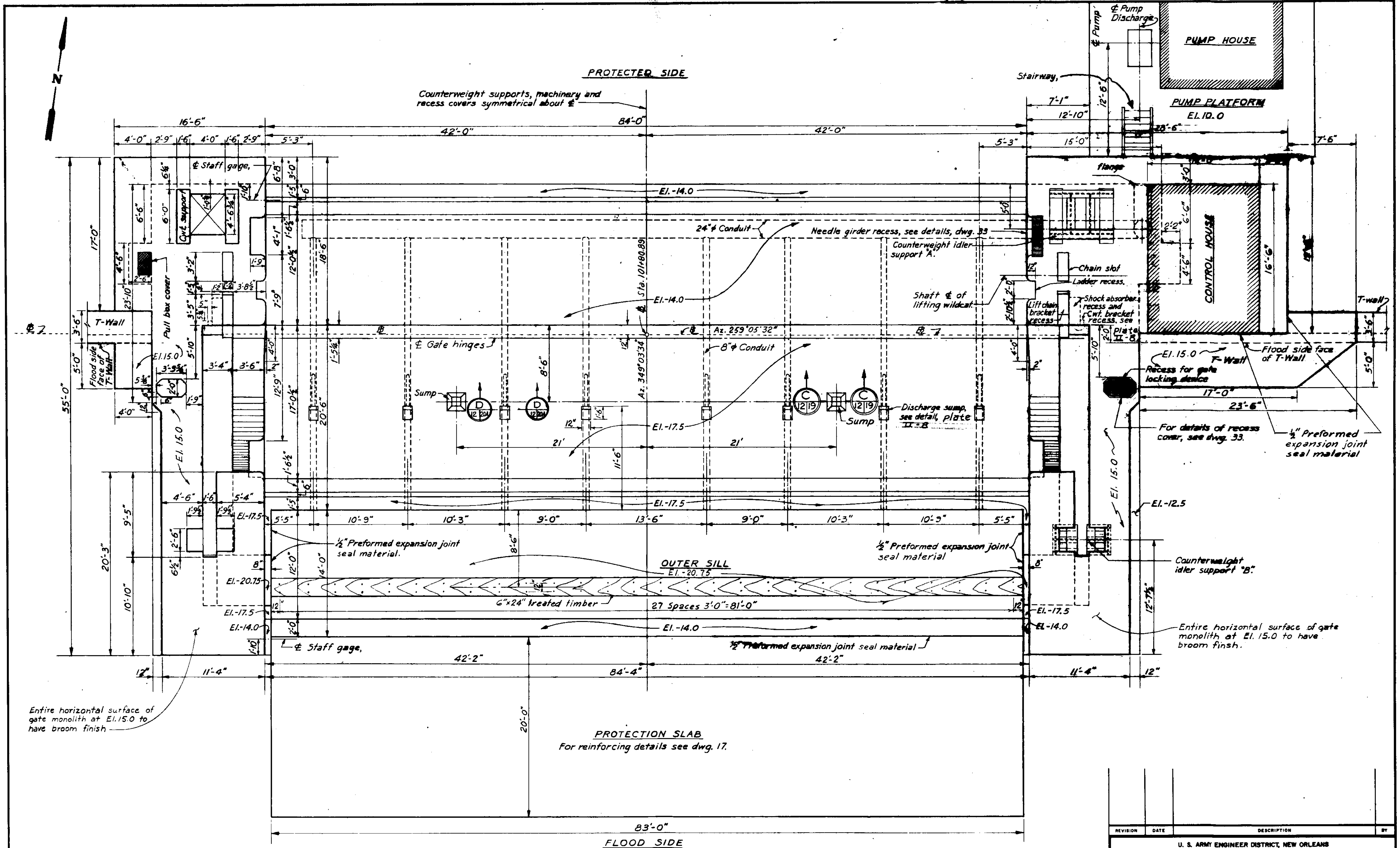
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

GATE BAY AND FLOODWALL PILING LAYOUT

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO:
D.A.M.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature]			SPEC. NO. DACW29-73-B-0111		DWG. 11 of 64



PLAN

Scale: ¼" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

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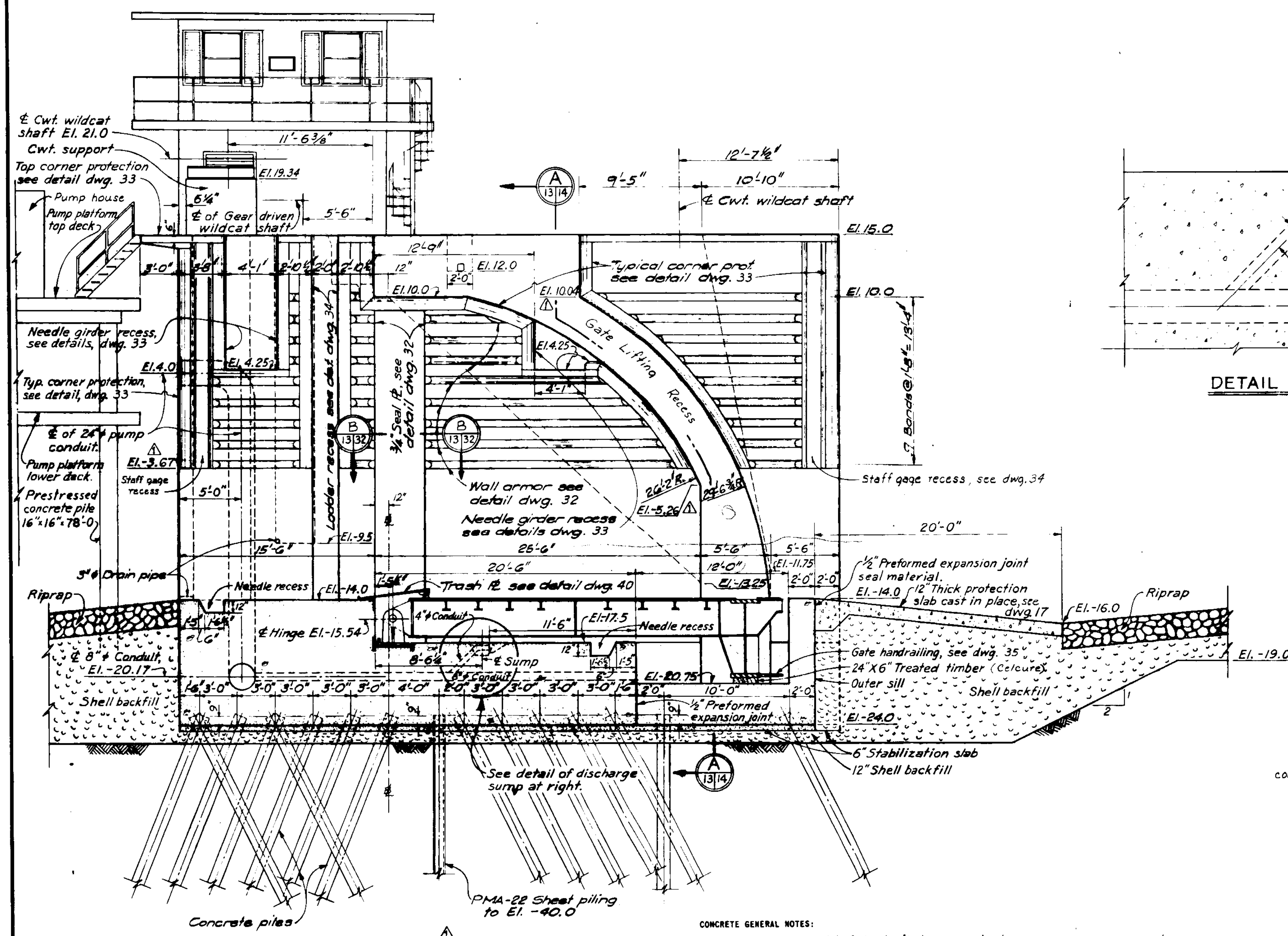
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

PLAN OF GATE BAY MONOLITH

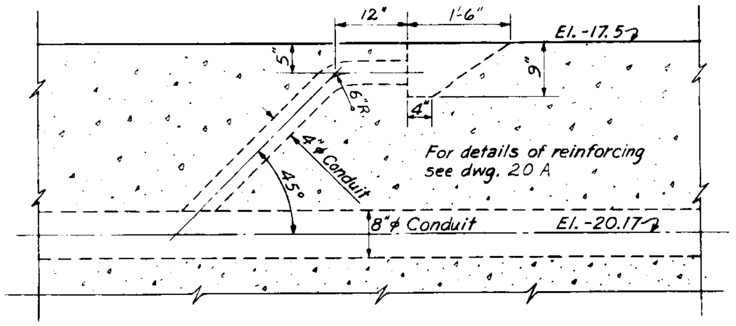
DESIGNED	DRAWN	CHECKED	DATE	SCALE	FILE NO.
D.A.M.	R.B.S.	R.N.J.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED	[signature] ENGINEER		SPEC NO. DACW 29-73-B-0111		DWG. 12 OF 64

PLATE II-7



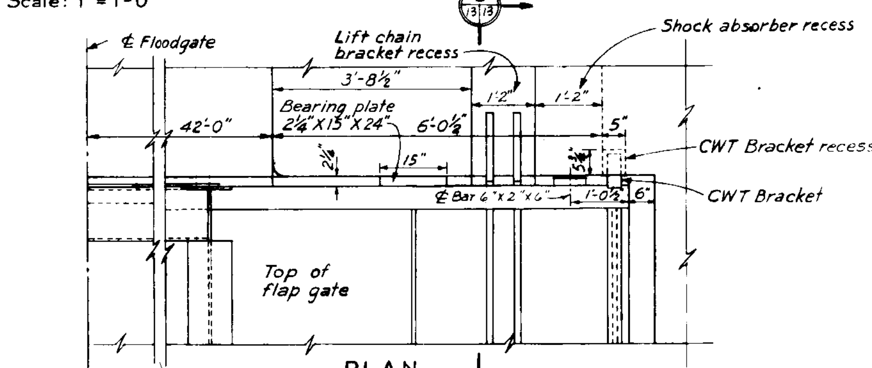
SECTIONAL ELEVATION

Scale: ¼"=1'-0"



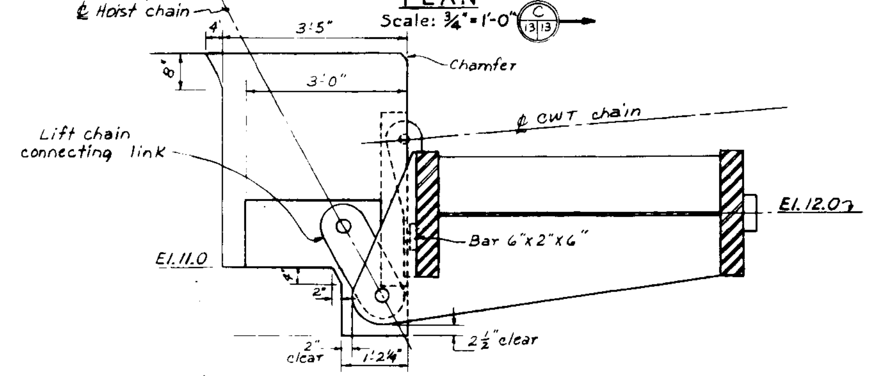
DETAIL OF DISCHARGE SUMP

Scale: 1"=1'-0"



PLAN

Scale: ¾"=1'-0"



COUNTERWEIGHT BRACKET AND SHOCK ABSORBER RECESS

SECTIONAL ELEVATION AT (C 13|13)

Scale: ¾"=1'-0"

CONCRETE GENERAL NOTES:

Elevations are expressed in feet and refer to mean sea level.

Items marked C.R.S. shall be corrosion-resisting steel.

All unformed surfaces shall be given a wood float finish.

Unless otherwise indicated all exterior formed surfaces not to be covered by backfill shall be class "A" finish. All exterior formed surfaces to be covered by backfill shall be class "D" finish.

All horizontal walking surfaces at El. 15.0 on the gate structure and floodwalls, and both decks of the pump platform shall receive a broom finish.

All exposed surfaces as indicated on the Control House and Pump House drawings shall receive an exposed aggregate finish.

All exposed corners of concrete including joints, edges, external corners, and vertical expansion joints shall be chamfered 3/4".

All primary reinforcement in the gate structure shall have a minimum cover of 4" unless otherwise indicated.

All primary reinforcement on building exteriors shall have a minimum cover of 2" unless otherwise indicated.

Secondary reinforcement cover may be reduced from the above by the diameter of the bar.

All bottom layers of reinforcement in gate bay slab to be 12" clear from bottom of slab.

Clear distance between layers of parralel reinforcement shall not be less than 6". In horizontal layers the bars in the upper layers should be placed directly over the lower layers.

Reinforcing bar designation numbers conform to the current numbering system of the "Concrete Reinforcing Steel Institute".

Lap splice lengths for reinforcing steel shall be in accordance with ACI "Manual of Standard Practice for Detailing Reinforced Concrete Structures" - ACI315-65 as shown in the table below.

All anchor bolts embeded in concrete shall be of structural grade steel unless otherwise noted.

MINIMUM LAP LENGTH

f'_c = 3,000 psi f'_c = 20,000 psi

Bar No.	Top Bars	Other Bars
3	12"	12"
4	14"	14"
5	18"	18"
6	24"	22"
7	33"	25"
8	43"	30"
9	55"	39"
10	69"	49"
11	85"	60"

REVISION	DATE	DESCRIPTION	BY
1	8-7-73	~~Revised dimension.~~ Mod #1.	D.J.H.

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NEW ORLEANS TO VENICE, LOUISIANA
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EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

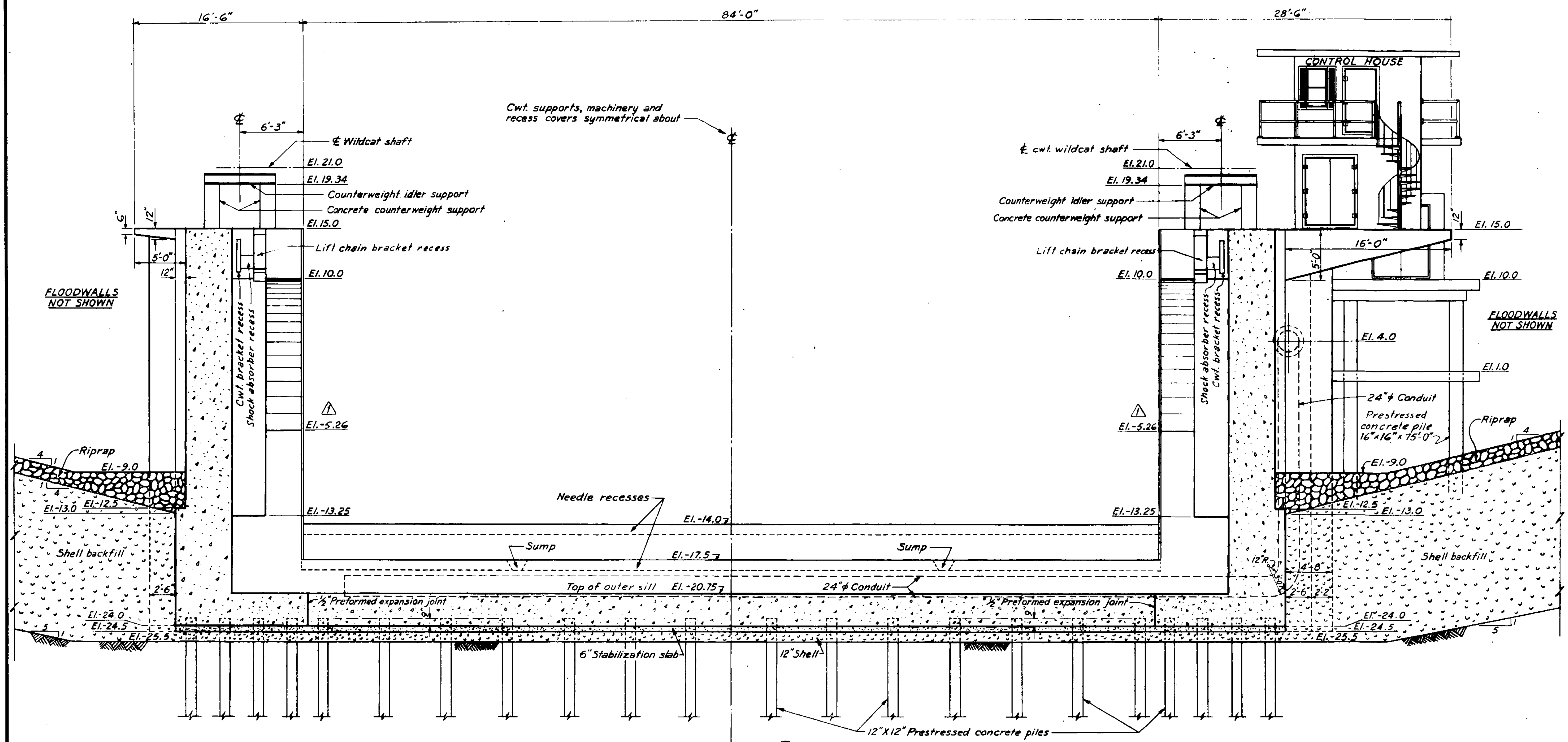
SECTIONAL ELEVATION OF GATE BAY MONOLITH

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.A.M.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081

SUBMITTED: [signature] ENGINEER

SPEC. NO. DACW29-73-B-0111

DWG. 13 OF 64



SECTION (A 13|14)

Scale: ¼"=1'-0"

Revision	Date	Description	By
1	8-7-73	Revised El. Mod. #1.	D.J.H.

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NEW ORLEANS TO VENICE, LOUISIANA
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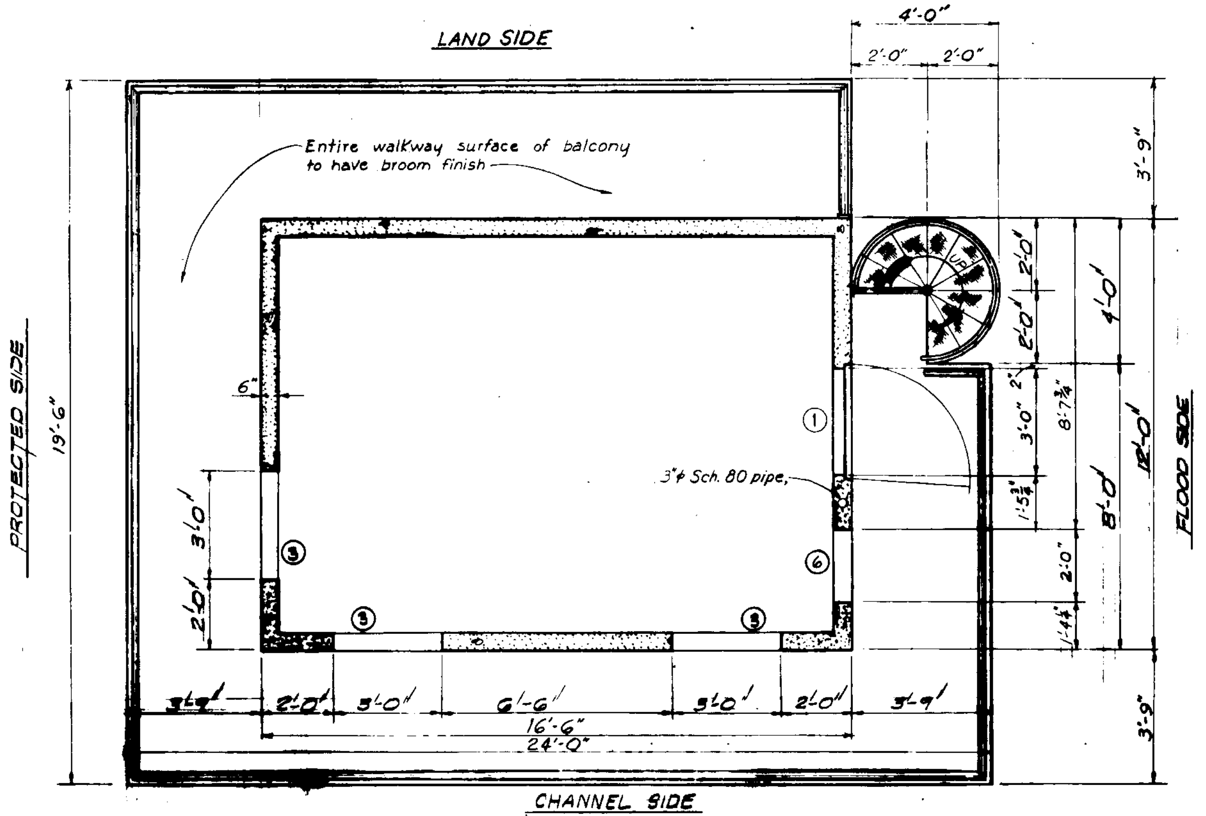
EMPIRE FLOODGATE

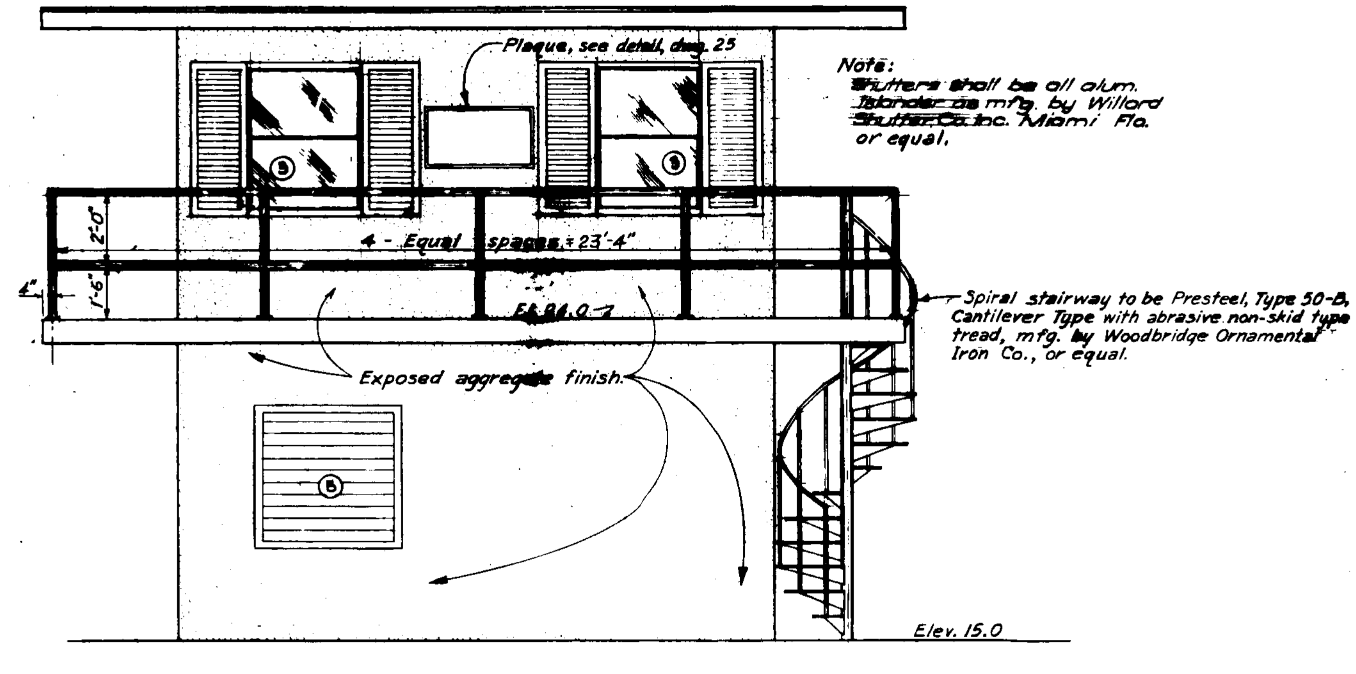
PLAQUEMINES PARISH, LA.

TRANSVERSE SECTION OF GATE BAY MONOLITH

Designed:	Drawn:	Checked:	Date:	Scale:	File No.
D.A.M.	R.G.S.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081
Submitted: [signature]			Spec. No. DACW29-73-B-0111		Dwg. 14 of 64



2nd FLOOR PLAN
Scale: ½"=1'-0"

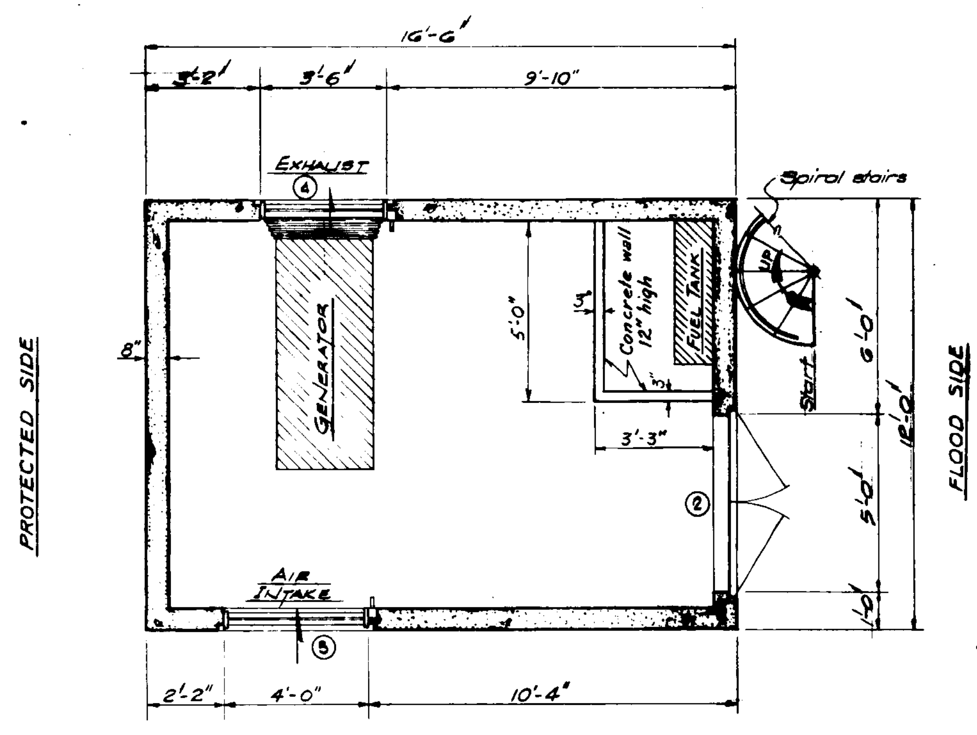


Note:
~~Shutters shall be all alum.~~
~~Islander as~~ mfg. by Willord
~~Shutter Co. Inc.~~ Miami Fla.
or equal.

Spiral stairway to be Presteel, Type 50-B, Cantilever Type with abrasive non-skid type tread, mfg. by Woodbridge Ornamental Iron Co., or equal.

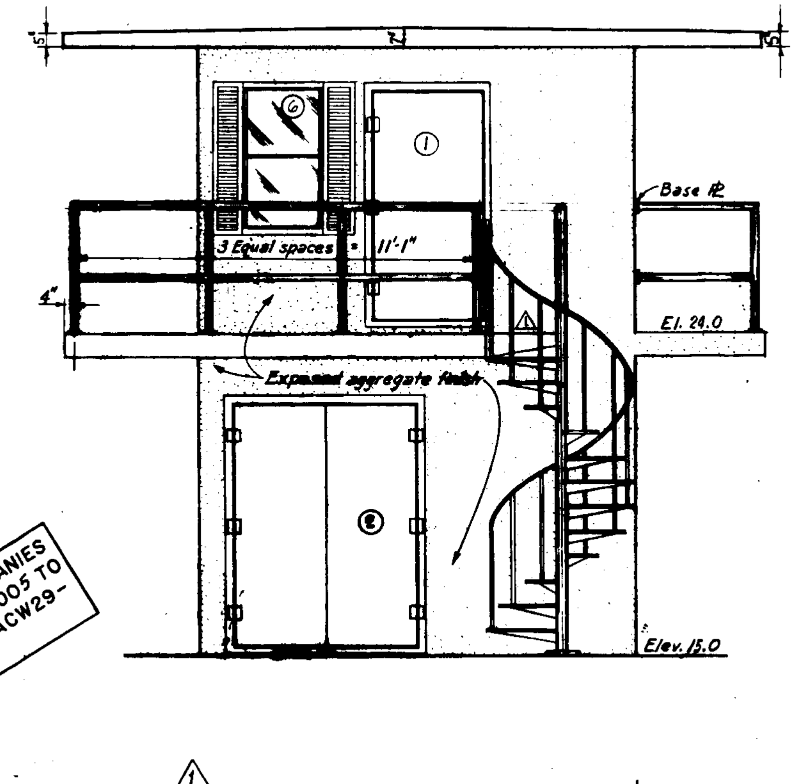
CHANNEL SIDE ELEVATION
Scale: ½"=1'-0"

DOOR, WINDOW & LOUVER SCHEDULE		
NO.	MARK	SIZE & TYPE
1	1	3'-0"x6'-8" Weather-tight door, square corner assembly with type A mortise lock. Model c.c. 3007 or equal as mfg'd. by Cornell Carr Co., Route No. 25, Monroe, Conn.
1	2	5'-0"x6'-8" Weather-tight door, square corner assembly with mortise lock. Model c.c. 3003 or equal, as mfgd by Cornell Carr Co., Route No. 25, Monroe, Conn.
4	3	3'-0"x4'-0" Weather-tight window. Model c.c. 1006, with ⅛" glass, or equal as mfg'd. by Cornell Carr Co. Route No. 25, Main Street, Stepney, Conn.
1	4	3'-0"x3'-6" Adjustable louver Model LW-P-3131 FA or equal, as mfg'd. by The American Warming & Ventilating, Inc. (16 ga. galv. steel)
1	5	4'-0"x4'-0" Adjustable louver. Model LW-P-3131 FA or equal, as mfgd. by The American Warming & Ventilating, Inc. (16 ga. galv. steel)
1	6	2'-0"x4'-0" Weather-tight window. Model c.c. 1006 with ⅛" glass or equal as mfgd by Cornell Carr Co., Route No. 25, Main Street, Stepney, Conn.



1ST FLOOR PLAN
Scale: ½"=1'-0"

THIS PLAN ACCOMPANIES MODIFICATION P00005 TO CONTRACT NO. DACW29-73-C-0151



FLOOD SIDE ELEVATION
Scale: ½"=1'-0"

REVISION	DATE	DESCRIPTION	BY
1	11-18-74	Revised Stairway Landing Mod. # 5	GPT

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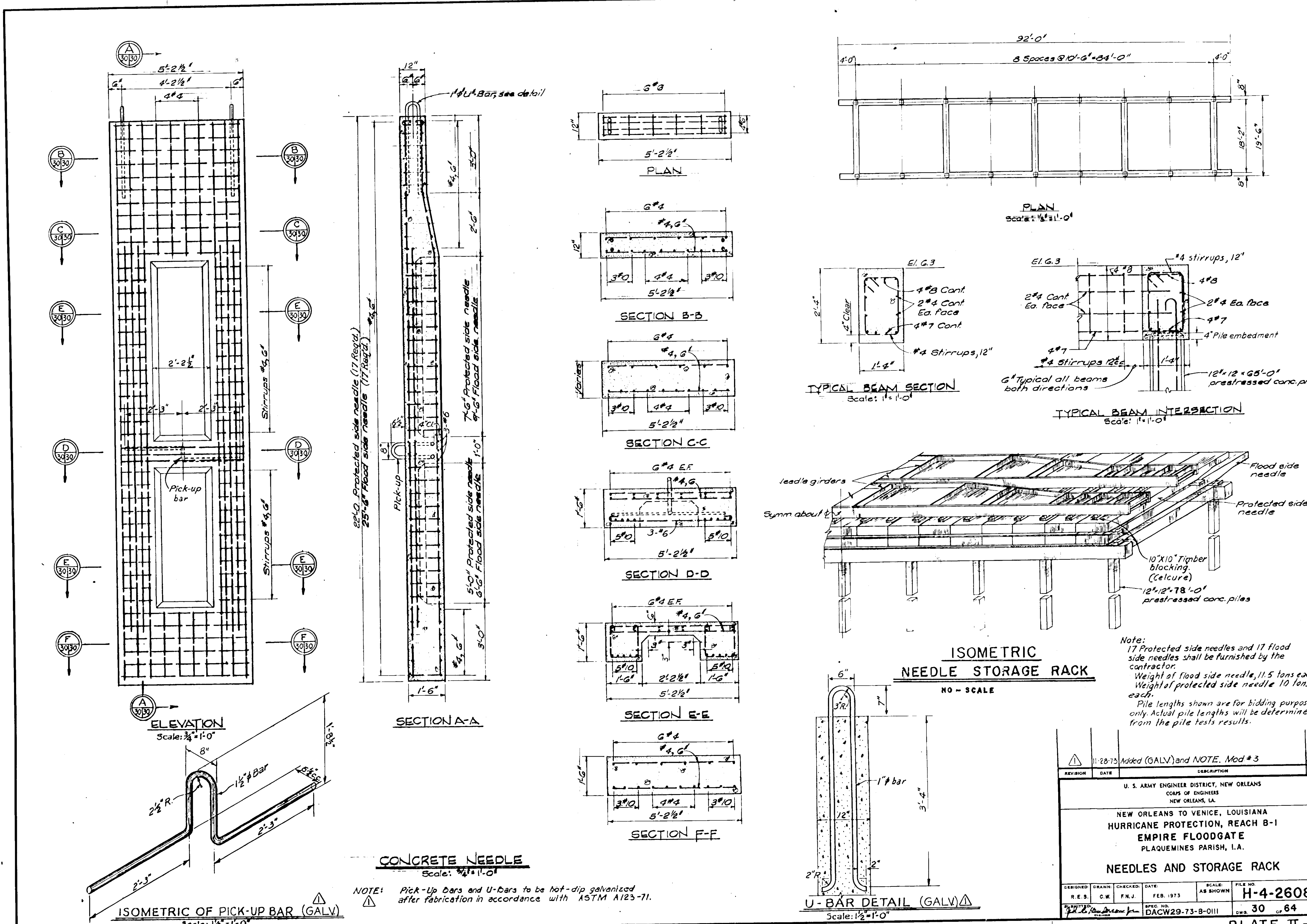
NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

CONTROL HOUSE PLAN AND ELEVATIONS

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.A.M.	C.W.	F.H.J.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature]			SPEC. NO. DACW29-73-B-0111		DWG. 24 OF 64



NOTE: Pick-Up bars and U-Bars to be hot-dip galvanized after fabrication in accordance with ASTM A123-71.

Note:
17 Protected side needles and 17 flood side needles shall be furnished by the contractor.
Weight of flood side needle, 11.5 tons each.
Weight of protected side needle 10 tons each.
Pile lengths shown are for bidding purposes only. Actual pile lengths will be determined from the pile tests results.

REVISION	DATE	DESCRIPTION	BY
1	11-28-73	Added (GALV) and NOTE. Mod #3	J.C.S.

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NEW ORLEANS TO VENICE, LOUISIANA
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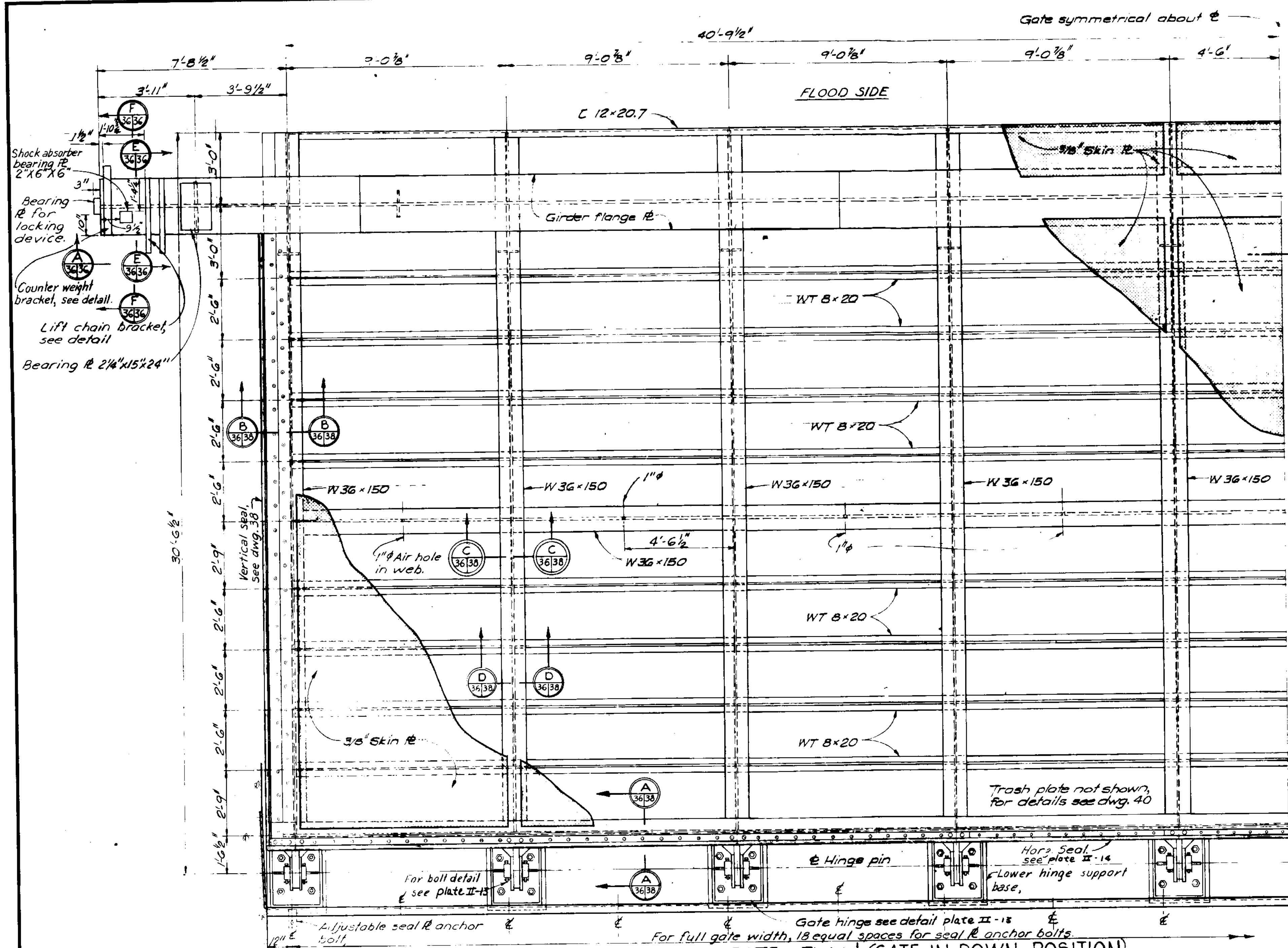
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

NEEDLES AND STORAGE RACK

DESIGNED	DRAWN	CHECKED	DATE	SCALE	FILE NO.
R.E.S.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081

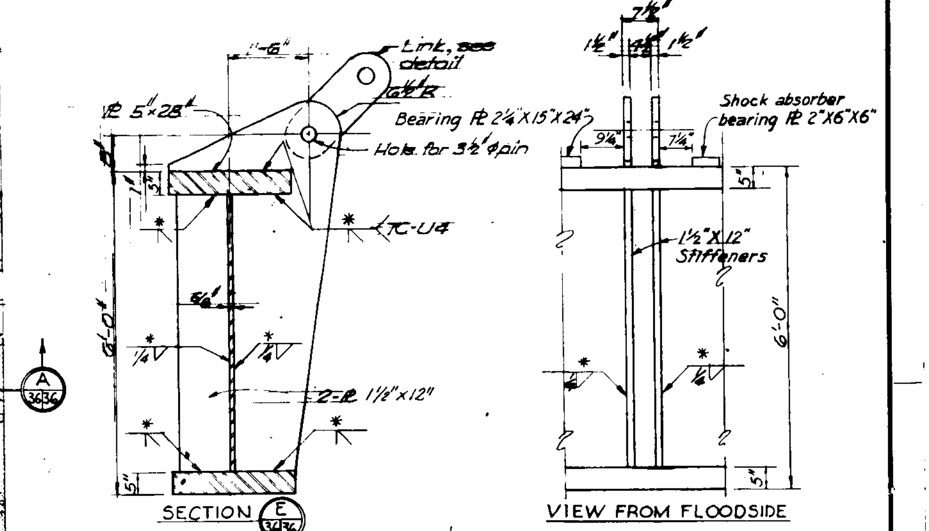
SPEC. NO. DACW29-73-B-0111 — DWG. 30 of 64

PLATE II-11



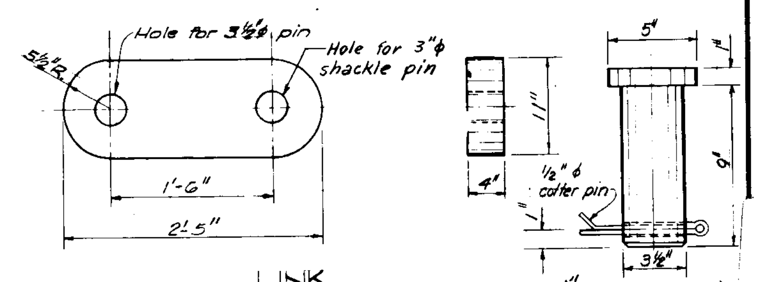
GATE-PLAN (GATE IN DOWN POSITION)

Scale: ⅛"=1'-0"



LIFT CHAIN BRACKET

Scale: ¾"=1'-0"

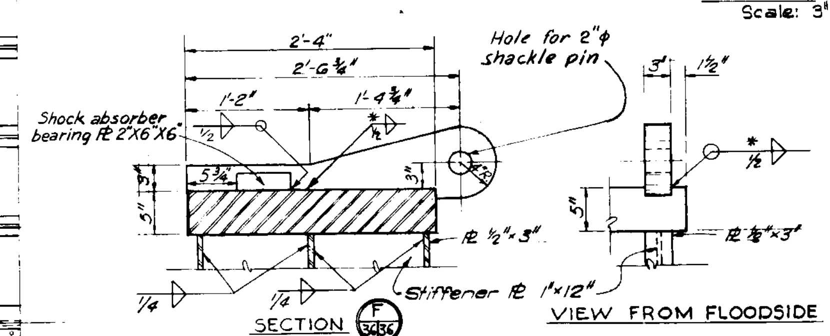


LINK

Scale: 1½"=1'-0"

3½"φ PIN (CRS)

Scale: 3"=1'-0"

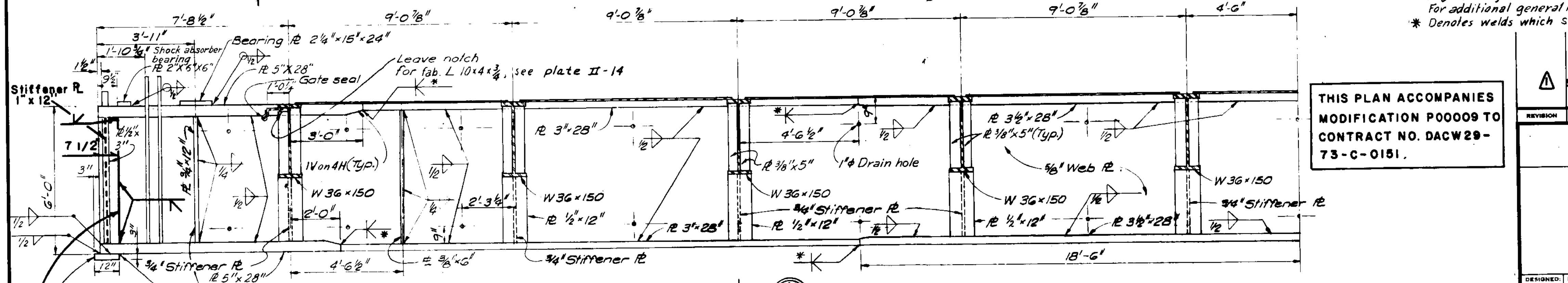


COUNTERWEIGHT BRACKET

Scale: 1½"=1'-0"

GENERAL STRUCTURAL STEEL NOTES

All material shall be structural steel except as otherwise indicated.
All bolts shall be A325 bolts unless otherwise indicated.
Items marked C.R.S. shall be corrosion-resisting steel.
Welding symbols are American Welding Society Standard.
A ⅛" watertight fillet weld shall be provided between all intermittent welds.
For additional general notes see plate II-8
* Denotes welds which shall be radiographed.



SECTION A 36|36

Scale: ½"=1'-0"

THIS PLAN ACCOMPANIES MODIFICATION P00009 TO CONTRACT NO. DACW29-73-C-0151.

REVISION	DATE	DESCRIPTION	BY
1	9-1775	Added total of 4 stiffeners to ends of plate girder. Mod. # 9	SSG

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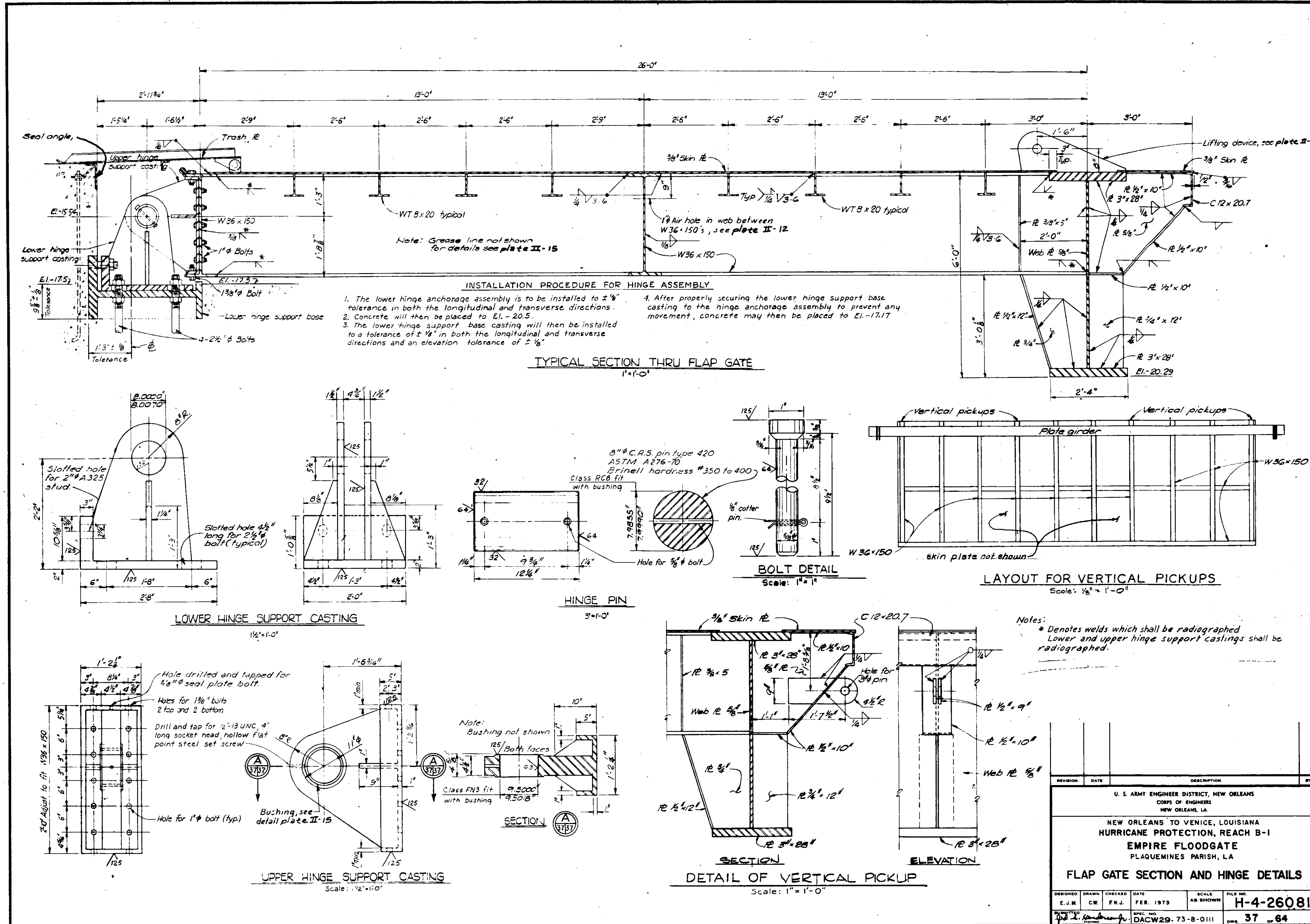
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

FLAP GATE-PLAN AND SECTIONS

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
E.J.M.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature]			SPEC. NO. DACW29-73-B-0111		DWG. 36 OF 64



INSTALLATION PROCEDURE FOR HINGE ASSEMBLY

1. The lower hinge anchorage assembly is to be installed to ± 1/8" tolerance in both the longitudinal and transverse directions.
2. Concrete will then be placed to El. - 20.5.
3. The lower hinge support base casting will then be installed to a tolerance of ± 1/8" in both the longitudinal and transverse directions and an elevation tolerance of ± 1/8".
4. After properly securing the lower hinge support base casting to the hinge anchorage assembly to prevent any movement, concrete may then be placed to El.-17.17

Notes:
* Denotes welds which shall be radiographed
Lower and upper hinge support castings shall be radiographed.

REVISION	DATE	DESCRIPTION	BY

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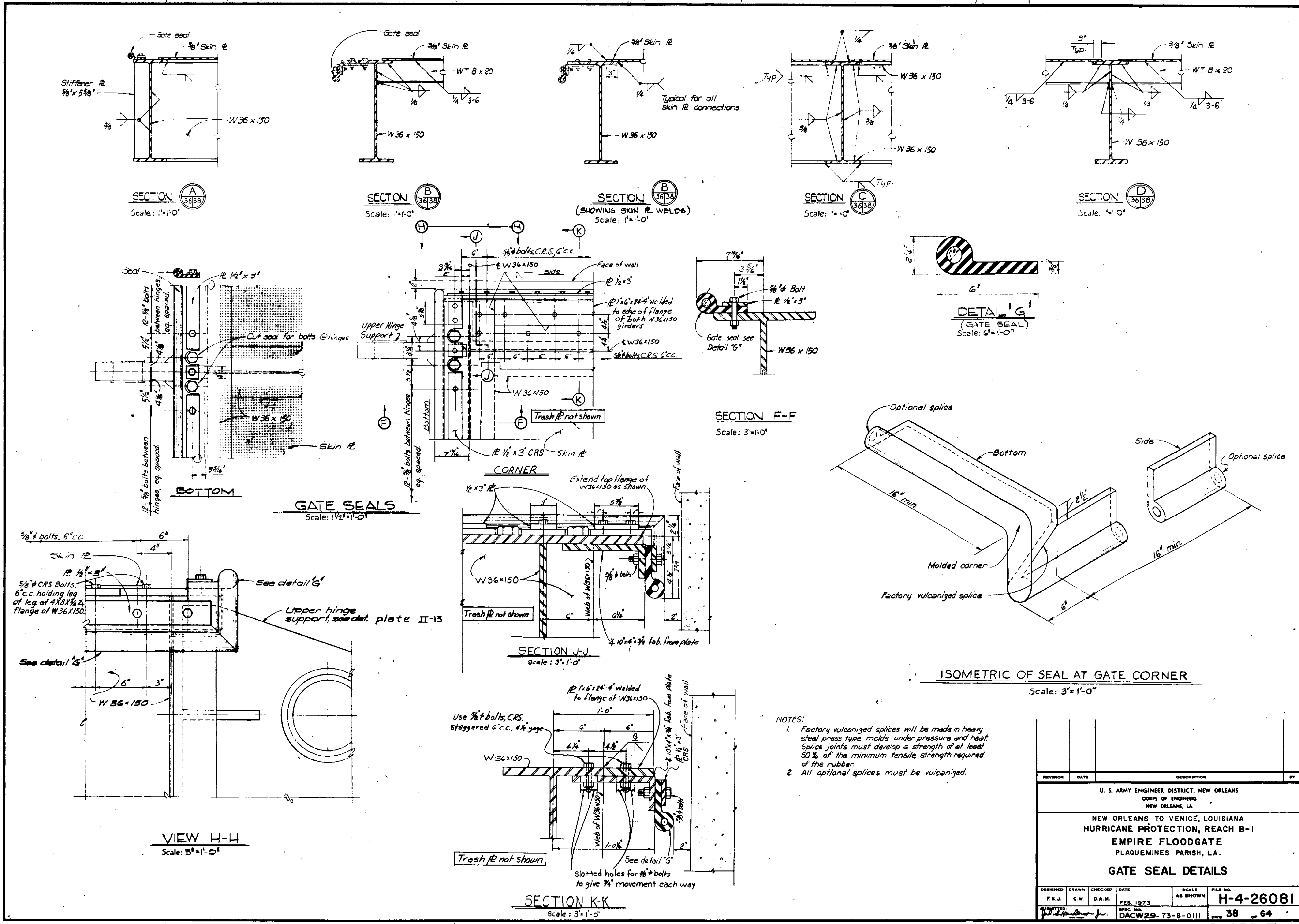
FLAP GATE SECTION AND HINGE DETAILS

DESIGNED	DRAWN	CHECKED	DATE	SCALE	FILE NO.
E.J.M.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081

SUBMITTED: [signature] SPEC NO. DACW29-73-B-0111 DWG 37 of 64

PLATE II-13



NOTES:

1. Factory vulcanized splices will be made in heavy steel press type molds under pressure and heat. Splice joints must develop a strength of at least 50% of the minimum tensile strength required of the rubber.
2. All optional splices must be vulcanized.

REVISION	DATE	DESCRIPTION	BY

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NEW ORLEANS TO VENICE, LOUISIANA
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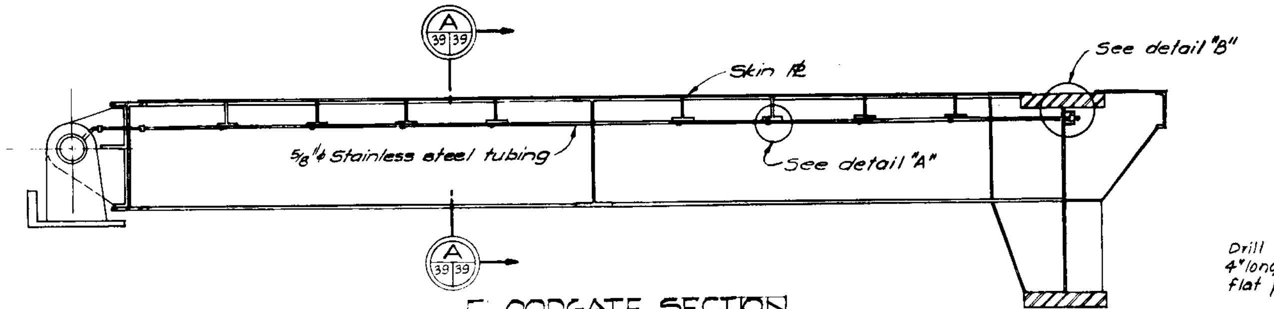
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

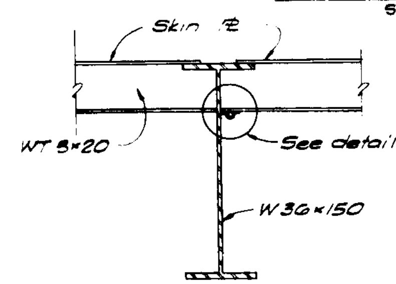
GATE SEAL DETAILS

DESIGNED	DRAWN	CHECKED	DATE	SCALE	FILE NO.
F.N.J.	C.W.	O.A.M.	FEB 1973	AS SHOWN	H-4-26081
SUBMITTED			SPEC. NO. DACW29-73-B-0111		DWG. 38 OF 64

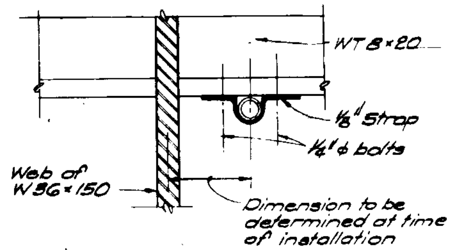
PLATE II-14



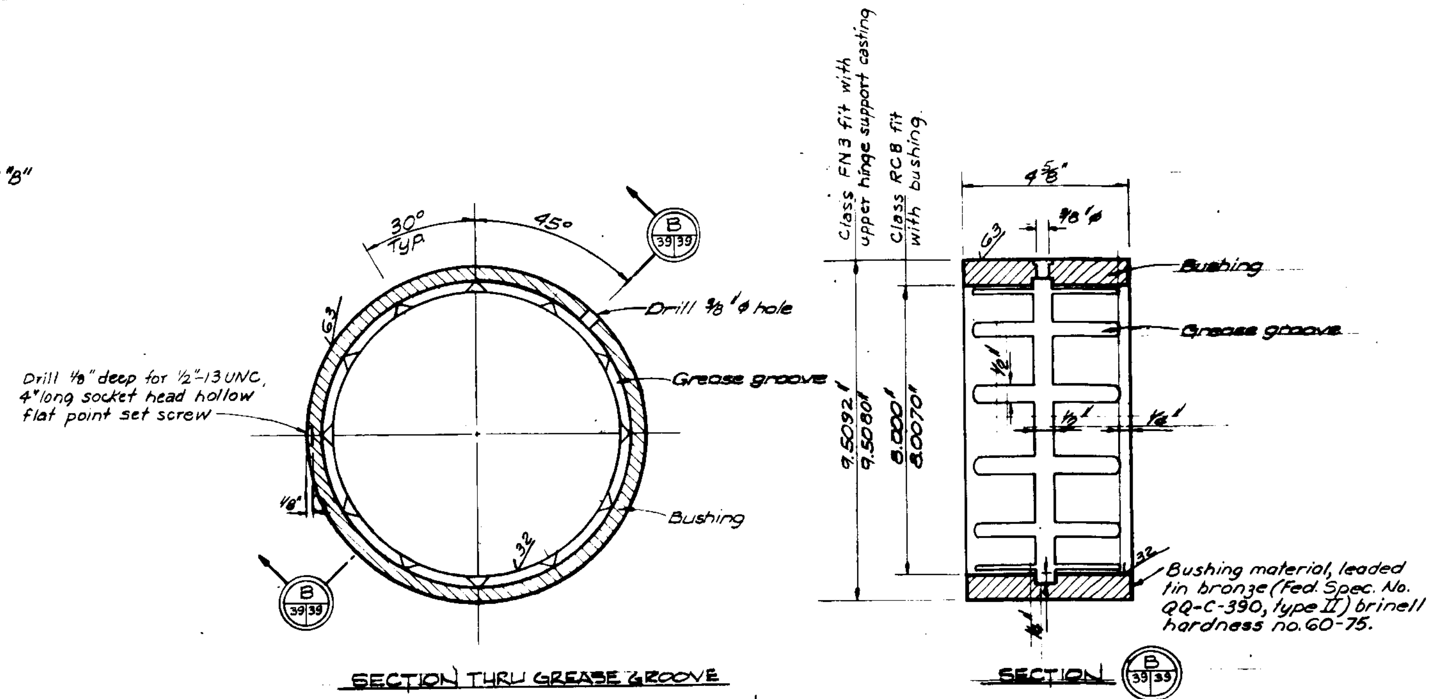
FLOODGATE SECTION
Scale: 1/2" = 1'-0"



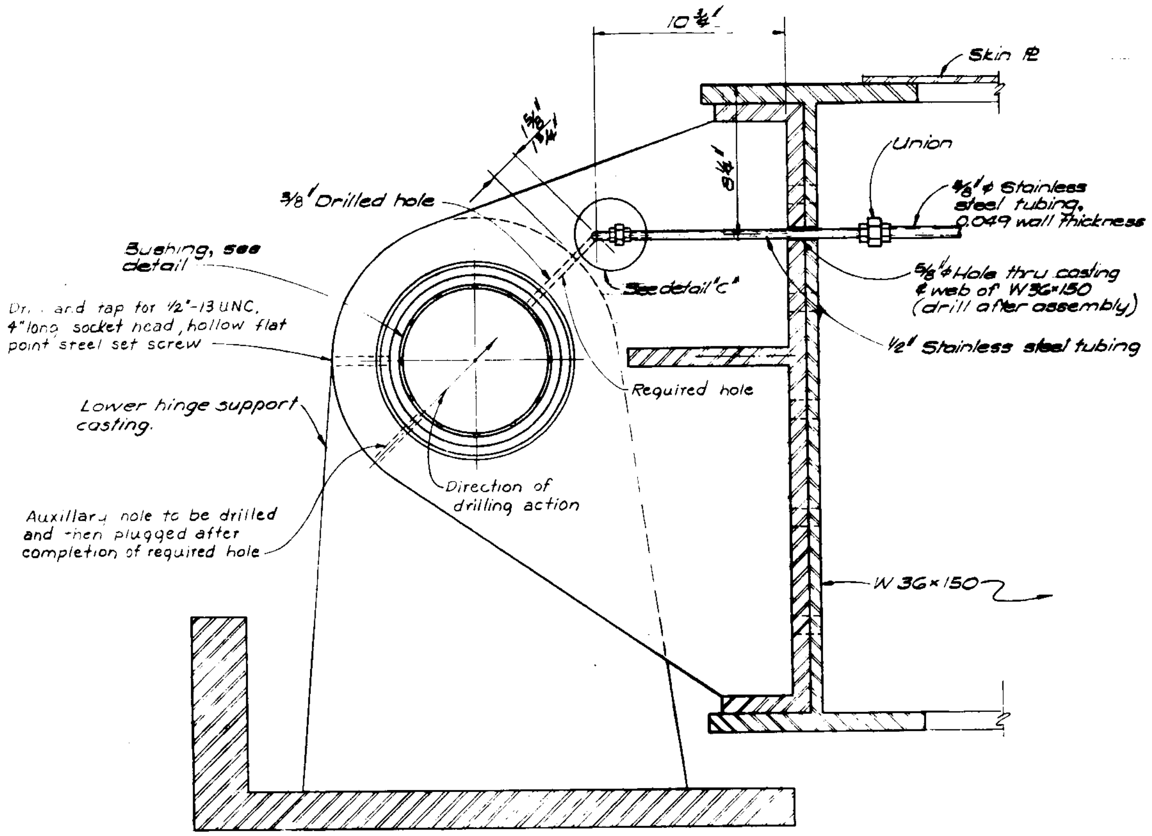
SECTION A 39 39
Scale: 1" = 1'-0"



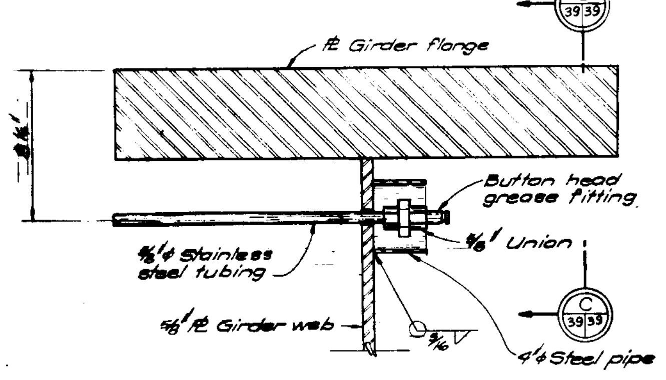
DETAIL 'A'
Scale: 6" = 1'-0"



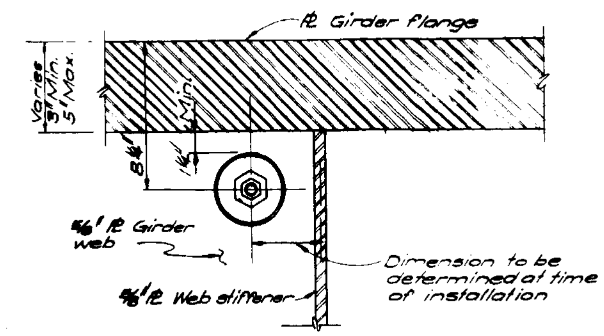
BUSHING DETAIL
Scale: 6" = 1'-0"



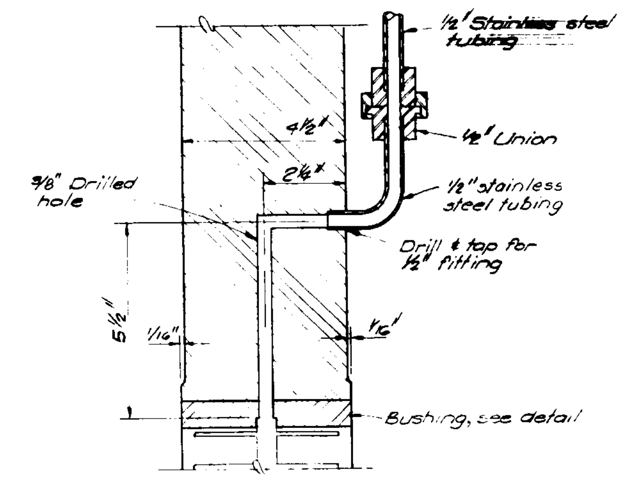
DETAIL @ HINGE
Scale: 3" = 1'-0"



DETAIL "B"
Scale: 3" = 1'-0"



SECTION C 39 39
Scale: 3" = 1'-0"



DETAIL 'C'
Scale: 6" = 1'-0"

NOTE: A separate lubrication line is required for each hinge.

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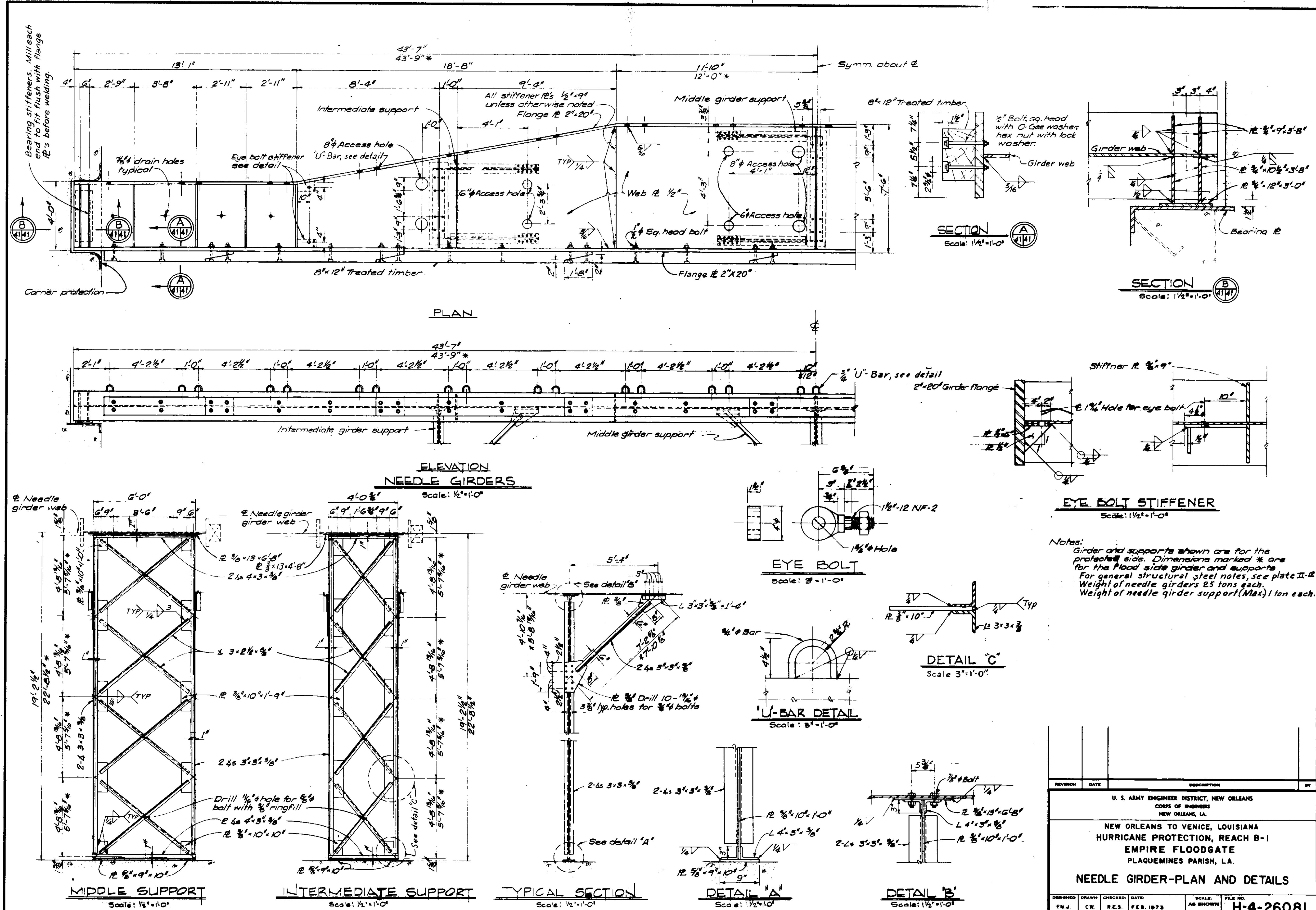
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

HINGE LUBRICATION DETAILS

DESIGNED	DRAWN	CHECKED	DATE	SCALE:	FILE NO.
F.N.J.	C.W.	D.A.M.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature]			SPEC NO. DACW29-73-B-0111		DWG. 39 of 64

PLATE II-15



Notes:
Girder and supports shown are for the protected side. Dimensions marked * are for the flood side girder and supports.
For general structural steel notes, see plate II-12
Weight of needle girders 25 tons each.
Weight of needle girder support (Max.) 1 ton each.

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NEW ORLEANS TO VENICE, LOUISIANA
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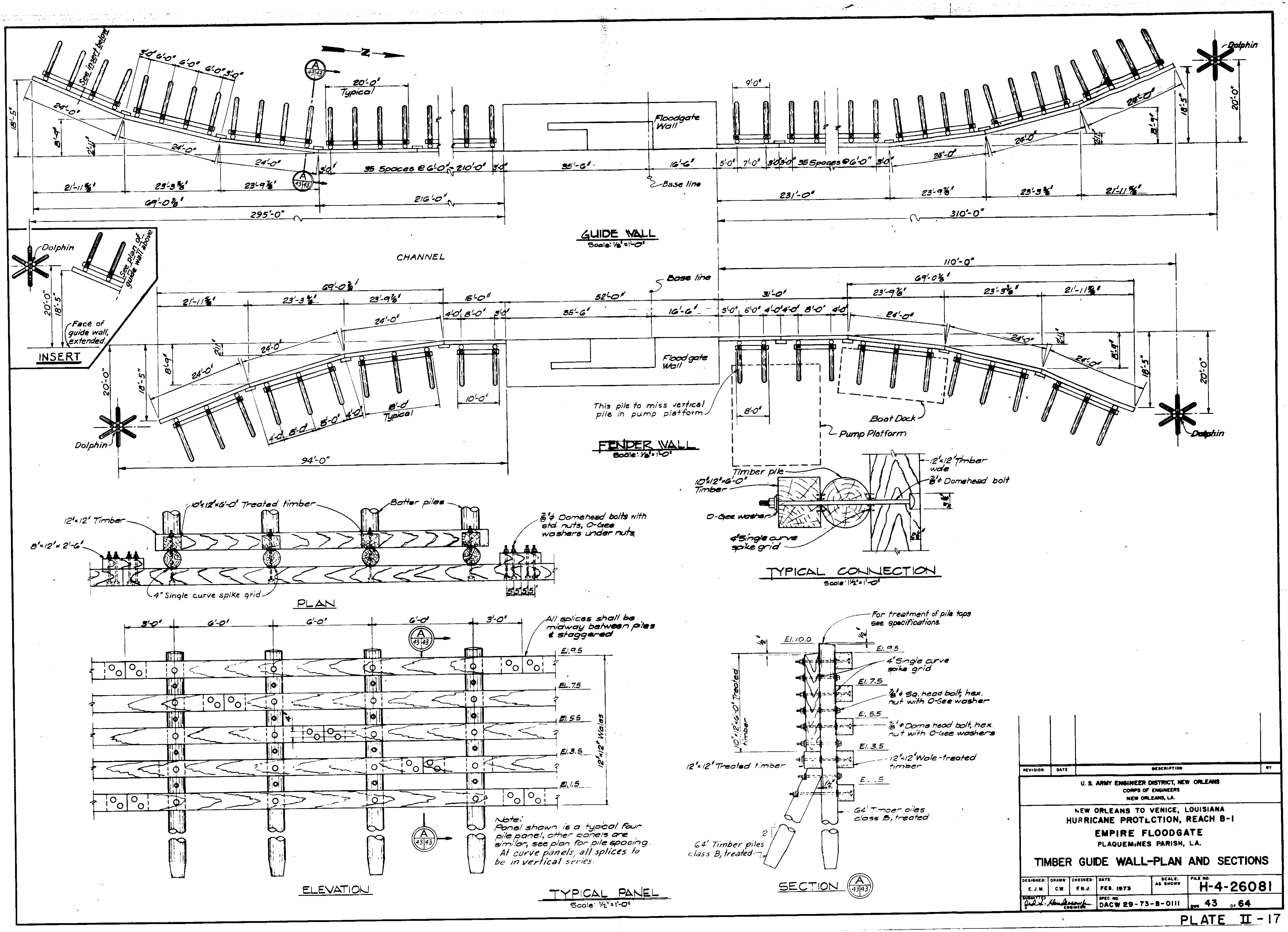
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

NEEDLE GIRDER-PLAN AND DETAILS

DESIGNED	DRAWN	CHECKED	DATE	SCALE	FILE NO.
F.N.J.	C.W.	R.E.S.	FEB. 1973	AS SHOWN	H-4-26081

SPEC. NO. DACW29-73-B-0111 DWG. 41 OF 64

PLATE II-16



GUIDE WALL
Scale: 1/8"=1'-0"
CHANNEL
Floodgate Wall
Base line
Dolphin
See insert below
35 Spaces @ 6'-0" = 210'-0"
295'-0"
216'-0"
310'-0"
231'-0"
20'-0" Typical
INSERT
See plan of guide wall above
Face of guide wall, extended.
FENDER WALL
Scale: 1/8"=1'-0"
110'-0"
94'-0"
18'-0" Typical
This pile to miss vertical pile in pump platform
Pump Platform
Boat Dock
Timber pile
10"x12"x6'-0" Timber
12"x12" Timber wale
3/4"φ Domehead bolt
O-Gee washer
4" Single curve spike grid
TYPICAL CONNECTION
Scale: 1 1/2"=1'-0"
12"x12" Timber
8"x12"x2'-6"
10"x12"x6'-0" Treated timber
Batter piles
3/4"φ Domehead bolts with std. nuts, O-Gee washers under nuts.
4" Single curve spike grid
PLAN
All splices shall be midway between piles & staggered
El. 9.5
El. 7.5
El. 5.5
El. 3.5
El. 1.5
12"x12" Wales
ELEVATION
Note: Panel shown is a typical four pile panel, other panels are similar, see plan for pile spacing. At curve panels, all splices to be in vertical series.
TYPICAL PANEL
Scale: 1/2"=1'-0"
For treatment of pile tops see specifications.
El. 10.0
4" Single curve spike grid
3/4"φ Sq. head bolt, hex. nut with O-Gee washer
7/8"φ Dome head bolt, hex. nut with O-Gee washers
12"x12" Wale-treated timber
10"x12"x6'-0" Treated timber
12"x12" Treated timber
64' Timber piles class B, treated
SECTION A 43|43
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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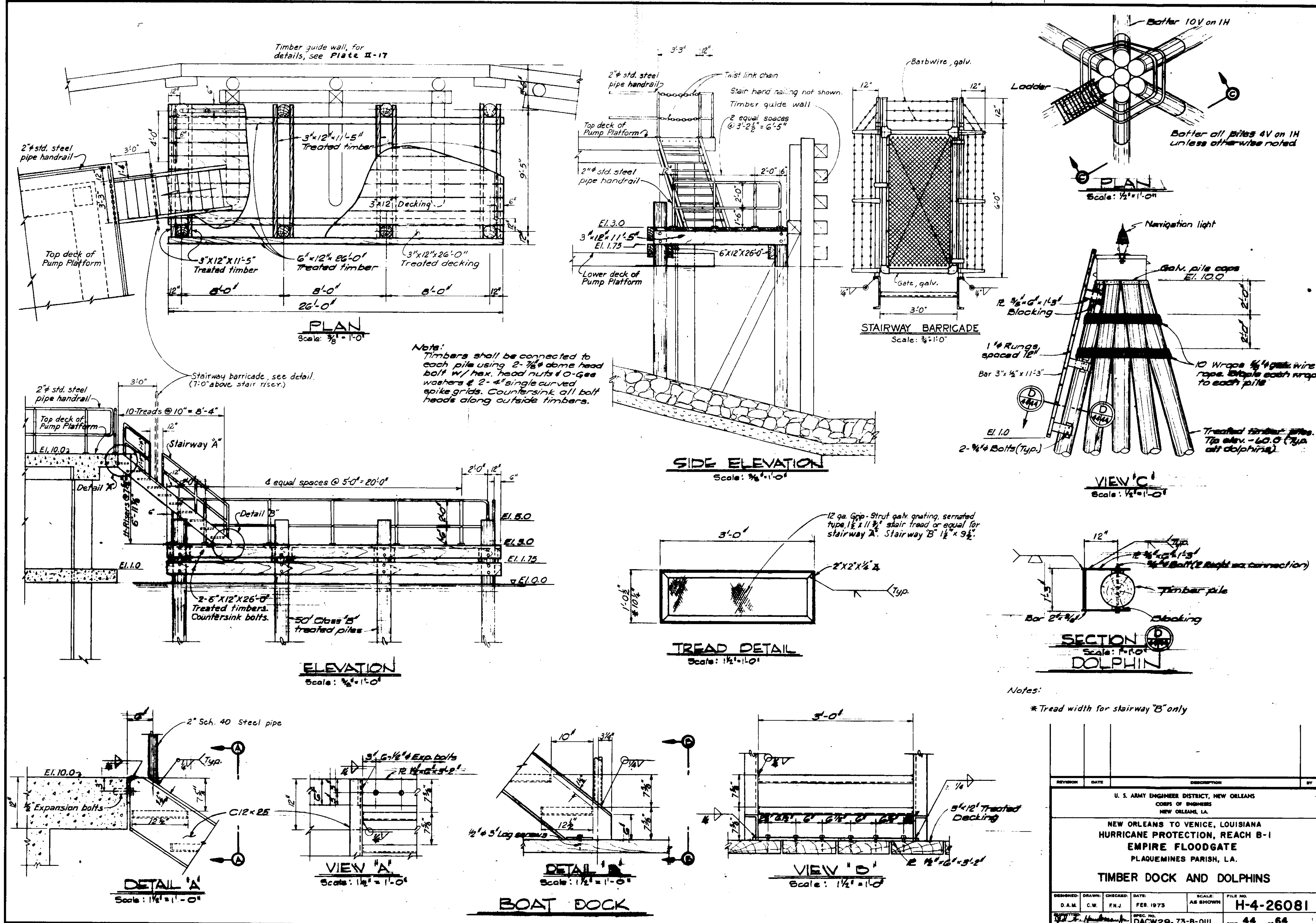
NEW ORLEANS, LA.
NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.
TIMBER GUIDE WALL-PLAN AND SECTIONS
DESIGNED: E.J.M. DRAWN: C.W. CHECKED: F.N.J. DATE: FEB. 1973 SCALE: AS SHOWN
FILE NO. H-4-26081
SPEC. NO. DACW 29-73-B-0111
SHEET 43 OF 64
PLATE II - 17



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NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

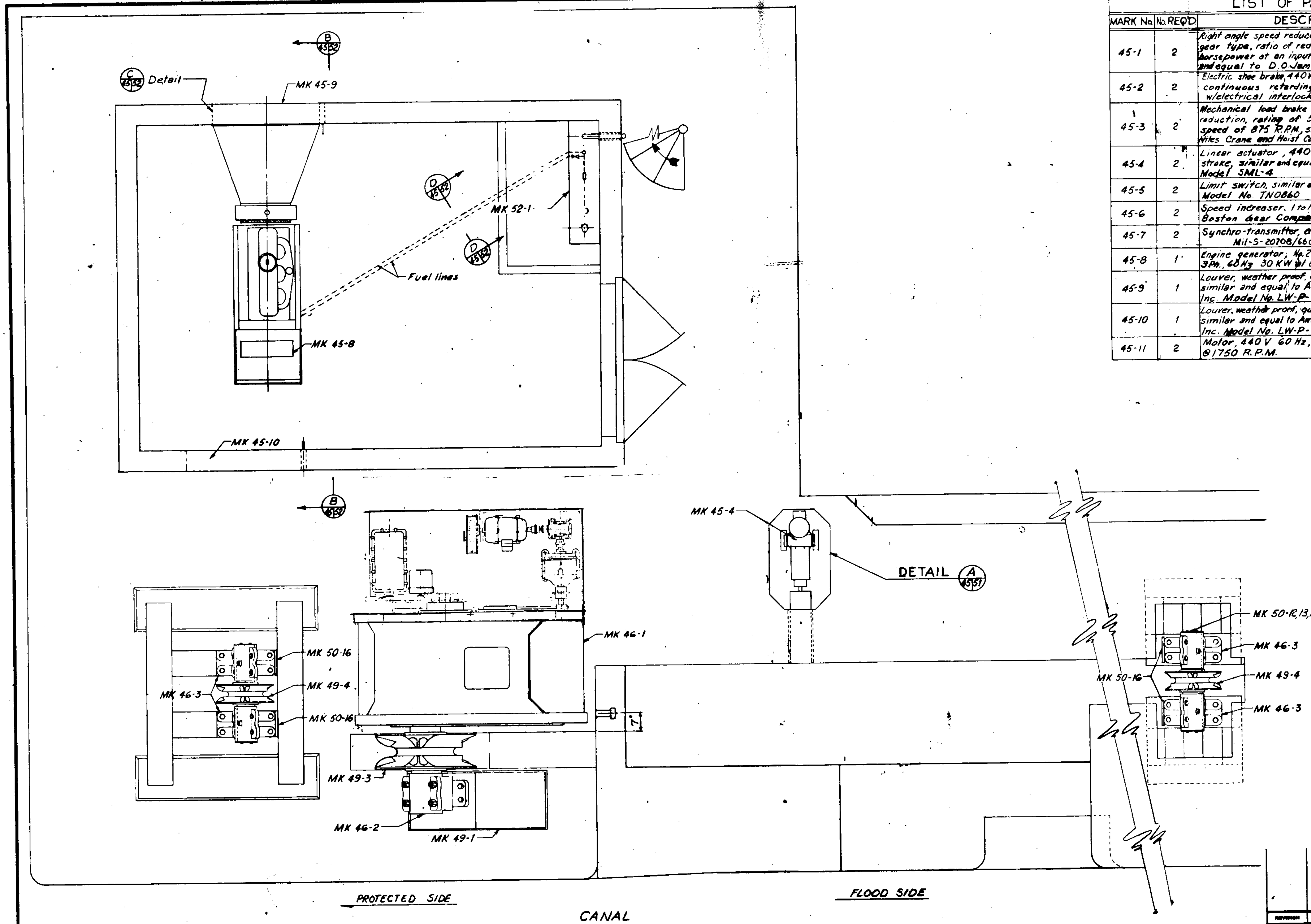
TIMBER DOCK AND DOLPHINS

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.A.M.	C.W.	F.N.J.	FEB. 1973	AS SHOWN	H-4-26081

SPEC. NO. DACW29-73-B-0111 — DWG. 44 of 64

LIST OF PARTS NOT DETAILED

MARK No.	No. REQ'D	DESCRIPTION	MATERIAL	USED WITH
45-1	2	Right angle speed reducer, single reduction, spiral bevel gear type, ratio of reduction 2 to 1, min. rating of 7½ horsepower at an input speed of 1750 R.P.M., similar and equal to D.O. James Model No. 400RA	Comm. Grade	MK 45-2 MK 45-3 MK 45-11
45-2	2	Electric shoe brake, 440V, 3Ph., 60Hz, 50 Ft/lb. min. continuous retarding torque, hand release w/electrical interlock, NEMA 4 water tight inclosure	Comm. Grade	MK 45-1
45-3	2	Mechanical load brake with 7.5:1 integral spur gear reduction, rating of 5 horsepower at an input speed of 875 R.P.M., similar and equal to Shepard Niles Crane and Hoist Corp. Form B, catalog No. 4001	See Para. 15-8	MK 45-1 MK 46-1
45-4	2	Linear actuator, 440V, 3Ph, 60Hz, with an 8 inch stroke, similar and equal to RACO Machine Co. Model SML-4	Comm. Grade	
45-5	2	Limit switch, similar and equal to Westinghouse Model No. TN0860	See Para. 15-10	MK 46-1
45-6	2	Speed increaser, 1 to 10 ratio similar and equal to Boston Gear Company Optimount Unit No. 221	Comm. Grade	MK 45-5 MK 46-1
45-7	2	Synchro-transmitter, as per MilSpec Mil-S-20708/66C		MK 46-1
45-8	1	Engine generator; No. 2 diesel fuel type engine, 480V, 3Ph., 60Hz 30 KW at 80% P.F. generator.	Comm. Grade	
45-9	1	Louver, weather proof, quadrant operated, 42"x36" similar and equal to American Warming and Ventilating Inc. Model No. LW-P-3131FA.	Galv. Steel	MK 45-8
45-10	1	Louver, weather proof, quadrant operated, 48"x48" similar and equal to American Warming and Ventilating Inc. Model No. LW-P-3131FA.	Galv. Steel	MK 45-8
45-11	2	Motor, 440V 60 Hz, 3 Phase, T.E.F.C. 7½ H.P. @1750 R.P.M.	See Para. 15-7	MK 46-1



PLAN
Scale: 3/4"=1'-0"

REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

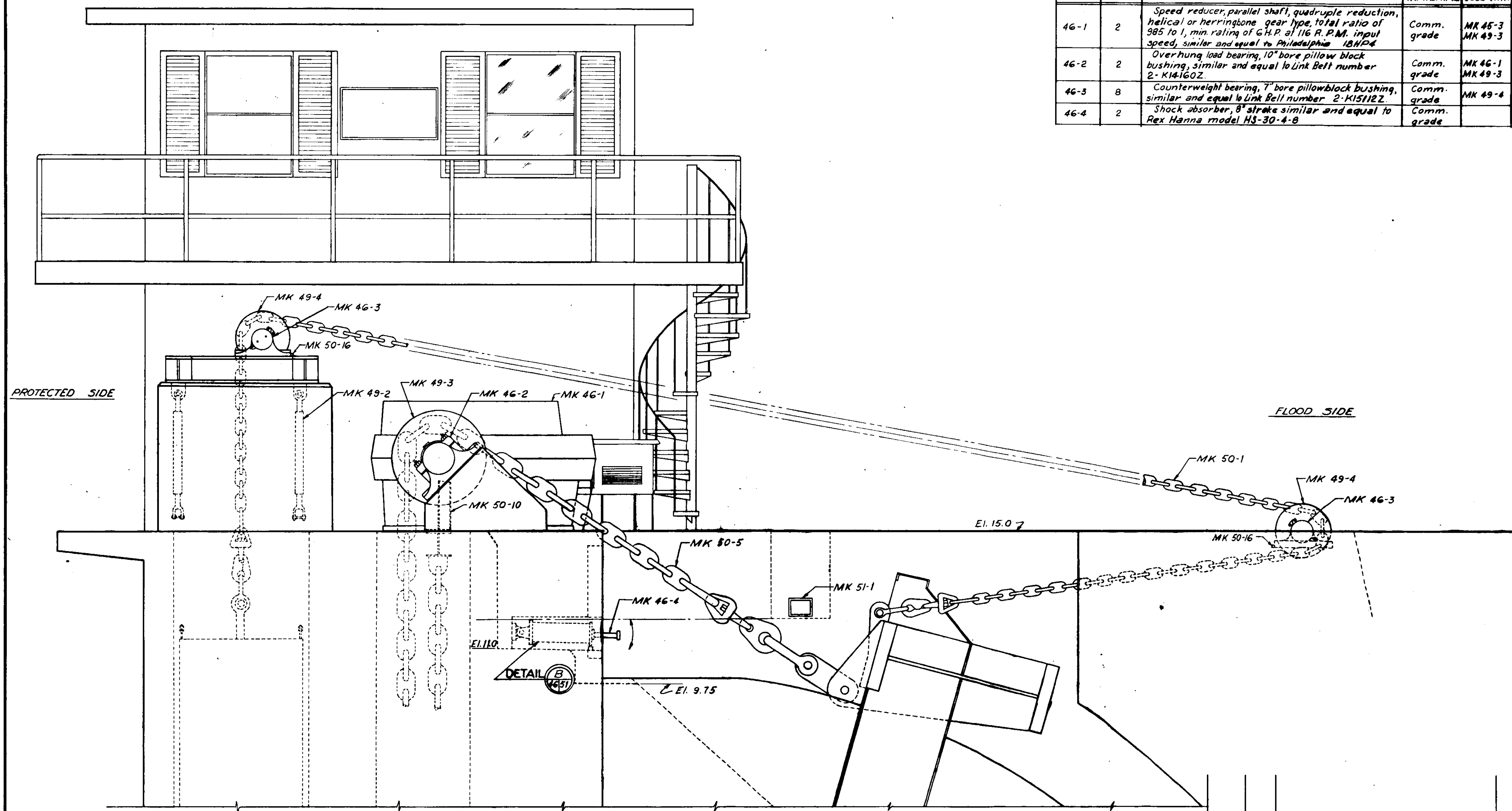
PLAN-MACHINERY ARRANGEMENT

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.C.S.	A.A.D.	W.A.W.	FEB. 1973	AS SHOWN	H-4-26081

SUBMITTED: [signature]
SPEC. NO. DACW29-73-B-0111
DWG. 45 OF 64

LIST OF PARTS NOT DETAILED

MARK NO.	NO. REQ'D	DESCRIPTION	MATERIAL	USED WITH
46-1	2	Speed reducer, parallel shaft, quadruple reduction, helical or herringbone gear type, total ratio of 985 to 1, min. rating of G.H.P. at 116 R.P.M. input speed, similar and equal to Philadelphia 18HP4	Comm. grade	MK 45-3 MK 49-3
46-2	2	Overhung load bearing, 10" bore pillow block bushing, similar and equal to Link Belt number 2-K14160Z.	Comm. grade	MK 46-1 MK 49-3
46-3	8	Counterweight bearing, 7" bore pillowblock bushing, similar and equal to Link Belt number 2-K15112Z.	Comm. grade	MK 49-4
46-4	2	Shock absorber, 8" stroke similar and equal to Rex Hanna model HS-30-4-8	Comm. grade	



ELEVATION

Scale: 3/4"=1'-0"

REVISION	DATE	DESCRIPTION	BY

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NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

ELEVATION-MACHINERY ARRANGEMENT

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
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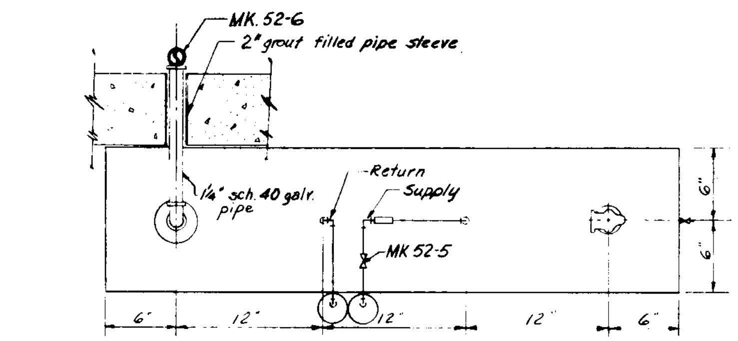
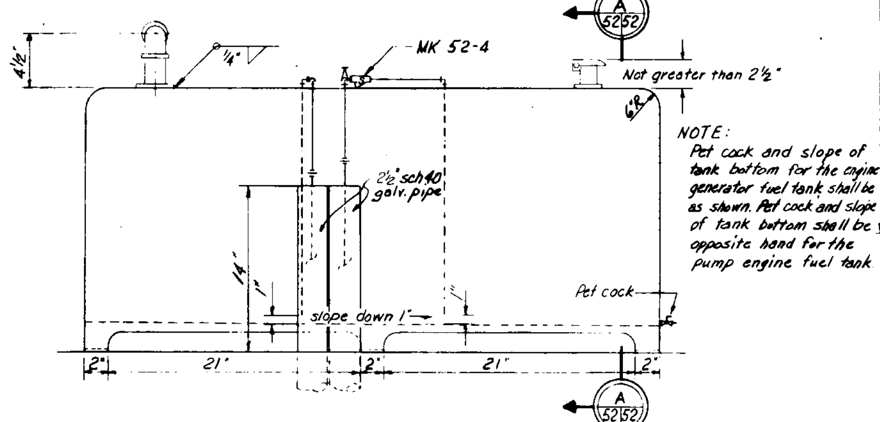
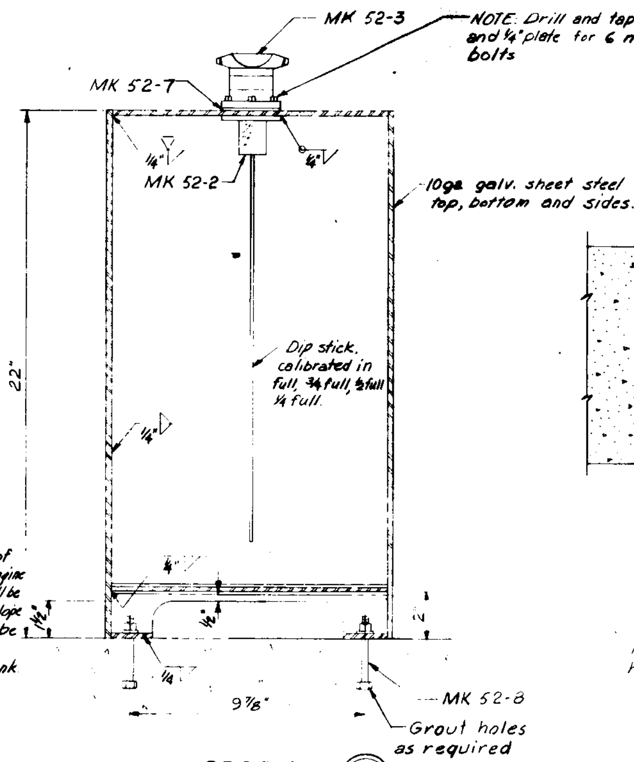
SPEC. NO. DACW29-73-B-0111
DWG. 46 OF 64



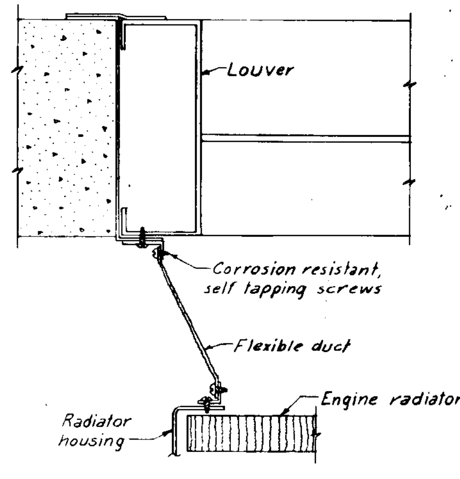
PLAN



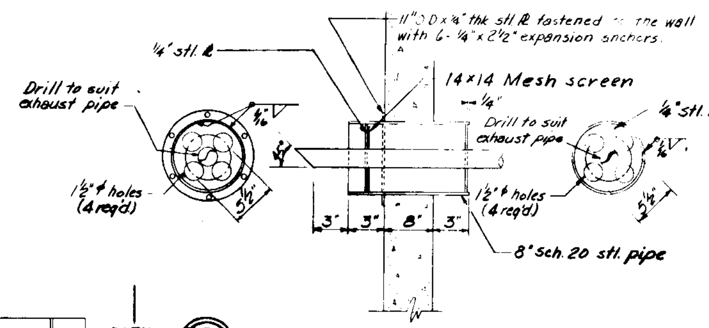
FUEL TANK MK. 52-1
MAT'L: STRUCTURAL STEEL (2 REQ'D)
Scale: 2"=1'-0"



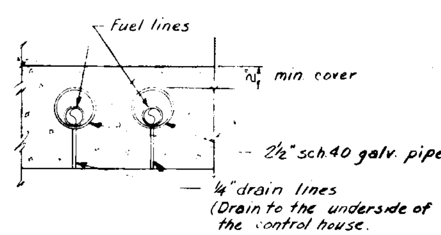
SECTION A 52/52
Scale: 4"=1'-0"



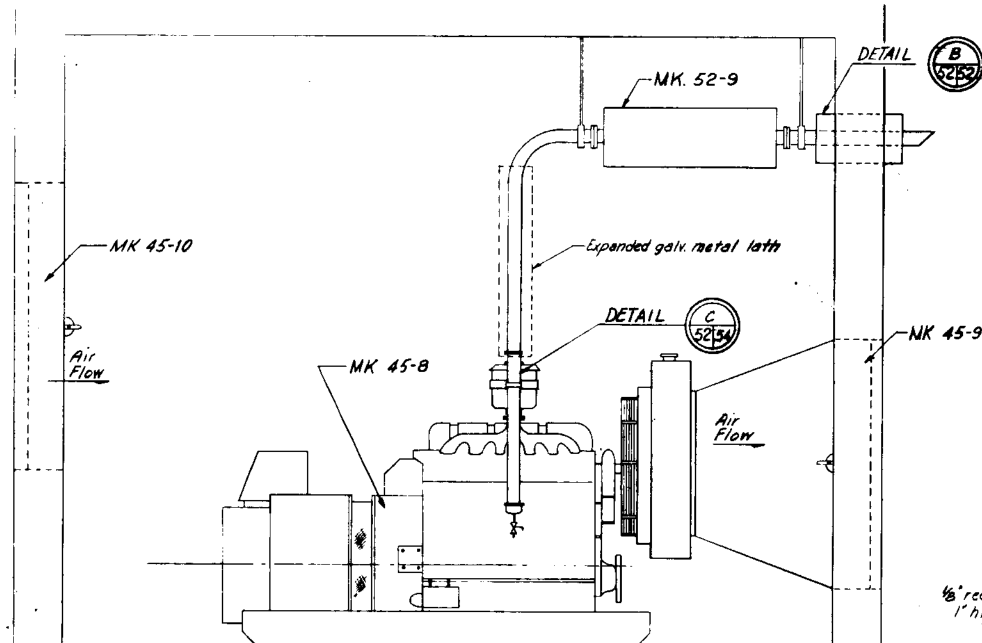
DETAIL B 53/52 C 45/52
N.T.S.



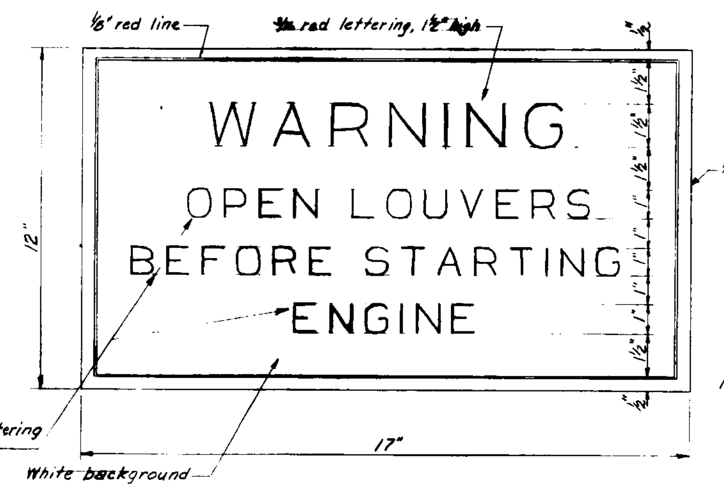
DETAIL B 52/52
N.T.S.



SECTION D 45/52 G 53/52
N.T.S.



SECTION B 45/52
Scale: 1½"=1'-0"



WARNING PLATE MK. 52-10
MAT'L: MASONITE 3 REQ'D.
N.T.S.

NOTE: Fasten signs with epoxy cement adjacent to the quadrant operator of each louver, MK. Nos 45-9, 45-10 and 53-6.

LIST OF PARTS NOT DETAILED

MK. No.	REQ'D.	DESCRIPTION	MAT'L.	USED WITH
52-2	1	Strainer, zinc dichrome finish steel with .062" holes and attached dip stick. Tedeco No. MF-366 or equal.	Steel	MK 52-1
52-3	1	Filler cap, spring loaded, 1½" diameter bore, similar or equal to Tedeco filler cap with mounting flange No. MF-910	Comm. Grade	MK 52-1
52-4	1	Pipe strainer, ⅜" in line type.	Comm. Bronze	MK 52-1
52-5	1	⅜" I.P.S. globe valve	Comm. Bronze	MK 52-1
52-6	1	Vent cap, 1¼" NPT with desiccant cartridge, Tedeco desiccant cartridge vent No. M-11	Comm. Grade	MK 52-1
52-7	1	Gasket, 1/16" thk., 1½" I.D. x 2½" O.D. neoprene, drilled to accomodate MK. 52-3	Neoprene	MK 52-1
52-8	6	⅜"-16 UNC-2 hex head bolt, 4" lg. w/hex nuts and ⅜" washer	Steel	MK 52-1
52-9	1	Silencer, residential type, similar and equal to the "STC" series of the Burgess-Manning Co.	Comm Grade	MK 45-8

REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

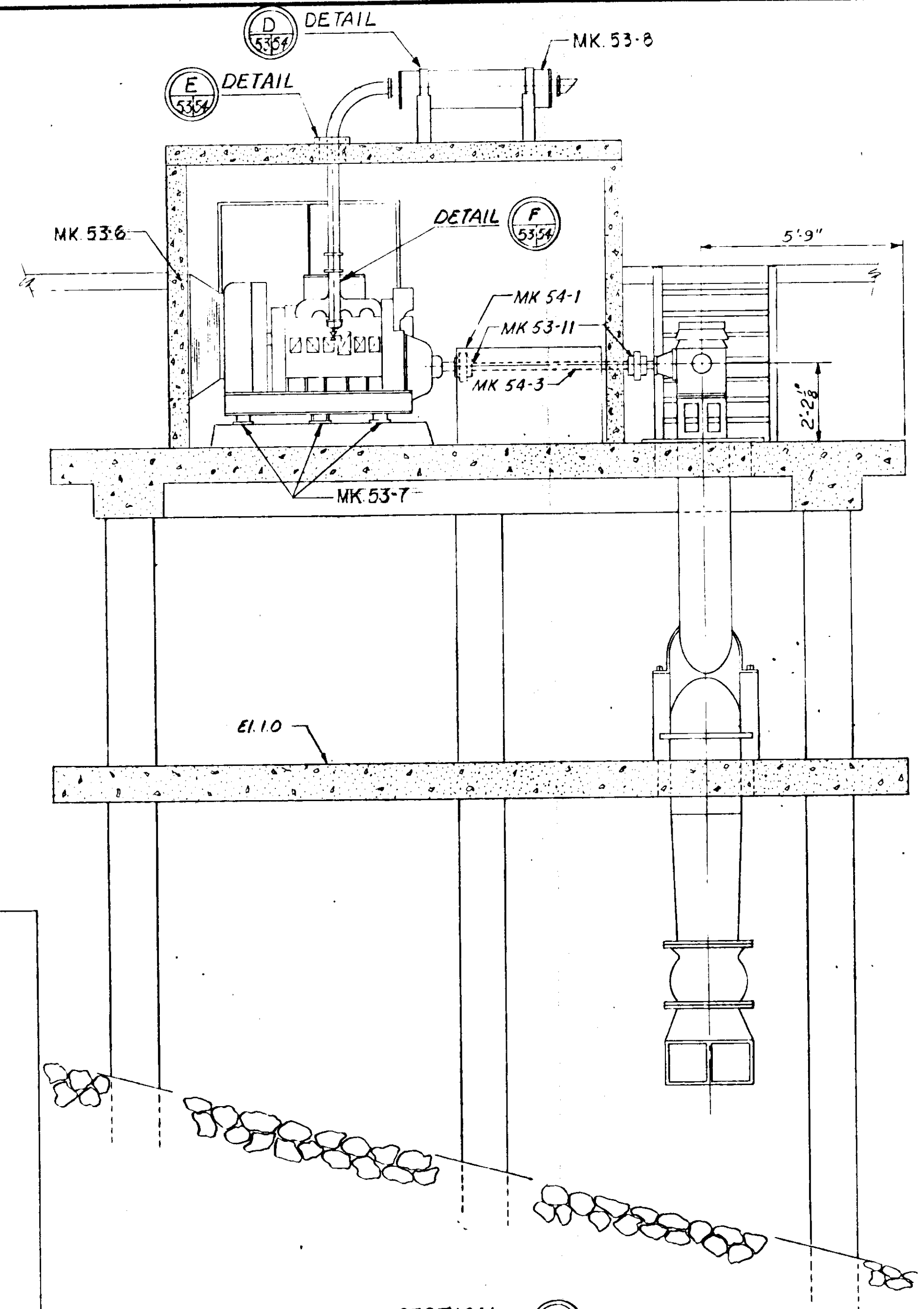
NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

ENGINE GENERATOR LAYOUT

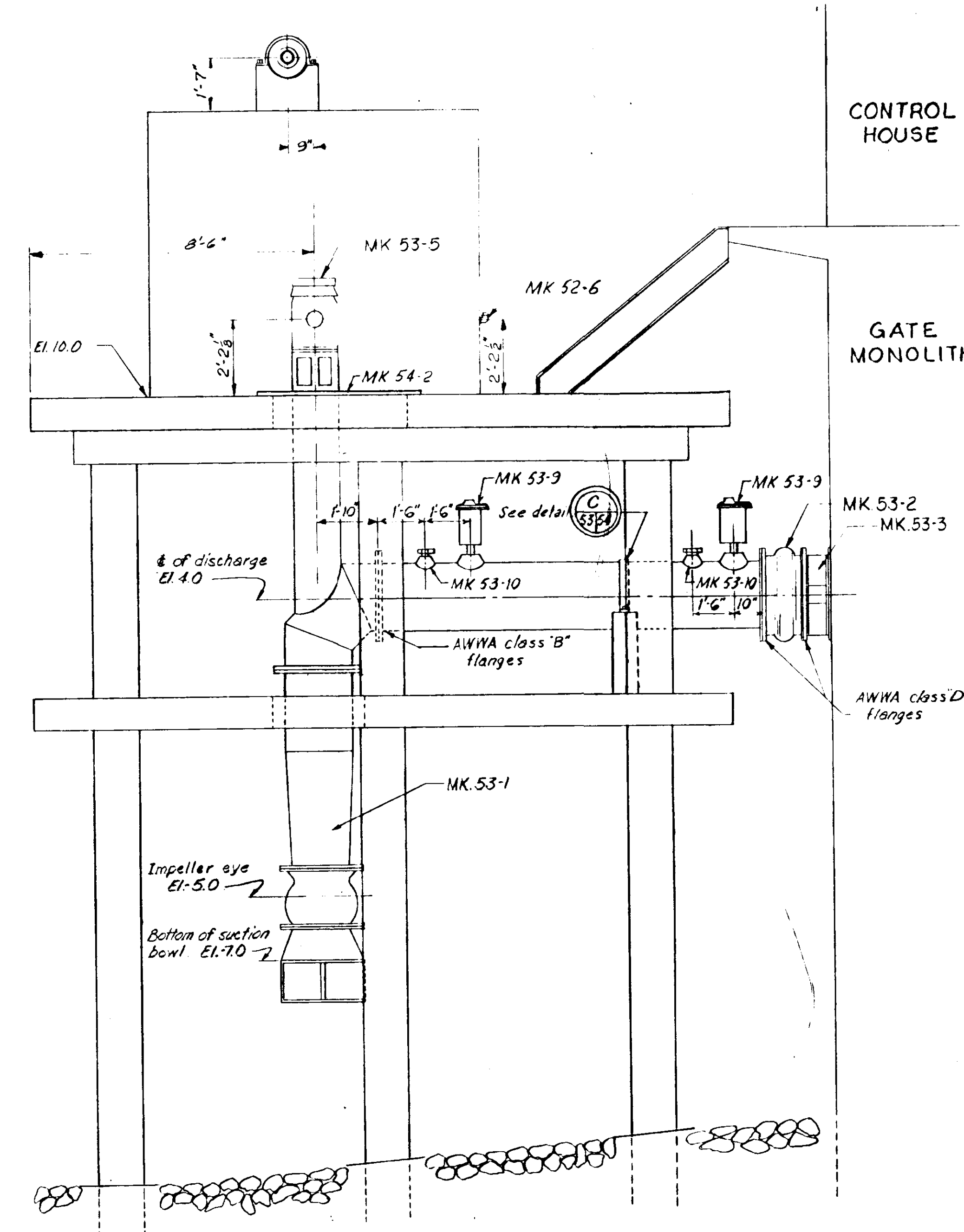
DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.C.B.	A.A.D.	W.A.W.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: F.G. Mann			SPEC. NO. DACW29-73-B-0111		DW. 52 OF 64

LIST OF PARTS NOT DETAILED

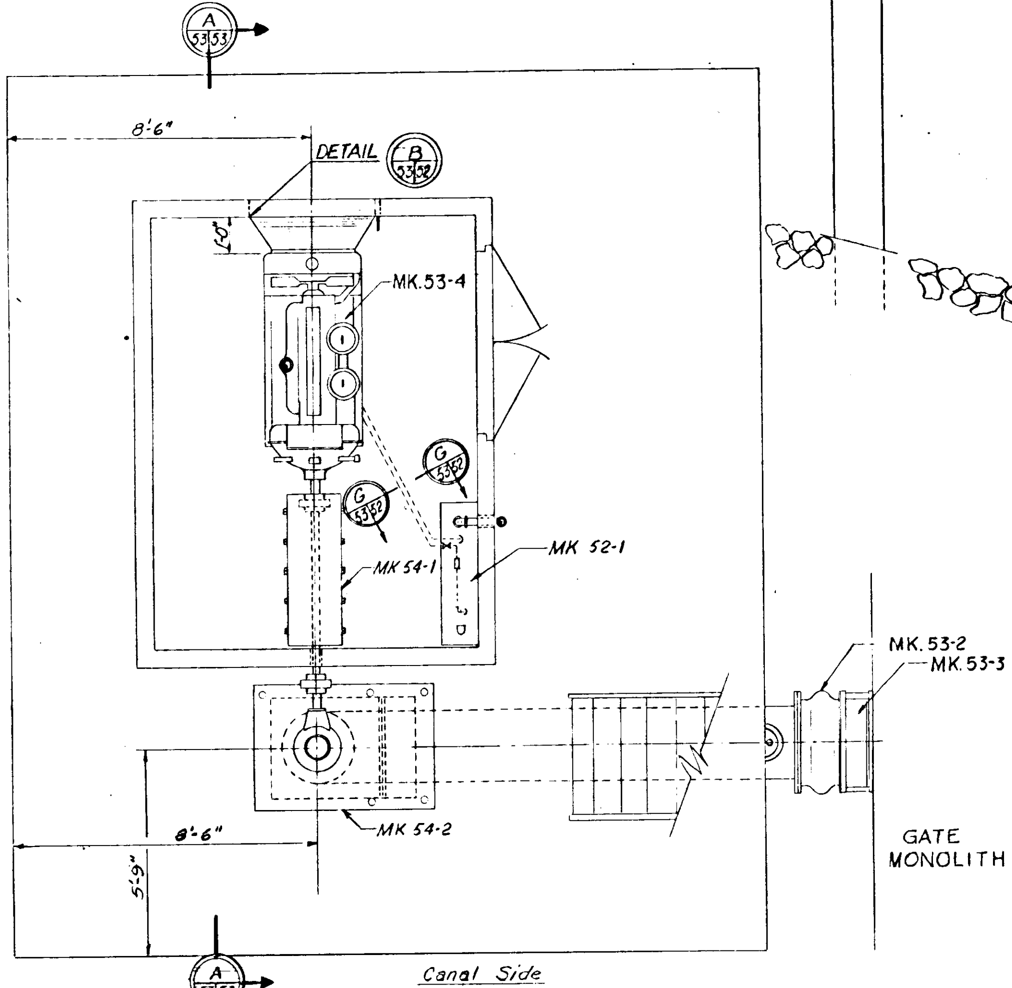
MK. NO.	REQ'D.	DESCRIPTION	MATERIAL	USED WITH
53-1	1	Vertical pump, 12,000 G.P.M. at a TDH of 19.5 ft. shut off head approximately 50 ft.	Comm Grade	53-5
53-2	1	Rubber expansion joint, 24" I D with steel retaining rings, similar and equal to Hewitt-Robins 24" I D single arch rubber expansion joint.	Comm Grade	53-1
53-3	1	Check valve, 24" nominal diameter similar and equal to Centerline, Inc. series "CLC 24" check valve with an Inconel spring.	Comm. Grade	53-1
53-4	1	Diesel engine, minimum rating of 110 BHP at 1400 RPM with standard equipment, similar and equal to G.M. model no. 6030-C.	Comm. Grade	53-1 53-5
53-5	1	Right angle gear reducer, 2 to 1 ratio rated for 100 h.p. at an input speed of 1400 R.P.M., similar and equal to Randolph Manufacturing Company Model No. 16.	Comm. Grade	53-1 53-4
53-6	1	Louver, weatherproof, quadrant operated, 42"x42" similar and equal to American Warming and Ventilating, Inc. model no. LW-P-3131FA	Galv. steel.	53-4
53-7	6	Vibration isolators similar and equal to Korfund Vibro Isolators type KL.	Comm. Grade	53-4
53-8	1	Silencer, residential type similar and equal to Kittell Muffler and Engineering Co. model no. 1460-TR4	Comm. Grade	53-4
53-9	2	Air vent, float type, 285 s.c.f.m. @ 12 psi. 1 1/8 sq. in. orifice, with 2-in. diameter threadolet welding fitting, similar and equal to Armstrong Machine Works Model 6-AV, size 2 inch for venting during filling only.	Comm. Grade	53-1
53-10	2	Vacuum breaker, 100 s.c.f.m @ 6.5 inch mercury vacuum with 1 1/2 inch diameter threadolet welding fitting, similar and equal to Johnson Corp. No. VB8-151-SS-T-S-V.	Comm. Grade	53-1
53-11	2	Coupling floating shaft type max. bore rigid half 3 1/8", max. bore flexible half 2 3/4" similar and equal to Link Belt #SGS 260.	Comm. Grade	53-1 53-4 54-3



SECTION A 53/53
Scale: 1/2" = 1'-0"



CHANNEL SIDE ELEVATION
Scale: 1/2" = 1'-0"



PLAN
Scale: 1/2" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

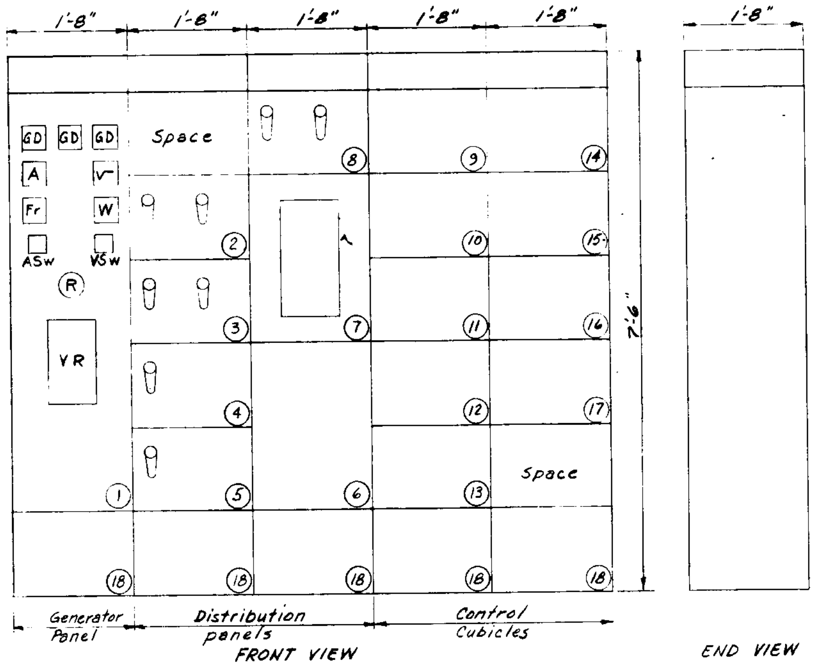
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

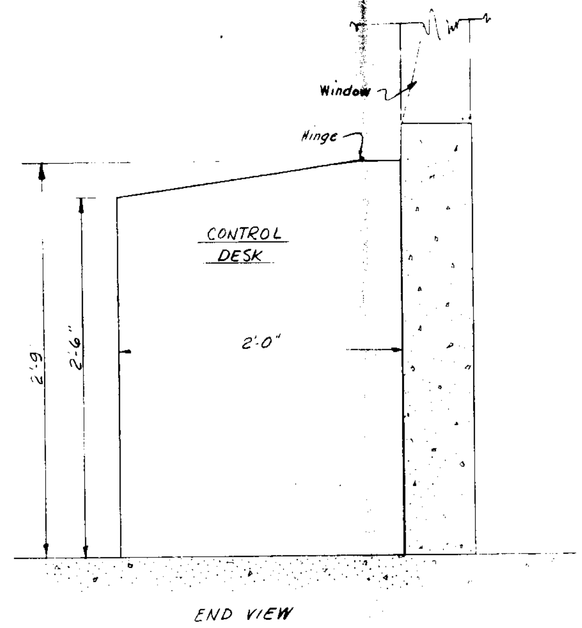
PUMPING UNIT LAYOUT

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
D.C.S.	A.A.D.	W.A.W.	FEB. 1973	AS SHOWN	H-4-26081

SUBMITTED: [signature] ENGINEER
SPEC. NO. DACW29-73-B-0111
DWG. 53 OF 64

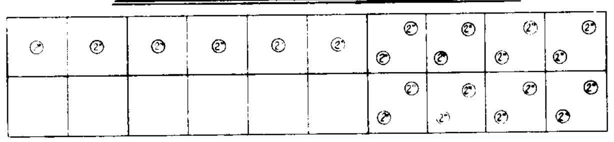


SWITCHBOARD & CONTROL CENTER

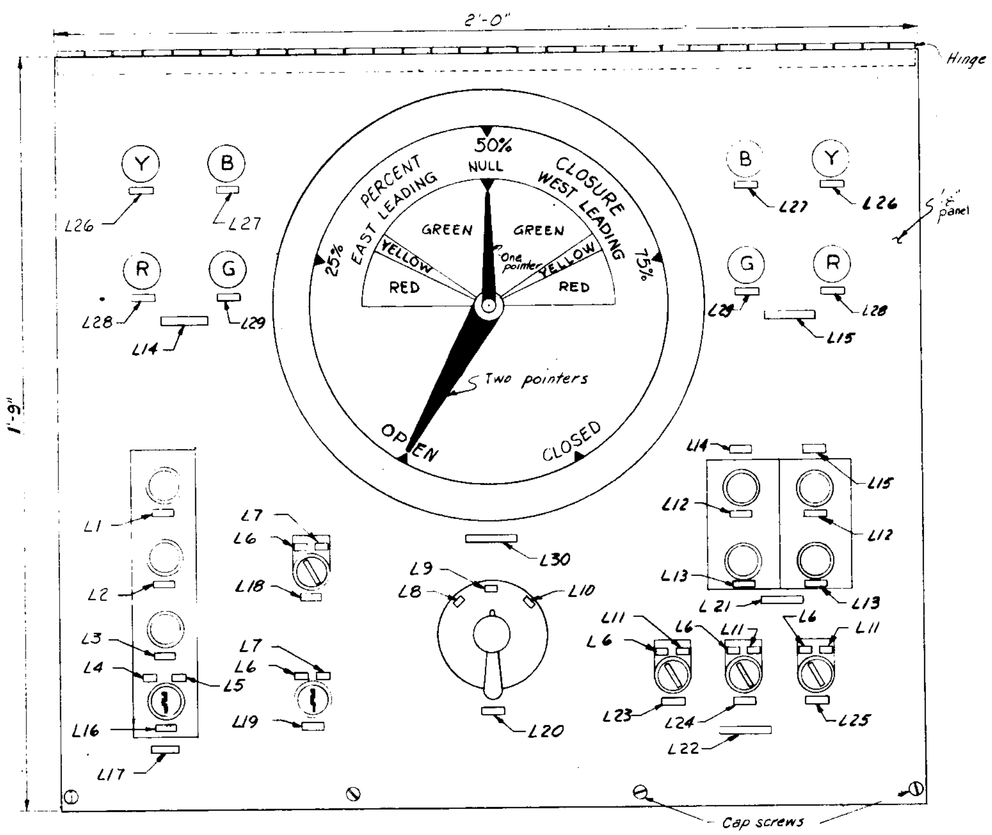


CONTROL DESK

SECTION A 58/57
Scale 2"=1'-0"



CONDUIT ARRANGEMENT



CONTROL DESK TOP
Scale: 6"=1'-0"

EQUIPMENT LIST				
Description of equipment	Purpose of function	Swbd space No.	Location control center No. 1	
0-600 V a-c voltmeter with fuses	Ground detection	1	-	-
0-150 amp ac ammeter	Generator current	1	-	-
0-600 scale, 150 V a-c voltmeter	Generator voltage	1	-	-
55-65 cycle, 150 V frequency meter	Generator frequency	1	-	-
0-100 kw, 3 ph watt meter	Generator power	1	-	-
Ammeter switch	Phase current	1	-	-
Voltmeter switch	Phase voltage	1	-	-
Rheostat	Manual voltage control	1	-	-
Voltage regulator	Auto voltage control	1	-	-
Potential & control transformers, 480/120, fused	Instruments & control	1	-	-
Current transformers, 150-5 amp	Instruments	1	-	-
Circuit breaker, 3 pole, 50 amp, 600 v	440 v, 3 phase, gen main	2	-	-
Circuit breaker, 3 pole, 50 amp, 600 v	440 v, 3 phase, main	2	-	-
Circuit breaker, 3 pole, 25 amp, 600 v	East hoist and brake	3	-	-
Circuit breaker, 3 pole, 25 amp, 600 v	West hoist and brake	3	-	-
Circuit breaker, 3 pole, 20 amp, 600 v	Latching Devices	4	-	-
Circuit breaker, 3 pole, 15 amp, 600 v	Lt trans primary	5	-	-
Transformer, 50 kva, 480-120/240 v	120/240 v supply	6	-	-
Lighting panel, 16 circuit	Control house	7	-	-
Circuit breaker, 3 pole, 20 amp, 600 v.	Two spare breakers	8	-	-
Reversing mag starter, size 2, 5 pole (3NO, 2NC) 120 v	Gate hoist motor (E)	-	9	G1-6
Reversing mag starter, size 2, 5 pole (3NO, 2NC) 120 v	Gate hoist motor (W)	-	10	G1-6
Brake mag. contactor, size 00, 2 pole, 120 v	Gate brake (E)	-	11	G1-22
Brake mag contactor, size 00, 2 pole, 120 v	Gate brake (W)	-	11	G1-22
Reversing mag contactor, size 00, 4 pole, 120 v	Main control relay (E)	-	12	G1-4
Reversing mag contactor, size 00, 4 pole, 120 v	Main control relay (W)	-	12	G1-4
Auxiliary relay, 4 pole, 120 v	Interlocking relay	-	13	G1-3
Reversing mag. starter, size 00, 3 pole, 120 v.	Gate latch motor (E)	-	14	G1-9
Reversing mag starter, size 00, 3 pole, 120 v.	Gate latch motor (W)	-	14	G1-9
Auxiliary relay, 2 pole, 120 v.	Auxiliary control relay (E)	-	15	ES-1(4)
Auxiliary relay, 2 pole, 120 v.	Auxiliary control relay (W)	-	15	WS-1(4)
Auxiliary relay, 3 pole, 120 v	Navigation signal relay	-	16	S1-1
Contactor, mech. driven, 6 pole (4NO, 2NC) 120 v.	Differential contact switch	-	17	DS
Terminal boards	Connection points	-	18	TB

LIST OF LABEL PLATES		
No.	INSCRIPTION	SIZE OF LETTERING
L1	RAISE	3/16"
L2	LOWER	3/16"
L3	STOP	3/16"
L4	ON	1/8"
L5	OFF	1/8"
L6	AUTO	1/8"
L7	MANUAL	1/8"
L8	EAST HOIST	1/8"
L9	BOTH HOISTS	1/8"
L10	WEST HOIST	1/8"
L11	TEST	1/8"
L12	LATCH	3/16"
L13	UNLATCH	3/16"
L14	EAST	3/8"
L15	WEST	3/8"
L16	START	3/16
L17	HOIST	3/8"
L18	BYPASS SWITCH	3/16"
L19	DIFFERENTIAL INTERLOCK	3/16"
L20	HOIST CONTROL SWITCH	3/8"
L21	LATCHING DEVICE	3/8"
L22	NAVIGATION SIGNALS	3/8"
L23	HORN	3/16"
L24	RED LIGHT	3/16"
L25	GREEN LIGHT	3/16"
L26	GATE LATCHED	3/16"
L27	GATE OPERATING	3/16"
L28	GATE CLOSED	3/16"
L29	GATE OPENED	3/16"
L30	GATE POSITION INDICATOR	3/8"

REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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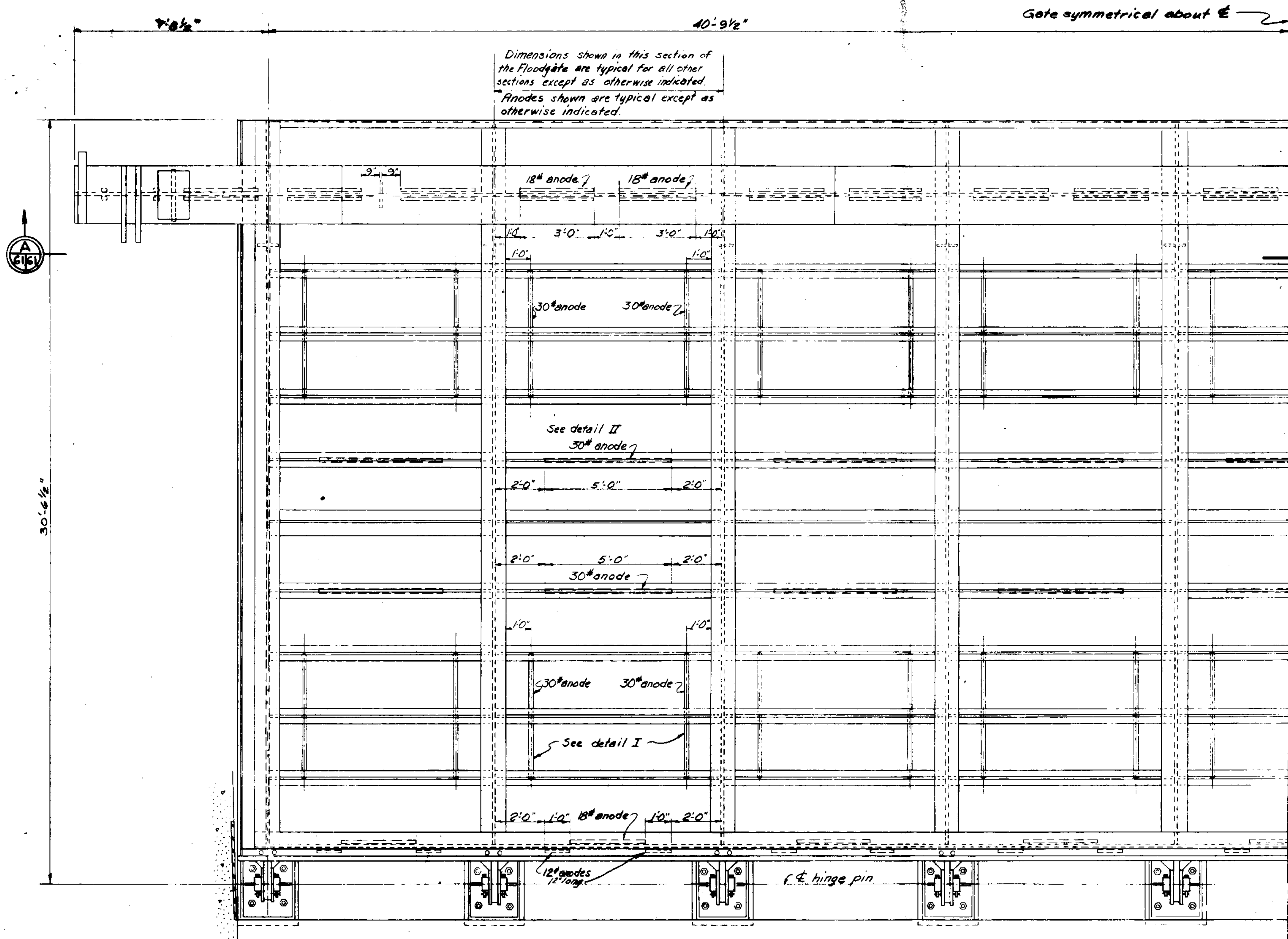
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

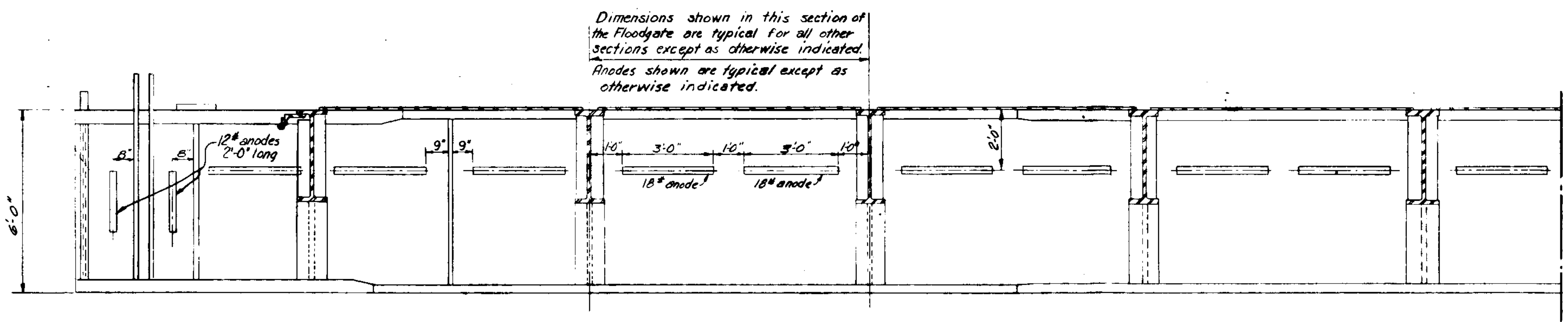
SWITCHBOARD, CONTROL CENTER AND DESK

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
G.P.J.	A.A.D.	R.T.H.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature] ENGINEER			SPEC. NO. DACW29-73-B-0111		DWG. 57 OF 64

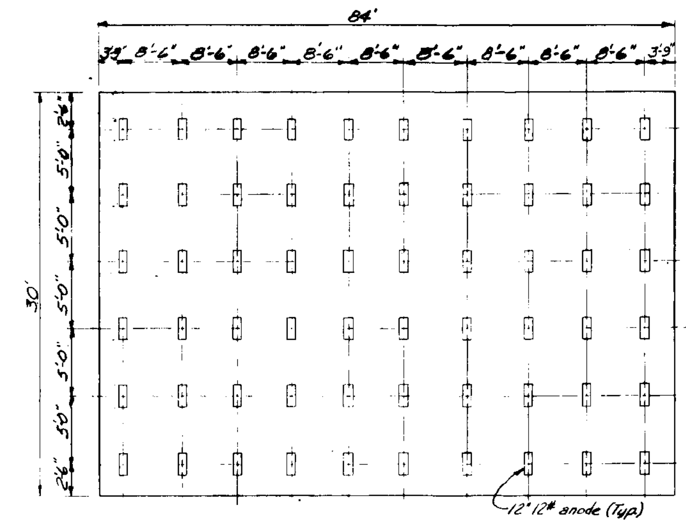


PLAN VIEW OF GATE
Scale: ½"=1'-0"

NOTE: Skin plate not shown

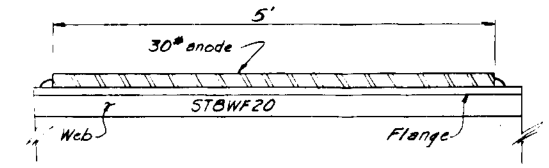


SECTION A
Scale: ½"=1'-0"



PROTECTED SIDE

SKIN PLATE ANODE LAYOUT
N.T.S.



DETAIL II (Typical)
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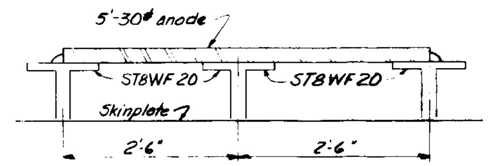

DETAIL I (Typical)
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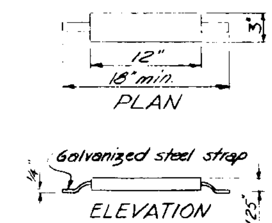
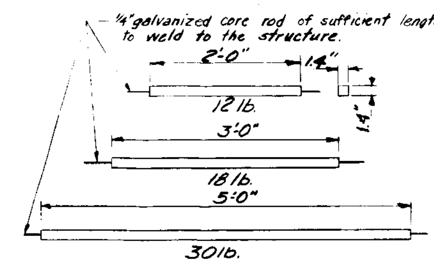


12 lb. ZINC ANODE
N.T.S.



1.4"x1.4" ZINC ANODE
N.T.S.

REVISION	DATE	DESCRIPTION	BY

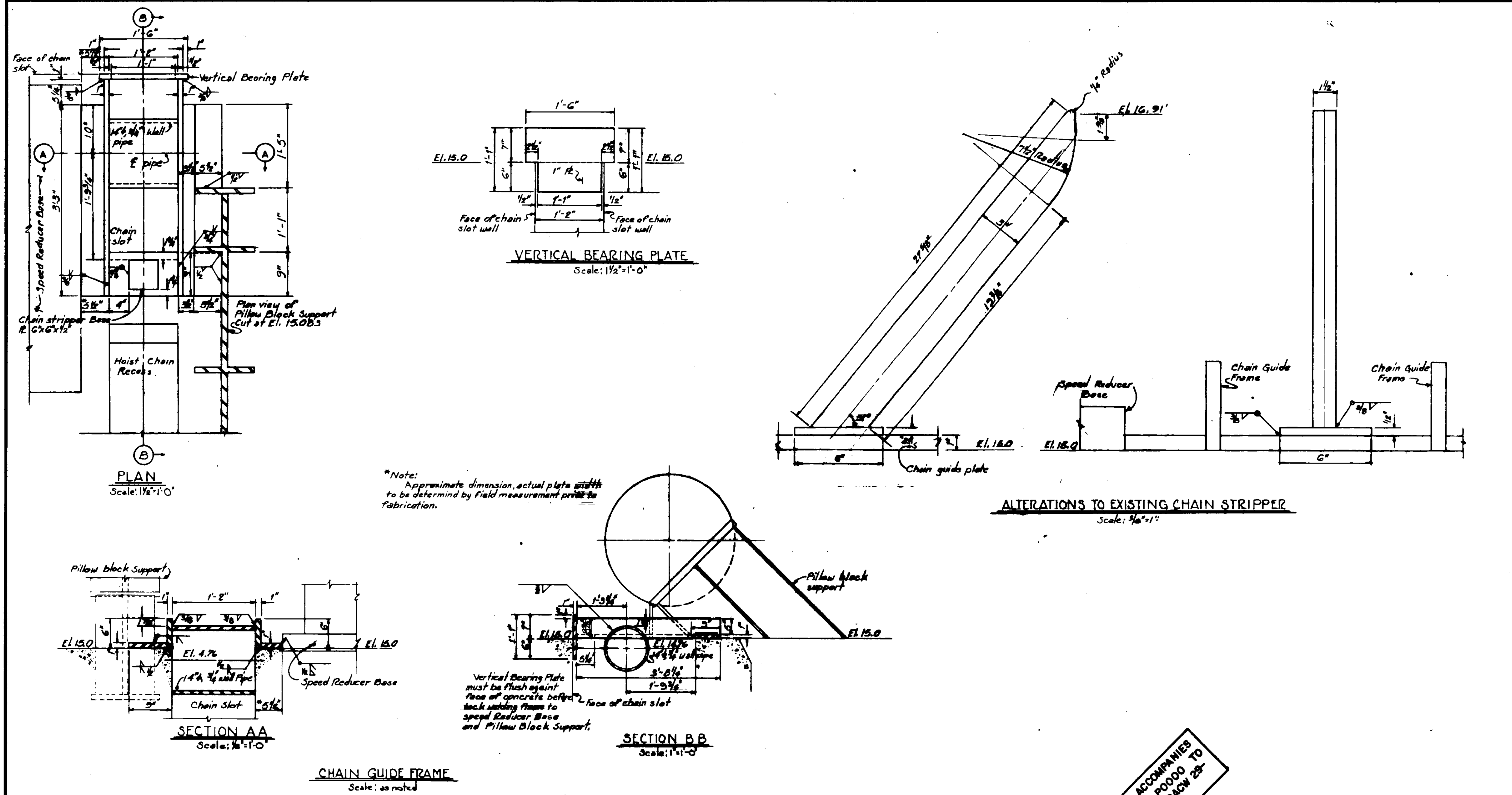
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

CATHODIC PROTECTION

DESIGNED:	DRAWN:	CHECKED:	DATE:	SCALE:	FILE NO.
R.T.H.	A.A.D.	G.P.J.	FEB. 1973	AS SHOWN	H-4-26081
SUBMITTED: [signature]			SPEC. NO. DACW29-73-B-0111		DWG. 61 OF 64

PLATE II-24



THIS PLAN ACCOMPANIES MODIFICATION P0000 TO CONTRACT NO. DACW 29-73-C-0151

Revision	Date	Description	By
	8-4-75	Delete Dwg. 49A and added 49 B Mod 9	J.J.H.

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.

REVISED CHAIN GUIDE

Designed	Drawn	Checked	Date	Scale	File No.
D A M	J.J.H.	F.N.J.	AUG 1975	AS SHOWN	H-4-26081

Spec. No. DACW29 - 73-B-0111
Dwg. 49B of 64

SECTION III - SUMMARY OF DESIGN

3-01 Hydrology and Hydraulic Design

a. Hydrology. Descriptions and analyses of the tidal hydraulic methods and procedures used in the hydraulic design are included in "Design Memorandum No. 1, Appendix A, Hydrology and Hydraulics." Included in the descriptions and analyses are the essential data, climatology, assumptions, and criteria used, and the results of studies which provide the basis for determining surges, routing, wind tides, runup, overtopping, and frequencies. The design hurricane critical to the Empire area as defined in the above mentioned design memorandum and also in "Design Memorandum No. 2, Section II - Hydraulic Analysis of Floodgate," has a frequency of about one in 100 years, a central pressure index of 28.02 inches, a maximum windspeed of 91 m.p.h. at a radius of 30 nautical miles. The forward speed of the hurricane is 11 knots.

The range of normal predicted tides in the project area is 1 foot and the mean tide varies from 0.4 to 1.0 foot m.s.l. The difference in height of hurricane surge heights for an occurrence design hurricane at high or low tides is only a few tenths of a foot.

Flood routing computations were not made in detail and, consequently, are not presented herein. Sufficient computations were made to estimate the magnitude of maximum state differentials and average velocities and to insure that these velocities would not produce serious, adverse effects on navigation or on the riprap protection which will be provided at each end of the floodgate.

In addition to protecting the area from hurricane tidal overflow, the Empire Floodgate structure will also provide drainage for an area of 365 acres. This area will be inclosed by the hurricane protection levee, the levee along the Mississippi River, and the levees essentially parallel to the Mississippi River levee, which have been constructed to approximate elevation 8 by local interests.

b. Hydraulics of Structures.

1. The floodgate area of 1,176 square feet below mean sea level, which is required to meet the requirements of navigation, is so large with respect to the drainage area that negligible head differentials will be experienced when the fully open floodgate is admitting inflows from hurricane tides to the area or is releasing runoff from high intensity storms occurring in conjunction with normal tides on the gulfside.

2. As the hurricane tide rises, the maximum flow through the floodgates will be 7,500 c.f.s. The maximum average velocity will be 4.7 f.p.s. under a differential head of less than 0.1 foot. The maximum inflow of 1,730 c.f.s. resulting from the 100-year 24-hour storm occurring in conjunction with the average elevation of 0.5 on the gulfside of the floodgate can be conveyed through the structure under a head of about 0.02 foot. For this flow, the maximum average velocity through the structure will be 1.4 f.p.s.

3. After the floodgate is closed to prevent further ingress of water from rising hurricane tides, additional ponding above elevation 5 in the area between the hurricane protection levee and the existing levee will result from rainfall during the period of gate

closure. It is unlikely that the floodgate will be closed for more than 72 hours. With some wave overtopping and with 100 percent runoff from the 25-year 3 day rainfall of 13 inches indicated by the data contained in U.S. Weather Bureau Technical Paper No. 49, "Two to ten-day Precipitation for Return Periods 2 to 100 years in the Contiguous United States," ponding would occur to elevation 6.3 feet. With a sudden reversal of winds during the periods of gate closure, an elevation of -2 could be produced on the gulfside.

4. Although a reverse head of 8.3 feet is used for the structural design, it is not critical for the conditions in the channel on the gulfside of the floodgate which will normally prevail when the floodgate is reopened after a hurricane has subsided. Since gulfside stages generally recede more slowly after a hurricane has passed than they rise during the passage of a hurricane, maximum velocities for a complete and uninterrupted opening of the floodgate will normally be less than those experienced before closure during the approach of the hurricane.

5. If necessary, the floodgate can be opened gradually to slowly reduce the elevation on the landside. This landside stage can also be gradually lowered by the operation of the Empire Lock to convey impounded water to the Mississippi River. This lock, owned by the State of Louisiana, has a usuable length of 200 feet and a sill at elevation -10 with a width of 40 feet.

3-02 Soils and Foundation

a. Investigations. Design Memorandum "New Orleans to

Venice, La., Design Memorandum No. 1, General Design, Reach B-1, Tropical Bend to Fort Jackson," contains foundation investigation data, including soil borings and soil mechanic laboratory tests, for the project site. One 5-inch diameter undisturbed boring No. 1-SEU and four general-type disturbed core borings Nos. 2-SE through 5-SE are located as shown on Plate III-18. The general-type and undisturbed boring logs are shown on plates III-16 and III-17.

b. Soils. A description of the subsurfaces soil conditions is included in paragraph 2-07.

c. Stability of Slopes. Construction slopes and permanent slopes at the project site were analyzed by the "method of planes" for stability with a minimum factor of safety of 1.3 with respect to shear strength and the (Q) design shear strengths. The water conditions, assigned foundation stratification, design shear strengths, critical failure surfaces, and their corresponding analyses are shown on plates III-2 to III-6. The relief facilities provided the required pressure reduction in the pervious layers for stability during construction.

d. Stability of "I"-Floodwall. Tidal hydraulic analyses indicate that the I-wall will be subjected to the pressure and forces imparted by breaking waves. In the stability analyses, the dynamic wave effect was applied as a line force acting through the centroid of the dynamic wave pressure distribution diagram. The static water pressure diagram resulting from wave action was considered effective only to the top of the impervious clay, inasmuch as the period of time the wave will exist is too short to allow water pressure to become effective in the impervious clays. The stability and required penetration of the steel sheet piling below the fill surface were determined by the method of planes. The long-term (s) shear strengths (C=O) governed for design. A factor of safety of 1.25 was applied to the friction angle as follows:

$$\phi d = \text{developed friction angle} = \tan^{-1} \frac{\text{Tan } \phi_A}{\text{Factor of Safety}}$$

. This developed angle was used to determine K_A and Kp, lateral earth pressure coefficient values, as follows: $K_A = \text{Tan}^2 \left(45 - \frac{\phi d}{2}\right)$ and $K_P = \frac{1.}{K_A}$

Using the resulting shear strengths, net horizontal water and earth pressure diagrams were determined for movement toward each side of the sheet. Using these distributions of pressures, the summation of horizontal forces was equated to zero for various tip penetrations. At these penetrations, summatioans of overturning moments about the bottom of the sheet pile were determined. The depths of penetration required for stability were determined as those where the summation of moments was equal to zero. The analysis is shown on plate III-10.

e. Stability of Floodgate Structure and "T-Wall".

1. Steel sheet pile cutoff. A steel sheet pile cutoff was used beneath the floodgate and T-walls to provide protection against hazardous seepage. The recommended tip elevations of the cutoffs beneath the floodgate and T-walls are shown on plates III-11 through III-13. The net pressure diagram along the sheet pile cutoff was determined as follows:

Conventional stability analysis by the method of planes, utilizing a factor of safety of 1.3 incorporated in the soil strength parameters, was performed to determine the stability against rotational failure. The use of a factor of safety of 1.3 is also recommended by Mr. Gregory P. Tschebotarioff in Chapter 5 of "Foundation Engineering," edited by G. A. Leonards, and dated 1962. The analysis was performed at 1-foot intervals with the active wedge located at the flood side edge of the structure and the passive wedge located at the protected side edge of the structure.

The assumption was made that the value of (R_B) at the bottom of the base of the structure was zero.

For each analysis the net driving force, i.e., $(D_A - D_P) - (R_A + R_B + R_P)$ was determined. The value of D_A included the weight of water between the tailwater elevation and the SWL elevation located above the active wedge.

The assumption was made that the net driving force above the bottom of the base of the structure was carried by the structure.

Considering driving (D_A) positive and all resistance negative (DDp, Rp, R_B, and R_A) in the expression $D = D_A - D_P - R_P - R_B - R_A$, using the method of planes stability analyses, D was determined by assuming failure at the bottom of the base of the structure and at each foot in depth thereafter. The value of the algebraic difference in D between 1-foot intervals, was used to develop the pressure diagram. If the incremental difference is negative, the pressure diagram indicates an available horizontal resistance in excess of that required, and if the incremental difference is positive, the pressure diagram indicates an unbalanced horizontal pressure in excess of the available soil resistance. It is considered that such an excess must be carried by the sheet pile cutoff.

The net pressure diagrams presented on plates III-11 through III-13 indicate that the total available horizontal resistance is in excess of the total horizontal waterload. Therefore, the bearing piles are not required to carry any additional lateral load acting on the sheet pile cutoff.

2. Bearing pile foundations. The floodgate and T-walls are supported by piling, battered as required, to provide stability against the unbalanced lateral waterloads. The inverted T-type floodwalls were used in lieu of I-type floodwalls where the height of the I-wall above ground and the magnitude of the dynamic wave force render the I-type floodwall impracticable. In compression, a factor of safety of 1.75 was applied to the shear strengths, and a lateral earth pressure coefficient (K_o = 1.0) was used for determining the normal pressure on the pile surface. In tension, a factor of safety of 2.0 was applied to the shear strengths and a coefficient (K_o = 0.7) was used. Pile design loads vs. tip elevations and subgrade moduli vs. tip elevations are shown on plates III-14 and III-15. Settlement of the piles due to consolidation will not be a problem since the major loads are caused by hurricane water heads of insufficient duration for consolidation of the foundation clays to ensue.

During construction, four 12 inch x 12 inch precast, prestressed concrete test piles of different lengths (Tip elevations: -78.0 feet and -88.0 feet) were driven at the locations shown on plate III-23 and tested in compression and tension. Pile test loads were 15 tons in tension and 40 tons in compression. The test piles were left in place.

3. Shell backfill. Clamshell is used as backfill around the structure to reduce lateral pressures, and to keep the settlement of the riprap protection and the heights and lengths of the floodwalls to a minimum.

4. Erosion protection. To guard against loss of channel and backfill material due to erosion and subsequent undermining of the floodgate and floodwalls, 2 feet of riprap on a minimum 1-foot blanket of clamshell will be provided as shown on plate III-1.

3-03 Structural Design.

a. General. Structural design has been made in accordance with standard engineering practice and with criteria set forth in Engineering Manual for Civil Works Construction published by the Office, Chief of Engineers.

b. Pertinent data. Pertinent data relevant to the hurricane design wave, to the elevations of the water surface, structure and channel, and to the dimensions of the structure and channel are shown in the following tabulation:

1. Design water elevations (feet m.s.l.)

	Gulfside	Landside	
Direct head from hurricane	+12.1	+2.0	∴ $\Delta H = 10.1$
Reverse head from hurricane	-2.0	+6.3	∴ $\Delta H = 8.3$ (Reverse)

	Gulfside	Landside
Direct head for maintenance	+ 5.0	- 1.0
Reverse head for maintenance	- 2.0	+ 5.0

2. Structure elevations (feet m.s.l.)

Top of wall	+15.0
Top of timber guide walls & fenders	+ 9.5
Top of sill	-17.5/-14.0
Centerline of gate hinges	-15.54
Centerline of hoist wildcat	+17.75
Centerline of cwt, wildcats	+15.0/+21.0
Centerline of needle girders	+ 5.0
Bottom of channel outside limits of riprap	-12.0

3. Structure dimensions.

	Feet
Channel design width	84.0
Gate width (seal to seal)	84.5
Gate recesses	5.5

4. Hurricane design wave.

Fetch length	F	2 miles
Fetch width	W	1 mile
Ratio (from p27-TR4)	Fe/F	0.81
Effective fetch	Fe	8,554 feet
Windspeed	U	77 m.p.h.
Stillwater level elev.	swl	+12.1 feet
Avg. depth of fetch	d	15.7 feet

Depth at bottom seal of gate	d_t	26.85 feet
Min. depth (marsh +15. m.s.l.)	d_{Lim}	10.6 feet
Significant wave height	H_s	5.2 feet
Wave period	T	5.8 sec.
Deepwater wave length	L_o	172 feet
Relative depth	d/Lo	.091
Shoaling coef.	Hs/H'o	.9445
Deepwater wave length	H'o	5.5 feet
Wave steepness	$H'o/T^2$	.163
Design wave height	H.01	8.8 feet
Height of breaking wave= $.8d_{Lim}$	H_b	8.5 feet
Design depth at structure	d_d	~~24.1~~ 10.1 feet

c. Unit weights. The following values of unit weights are used in design calculations:

Item	Lb. per cu. ft. Submerged	Saturated
Water	--	62.5
Concrete	87.5	150.0
Steel	427.5	490.0
Riprap	63.0	125.5
Shell	30.0	92.5

Item	Lb. per cu. ft.	
	Submerged	Saturated
Earth	57.5	120.0

d. Design loads. The assumed design loads used in the design of the structure, gate, and abutment walls are tabulated below:

1. Lateral pressures (p.s.f./ft.)	Submerged	Saturated
Earth	25.875	54.0
Shell	13.5	41.625
Riprap	28.35	56.475

2. Uniform live loads.	Lbs. per sq. ft.
Walkways & stairs	100
Control building floor	200
Control building roof	20

3. Wind loads on exposed vertical surfaces and projected area of sloped surfaces. (Allowable stresses increased one-third) 30 p.s.f.

4. Wave loads. See paragraph b. 4.

e. Working stresses.

1. General. The allowable working stresses for structural steel and concrete are in accordance with those recommended in "Working Stresses for Structural Design," EM 1110-1-2101 of 1 November 1963.

2. Allowable working stresses for structural steel, ASTM A-36. See Appendix A, Table I.

3. Allowable working stresses for concrete. See Appendix A, Table II.

4. Application of working stresses.

a. Group 1 loading. Allowable working stresses as listed for structural steel and for reinforced concrete were applied to the following loads:

Dead load

Live load

Buoyancy

Earth pressure

Water pressure

b. Group 2 loading. Allowable working stresses as listed for structural steel and for reinforced concrete were applied to the following loads when combined with Group 1 loads:

Wind loads

Wave loads

5. Prestressed concrete piles. Prestressed concrete piles conform to the requirements of the Joint Committee of the American Association of State Highway Officials and the Prestressed Concrete Institute for Standard 12" x 12" solid concrete piles with a minimum ultimate design strength of 5,000 p.s.i. at 28 days.

6. Timber piles. Timber piles are Type I, Class B, Southern Pine or Douglas Fir, clean-peeled piles in accordance with the requirements of Federal Specification MM-P-371b, dated 25 April 1967.

f. Foundation.

1. General. The results of subsurface explorations, soils tests, and foundation studies are presented in Section III. The gate, outer sill structures and the abutment walls are founded on prestressed concrete piling. Allowable pile loads and moduli of horizontal subgrade reaction are indicated on plates III-14 and III-15. Unbalanced lateral forces are resisted by batter piles.

2. Pile foundation and stability analysis. The pile foundations were designed in accordance with EM 1110-2-2906, July 1969, "Design of Pile Structures and Foundations." Computed pile loads were determined from the rational method of pile foundation analysis (method developed by A. Hrennikoff). A GE-400 automatic data processing system with teletype time sharing and programs K29WL3 and K29022 were utilized for computing pile loads and comparing computed loads with allowable axial and transverse loads to determine the critical pile loads for all load cases on the structure and on each T-wall monolith. All piles were assumed to have a pinned end at the base of the structure and to be friction type piles. For plan and sections of pile foundations, see plates III-23 and III-19.

3. Cutoff wall. To provide protection against hazardous seepage under the structures, an MA-22 steel sheet pile cutoff is located under the gate structures and adjacent T-type abutment walls as indicated on plate III-18. An uncapped PZ-32 steel sheet pile cutoff wall to elevation -15.0 is used as a foundation for the future I-type walls.

g. Wave loads. Net wave pressures have been computed from the hurricane design wave date in accordance with recommendations of "Shore Protection, Planning and Design," Technical Report No. 4, Third Edition, 1966, by the Coastal Engineering Research Center, Corps of Engineers. The hurricane design wave was assumed to approach the structure at a 90° angle. See paragraph b. 4.

h. Gate bay.

1. General. The gate structure is a monolithic reinforced concrete U-frame with a recess in the base to allow for a steel gate with horizontal hinges at the bottom. The clear channel is 84 feet wide and the structure walls are 10 feet thick. The total structure width is 106 feet, top of walls are at elevation 15.0, and top of sill is at elevation -14.0. A control house is provided above one wall for operation of the gate, and needle dams are provided for unwatering the gate while the gate is in the closed position. (See plates III-19 and III-20 for plan and sections of the gate structure.) The outer sill is a reinforced concrete, modified inverted T-wall which acts as a retaining wall for the gate recess, supports and protects the gate while the gate is open, and supports one end of each of the side retaining walls. The top of the outer sill is at elevation -14 and is 99 feet wide. (See plates III-19 and III-20 for plan and sections of the outer sill and the side retaining walls.)

2. Design loading conditions.

Case I - Operating conditions. Maximum direct head (hurricane). Gate closed; flood side water at elevation +12.1, protected side water at elevation +2.0; uplift with sheet pile cutoff considered impervious--no wave force.

Case II - Same as Case I, except uplift with sheet pile cutoff considered pervious.

Case III - Maximum direct head with wave forces (hurricane). Gate closed; flood side water at elevation +12.1, protected side water at elevation +2.0; uplift with sheet pile cutoff considered impervious.

Case IV - Same as Case III except uplift with sheet pile cutoff considered pervious.

Case V - Maximum reverse head. Gate closed; flood side water at elevation -2.0, protected side water at elevation +6.3; uplift with sheet pile cutoff considered impervious.

Case VI - Same as Case V except uplift with sheet pile cutoff considered pervious.

Non-operating conditions

Case VII - Gate dewatered. Gate removed; needle beams and girders in place; flood side water at elevation +5.0; protected side water at elevation +5.0; full uplift.

Cast VIII - Construction condition. Gate closed; no uplift.

3. Base slab.

(a) The base slab has been treated as a monolithic unit and has been designed to resist bending moments in both the longitudinal and transverse directions for the various loading conditions described in paragraph h. 2. (See plates III-24 through III-28.)

(b) The longitudinal and transverse bending moment diagrams were developed with the assumption that the total amount of all forces producing bending were uniformly distributed over the width of the base in each direction of bending.

(c) The total bending moment in the longitudinal direction has been distributed equally across the width of the base. However, because it was assumed that large moments will be concentrated at the walls the reinforcing steel required per foot of width (as determined from the longitudinal moment diagrams) will be doubled in a 20-foot strip under and adjacent to the walls.

(d) Because the base slab has a depth of 10 feet (15.5 feet wide) on the protected side and a depth of 6.5 feet (20.5 feet wide) on the flood side, it was assumed that the total transverse moment would not be equally distributed on a per foot of width basis. Since the deflections of both sides of the slab are equal, it was assumed that the total transverse moment would be distributed according to the relative stiffnesses (bd^3) of each side. Therefore, each side of the slab was designed for the transverse moment proportional to its stiffness. The transverse moments for each side of the slab were also checked by computing the moments for the flood side and the protected side independently. The moments obtained by this method were compatible with the moments obtained by using the relative stiffnesses of each side of the slab.

(e) Cases III and IV were found to be critical for design in the longitudinal direction and Case VIII was critical in the transverse direction.

(f) The base under Case VII has a factor of safety of 1.18 against uplift if the tension capabilities of the piles are disregarded and 1.84 considering all piles to be active in tension.

4. Gate bay walls.

(a) The gate bay walls were designed to resist the moments and shears caused by water and wave combined with the reaction from the gate. Each wall was treated as a monolithic unit; the moment of inertia for the transformed concrete section was calculated and used in the design of the concrete. See plate III-29.

(b) A steel grillage has been designed to distribute the large gate reaction into the gate bay wall. This was required because of the reduction in concrete section at the gate reaction due to the shock absorber and chain slot recesses.

i. Gate.

1. General. The gate is fabricated structural steel, mounted on horizontal hinges at the bottom and operated by lifting chains connected to each end of a horizontal girder at the top. This horizontal girder spans the full width of the gate and supports vertical beams at the top. Each vertical beam is supported by a hinge at the bottom and horizontal ribs span between the vertical beams to support the skinplate. (See plate III-21 for elevation, sections, and details of the gate.)

2. Design loading conditions. (See loading conditions shown in para h. 2.)

Case I Maximum direct head with no wave forces

Case III Maximum direct head with wave forces

Case V Maximum reverse head

j. <u>Counterweights</u>.

1. Each of the two counterweights weighs approximately 40,000 pounds and consists of lead billets contained in a structural steel cage which is suspended from the counterweight chain in a vertical recess in each concrete wall of the structure as shown on plate III-20.

2. Each counterweight chain is supported by two idler wildcats, one located directly over the counterweight recess in each concrete wall and the other cantilevered over the flood side end of each wall. The idler wildcat that is located over the counterweight recess serves only to change the chain direction to permit vertical movement of the counterweight and is supported by steel beams over concrete supports. The idler wildcat that is cantilevered over the flood side end of each wall is positioned to cause the counterweight to perform the following functions:

(a) Exert a lifting force on the gate when the gate is in the open position in order to assist the hoist machinery to overcome the initial forces required to close the gate, i.e., silt on top of gate, hinge friction, inertia of gate, etc. (Weight of each counterweight will be transferred to support framing by two hangers with turnbuckles while gate is stored in the open position).

(b) Exert a retarding force on the gate after it reaches an angle of 50° with the horizontal to prevent the gate from slamming shut while closing.

(c) Exert a horizontal force on the closed gate to assist in opening the gate while it still has a differential head acting to hold the gate in the closed position.

k. Needle dams. The needle dams consist of reinforced concrete needles supported by a single span steel needle girder with intermediate vertical supports to reduce moments and deflections due to weight of girder. The needle girder with intermediate supports and typical needle for the flood side needle dams are shown on plate III-32 and design shown on plate III-33. Both the span and height of the needle dam on the protected side are less than those shown for the flood side, but the design analysis will be similar.

l. Control house. The control house is two-story, with operating floor at elevation 24.0 to enable the operator to view the operation of the gate over the sight obstruction of the gate machinery. The second floor also houses the electric panels. The first floor houses the engine generator and can be used for storage.

m. Abutment walls.

1. General. An inverted T-type reinforced concrete floodwall abuts the structure wall and extends for 150 feet on each side of the structure to meet a minimum backfill final grade of elevation +8.0 feet. An uncapped PZ-32 steel sheet pile wall extends from this point into the final levee crown on each side of the structure. The tops of the concrete floodwalls are at elevation +15.0 and reinforced concrete walkway is provided for access to the structure and the control house. For plan and profile of the abutment walls, see plate III-18.

2. Inverted T-wall. The inverted T-wall is divided into two 25-foot and two 50-foot monoliths on each side of the structure. The bottom of the base varies from elevation -16.25 to elevation -3.75, based on final grades. This wall is supported by prestressed concrete piles. See plate III-19 for typical sections and plate III-23 for pile foundation plan. See plate III-30 for design of stem. Design analyses of the other T-wall monoliths are similar.

3. I-wall. After major settlement of the levee has taken place, the future 2-foot thick reinforced concrete I-wall will be constructed and supported on existing interim protection PZ-32 steel sheet piling cutoff at elevation 9.0 and having a tip elevation of -15.0 feet. The new I-wall will extend a minimum distance of 2 feet below final grade to elevation 6.0 and have a top elevation of 15.0 feet. See plates III-19, II-4, and II-5. At the levee tie-in on each side of the structure, the new I-wall will be divided into three equal monoliths 35 feet long. See plate III-31 for section and design analysis of the typical I-wall monoliths.

n. Timber guide walls and fenders. A 300-foot long timber guide wall and a 100-foot long timber fender are located on each side of the gate structure. The guide wall is on the west side of the channel and the fender is on the east side as indicated on plate III-22. The tops of the guide wall and fender are at elevation +9.5. Braced piles, consisting of one vertical pile and one batter pile, are located 6 feet on centers with horizontal timber walls and fender timbers as shown on plate III-22. Piling and timbers are creosoted with 25-pound treatment for protection against marine borers. Removable floating creosoted timber camels will be placed in the gate recesses for protection from marine traffic hitting the wall projections. Construction of the timber fenders is the same as the construction of the guide walls except that the maximum pile spacing is 8 feet.

o. Breakwater. A breakwater with top elevation of +3.0 will be provided to the southwest of the structure, as shown on plate II-2. The breakwater will cause the larger hurricane waves in the wave spectrum approaching the structure from Adams Bay to break on the breakwater during the closing operation, thus limiting the incident wave heights to those equal in height to the smaller waves which approach directly along the channel alinement. The breakwater will provide a quieted area and a substantial reduction in waveloads on the gate machinery due to slammings during closing operations. It is considered that in no case would it be necessary to delay closing the floodgate after the ingress of hurricane tides has produced an elevation of 5.0 on the landside of the structure. The width of the breakwater is one-half the incident deep water wave length and is of sufficient height to limit waves to a height of 78 percent of the depth, 3 feet over the breakwater.

p. Access road. The existing shell access road between the new La. State Highway 23 and the structure will be used until the new levee is completed between levee station 118+00 and the structure. This is necessary since the new road is to be constructed on the landside berm of the levee. See plate III-1 for general alinement.

3-04 Operating Machinery Design.

a. General. The design of the gate operating machinery involves a motor-powered chain hoist and a freewheeling counterweight system. The counterweights aid the hoist machinery in closing the gate from 0° to 50° and oppose the hoist machinery in closing the gate from 50° to 90°. The counterweights prevent wave action from slamming the gate and causing large stress variations in the hoist chain during the later portion of the closing cycle and also provide a positive force on the gate for opening against small differential heads.

b. Hoist load. The following assumptions were made in determining the maximum design hoist load:

1. A 4-foot layer of silt will cover the gate because of the 4-foot difference in elevation between the structure sill and the channel.

2. This layer of silt will remain intact from 0° to 30°.

3. The layer of silt will fail and slide off the gate at the 30° position.

4. The pumped water will eliminate all suction.

5. No buoyancy will be present from the air pocket.

6. No wind pressure will be exerted on the gate.

7. No wave pressure will be exerted on the gate.

8. No differential head will exist.

Hoisting loads were calculated for gate closure angles at 10° intervals and various silting conditions. The maximum hoist load occurs while hoisting the gate from the fully open position with 4 feet of silt.

c. Chain factor of safety. The factor of safety is the chain breaking strength load divided by the maximum design hoist load.

1. For maximum loading, the factor of safety for the hoist chain (2 1/8" diameter die lock chain) is 3.4. For condition of no silt, this chain has a factor of safety of 7.0.

2. The counterweight chain (1 1/4" diameter die lock chain) has a factor of safety of 5.0.

3-05. Cathodic Protection.

a. Salinity records. Records reveal variations in salinity from a minimum of 1,800 p.p.m. to a maximum of 30,100 p.p.m. Salinity readings of the four inland stations are in excess of 10,000 p.p.m. more than 90 percent of the time. Salinity readings from the Empire area indicated that a high corrosion rate must be anticipated. Accordingly, the design has been made adequate for the maximum corrosion rate.

b. Corrosion protection measures.

1. General. Cathodic protection provided for the flap gate is the sacrificial metal type as a supplement to 7.5 mils of a zinc rich vinyl paint and is designed to protect both sides of the gate. A current density of not less than 0.0003 amperes per square foot of protected surface is provided for the painted areas. The sacrificial metal type system was selected because the structure is unmanned and commercial power was not originally available at the site. Commercial power is now available.

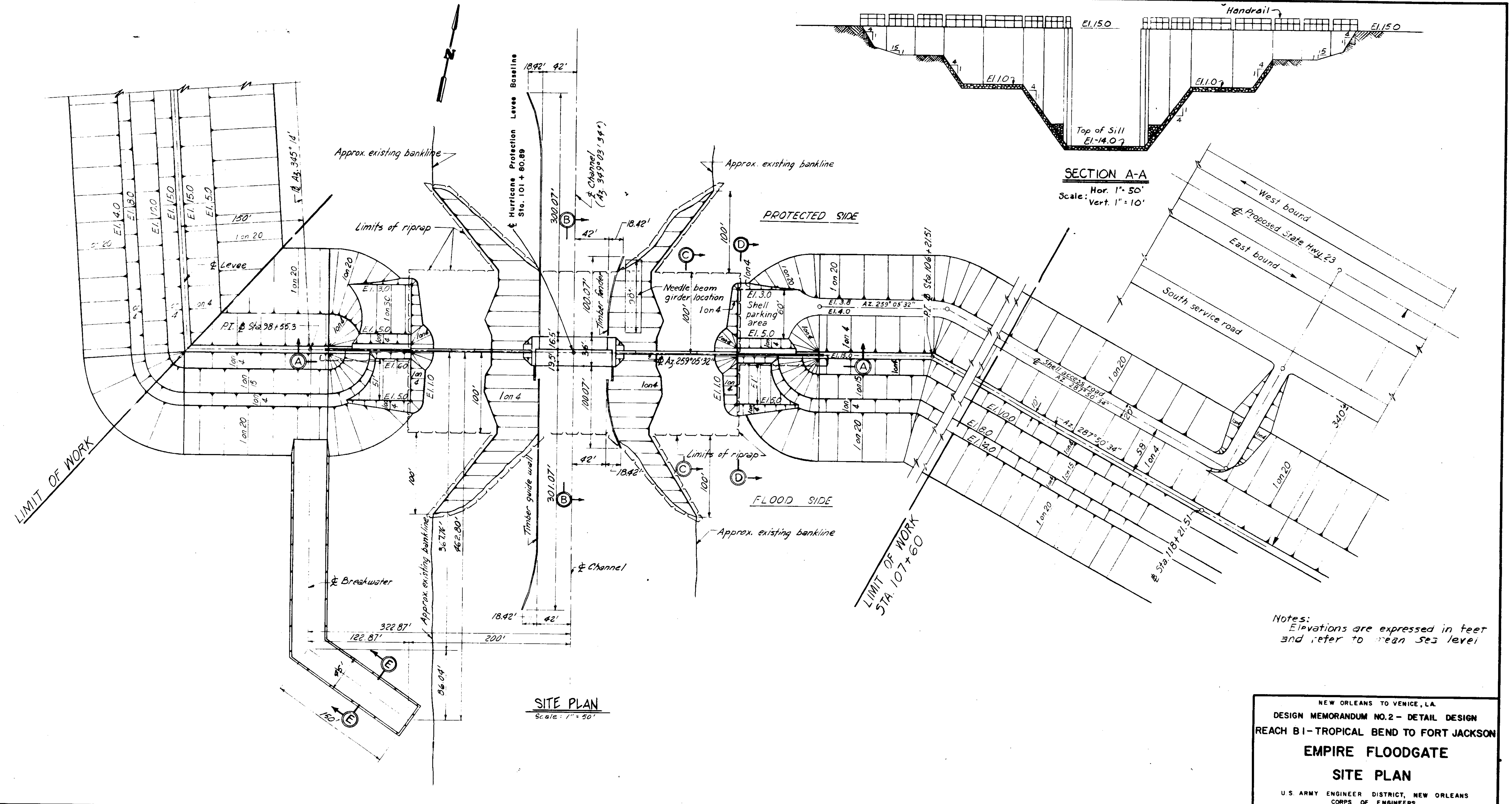
2. Anodes. The anodes are high purity zinc anodes rated 335 ampere-hours per pound at a 90 percent efficiency with a solution potential of -1.10 volts relative to a copper-copper sulphate reference half-cell. The system is designed to provide a polarization potential of -85.0 volts measured to a reference half-cell. Slab (hull) type anodes weighing 12 pounds are utilized on the skin plate and 1.4" x 1.4" square anodes weighing 6 pounds per foot are used on the structural members on the underside of the gate. The number and size of the anodes were selected to obtain 20-year life and to insure current distribution to shielded areas of the gate. The anodes are welded to the gate members and the skin plate. Details of anodes, mountings, and locations are shown on plate III-36.

3-06 Index of Selected Plates from Design Memorandum No. 2

Plate No.	Title	File No.
III-1	Site Plan	H-2-25048
III-2	Stream Closure Section Stability (Q)	H-2-25048
III-3	Stream Closure Section Stability (Q)	H-2-25048
III-4	Stream Closure Section Stability (Q)	H-2-25048
III-5	Structure Excavation Stability (Q)	H-2-25048
III-6	Section Along Baseline Existing Fill Stability (Q)	H-2-25048
III-7	Interim & Final Plans & Sections for Backfill	H-2-25048
III-8	Shell Core Excavation Stability (Q), Section AA	H-2-25048
III-9	Final Backfill Stability (Q), Section CC	H-2-25048
III-10	Cantilever Sheet Pile Floodwall Stability (S)	H-2-25048
III-11	Unbalanced Water Load Analysis Monolith T-1	H-2-25048
III-12	Unbalanced Water Load Analysis Structure & T-Wall	H-2-25048
III-13	Unbalanced Water Load Analysis Monolith T-3 & T-4	H-2-25048

Plate No.	Title	File No.
III-14	Pile Design Monolith T-1 & T-2	H-2-25048
III-15	Pile Design Monolith T-3 & T-4, Floodgate	H-2-25048
III-16	General Type Borings Nos. 2-SE, 3-SE, 4-SE, and 5-SE	H-2-25048
III-17	Undisturbed Boring I-SEU Date	H-2-25048
III-18	Plan & Elevation	H-2-25048
III-19	Flap Gate Monolith Sections	H-2-25048
III-20	Flap Gate Monolith Plan & Section	H-2-25048
III-21	Flap Gate Elevations & Sections	H-2-25048
III-22	Guide Wall and Fender Wall	H-2-25048
III-23	Pile Foundation Plan	H-2-25048
III-24	Moment Diagrams & Pile Reactions For Base Slab	H-2-25048
III-25	Moment Diagrams & Pile Reactions For Base Slap	H-2-25048
III-26	Moment Diagrams & Pile Reactions For Base Slab	H-2-25048
III-27	Moment Diagrams & Pile Reactions For Base Slab	H-2-25048
III-28	Moment Diagrams & Pile Reactions For Base Slab	H-2-25048
III-29	Wall Design Analysis	H-2-25048
III-30	T-Wall Stem & Needle Beam Analysis	H-2-25048
III-31	I-Wall Design Analysis	H-2-25048

Plate No.	Title	File No.
III-32	Needle Beam Girder	H-2-25048
III-33	Needle Beam Girder Analysis	H-2-25048
III-34	Corrosion Protection	H-2-25048
A	Soil Boring Legend	H-2-25048



Notes:
Elevations are expressed in feet and refer to mean sea level

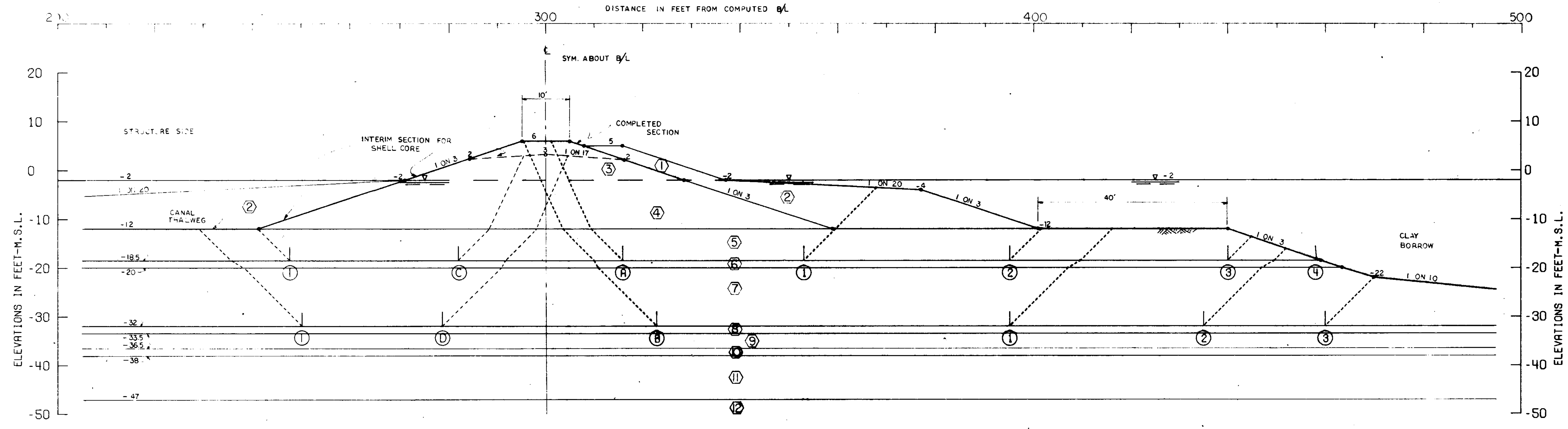
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

SITE PLAN

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES III-16 AND III-17

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.
2	CH	40.0	40.0	100.0	100.0	100.0	100.0	0.
3	SHELL	92.0	92.0	0.	0.	0.	0.	40.0
4	SHELL	30.0	30.0	0.	0.	0.	0.	40.0
5	CH	40.0	40.0	150.0	150.0	150.0	150.0	0.
6	SM	55.0	55.0	0.	0.	0.	0.	30.0
7	CH	40.0	40.0	250.0	250.0	350.0	350.0	0.
8	SM	55.0	55.0	0.	0.	0.	0.	30.0
9	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.
10	SM	55.0	55.0	0.	0.	0.	0.	30.0
11	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.
12	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 = VERT. 2 = BORING 1-SEU

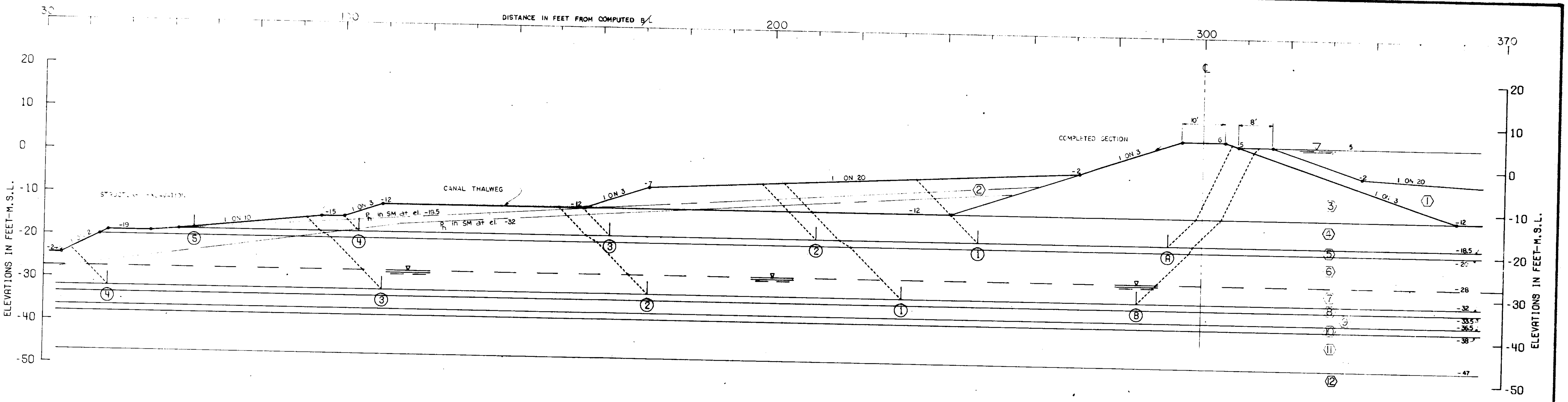
ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A 1	-18.50	10738	5550	3640	18317	4633	19928	13684	1.456
A 2	-18.50	10738	11850	1950	18317	1083	24538	17234	1.424
A 3	-18.50	10738	18600	1452	18317	628	30790	17689	1.741
A 4	-18.50	10738	20022	76	18317	1	30836	18315	1.684
B 1	-32.00	18449	25200	8853	38804	8523	52503	30281	1.734
B 2	-32.00	18449	39200	7281	38804	7087	64931	31717	2.047
B 3	-32.00	18449	47879	5000	38804	2650	71329	36154	1.973
C 1	-18.50	7095	5100	1950	11802	1055	14145	10747	1.316
D 1	-32.00	14519	9975	8852	29090	8682	33346	20408	1.634

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON
EMPIRE FLOODGATE
STREAM CLOSURE SECTION
STABILITY (Q)
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
OCTOBER 1970 FILE NO. H-2-25048



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES III-16 AND III-17

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	102.0	102.0	100.0	100.0	1[illegible]	100.0	0.
2	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.
3	SHELL	92.0	92.0	0.	0.	0.	0.	40.0
4	CH	102.0	102.0	150.0	150.0	150.0	150.0	0.
5	SM	117.0	117.0	0.	0.	0.	0.	30.0
6	CH	102.0	102.0	212.0	212.0	275.0	275.0	0.
7	CH	40.0	40.0	312.0	312.0	350.0	350.0	0.
8	SM	55.0	55.0	0.	0.	0.	0.	30.0
9	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.
10	SM	55.0	55.0	0.	0.	0.	0.	30.0
11	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.
12	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 - VERT. 2 - BORING 1-SEU

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A 1	-18.50	13546	6675	3569	27601	11330	23790	16271	1.462
A 2	-18.50	13546	12300	3211	27601	8780	29058	18820	1.544
A 3	-18.50	13546	19500	1950	27601	2763	34996	24838	1.409
A 4	-18.50	13546	28275	1050	27601	830	42871	26770	1.601
A 5	-18.50	13546	32745	112	27601	7	46403	27593	1.682
B 1	-32.00	21321	19250	13731	65440	37515	54303	27925	1.945
B 2	-32.00	21321	39900	10362	65440	23811	71583	41629	1.720
B 3	-32.00	21321	61600	8254	65440	15688	91175	49752	1.833
B 4	-32.00	21321	84000	4716	65440	5145	110037	60295	1.825

NOTES

- Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

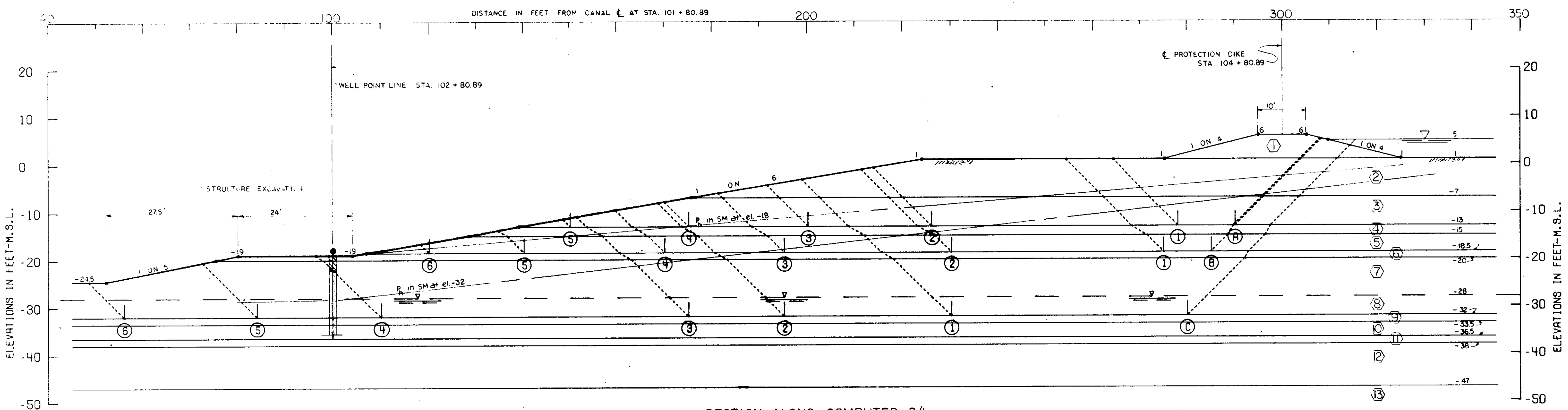
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE STREAM CLOSURE SECTION STABILITY (Q)

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048



SECTION ALONG COMPUTED B/L

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES III-16 AND III-17

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	80.0	80.0	120.0	120.0	120.0	120.0	0.
2	CH(O)	78.0	78.0	150.0	150.0	150.C	150.0	0.
3	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.
4	SM	117.0	117.0	0.	0.	0.	0.	30.0
5	CH	102.0	102.0	150.0	150.0	150.0	150.0	0.
6	SM	117.0	117.0	0.	0.	0.	0.	30.0
7	CH	102.0	102.0	212.0	212.0	275.0	275.0	0.
8	CH	40.0	40.0	312.0	312.0	350.0	350.0	0.
9	SM	55.0	55.0	0.	0.	0.	0.	30.0
10	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.
11	SM	55.0	55.0	0.	0.	0.	0.	30.0
12	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.
13	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 - VERT. 2 - BORING 1-SEU

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A 1	-13.00	4608	1200	3600	14304	8160	9408	6144	1.531
A 2	-13.00	4608	6400	3094	14304	7282	14102	7022	2.008
A 3	-13.00	4608	9000	2000	14304	3835	15608	10469	1.491
A 4	-13.00	4608	11500	1028	14304	1571	17136	12733	1.346
A 5	-13.00	4608	14000	314	14304	146	18922	14158	1.336
B 1	-18.50	7855	1500	10060	24154	16544	19416	7610	2.551
B 2	-18.50	7855	8250	9423	24154	15321	25529	8833	2.890
B 3	-18.50	7855	13500	6213	24154	8874	27568	15280	1.804
B 4	-18.50	7855	17250	3955	24154	4991	29060	19163	1.516
B 5	-18.50	7855	21750	1261	24154	1489	30866	22664	1.362
B 6	-18.50	7855	24724	557	24154	204	33136	23950	1.384
C 1	-32.00	15787	17500	19463	61172	45866	52751	15306	3.446
C 2	-32.00	15787	29750	14966	61172	34231	60504	26941	2.246
C 3	-32.00	15787	36750	12109	61172	27403	64647	33769	1.914
C 4	-32.00	15787	59500	6004	61172	8645	81292	52527	1.548
C 5	-32.00	15787	68600	5679	61172	7528	90067	53644	1.679
C 6	-32.00	15787	78398	3980	61172	2529	98166	58643	1.674

NOTES

- Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ∇ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

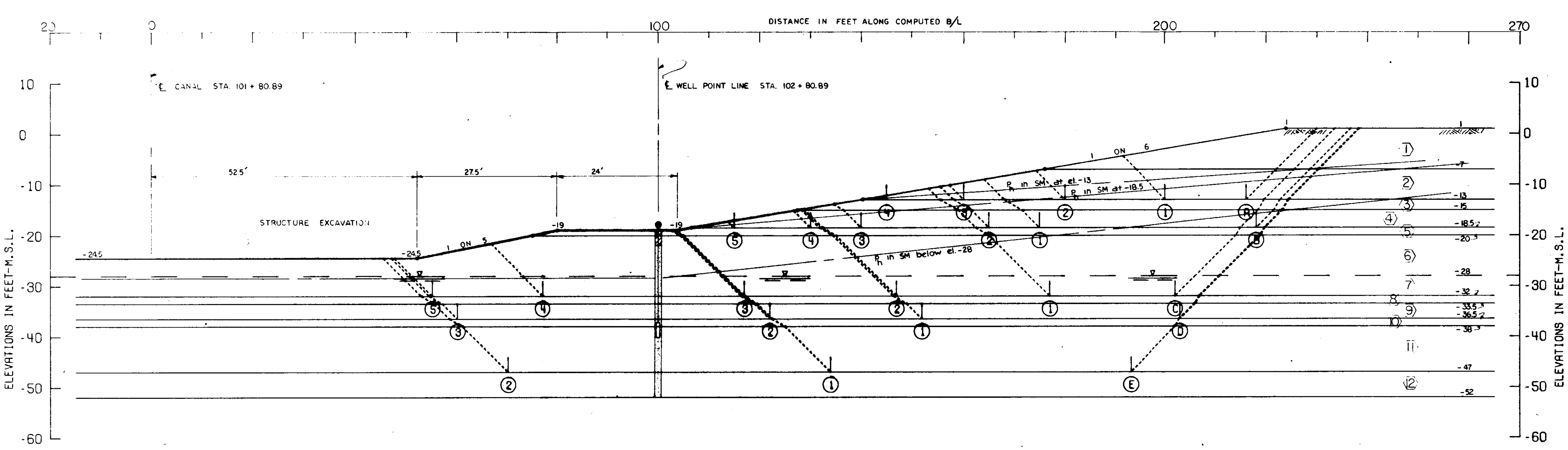
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE PROTECTION DIKE STABILITY (Q)

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE III-16 AND III-17

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	DEGREES
1	CH(O)	78.0	78.0	150.0	150.0	150.0	150.0	0.
2	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.
3	SM	117.0	117.0	0.	0.	0.	0.	30.0
4	CH	102.0	102.0	150.0	150.0	150.0	150.0	0.
5	SM	117.0	117.0	0.	0.	0.	0.	30.0
6	CH	102.0	102.0	212.0	212.0	275.0	275.0	0.
7	CH	40.0	40.0	312.0	312.0	350.0	350.0	0.
8	SM	55.0	55.0	0.	0.	0.	0.	30.0
9	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.
10	SM	55.0	55.0	0.	0.	0.	0.	30.0
11	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.
12	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 - VERT. 2 - BORING 1-SEU

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
			R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	-13.00	3600	1600	1971	7665	3770	7171	3894	1.842
A	2	-13.00	3600	3600	1142	7665	1907	8342	5757	1.449
A	3	-13.00	3600	5600	571	7665	484	9771	7180	1.361
A	4	-13.00	3600	6967	142	7665	30	10710	7635	1.403
B	1	-18.50	6421	6450	4341	16305	5618	17213	10687	1.611
B	2	-18.50	6421	7950	3376	16305	4124	17747	12180	1.457
B	3	-18.50	6421	11700	1239	16305	1421	19360	14883	1.301
B	4	-18.50	6421	13200	1007	16305	674	20629	15631	1.320
B	5	-18.50	6421	15224	364	16305	87	22010	16218	1.357
C	1	-32.00	14046	8750	12257	47034	27761	35053	19273	1.819
C	2	-32.00	14046	19250	8623	47034	17895	41920	29139	1.439
C	3	-32.00	14046	29750	6017	47034	9924	49814	37110	1.342
C	4	-32.00	14046	43750	5194	47034	6055	62991	40979	1.537
C	5	-32.00	14046	51437	3980	47034	2460	69464	44574	1.558
D	1	-36.50	19385	21675	16730	61156	26772	57790	34384	1.681
D	2	-36.50	19385	34425	12555	61156	16459	66365	44696	1.485
D	3	-36.50	19385	60775	8275	61156	5742	88435	55413	1.596
E	1	-47.00	31772	35400	27094	93422	37213	94267	56208	1.677
E	2	-47.00	31772	72414	20372	93422	18180	124559	75242	1.655

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

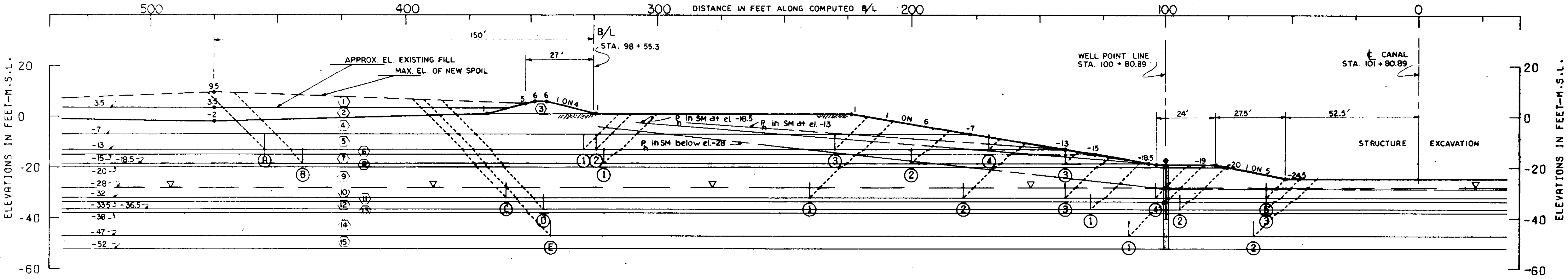
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE STRUCTURE EXCAVATION STABILITY (Q)

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

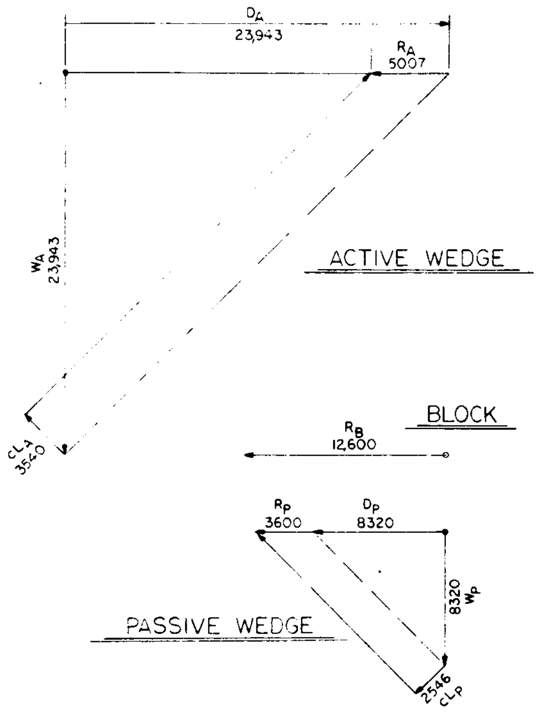
OCTOBER 1970 FILE NO. H-2-25048



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES III-16 AND III-17

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.



$$FS = \frac{5007 + 12600 + 3600}{23943 - 8320}$$

$$FS = \frac{21207}{15623} = 1.357$$

ASSUMED FAILURE SURFACE Ⓐ ①

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.0
2	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.0
3	CH	80.0	80.0	120.0	120.0	120.0	120.0	0.0
4	CH(O)	78.0	78.0	150.0	150.0	150.0	150.0	0.0
5	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.0
6	SM	117.0	117.0	0.0	0.0	0.0	0.0	30.0
7	CH	102.0	102.0	150.0	150.0	150.0	150.0	0.0
8	SM	117.0	117.0	0.0	0.0	0.0	0.0	30.0
9	CH	102.0	102.0	212.0	212.0	275.0	275.0	0.0
10	CH	40.0	40.0	312.0	312.0	350.0	350.0	0.0
11	SM	55.0	55.0	0.0	0.0	0.0	0.0	30.0
12	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.0
13	SM	55.0	55.0	0.0	0.0	0.0	0.0	30.0
14	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.0
15	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 - VERT. 2 - BORING 1 - SEU

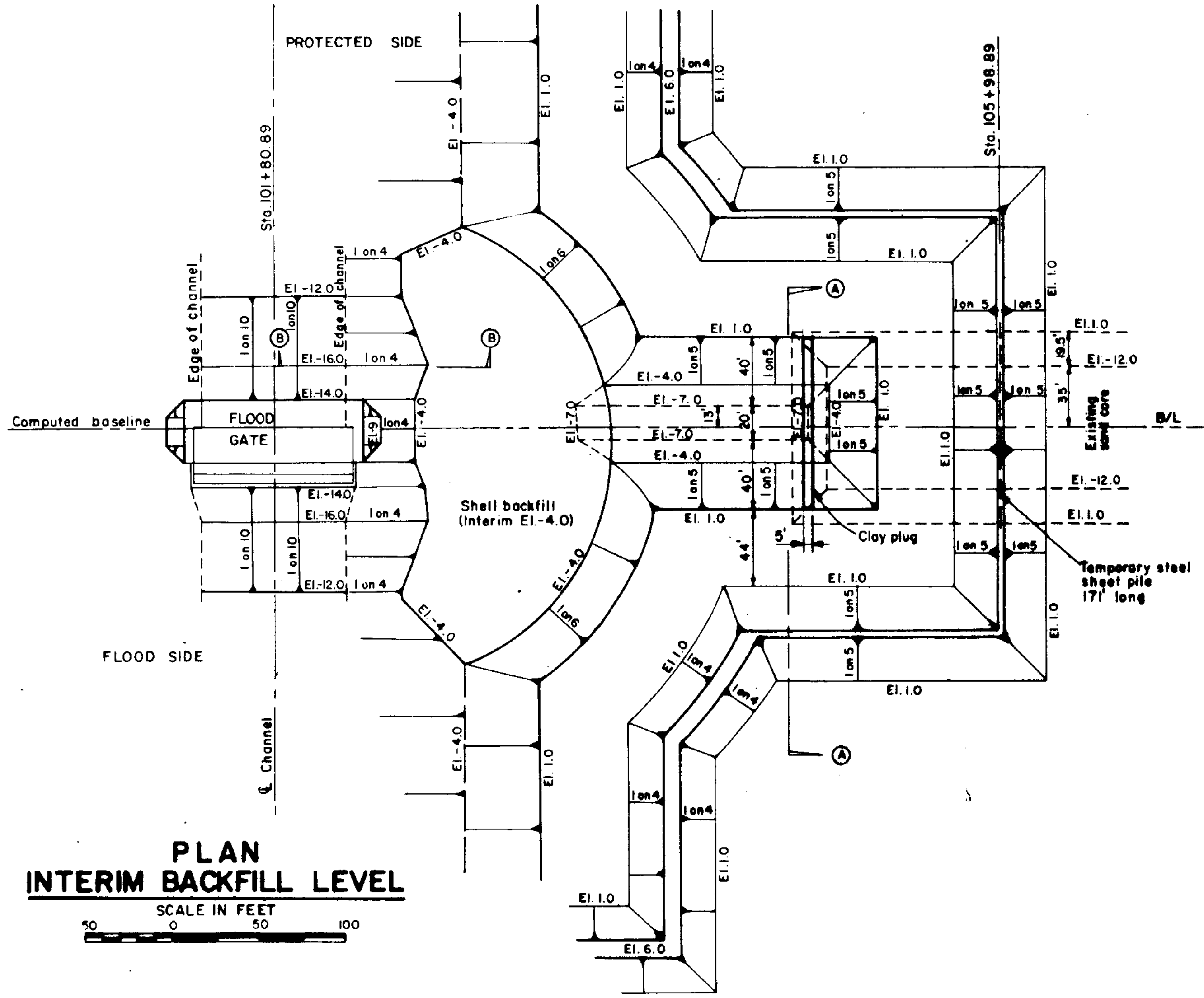
ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
Ⓐ	①	-13.00	5007	12600	3600	23943	8320	21207	15622	1.357
Ⓐ	②	-13.00	5007	13100	3600	23943	8071	21707	15872	1.368
Ⓐ	③	-13.00	5007	22500	3251	23943	7708	30758	16235	1.895
Ⓐ	④	-13.00	5007	28500	837	23943	1037	34344	22906	1.499
Ⓑ	①	-18.50	8919	17850	10061	35880	16544	36830	19336	1.905
Ⓑ	②	-18.50	8919	36000	6546	35880	9469	51465	26412	1.949
Ⓑ	③	-18.50	8919	45000	1231	35880	1413	55150	34467	1.600
Ⓒ	①	-32.00	16489	42000	20635	68287	48194	79124	20093	3.938
Ⓒ	②	-32.00	16489	63000	12614	68287	28558	92102	39729	2.318
Ⓒ	③	-32.00	16489	77000	7957	68287	15690	101446	52597	1.929
Ⓒ	④	-32.00	16489	89600	6004	68287	8306	112093	59980	1.869
Ⓒ	⑤	-32.00	16489	105000	4015	68287	3006	125503	65280	1.923
Ⓓ	①	-36.50	22085	91375	13492	81512	18887	126952	62625	2.027
Ⓓ	②	-36.50	22085	106675	11697	81512	13507	140457	68005	2.065
Ⓓ	③	-36.50	22085	121125	8276	81512	5743	151486	75769	1.999
Ⓔ	①	-47.00	35199	136200	25334	122582	30956	196732	91627	2.147
Ⓔ	②	-47.00	35199	164388	19948	122582	16789	219535	105793	2.075

NOTES

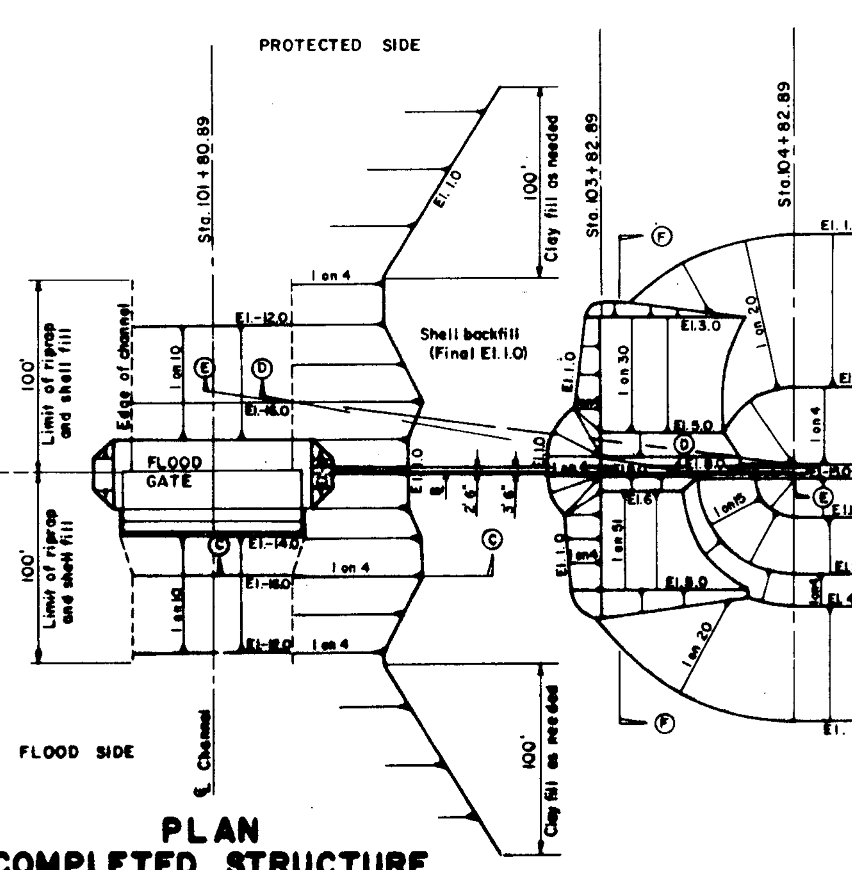
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

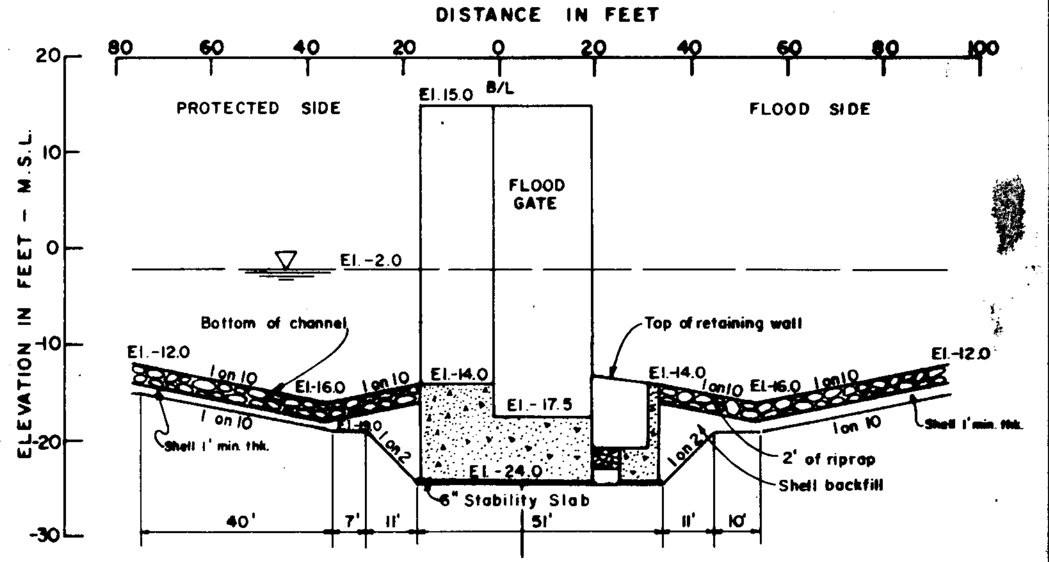
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON
EMPIRE FLOODGATE
SECTION ALONG BASELINE
EXISTING FILL STABILITY (Q)
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
OCTOBER 1970
FILE NO. H-2-25048



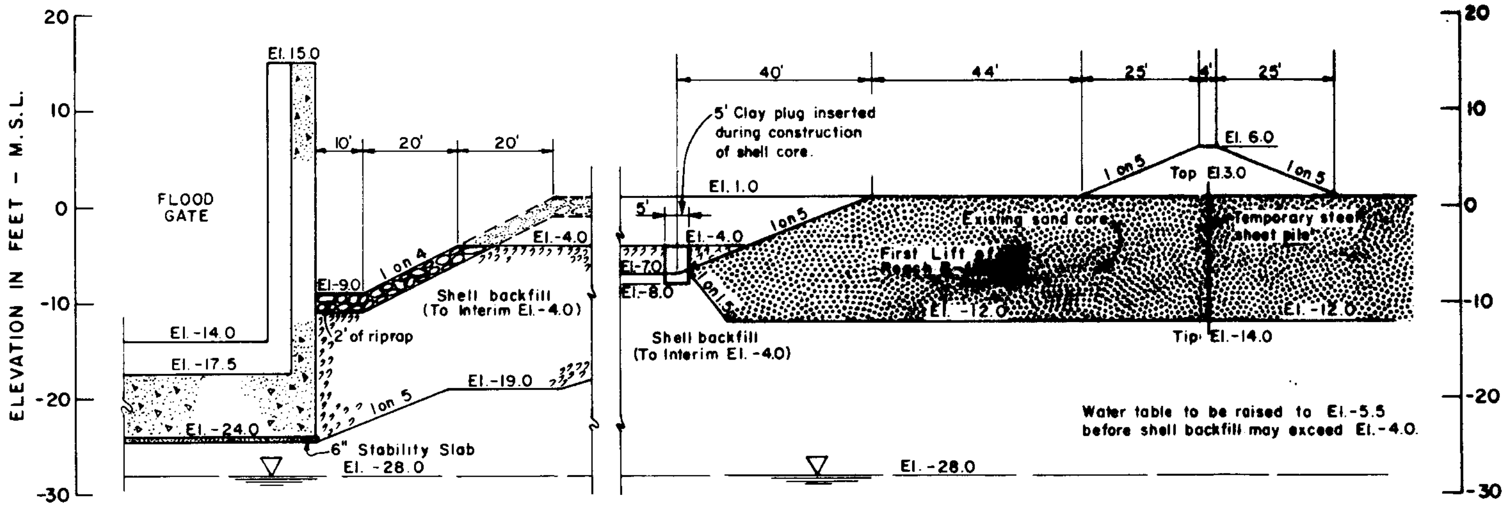
PLAN
INTERIM BACKFILL LEVEL
SCALE IN FEET
50 0 50 100



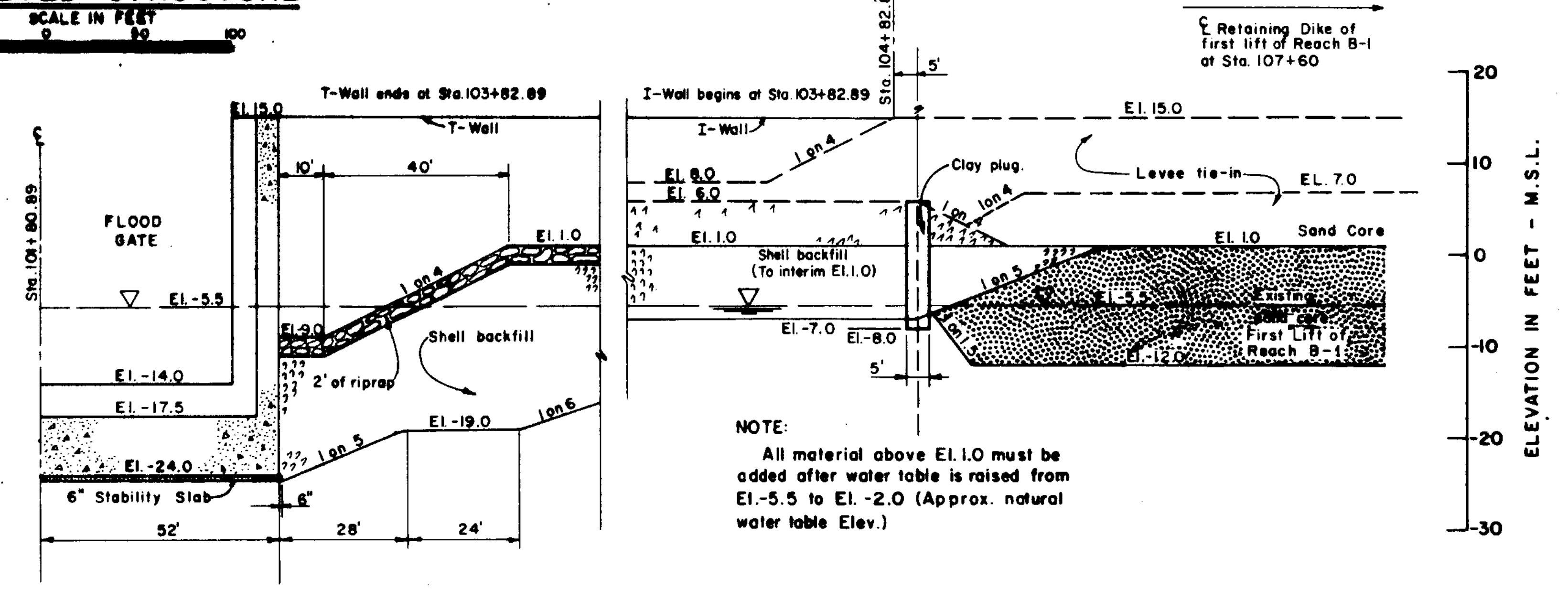
PLAN
COMPLETED STRUCTURE
SCALE IN FEET
50 0 50 100



SECTION ALONG ℄ CANAL



INTERIM SECTION ALONG COMPUTED B/L
HORIZONTAL SCALE IN FEET
20 0 20 40



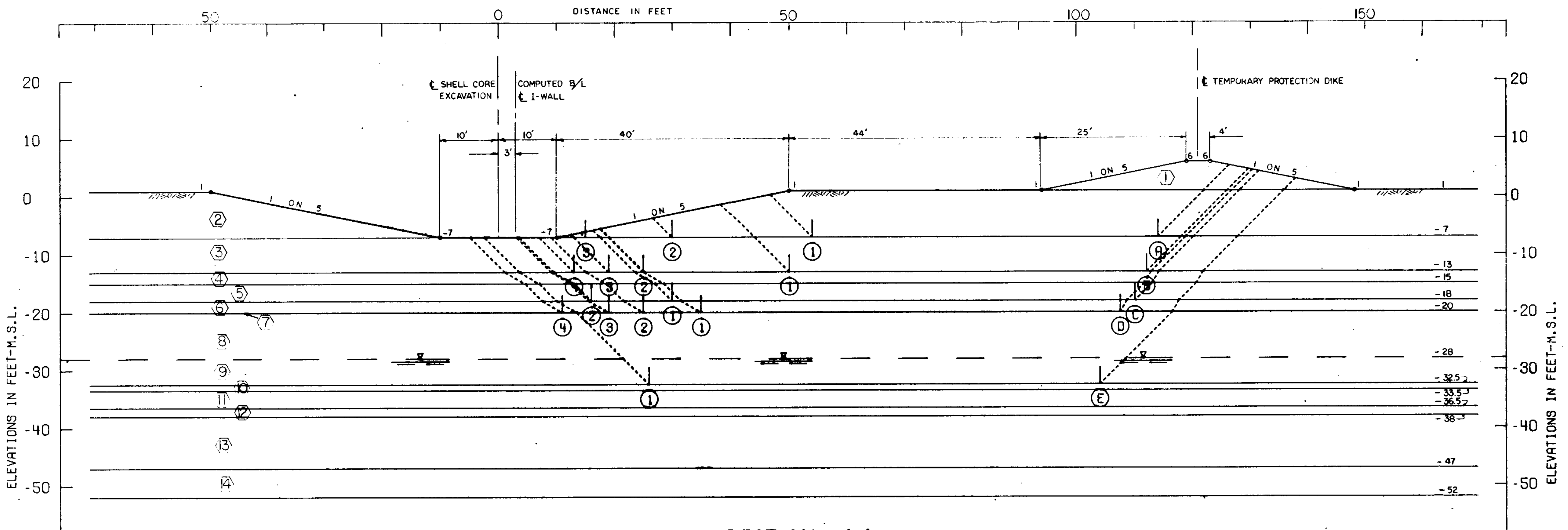
COMPLETED SECTION ALONG COMPUTED B/L
HORIZONTAL SCALE IN FEET
20 0 20 40

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
INTERIM AND FINAL PLANS
AND SECTIONS FOR BACKFILL

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048



SECTION AA

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	80.0	80.0	120.0	120.0	120.0	120.0	0.
2	CH(O)	78.0	78.0	150.0	150.0	150.0	150.0	0.
3	CH	102.0	102.0	100.0	100.0	100.0	100.0	0.
4	SM	117.0	117.0	0.	0.	0.	0.	30.0
5	CH	102.0	102.0	150.0	150.0	150.0	150.0	0.
6	SM	117.0	117.0	0.	0.	0.	0.	30.0
7		0.	0.	0.	0.	150.0	150.0	0.
8	CH	102.0	102.0	214.0	214.0	278.0	278.0	0.
9	CH	40.0	40.0	314.0	314.0	350.0	350.0	0.
10	SM	55.0	55.0	0.	0.	0.	0.	30.0
11	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.
12	SM	55.0	55.0	0.	0.	0.	0.	30.0
13	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.
14	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 = VERT. 2 = BORING 1-SEU

ASSUMED FAILURE NO.	SURFACE ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
(A) (1)	-7.00	3440	9000	2200	6393	2389	14640	4004	3.656
(A) (2)	-7.00	3440	12600	1000	6393	518	17040	5875	2.900
(A) (3)	-7.00	3440	14850	250	6393	32	18540	6361	2.914
(B) (1)	-13.00	4480	6200	2900	13864	6796	13580	7067	1.921
(B) (2)	-13.00	4480	8700	1650	13864	3060	14830	10803	1.373
(B) (3)	-13.00	4480	9300	1350	13864	2406	15130	11458	1.320
(B) (4)	-13.00	4480	9900	1200	13864	1903	15580	11960	1.303
(C) (1)	-18.00	7516	12000	6344	22852	8687	25860	14164	1.826
(C) (2)	-18.00	7516	14100	5095	22852	6537	26712	16314	1.637
(D) (1)	-20.00	10367	10875	13043	27033	12247	34285	14786	2.319
(D) (2)	-20.00	10367	12375	11341	27033	10119	34083	16914	2.015
(D) (3)	-20.00	10367	13275	10600	27033	9268	34242	17765	1.927
(D) (4)	-20.00	10367	14475	10098	27033	8828	34940	18205	1.919
(E) (1)	-32.50	16593	27300	16449	62378	35441	60343	26937	2.240

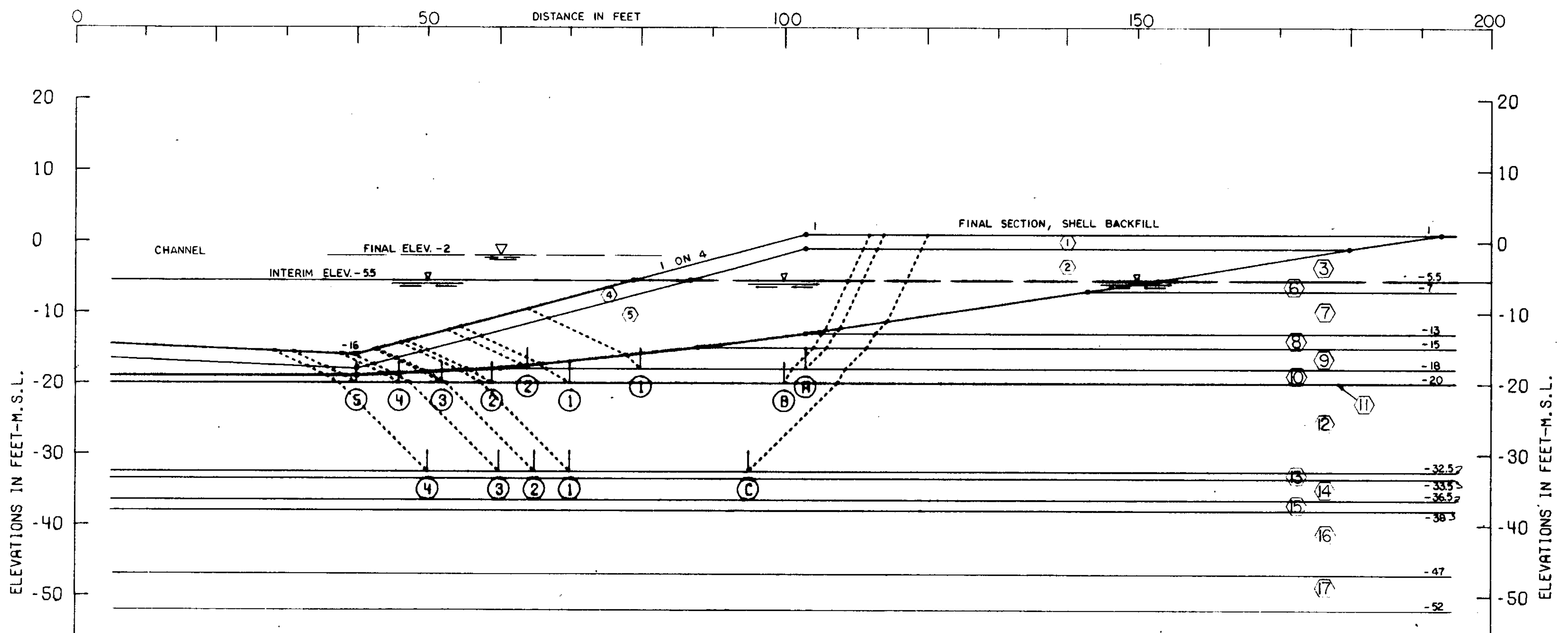
NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P}$

SEE PLATE III-7 FOR LOCATION OF SEC. AA

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON
EMPIRE FLOODGATE
SECTION AA
SHELL CORE EXCAVATION STABILITY (Q)
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
OCTOBER 1970
FILE NO. H-2-25048



SECTION CC

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F. VERT. 1	EFFECTIVE UNIT WT. P.C.F. VERT. 2	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 2	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 1	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 2	FRICTION ANGLE DEGREES
1	RIPRAP	125.0	125.0	0.	0.	0.	0.	40.0
2	SHELL	92.0	92.0	0.	0.	0.	0.	40.0
3	CH(O)	78.0	78.0	150.0	150.0	150.0	150.0	0.
4	RIPRAP	63.0	63.0	0.	0.	0.	0.	40.0
5	SHELL	30.0	30.0	0.	0.	0.	0.	40.0
6	CH(O)	16.0	16.0	150.0	150.0	150.0	150.0	0.
7	CH	40.0	40.0	100.0	100.0	100.0	100.0	0.
8	SM	55.0	55.0	0.	0.	0.	0.	30.0
9	CH	40.0	40.0	150.0	150.0	150.0	150.0	0.
10	SM	55.0	55.0	0.	0.	0.	0.	30.0
11		0.	0.	0.	0.	150.0	150.0	0.
12	CH	40.0	40.0	250.0	250.0	350.0	350.0	0.
13	SM	55.0	55.0	0.	0.	0.	0.	30.0
14	CH	40.0	40.0	400.0	400.0	425.0	425.0	0.
15	SM	55.0	55.0	0.	0.	0.	0.	30.0
16	CH	40.0	40.0	525.0	525.0	600.0	600.0	0.
17	ML	55.0	55.0	200.0	200.0	200.0	200.0	12.0

VERT. 1 = VERT. 2 = BORING 1-SEU

ASSUMED FAILURE SURFACE NO.	ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY
(A) (1)	-18.00	8178	3450	5686	13225	2253	17314	10971	1.578
(A) (2)	-18.00	8178	5850	3366	13225	1025	17394	12199	1.426
(B) (1)	-20.00	9807	4500	5392	15377	2031	19699	13346	1.476
(B) (2)	-20.00	9807	6150	3447	15377	1217	19404	14160	1.370
(B) (3)	-20.00	9807	7200	2297	15377	815	19304	14562	1.326
(B) (4)	-20.00	9807	8100	1528	15377	544	19436	14833	1.310
(B) (5)	-20.00	9807	8926	1472	15377	491	20205	14886	1.357
(C) (1)	-32.50	15549	8750	9432	33252	9677	33732	23575	1.431
(C) (2)	-32.50	15549	10500	8622	33252	8811	34671	24441	1.419
(C) (3)	-32.50	15549	12250	7922	33252	7979	35722	25273	1.413
(C) (4)	-32.50	15549	15750	7796	33252	6748	39096	26504	1.475

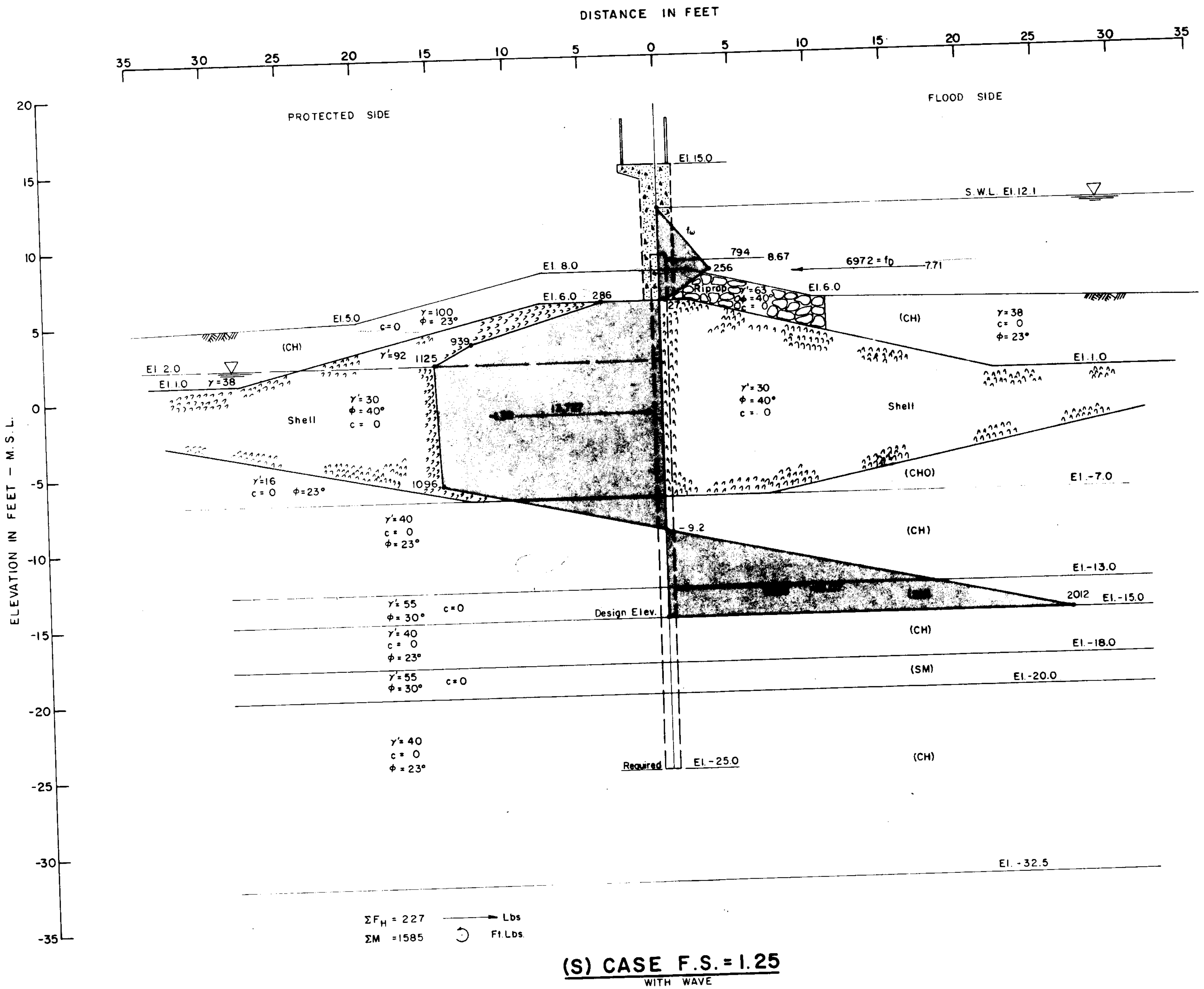
NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

SEE PLATE III-7 FOR LOCATION OF SECTION CC

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON
EMPIRE FLOODGATE
SECTION CC
FINAL BACKFILL STABILITY (Q)
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
OCTOBER 1970
FILE NO. H-2-25048



(S) CASE F.S. = 1.25
WITH WAVE

GENERAL NOTES

(S) - Shear strength case governed for design. Stability analysis by the method of planes with surfaces 45± $\frac{\phi_D}{2}$ and F.S.=1.25 applied to shear strength of the soil.

ϕ_A - Available angle of internal friction in degrees.

ϕ_D - Developed angle of internal friction = $\tan^{-1}\left(\frac{\tan \phi_A}{F.S.}\right)$

C_A - Unit cohesion available.

C_D - Unit cohesion developed = $C_A \div$ F.S.

(S) - Consolidated-drained shear strength of soil. For undisturbed shear test data see plates:

f_w - Net lateral water pressure. (Water pressure from waves effective to top of impervious clay layer).

ΣF_H - Summation of horizontal forces.

ΣM - Summation of moments about the sheet pile tip.

γ, γ' - Unit weights P.C.F.

S.W.L. - Still water level.

f_D - Dynamic wave force, effective to top of impervious clay layer. (El.-7.0)

NOTE:

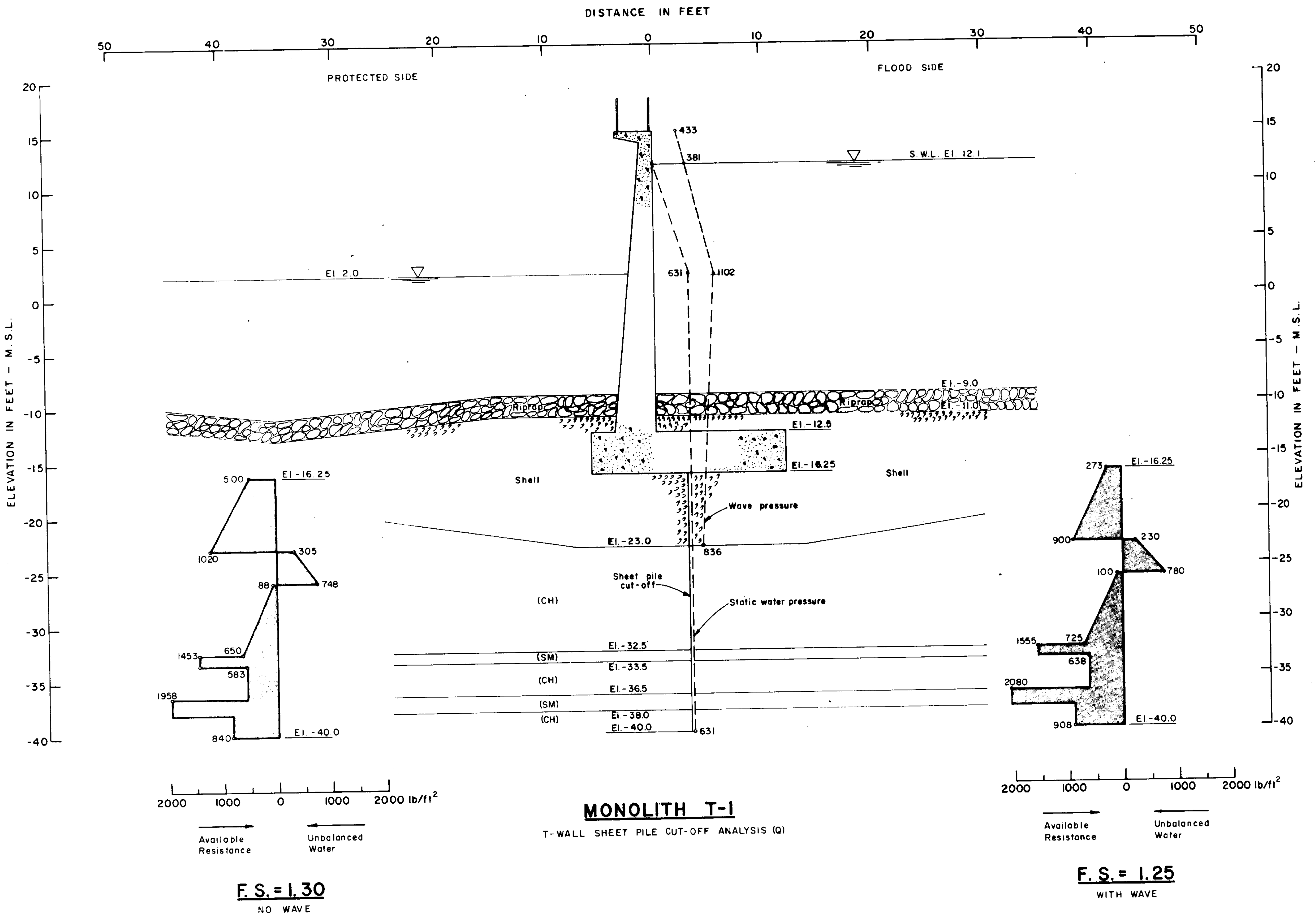
Any uplift pressures developed in shell core on the protected side will be relieved through shell backfill near T-wall and flat area. (El.1.0)

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH BI - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
CANTILEVER SHEET PILE FLOODWALL
STABILITY (S)

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048



MONOLITH T-1

T-WALL SHEET PILE CUT-OFF ANALYSIS (Q)

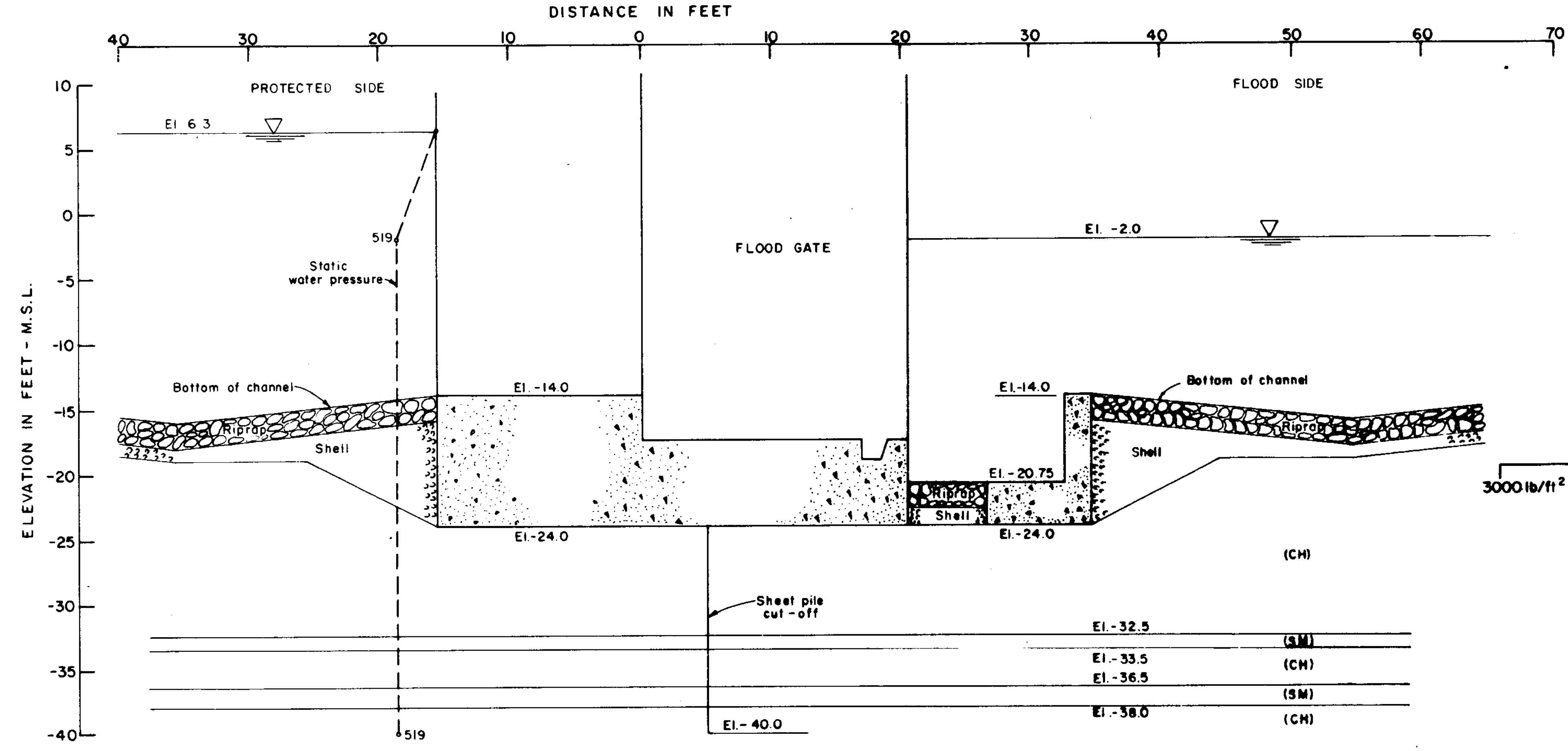
NOTES:
Resistance due to bearing piles supporting T-Wall was neglected.
Available resistance shown is that in excess of the resistance developed to balance the water load.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
UNBALANCED WATER LOAD ANALYSIS
MONOLITH T-1

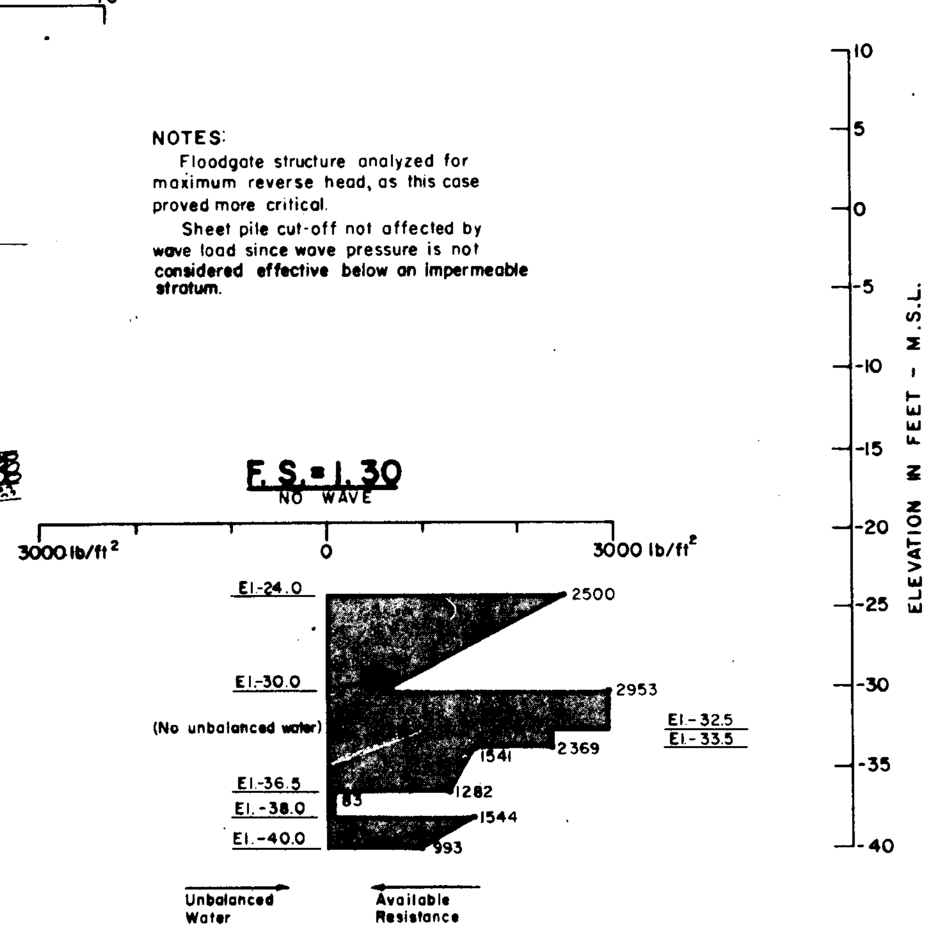
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 — FILE NO. H-2-25048

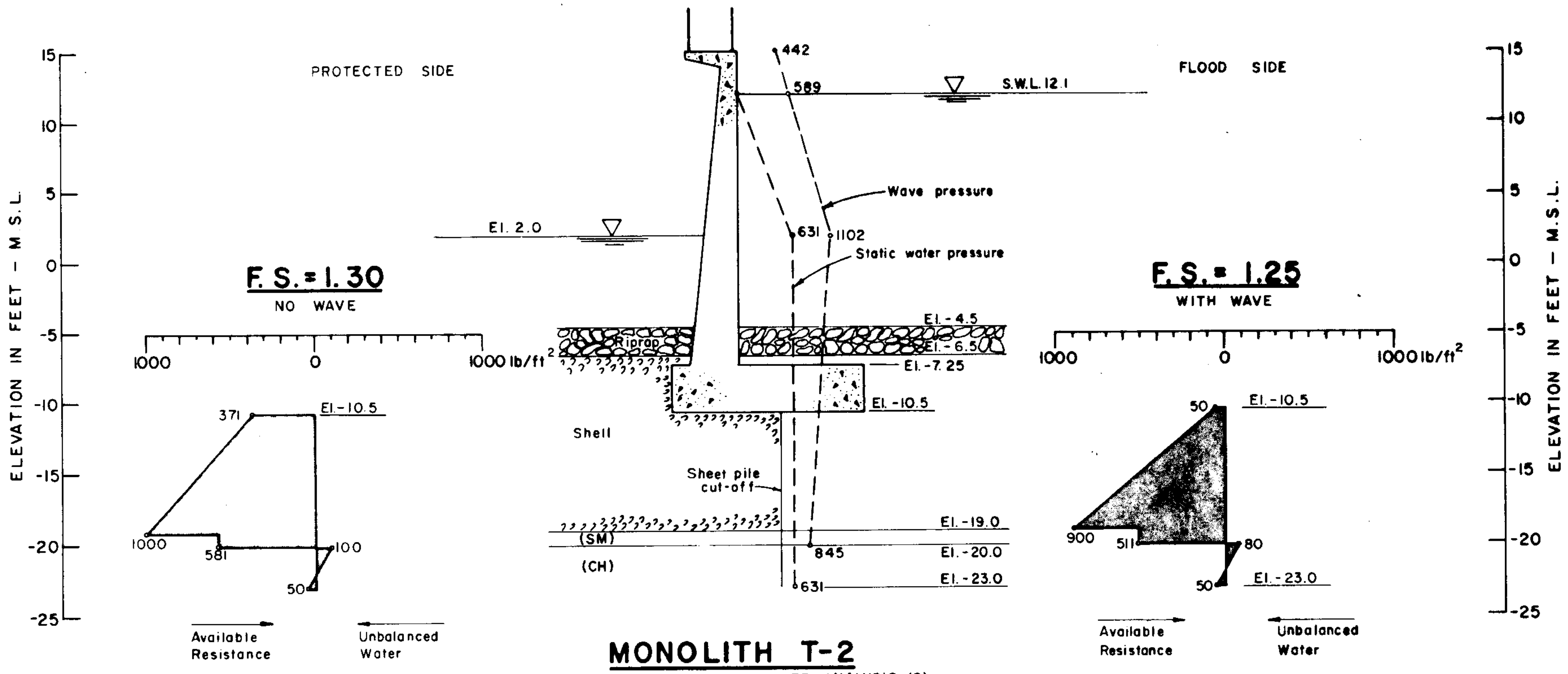


FLOOD GATE STRUCTURE

T-WALL SHEET PILE CUT-OFF ANALYSIS (Q)



NOTES:
Floodgate structure analyzed for maximum reverse head, as this case proved more critical.
Sheet pile cut-off not affected by wave load since wave pressure is not considered effective below an impermeable stratum.



MONOLITH T-2

T-WALL SHEET PILE CUT-OFF ANALYSIS (Q)

NOTES:
Resistance due to bearing piles supporting floodgate and T-Wall was neglected.
Available resistance shown is that in excess of the resistance developed to balance the water load.

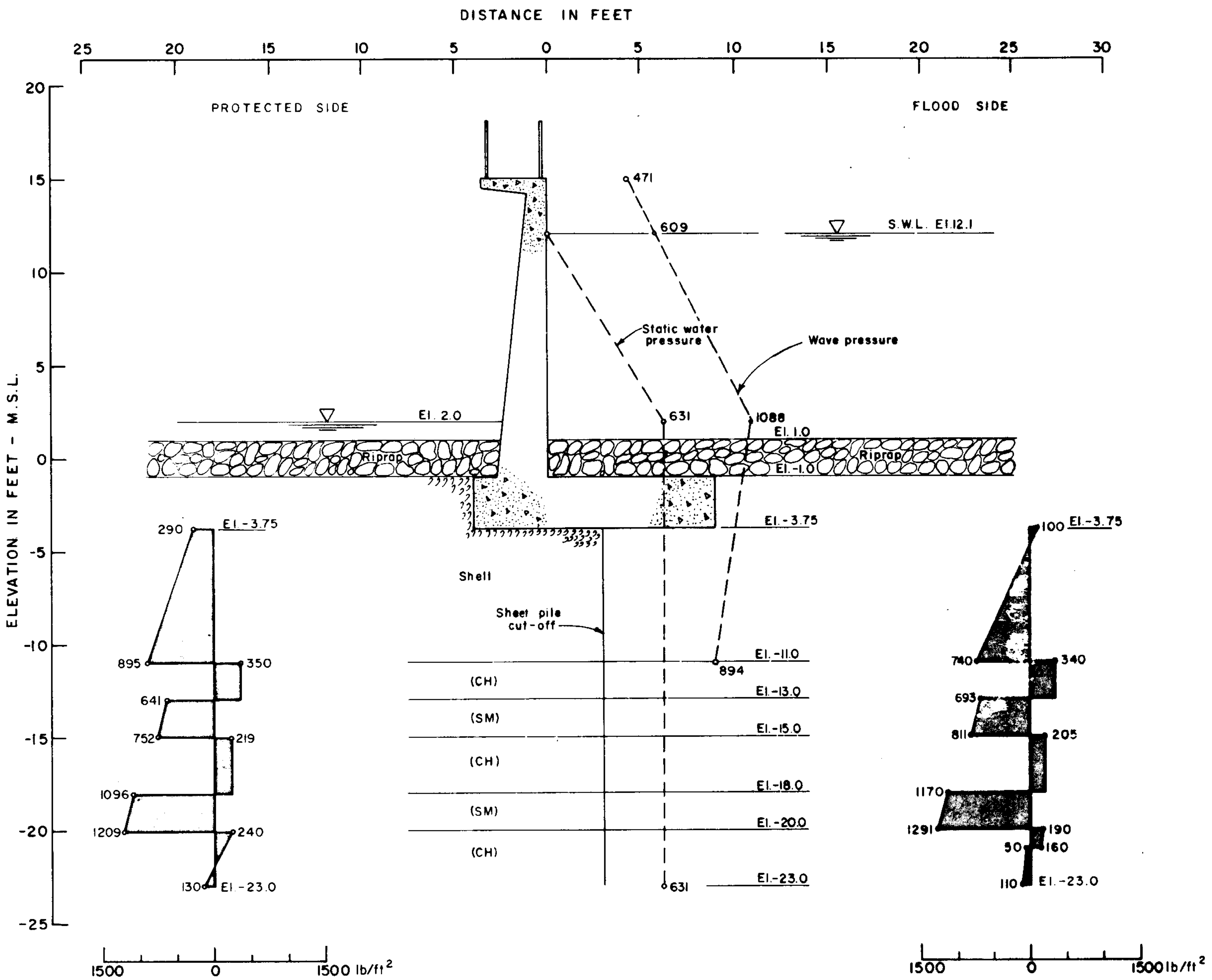
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

UNBALANCED WATER LOAD ANALYSIS STRUCTURE AND T-WALL

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048

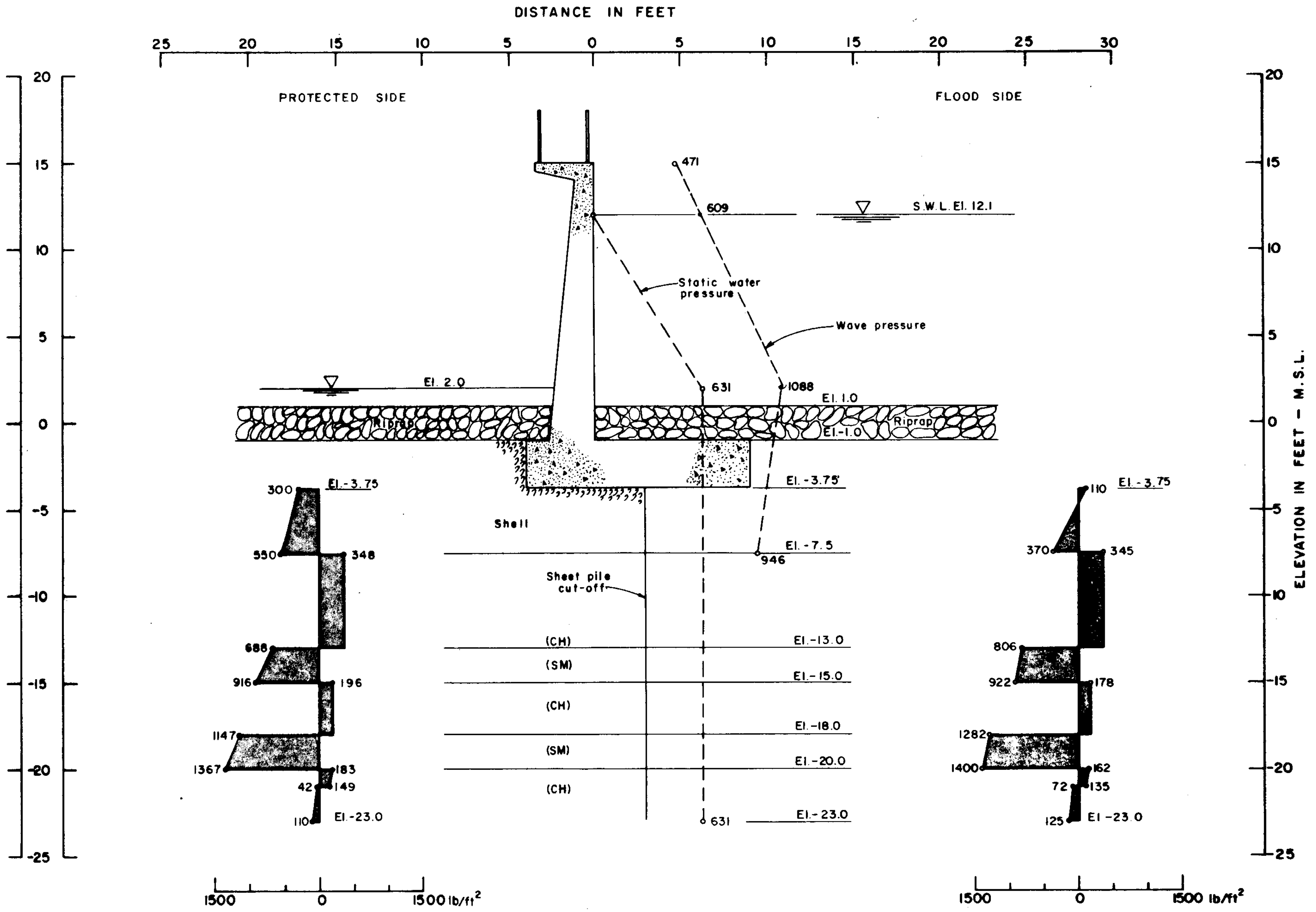


MONOLITH T-3

T-WALL SHEET PILE CUT-OFF ANALYSIS (Q)

F.S. = 1.30
NO WAVE

F.S. = 1.25
WITH WAVE



MONOLITH T-4

T-WALL SHEET PILE CUT-OFF ANALYSIS (Q)

F.S. = 1.30
NO WAVE

F.S. = 1.25
WITH WAVE

NOTES:

Resistance due to bearing piles supporting T-Wall was neglected.

Available resistance shown is that in excess of the resistance developed to balance the water load.

NEW ORLEANS TO VENICE, LA.
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EMPIRE FLOODGATE
UNBALANCED WATER LOAD ANALYSIS
MONOLITH T-3 AND T-4

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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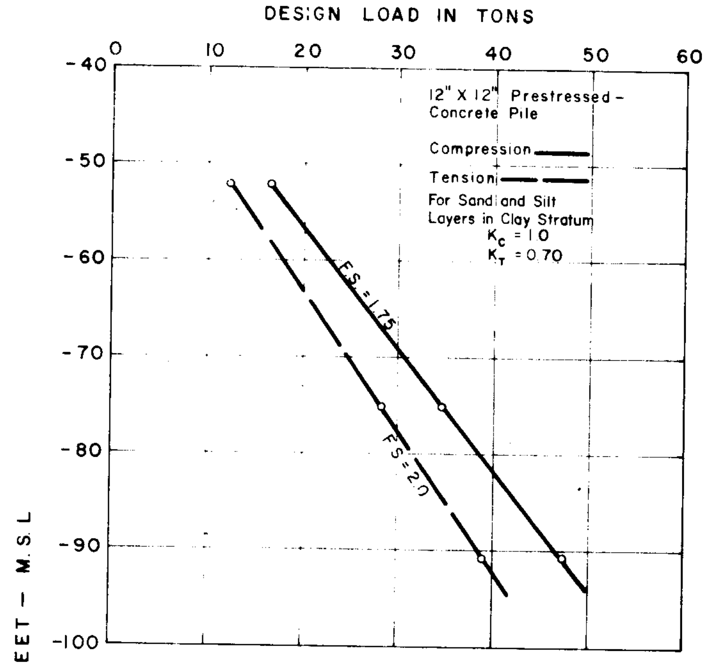
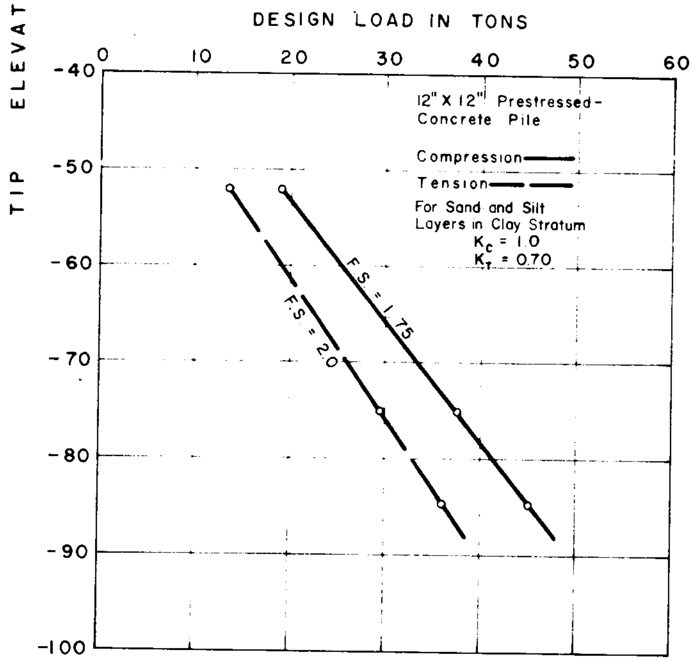
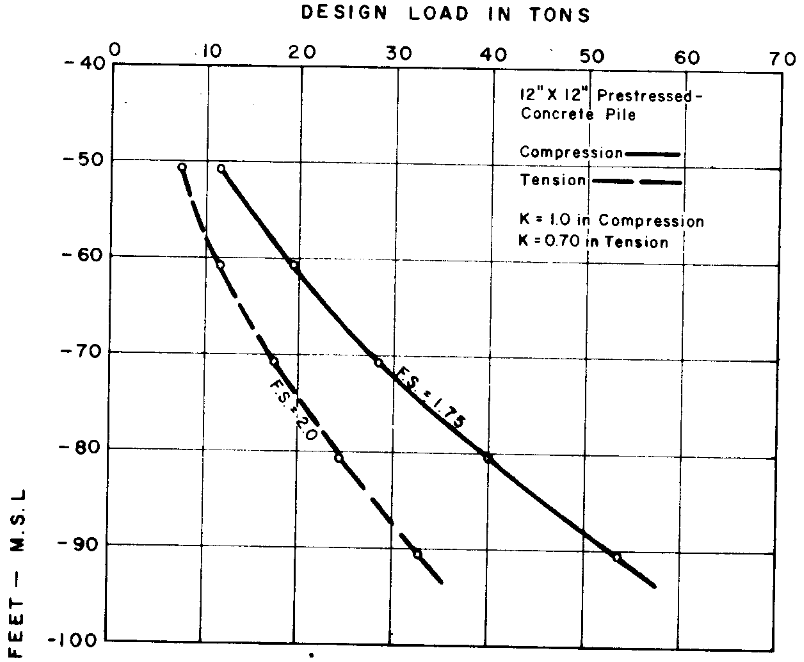


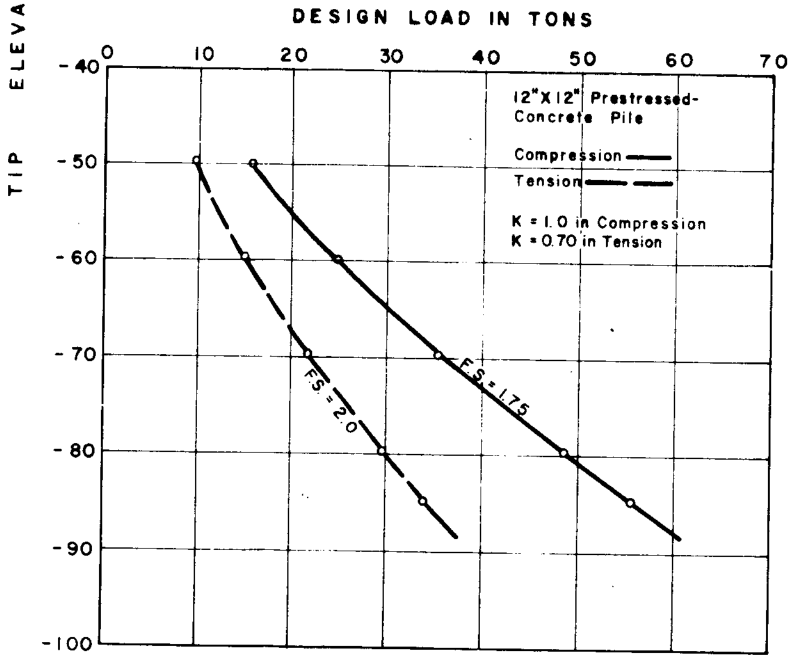
MONOLITH T-I
PILE DESIGN (Q)



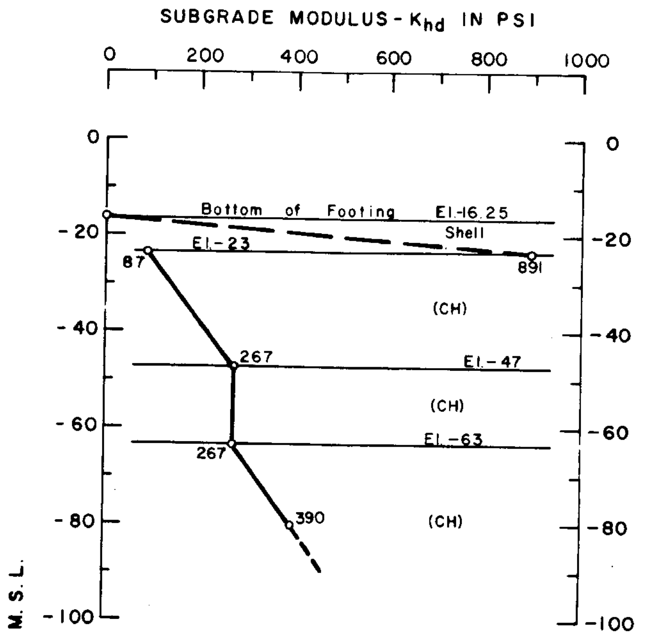
MONOLITH T-2
PILE DESIGN (Q)



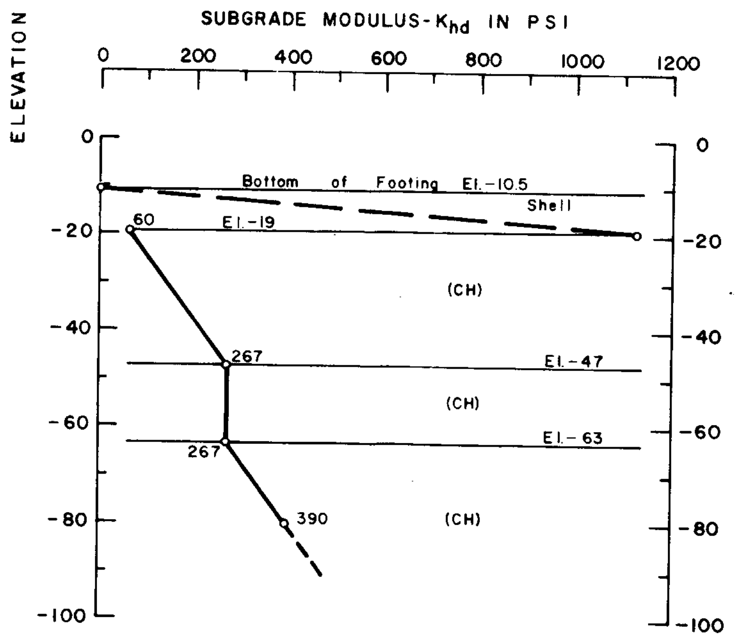
MONOLITH T-I
PILE DESIGN (S)



MONOLITH T-2
PILE DESIGN (S)



MONOLITH T-I
SUBGRADE MODULUS



MONOLITH T-2
SUBGRADE MODULUS

GENERAL NOTES

- N_h – 22 PCI for shell
- Δd_o – Thickness of shell (ft)
- d – Projected pile diameter (in)
- b – Unit conversion factor = 12"
- K_o – 80 q_u (PSF)
- q_u – Unconfined compressive Strength = 2C
- C – Cohesion
- K_{hd} – 0.4 K_od/b (for cohesive soils)
- 0.4 – Reduction factor for cyclic loading.
- K_{hd} – 0.5 $N_h \Delta d_o$ d/b(12) [for noncohesive soils]
- K_c – Lateral earth pressure Coefficient (Compression)
- K_T – Lateral earth pressure Coefficient (Tension)
- K – Conjugate stress ratio

NOTE:

See ~~plate~~ III-15 (Pile Design, Monolith T-3, T-4, Floodgate) for illustration of calculations for pile design based on (S) strengths.

NEW ORLEANS TO VENICE, LA.
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EMPIRE FLOODGATE
PILE DESIGN
MONOLITH T-I & T-2

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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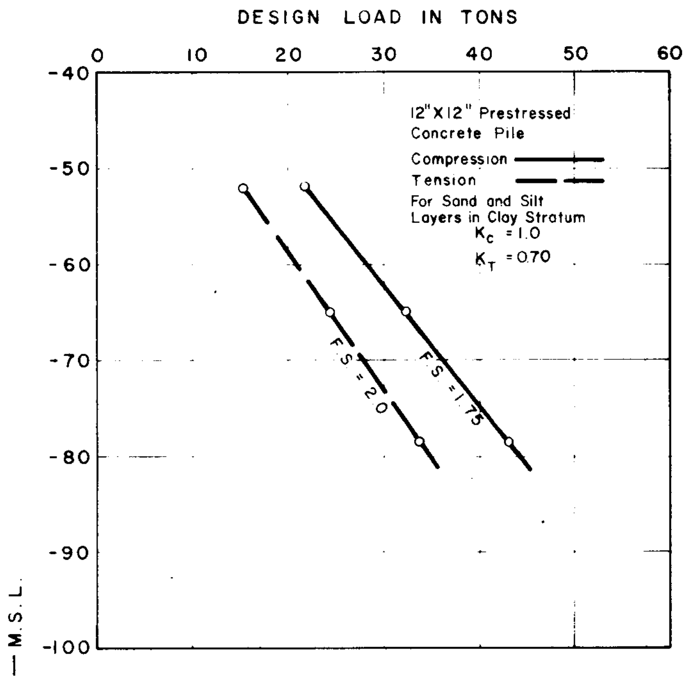
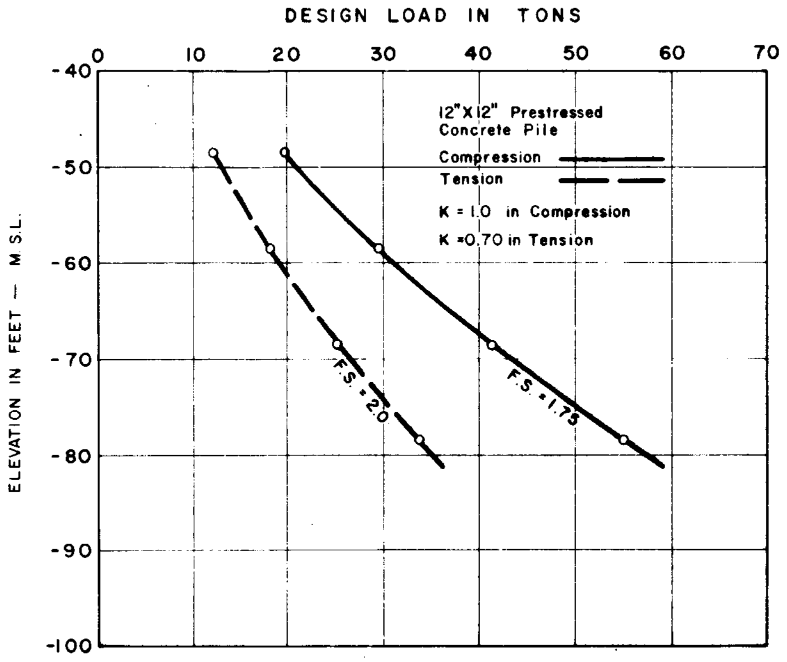
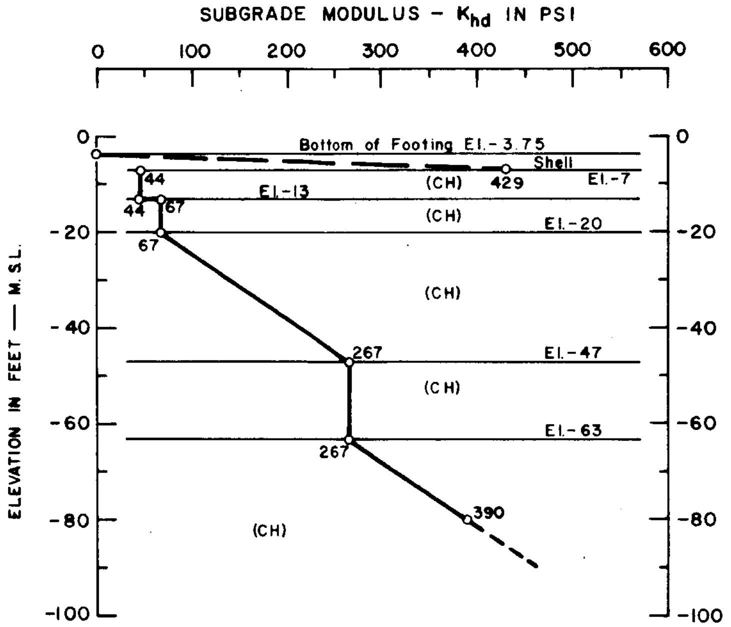
PLATE III - 14



MONOLITH T-3 & T-4
PILE DESIGN (Q)



MONOLITH T-3 & T-4
PILE DESIGN (S)



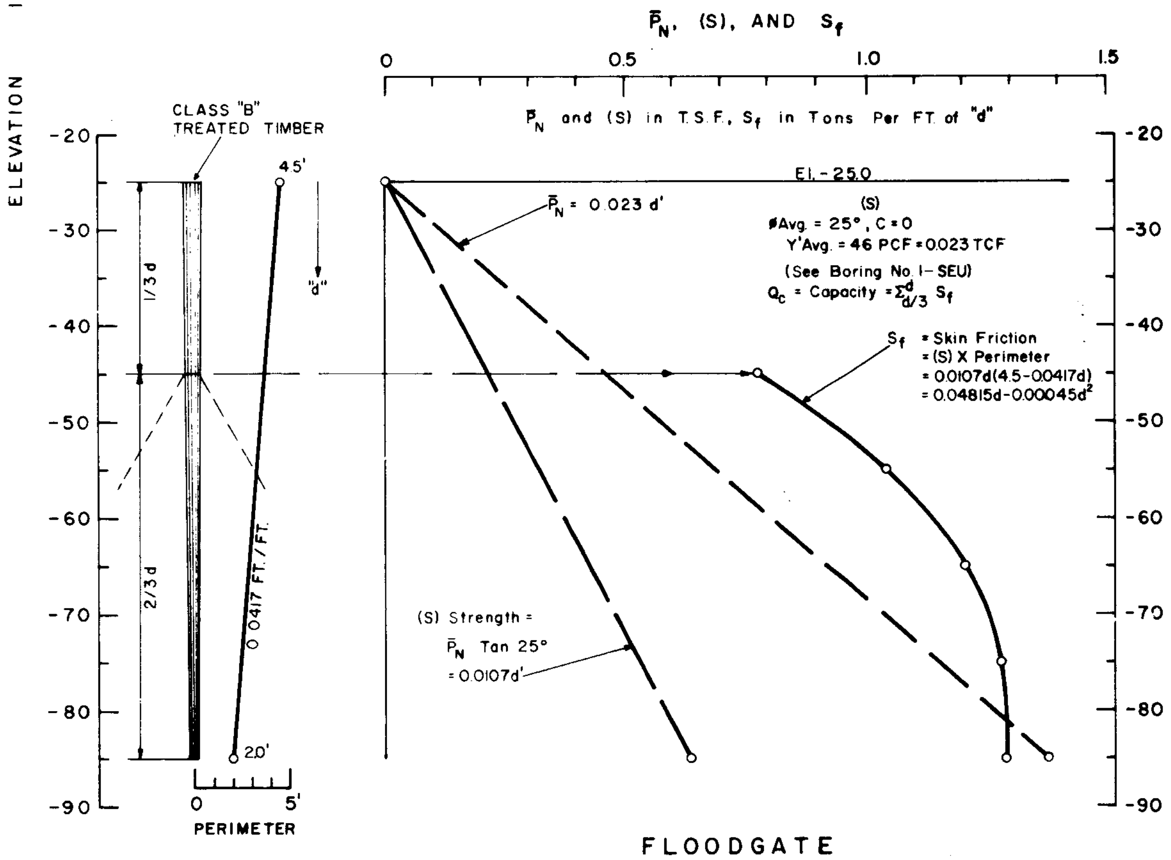
MONOLITH T-3 & T-4
SUBGRADE MODULUS

GENERAL NOTES

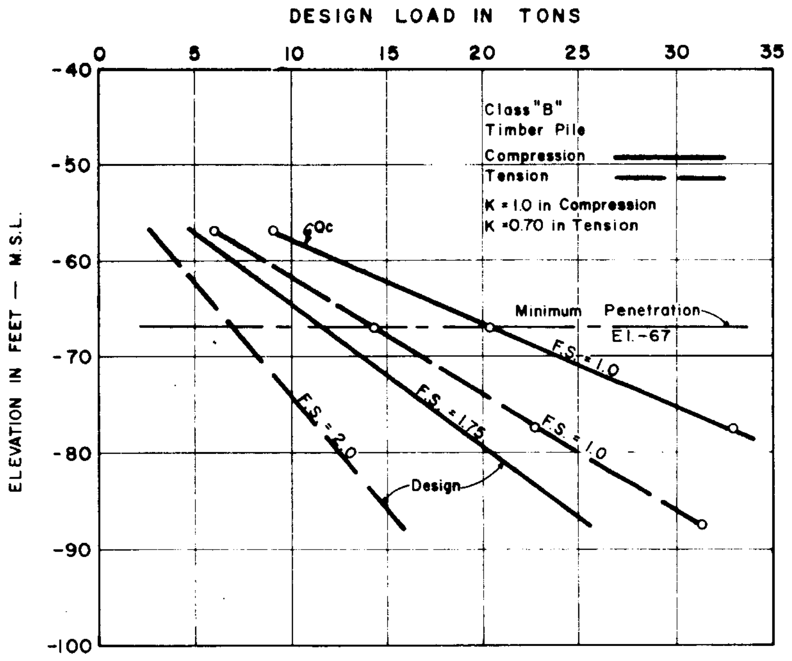
See plate III - 14 on pile design, Monolith T-1 and T-2.

NOTES:

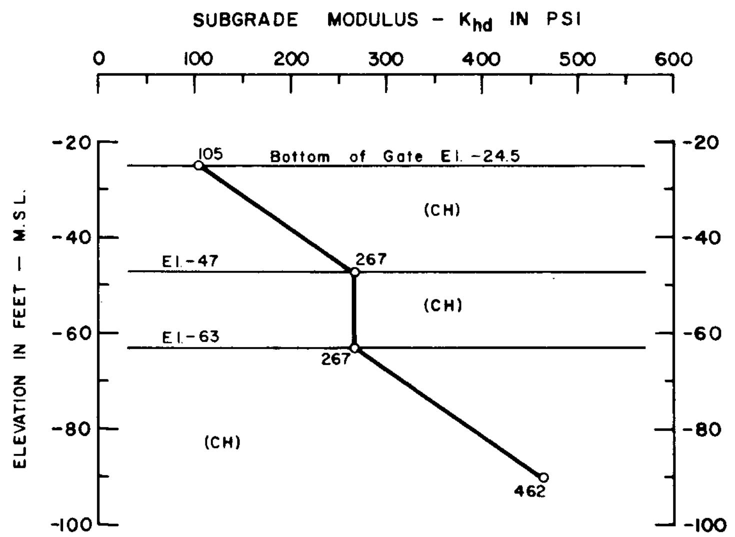
Settlement of structure due to consolidation is not a problem since the major loads are caused by hurricane water heads of insufficient duration for consolidation of the foundation clays to ensue.
See plate III - 16 for Tip elevation and location of Test Piles.



FLOODGATE
(S) CASE GOVERNED FOR DESIGN



FLOODGATE
PILE DESIGN (S)



FLOODGATE
BEARING PILE SUBGRADE MODULUS

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 – DETAIL DESIGN
REACH BI – TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE PILE DESIGN

MONOLITH T-3 & T-4, FLOODGATE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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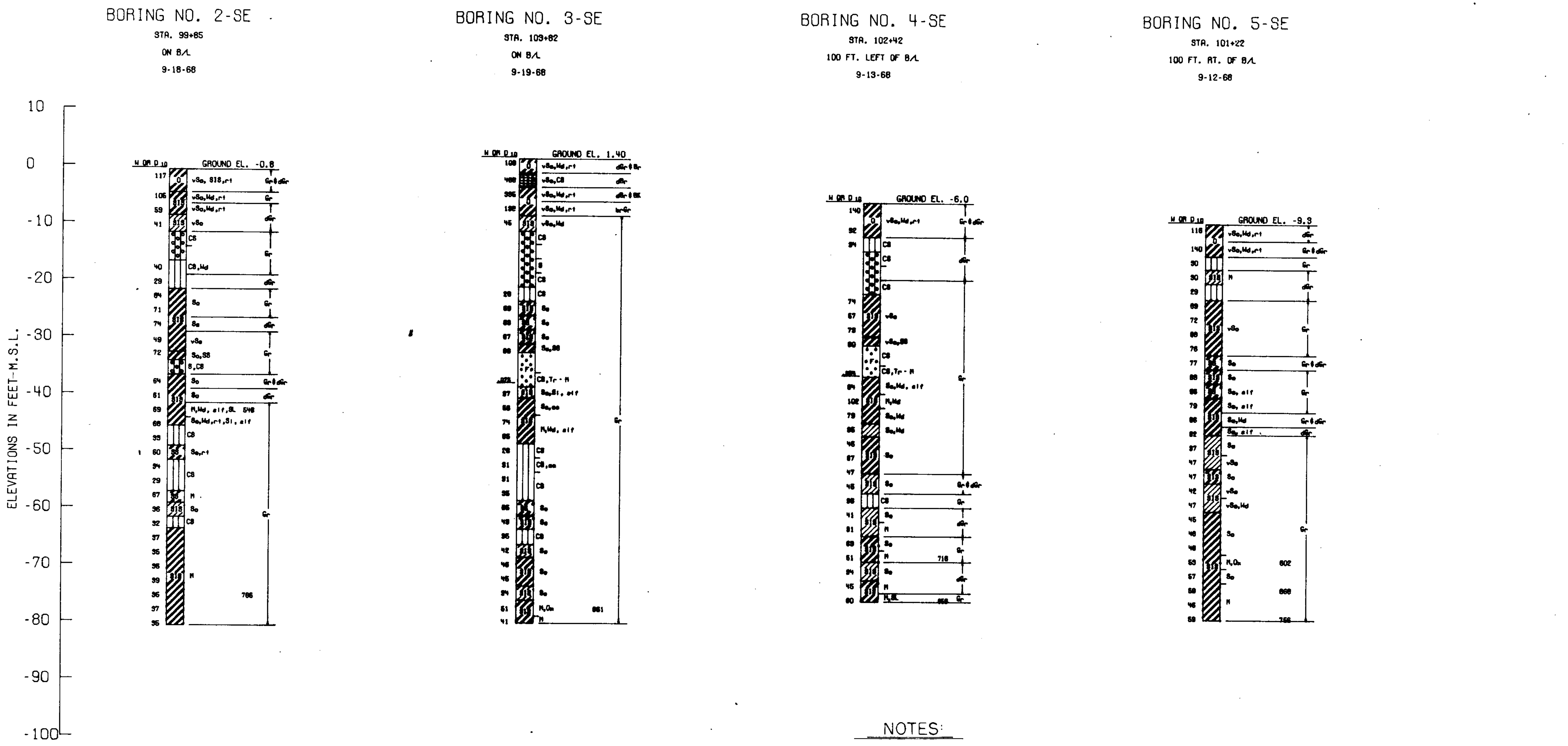

NOTES:

GENERAL TYPE BORINGS TAKEN WITH A 1⅞" I.D. CORE BARREL SAMPLER.

FOR SOIL BORING LEGEND, SEE PLATE A.

FOR LOCATION OF BORINGS SEE Plate III-18

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN

REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

GENERAL TYPE BORINGS

Nos. 2-SE, 3-SE, 4-SE & 5-SE

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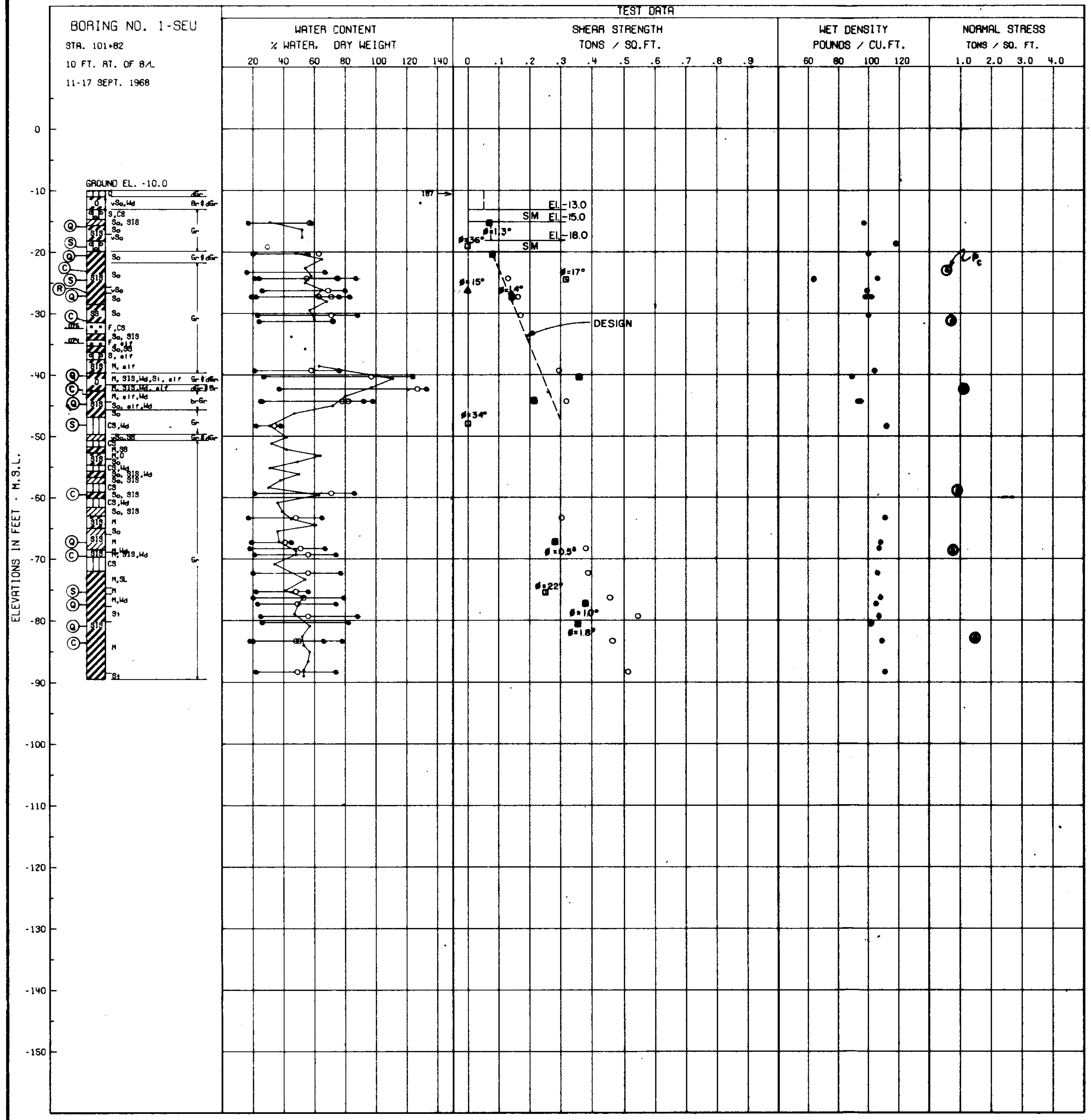
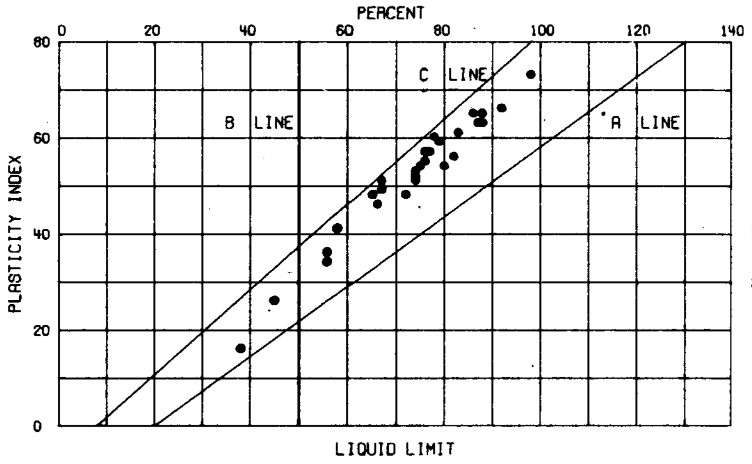
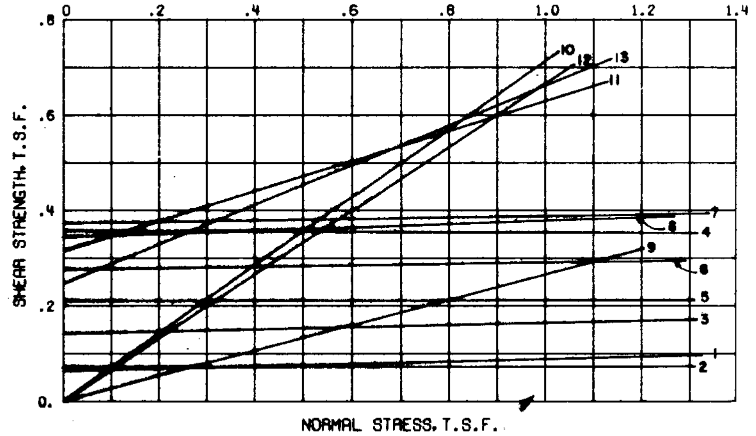


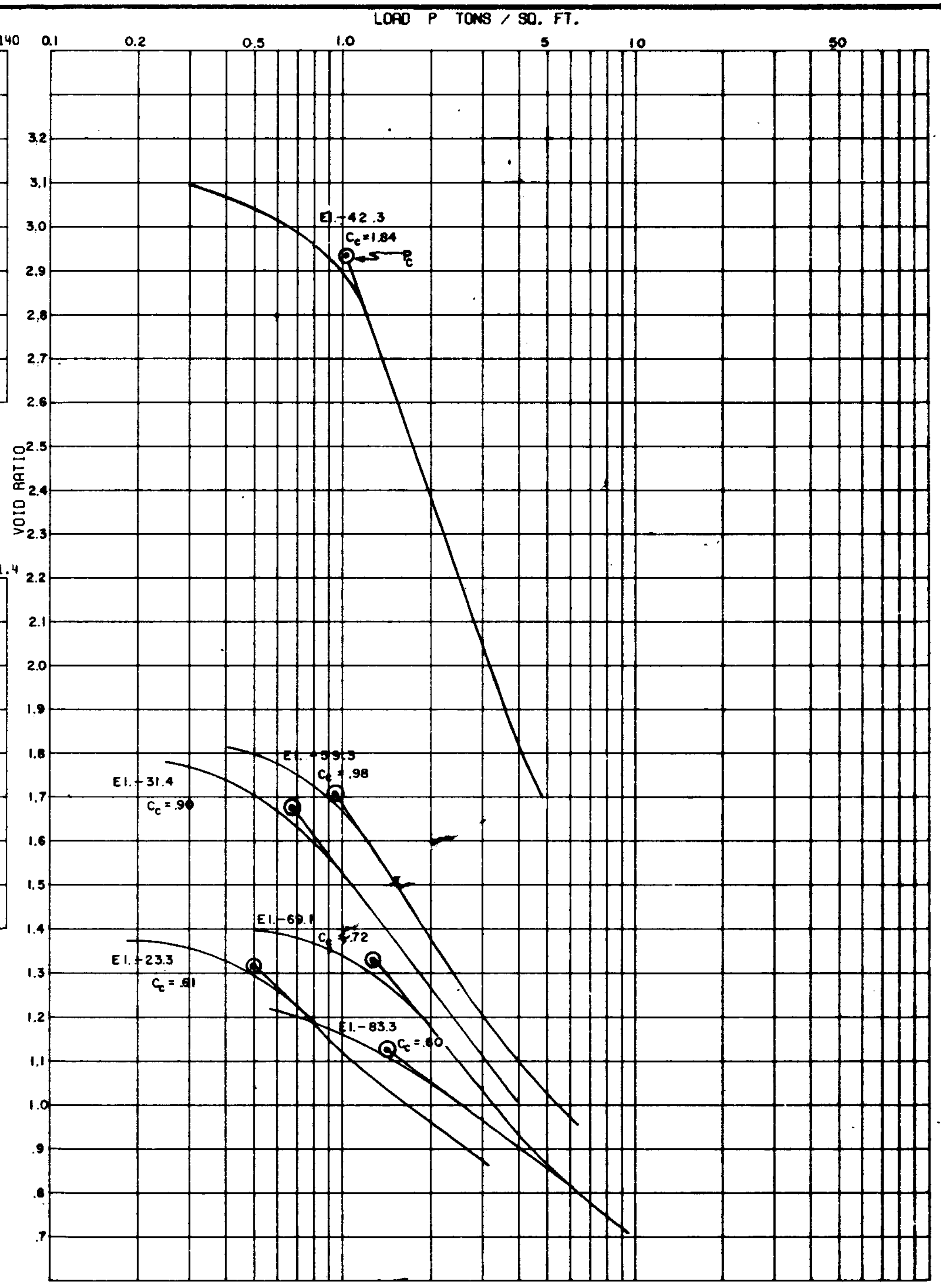


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
1-SEU	1	- 15.8	Q	1.3°	0.07	CH
	2	- 20.9		0°	0.08	CH
	3	- 27.1		1.4°	0.14	CH
	4	- 40.1		0°	0.36	CH
	5	- 44.9		0°	0.22	CH
	6	- 67.3		0.5°	0.28	CH
	7	- 77.0		1.0°	0.38	CH
	8	- 80.9		1.8°	0.35	CH
	9	- 26.4	R	15°	0	CH
	10	- 19.2	S	36°	0	SM
	11	- 24.8		17°	0.32	CH
	12	- 48.9		34°	0	ML
	13	- 75.2		22°	0.25	CH



CONSOLIDATION DATA

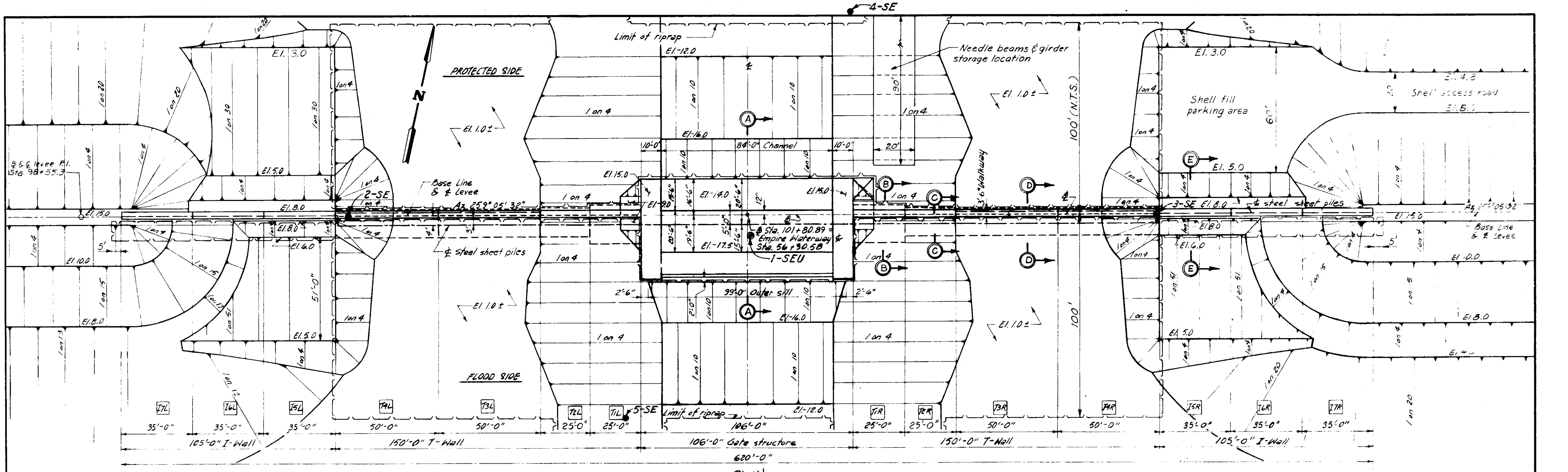
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

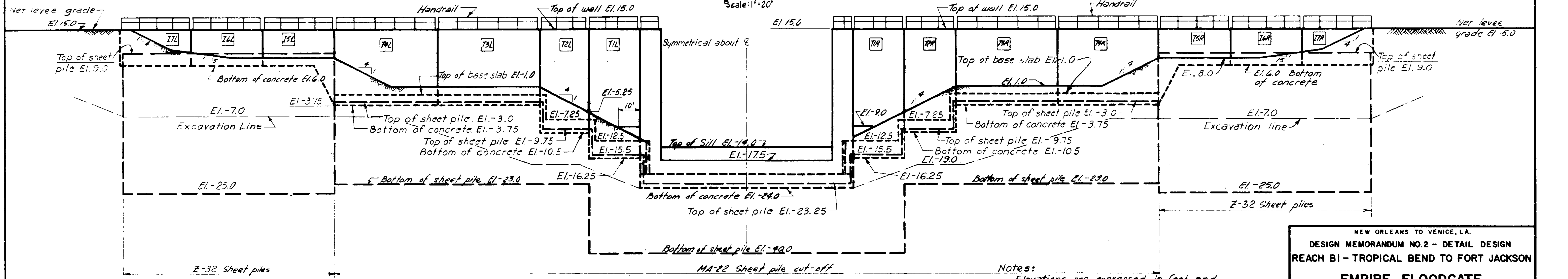
FOR LOCATION OF BORINGS SEE PLATE III - 18

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 — DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON
EMPIRE FLOODGATE
UNDISTURBED BORING
1-SEU DATA
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS



PLAN

Scale: 1" = 20'



FLOODSIDE ELEVATION

Scale: 1" = 20' Horiz.
1" = 10' Vert.

SOIL BORING LEGEND

- ● - General type Soil Boring
- ◉ - 5" dia. Undisturbed Soil Boring

Notes:

Elevations are expressed in feet and refer to mean sea level.

For tie-in to existing levee, see plate III-1
For sections, see plate III-19
For Soil Boring logs see plates III-16 and III-17

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
PLAN AND ELEVATION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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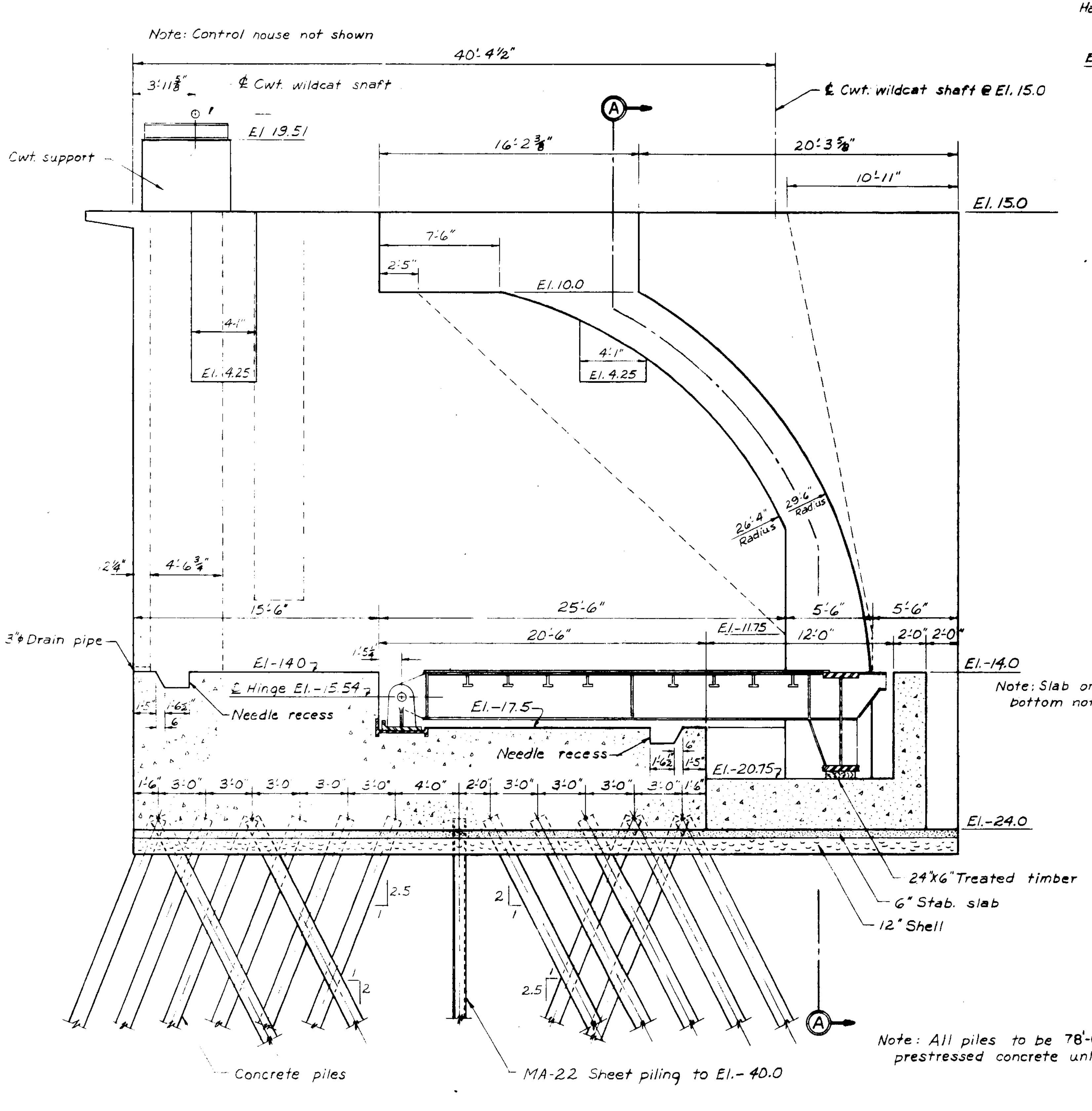
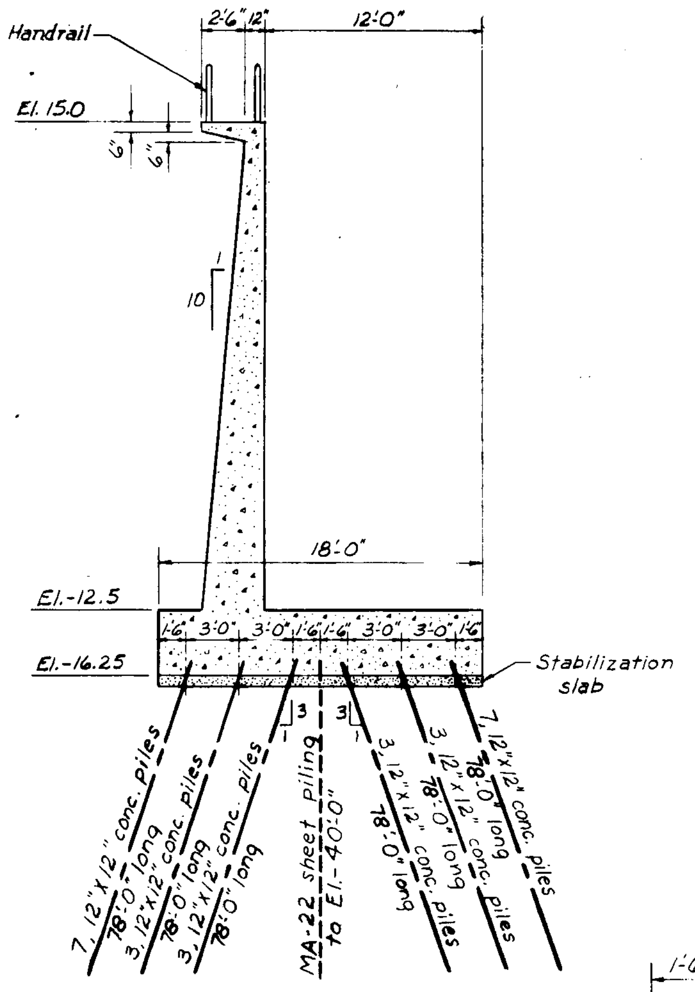


SECTIONAL ELEVATION

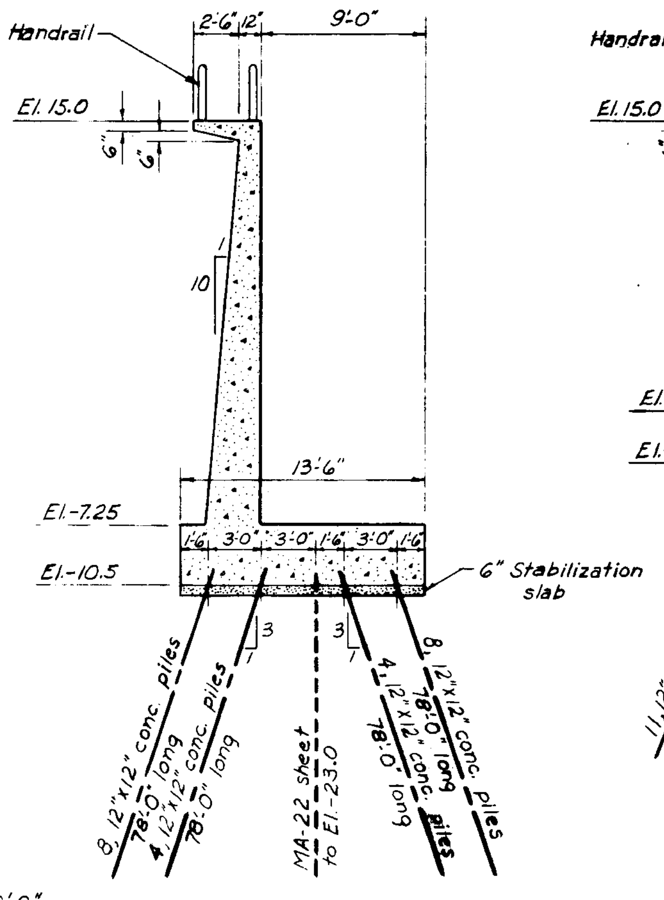
Scale: ¼"=1'-0"

Note: All piles to be 78'-0" long 12"x12" prestressed concrete unless otherwise noted.



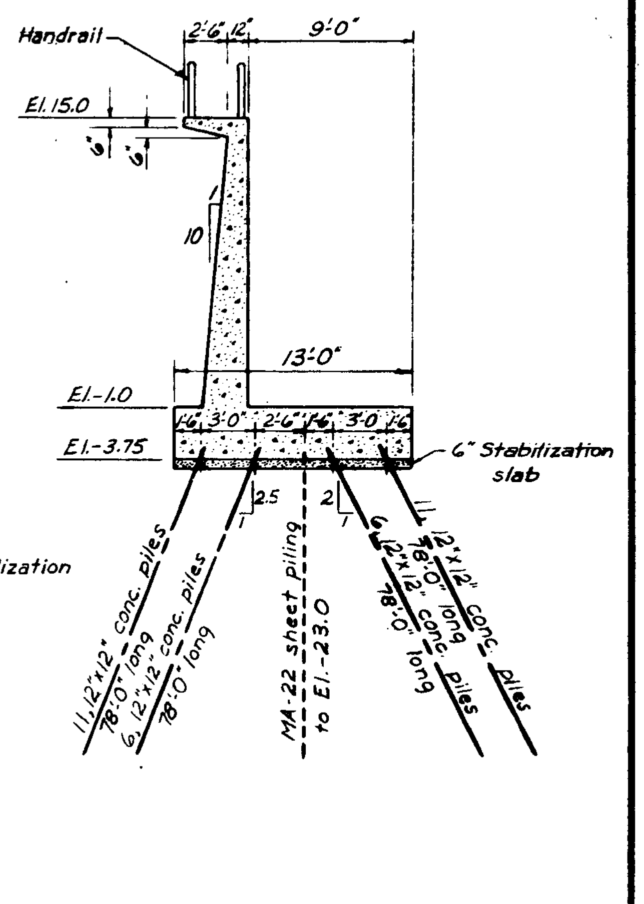
SECTION B-B

Scale: 3/16"=1'-0"



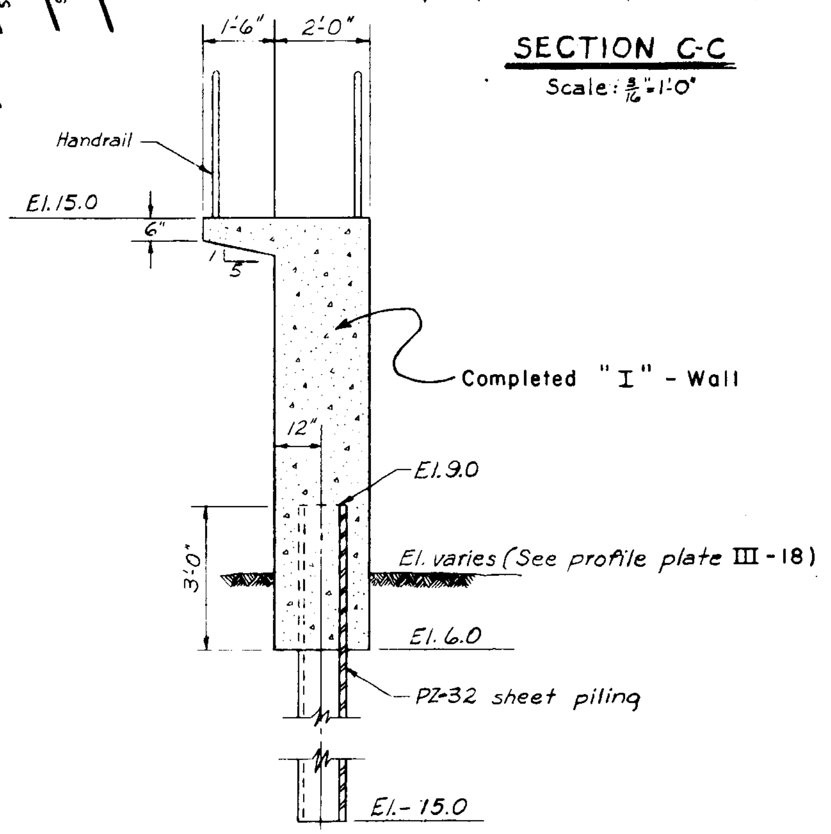
SECTION C-C

Scale: 3/16"=1'-0"



SECTION D-D

Scale: 3/16"=1'-0"



SECTION E-E

Scale: ½"=1'-0"

Note: Elevations are expressed in feet and refer to mean sea level.
For Section A-A, see plate III-20

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
FLAP GATE MONOLITH
SECTIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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OCTOBER 1970
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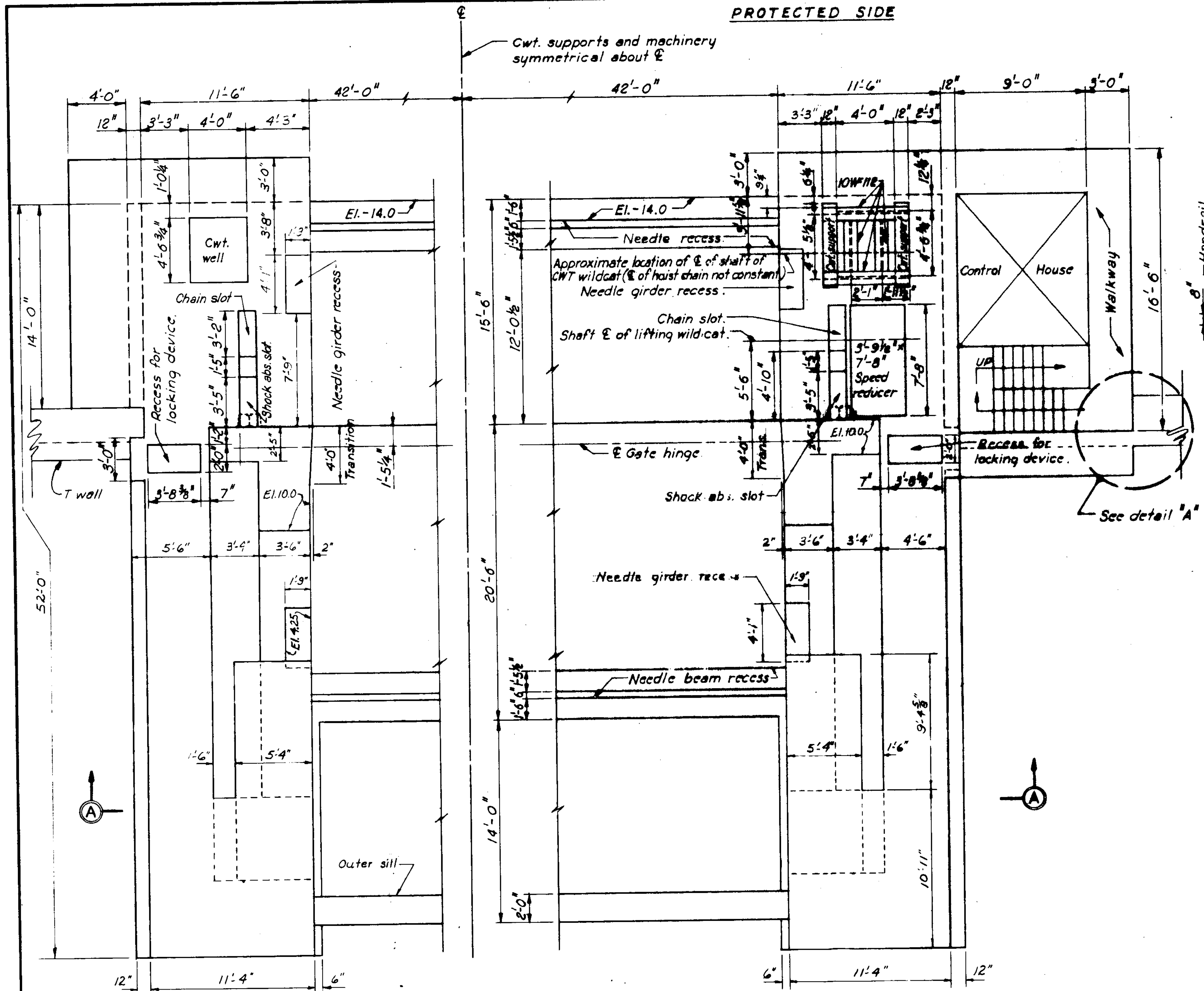
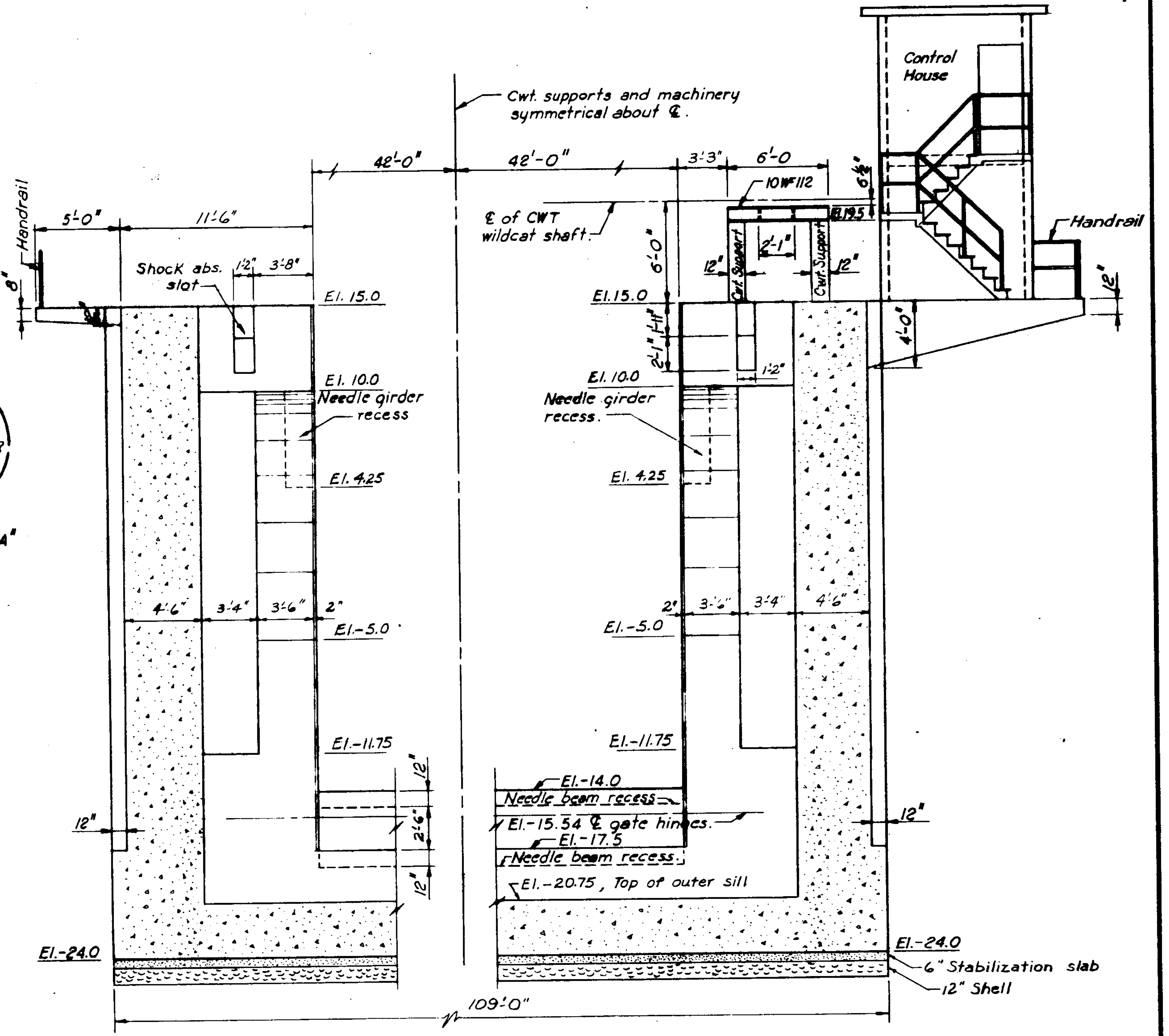


PLAN
Scale: ¼" = 1'-0"



SECTION A-A
Scale: ¼" = 1'-0"

Note:
Elevations are expressed in feet and refer to mean sea level.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1-TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
FLAP GATE MONOLITH
PLAN AND SECTION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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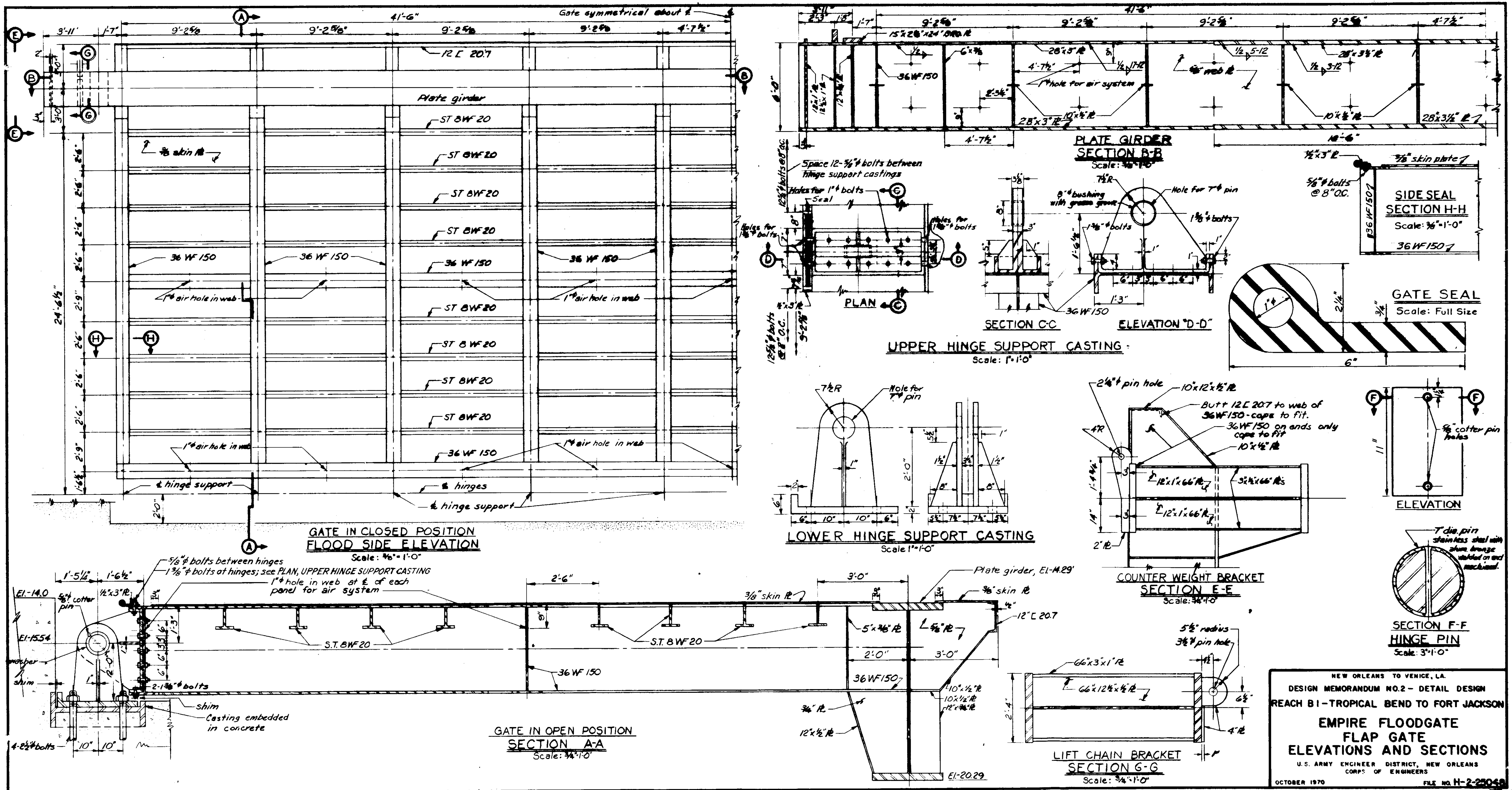
PLATE III-20



NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
FLAP GATE
ELEVATIONS AND SECTIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

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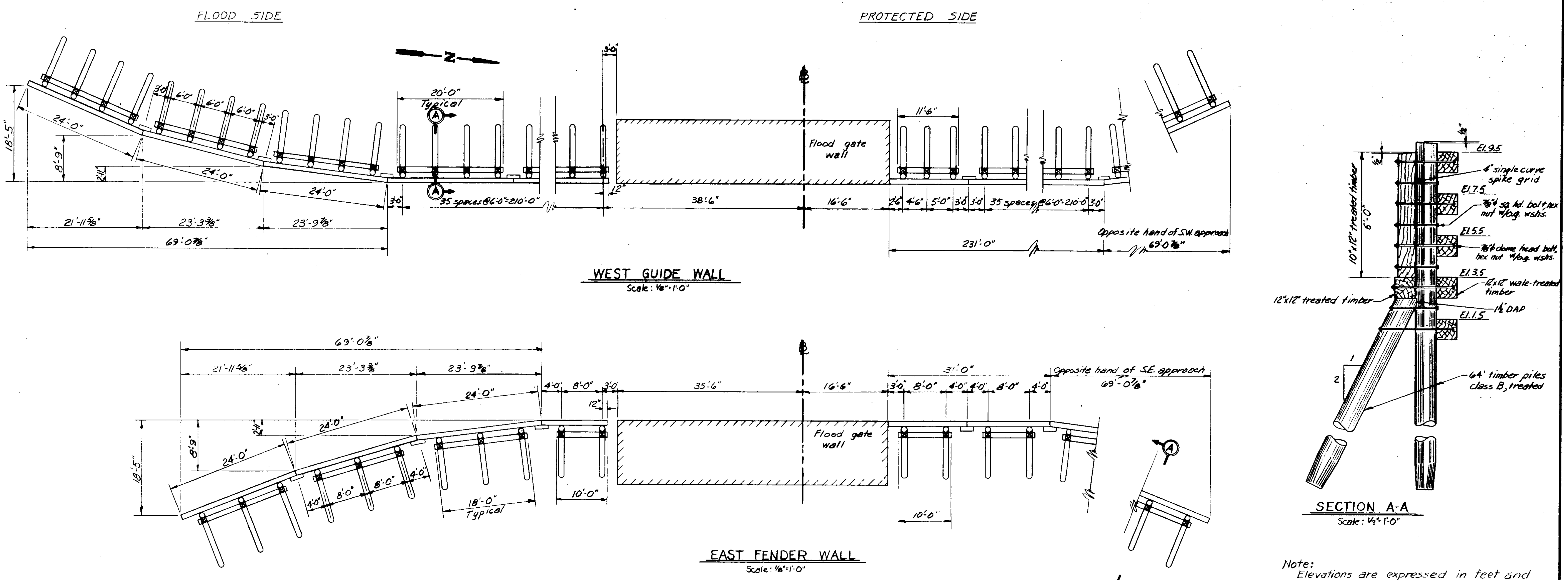

Note:
Elevations are expressed in feet and refer to mean sea level.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

GUIDE WALL AND FENDER WALL

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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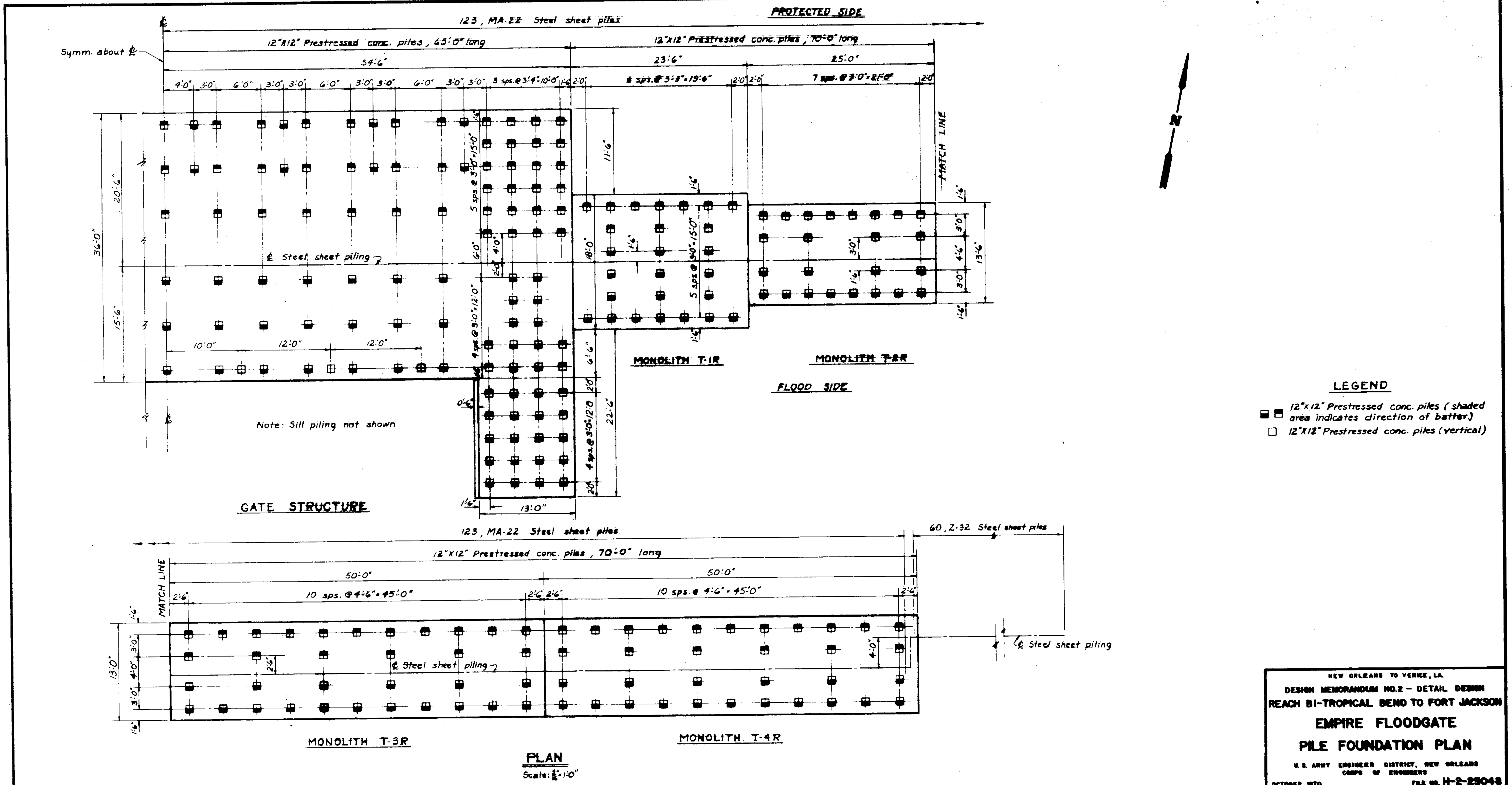

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO.2 – DETAIL DESIGN

REACH B1-TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

PILE FOUNDATION PLAN

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER, 1970
REVISED OCTOBER 1971

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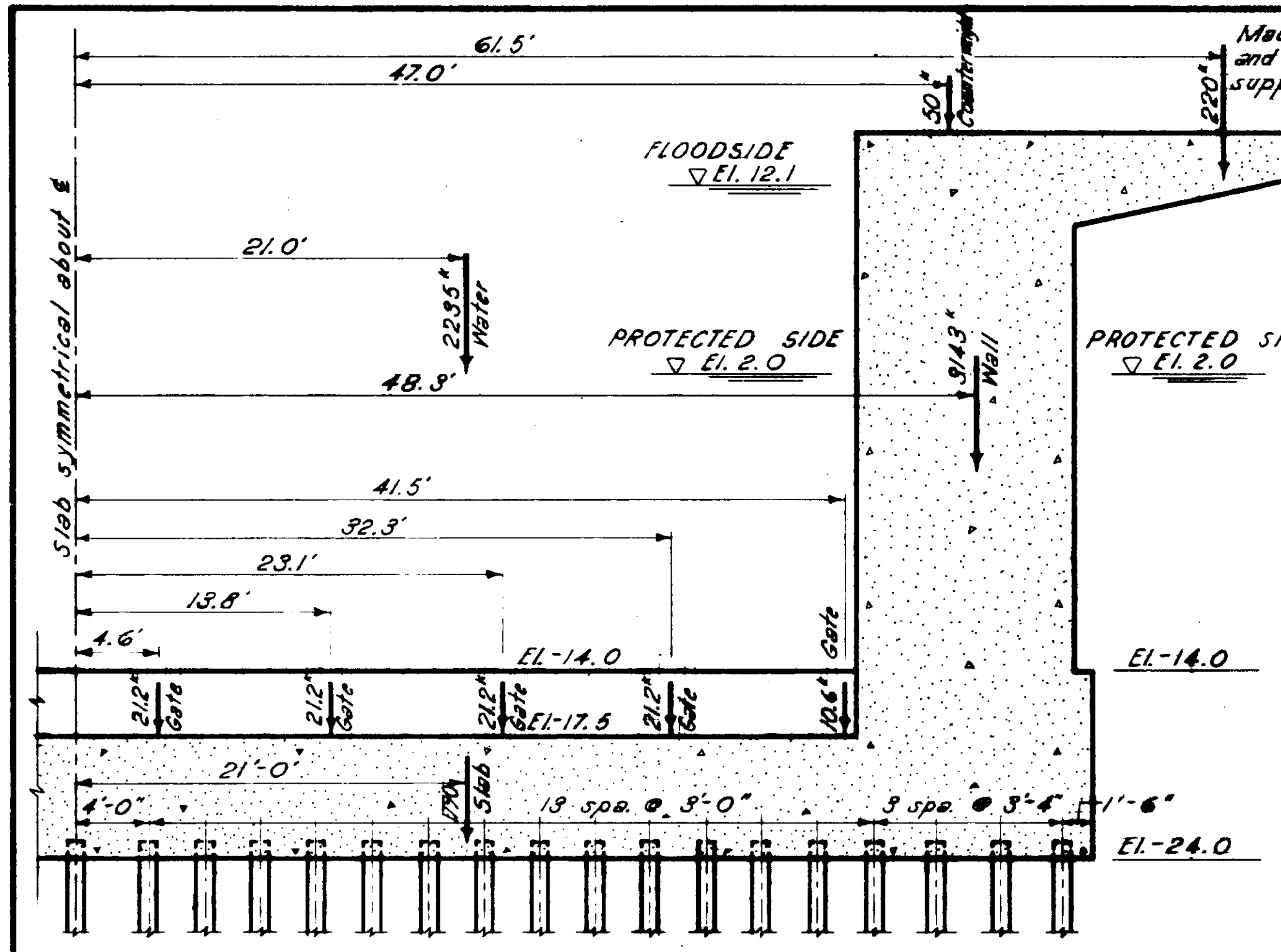
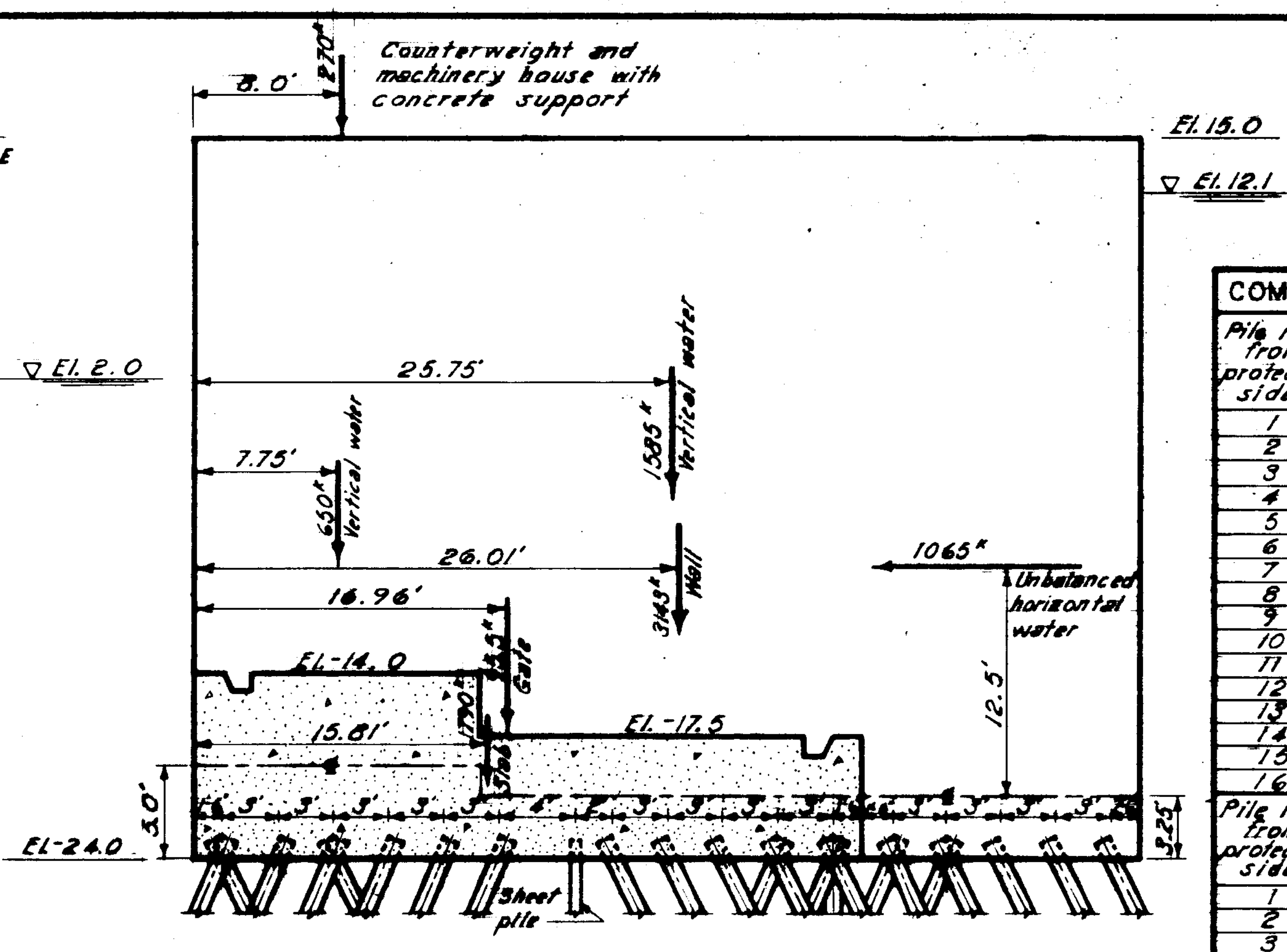


LOADING DIAGRAM

TRANSVERSE SECTION

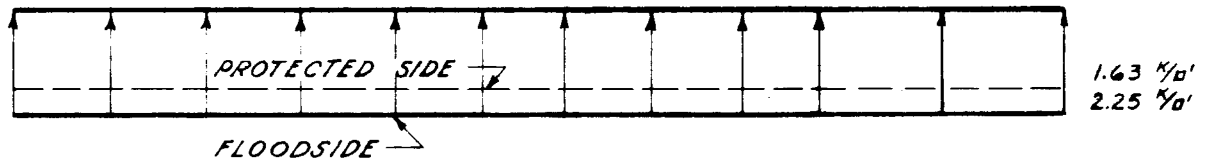
Scale: 1" = 5'



LOADING DIAGRAM

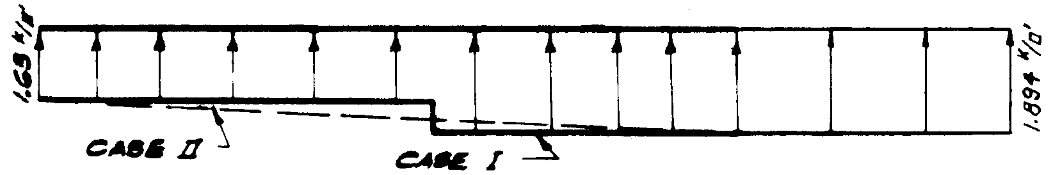
LONGITUDINAL SECTION

Scale: 1" = 5'



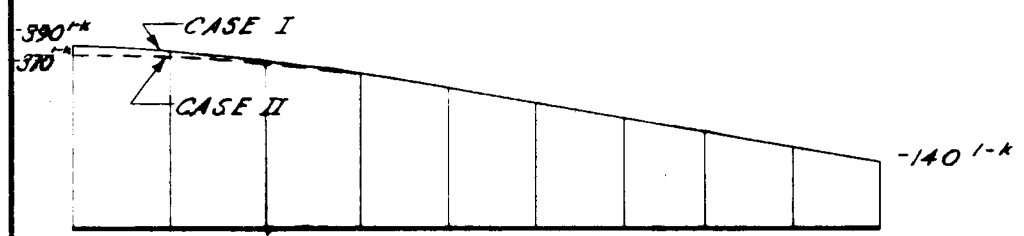
UPLIFT

Scale: 1" = 2 k/□'



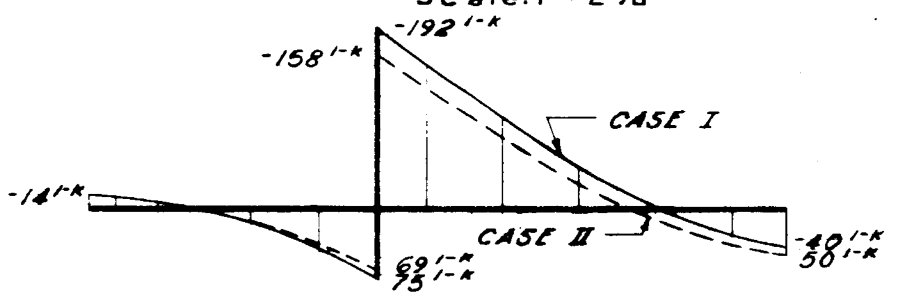
UPLIFT

Scale: 1" = 2 k/□



MOMENT DIAGRAM

Scale: 1" = 200 1-K



MOMENT DIAGRAM

Scale: 1" = 100 1-K

COMPUTED PILE LOADS BY HRENNIKOFF METHOD

Pile row from protected side	Dist. from protected side (Ft.)	CASE I					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	62.77	4.0	4.89	0	0.0
2	4.5	4.0	63.06	0	0.0	0	0.0
3	7.5	10.5	63.34	4.0	5.43	0	0.0
4	10.5	4.0	63.62	0	0.0	0	0.0
5	13.5	10.5	63.91	0	0.0	0	0.0
6	16.5	4.0	64.19	0	0.0	0	0.0
7	22.5	0	0.0	8.5	6.79	0	0.0
8	25.5	0	0.0	2.0	7.07	0	0.0
9	28.5	0	0.0	8.5	7.34	0	0.0
10	31.5	2.0	65.61	2.0	7.61	0	0.0
11	34.5	2.0	65.89	8.5	7.88	3.0	43.34
12	37.5	2.0	66.17	2.0	8.16	0	0.0
13	40.5	2.0	66.46	2.0	8.43	0	0.0
14	43.5	0	0.0	4.0	8.70	0	0.0
15	46.5	0	0.0	4.0	8.98	0	0.0
16	49.5	0	0.0	4.0	9.25	0	0.0

Pile row from protected side	Dist. from protected side (Ft.)	CASE II					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	60.47	4.0	-0.18	0	0.0
2	4.5	4.0	61.29	0	0.0	0	0.0
3	7.5	10.5	62.12	4.0	1.41	0	0.0
4	10.5	4.0	62.94	0	0.0	0	0.0
5	13.5	10.5	63.76	0	0.0	0	0.0
6	16.5	4.0	64.58	0	0.0	0	0.0
7	22.5	0	0.0	8.5	5.36	0	0.0
8	25.5	0	0.0	2.0	6.15	0	0.0
9	28.5	0	0.0	8.5	6.94	0	0.0
10	31.5	2.0	68.68	2.0	7.73	0	0.0
11	34.5	2.0	69.50	8.5	8.52	3.0	45.82
12	37.5	2.0	70.32	2.0	9.31	0	0.0
13	40.5	2.0	71.14	2.0	10.10	0	0.0
14	43.5	0	0.0	4.0	10.89	0	0.0
15	46.5	0	0.0	4.0	11.68	0	0.0
16	49.5	0	0.0	4.0	12.47	0	0.0

Notes:

Elevations are expressed in feet and refer to mean sea level.
Loads shown are for one-half of the structure.
Moments shown are for a one foot wide strip.

*Case I: Operating condition, gate closed. Water elevation 12.1 on Floodside, and elevation 2.0 on Protected side, sheet pile cutoff considered impervious, pile reactions assumed uniformly distributed in transverse direction.

*Case II: Same as Case I except sheet pile cutoff considered to be pervious.

*Cases I and II are Group I loadings.

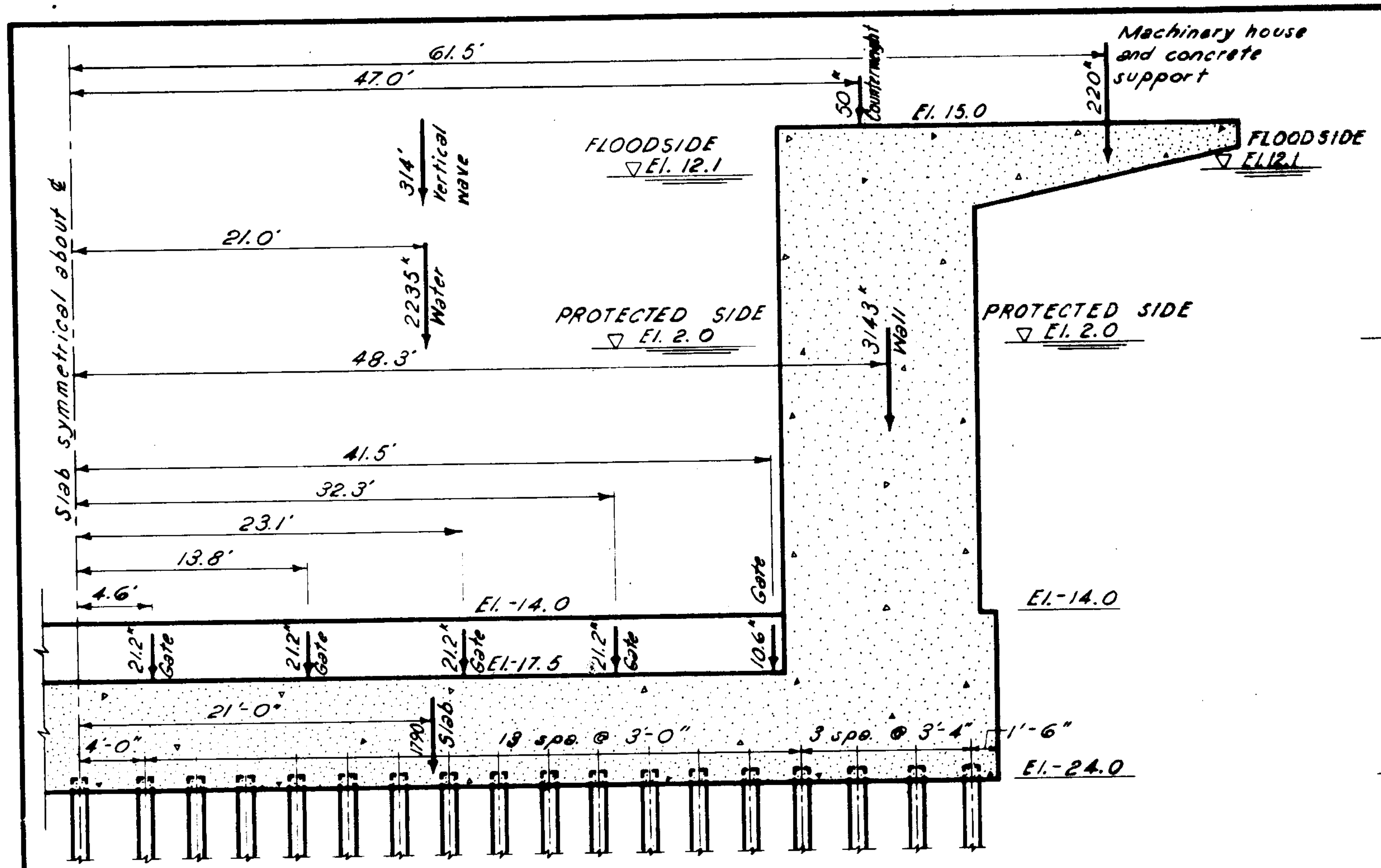
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH BI - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
MOMENT DIAGRAMS AND PILE REACTIONS FOR BASE SLAB

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970
REVISED OCTOBER 1971

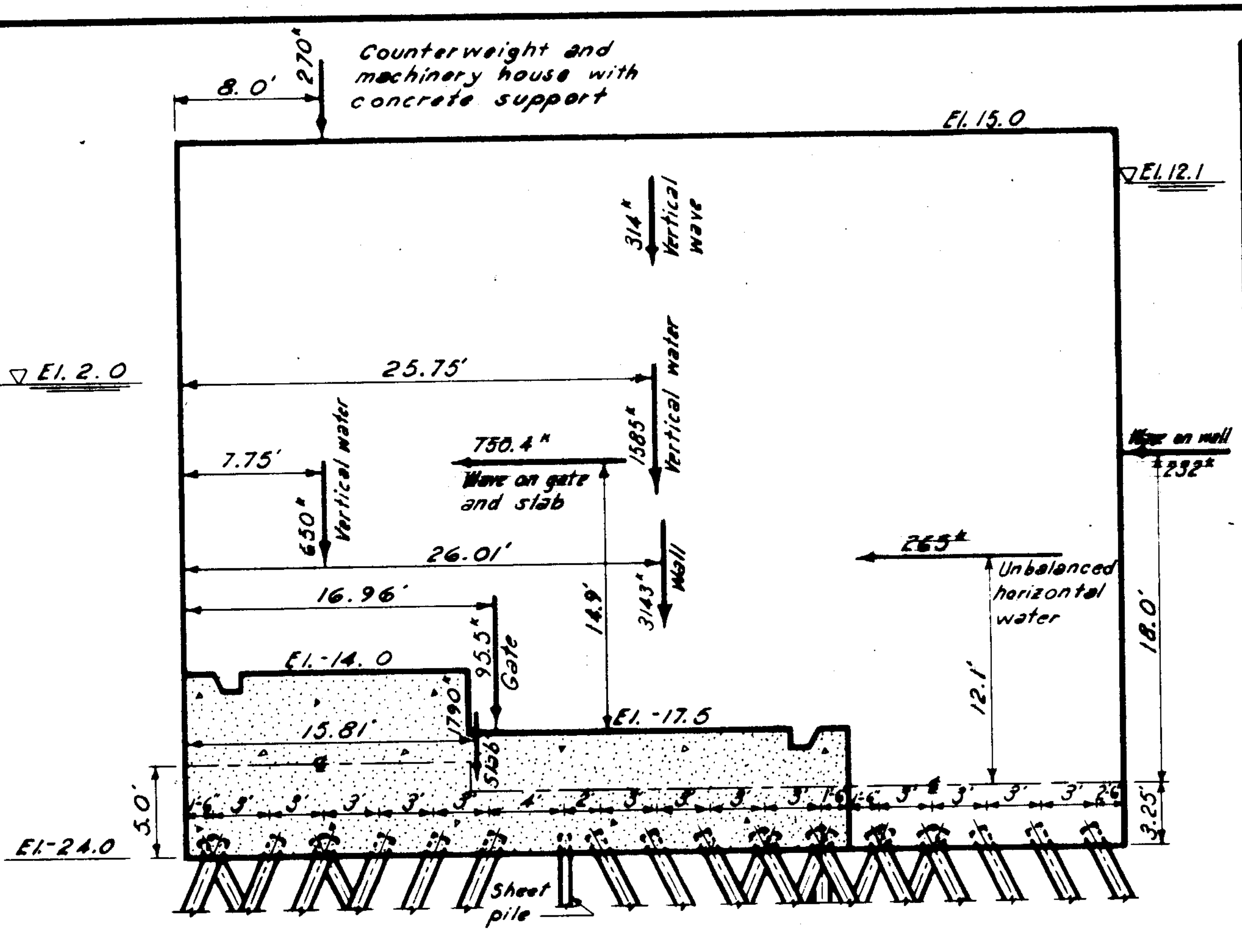
FILE NO. H-2-25048



LOADING DIAGRAM

TRANSVERSE SECTION

Scale: 1" = 5'



LOADING DIAGRAM

LONGITUDINAL SECTION

Scale: 1" = 5'

Pile row from protected side	Dist. from protected side (Ft)	CASE III					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	89.45	4.0	-12.24	0	0.0
2	4.5	4.0	89.48	0	0.0	0	0.0
3	7.5	10.5	89.51	4.0	-12.19	0	0.0
4	10.5	4.0	89.53	0	0.0	0	0.0
5	13.5	10.5	89.56	0	0.0	0	0.0
6	16.5	4.0	89.59	0	0.0	0	0.0
7	22.5	0	0.0	8.5	-12.06	0	0.0
8	25.5	0	0.0	2.0	-12.03	0	0.0
9	28.5	0	0.0	8.5	-12.01	0	0.0
10	31.5	2.0	89.72	2.0	-11.98	0	0.0
11	34.5	2.0	89.75	8.5	-11.96	3	47.76
12	37.5	2.0	89.78	2.0	-11.93	0	0.0
13	40.5	2.0	89.80	2.0	-11.91	0	0.0
14	43.5	0	0.0	4.0	-11.88	0	0.0
15	46.5	0	0.0	4.0	-11.85	0	0.0
16	49.5	0	0.0	4.0	-11.83	0	0.0

Pile row from protected side	Dist. from protected side (Ft)	CASE IV					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	87.21	4.0	-17.17	0	0.0
2	4.5	4.0	87.76	0	0.0	0	0.0
3	7.5	10.5	88.31	4.0	-16.11	0	0.0
4	10.5	4.0	88.86	0	0.0	0	0.0
5	13.5	10.5	89.41	0	0.0	0	0.0
6	16.5	4.0	89.96	0	0.0	0	0.0
7	22.5	0	0.0	8.5	-13.46	0	0.0
8	25.5	0	0.0	2.0	-12.93	0	0.0
9	28.5	0	0.0	8.5	-12.40	0	0.0
10	31.5	2.0	92.71	2.0	-11.87	0	0.0
11	34.5	2.0	93.26	8.5	-11.34	3	50.17
12	37.5	2.0	93.81	2.0	-10.81	0	0.0
13	40.5	2.0	94.36	2.0	-10.28	0	0.0
14	43.5	0	0.0	4.0	-9.75	0	0.0
15	46.5	0	0.0	4.0	-9.22	0	0.0
16	49.5	0	0.0	4.0	-8.69	0	0.0

Notes:

Elevations are expressed in feet and refer to mean sea level.

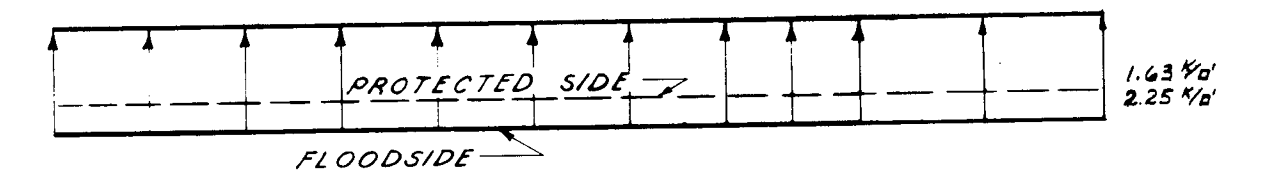
Loads shown are for one-half of the structure.

Moments shown are for a one foot wide strip.

Case III: Flood w/wave, gate closed, SWL at 12.1 on floodside and 2.0 on protected side, 100% uplift w/impervious cutoff.

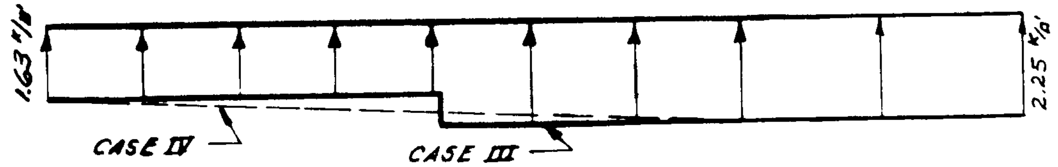
Case IV: Flood w/wave, same as III except uplift with with pervious cutoff.

Cases III and IV are Group 2 loadings.



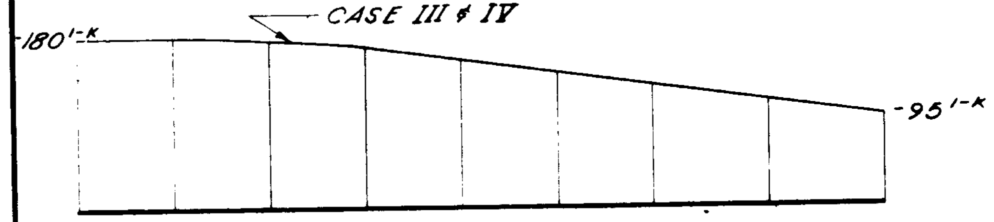
UPLIFT

Scale: 1" = 2 k/□'



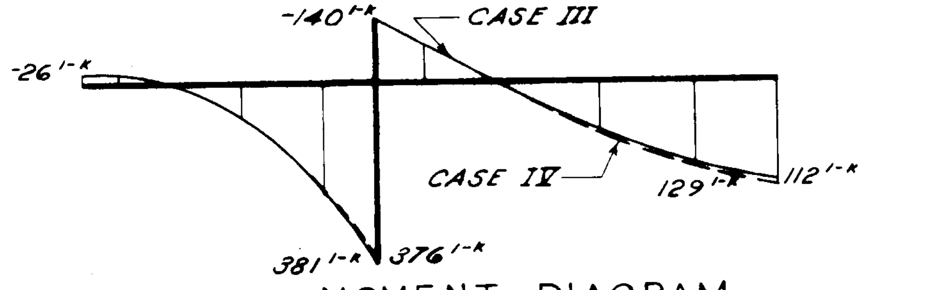
UPLIFT

Scale: 1" = 2 k/□



MOMENT DIAGRAM

Scale: 1" = 100'-k



MOMENT DIAGRAM

Scale: 1" = 200'-k

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO.2 - DETAIL DESIGN

REACH B1 - TROPICAL BEND TO FORT JACKSON

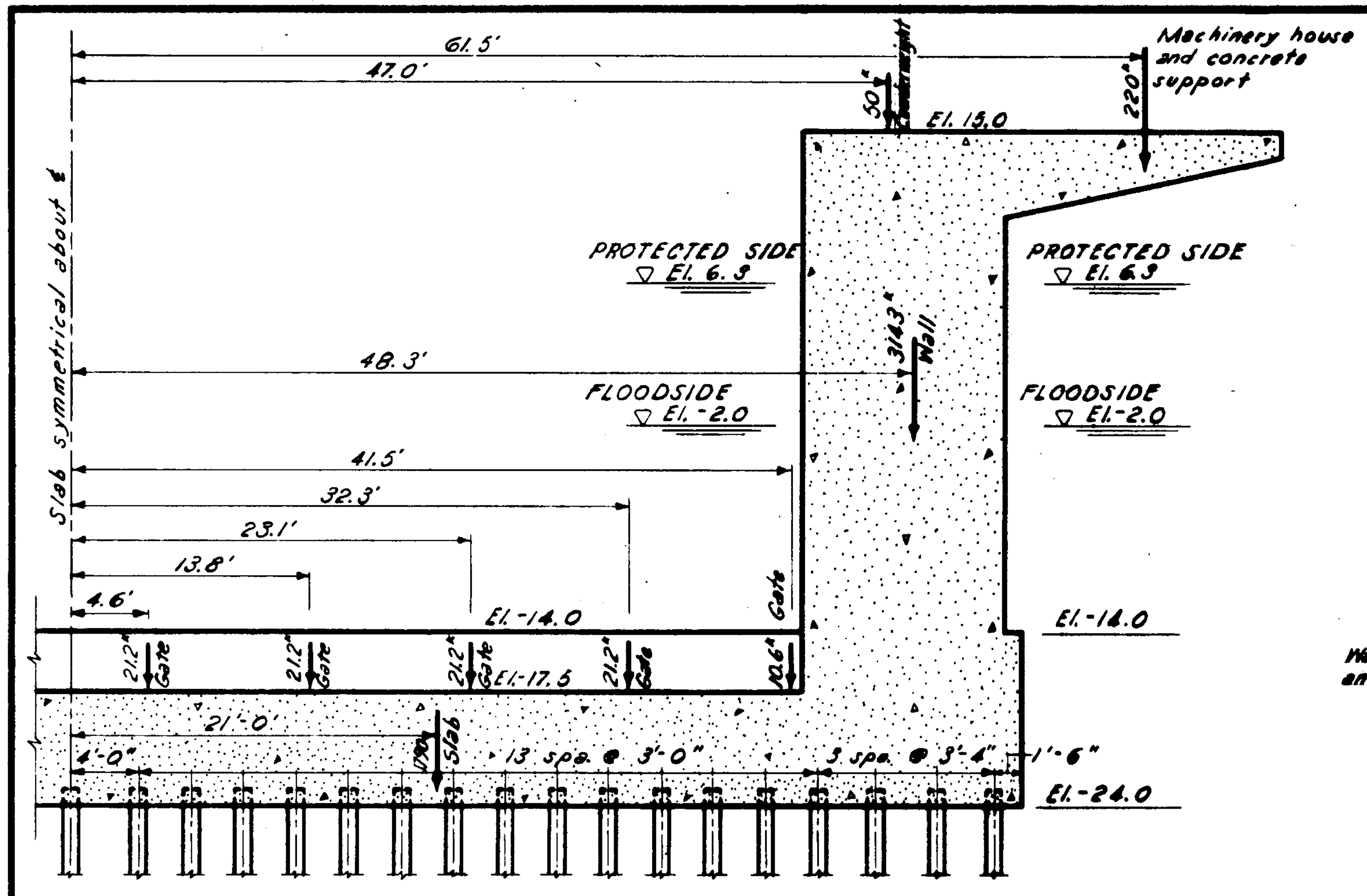
EMPIRE FLOODGATE

MOMENT DIAGRAMS AND PILE REACTIONS FOR BASE SLAB

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970
REVISED OCTOBER 1971

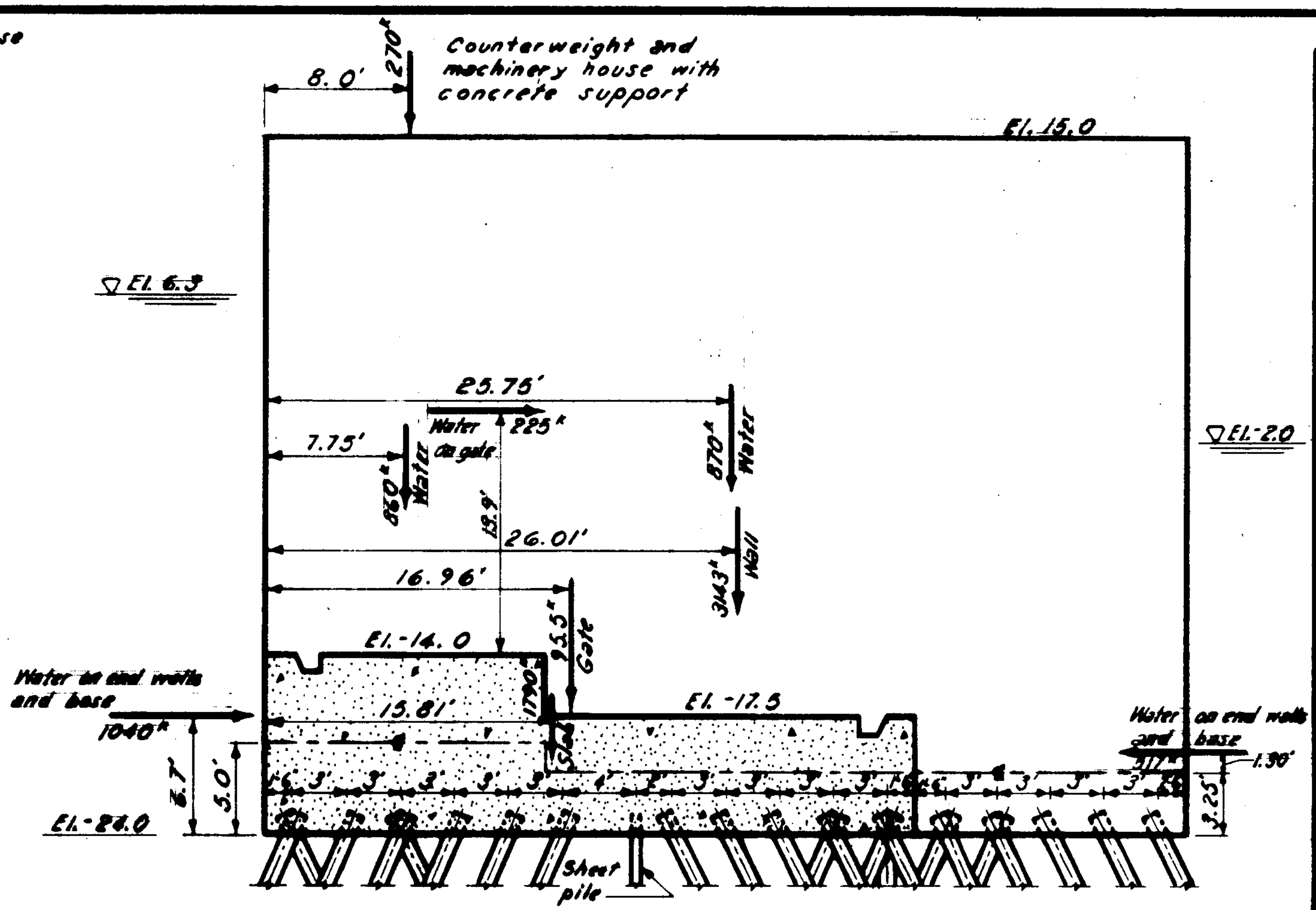
FILE NO. H-2-25049



LOADING DIAGRAM

TRANSVERSE SECTION

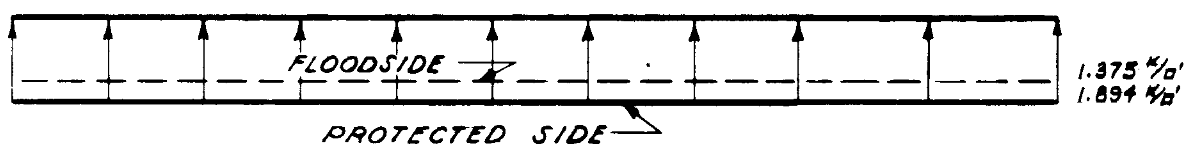
Scale: 1" = 5'



LOADING DIAGRAM

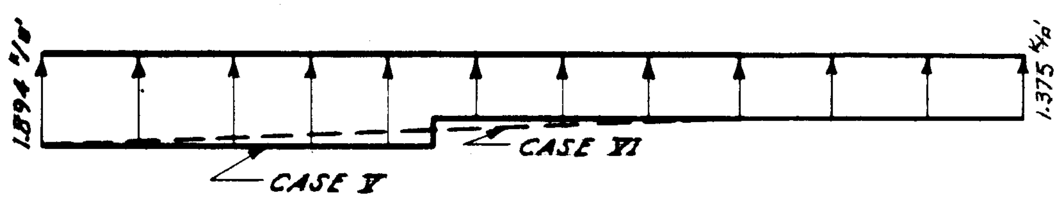
LONGITUDINAL SECTION

Scale: 1" = 5'



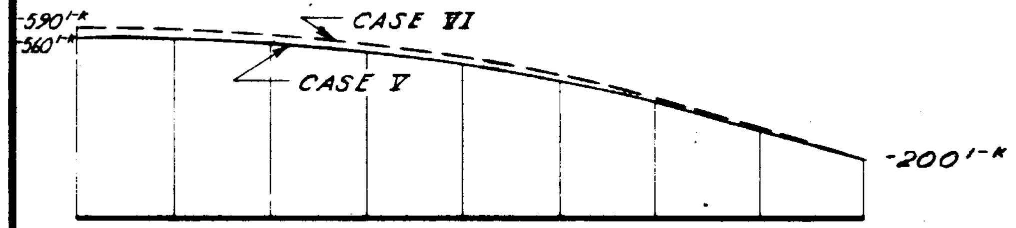
UPLIFT

Scale: 1" = 2 k/□'



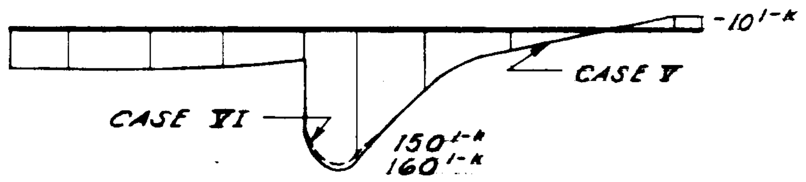
UPLIFT

Scale: 1" = 2 k/□



MOMENT DIAGRAM

Scale: 1" = 300'-K



MOMENT DIAGRAM

Scale: 1" = 100'-K

COMPUTED PILE LOADS BY HRENNIKOFF METHOD

Pile row from protected side	Dist from protected side (Ft.)	CASE V					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	28.35	4.0	44.97	0	0.0
2	4.5	4.0	28.14	0	0.0	0	0.0
3	7.5	10.5	27.93	4.0	44.56	0	0.0
4	10.5	4.0	27.72	0	0.0	0	0.0
5	13.5	10.5	27.51	0	0.0	0	0.0
6	16.5	4.0	27.30	0	0.0	0	0.0
7	22.5	0	0.0	8.5	43.56	0	0.0
8	25.5	0	0.0	2.0	43.35	0	0.0
9	28.5	0	0.0	8.5	43.15	0	0.0
10	31.5	2.0	26.26	2.0	42.95	0	0.0
11	34.5	2.0	26.05	8.5	42.75	3	36.83
12	37.5	2.0	25.84	2.0	42.55	0	0.0
13	40.5	2.0	25.63	2.0	42.35	0	0.0
14	43.5	0	0.0	4.0	42.15	0	0.0
15	46.5	0	0.0	4.0	41.95	0	0.0
16	49.5	0	0.0	4.0	41.74	0	0.0

Pile row from protected side	Dist from protected side (Ft)	CASE VI					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	29.13	4.0	44.70	0	0.0
2	4.5	4.0	28.56	0	0.0	0	0.0
3	7.5	10.5	28.00	4.0	44.62	0	0.0
4	10.5	4.0	27.44	0	0.0	0	0.0
5	13.5	10.5	26.87	0	0.0	0	0.0
6	16.5	4.0	26.31	0	0.0	0	0.0
7	22.5	0	0.0	8.5	43.91	0	0.0
8	25.5	0	0.0	2.0	43.97	0	0.0
9	28.5	0	0.0	8.5	42.83	0	0.0
10	31.5	2.0	23.50	2.0	42.28	0	0.0
11	34.5	2.0	22.94	8.5	41.74	3	34.47
12	37.5	2.0	22.37	2.0	41.20	0	0.0
13	40.5	2.0	21.81	2.0	40.66	0	0.0
14	43.5	0	0.0	4.0	40.12	0	0.0
15	46.5	0	0.0	4.0	39.57	0	0.0
16	49.5	0	0.0	4.0	39.03	0	0.0

Notes:

Elevations are expressed in feet and refer to mean sea level.

Loads shown are for one-half of the structure.

Moments shown are for a one foot wide strip.

Case V: Reverse head, gate closed, still water level at -2' M.S.L. on floodside and 6.3' M.S.L. on protected side, 100% uplift with impervious cutoff.

Case VI: Same as Case V except sheet pile cutoff is pervious.

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN

REACH B1 - TROPICAL BEND TO FORT JACKSON

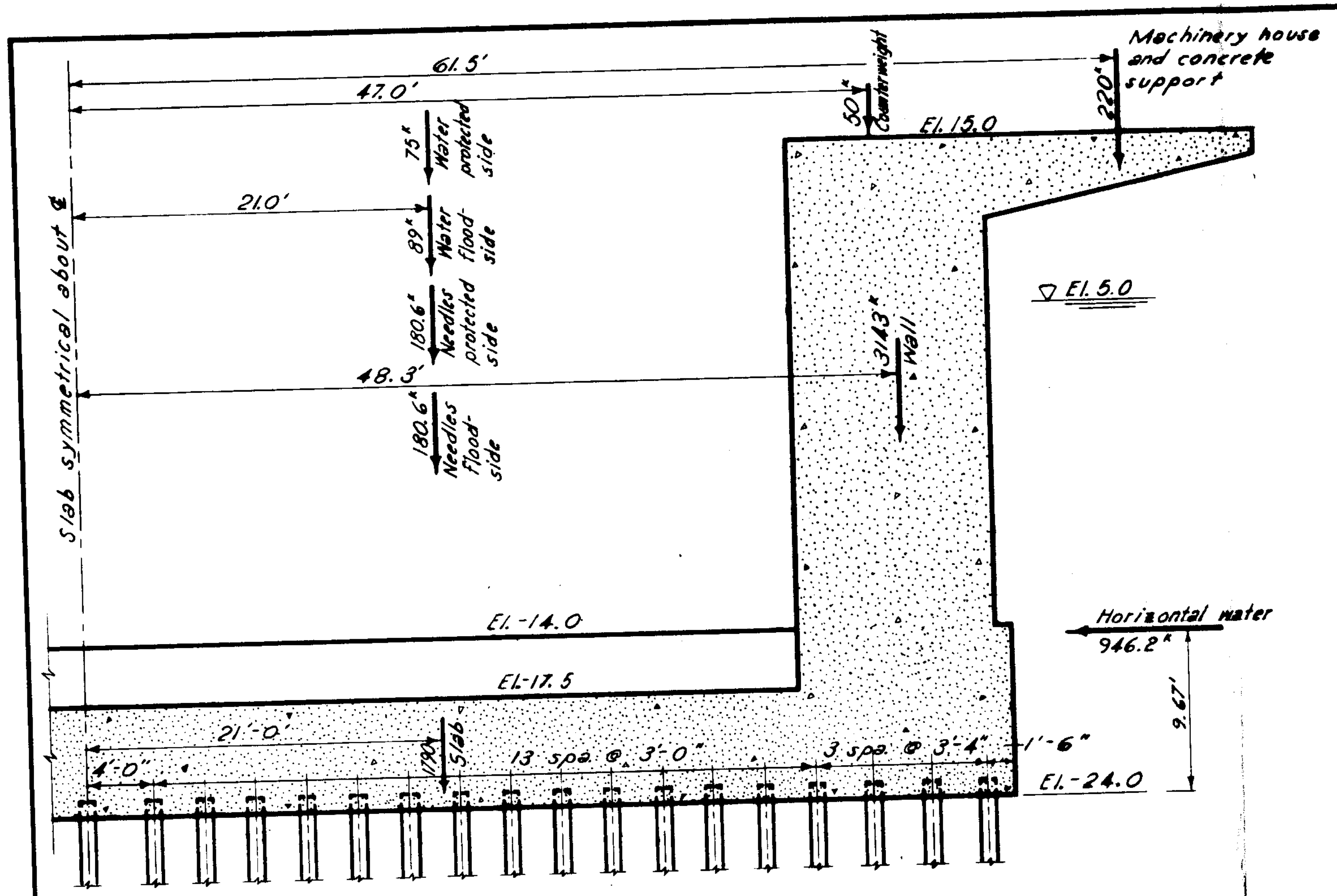
EMPIRE FLOODGATE

MOMENT DIAGRAMS AND PILE REACTIONS FOR BASE SLAB

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970
REVISED OCTOBER 1971

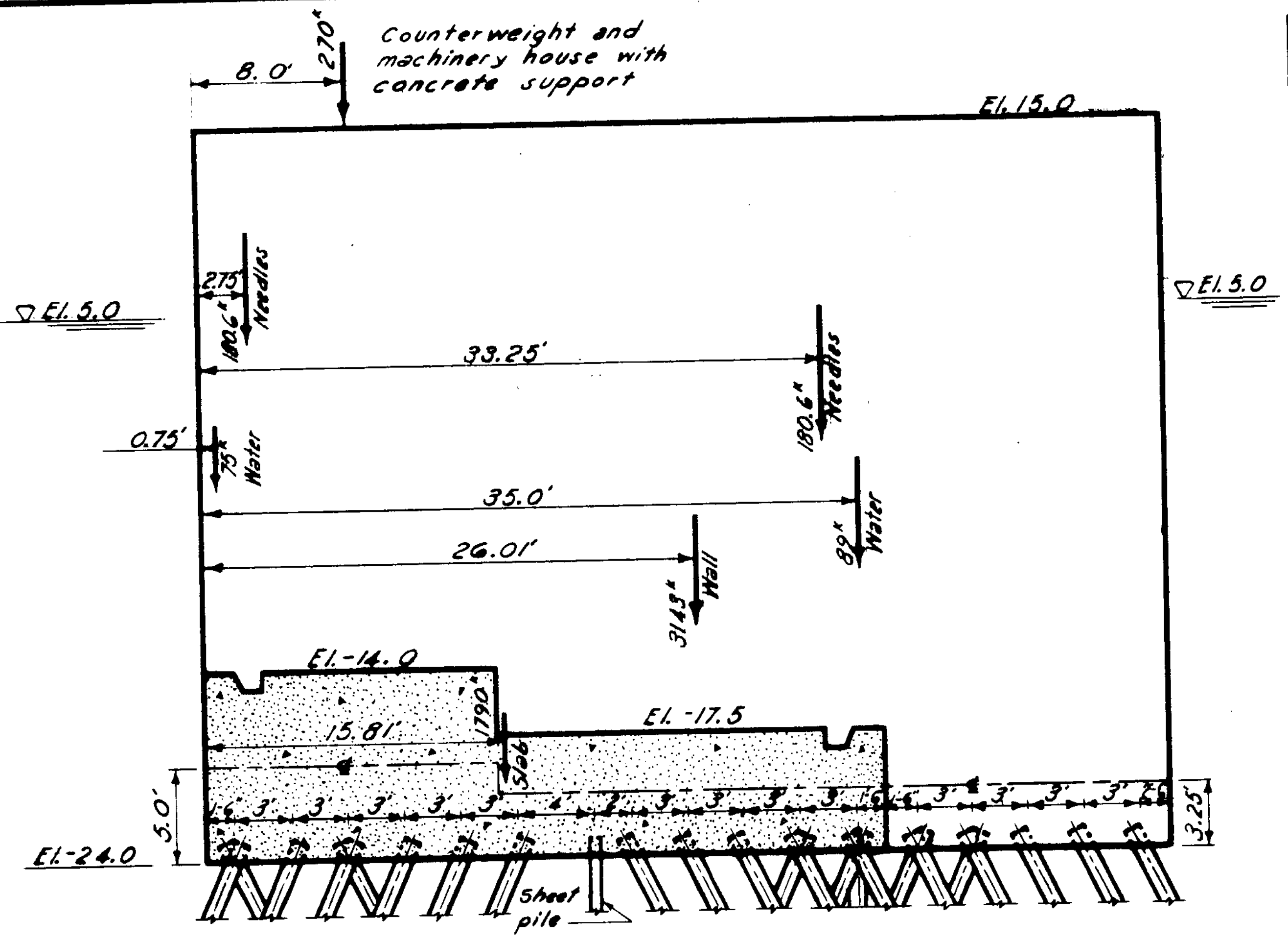
FILE NO. H-2-25048



LOADING DIAGRAM

TRANSVERSE SECTION

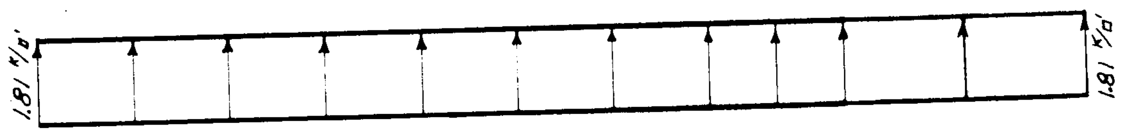
Scale: 1" = 5'



LOADING DIAGRAM

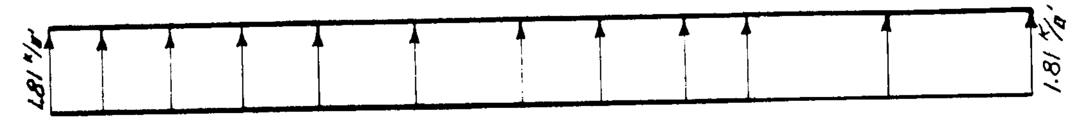
LONGITUDINAL SECTION

Scale: 1" = 5'



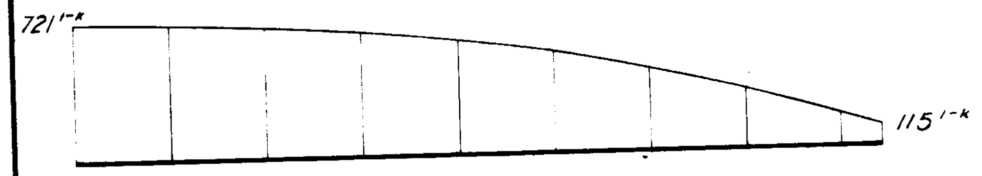
UPLIFT

Scale: 1" = 2 ^k/□'



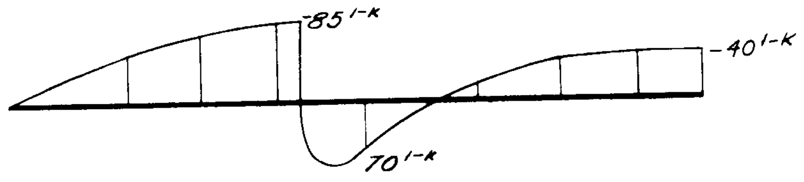
UPLIFT

Scale: 1" = 2 ^k/□



MOMENT DIAGRAM

Scale: 1" = 500^{1-K}



MOMENT DIAGRAM

Scale: 1" = 100^{1-K}

COMPUTED PILE LOADS BY HRENNIKOFF METHOD

Pile row from protected side	Dist from protected side (Ft)	CASE VII					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	17.61	4.0	5.68	0	0.0
2	4.5	4.0	19.02	0	0.0	0	0.0
3	7.5	10.5	20.44	4.0	8.41	0	0.0
4	10.5	4.0	21.85	0	0.0	0	0.0
5	13.5	10.5	23.26	0	0.0	0	0.0
6	16.5	4.0	24.68	0	0.0	0	0.0
7	22.5	0	0.0	8.5	15.22	0	0.0
8	25.5	0	0.0	2.0	16.58	0	0.0
9	28.5	0	0.0	8.5	17.94	0	0.0
10	31.5	2.0	31.74	2.0	19.30	0	0.0
11	34.5	2.0	33.16	8.5	20.66	3	30.11
12	37.5	2.0	34.57	2.0	22.03	0	0.0
13	40.5	2.0	35.99	2.0	23.39	0	0.0
14	43.5	0	0.0	4.0	24.75	0	0.0
15	46.5	0	0.0	4.0	26.11	0	0.0
16	49.5	0	0.0	4.0	27.47	0	0.0

Notes:

Elevations are expressed in feet and refer to mean sea level.

Loads shown are for one-half of the structure.

Moments shown are for a one foot wide strip.

Case VII: Dewatered condition, gate removed, needle beams in place, water el. 5.0 on all sides.

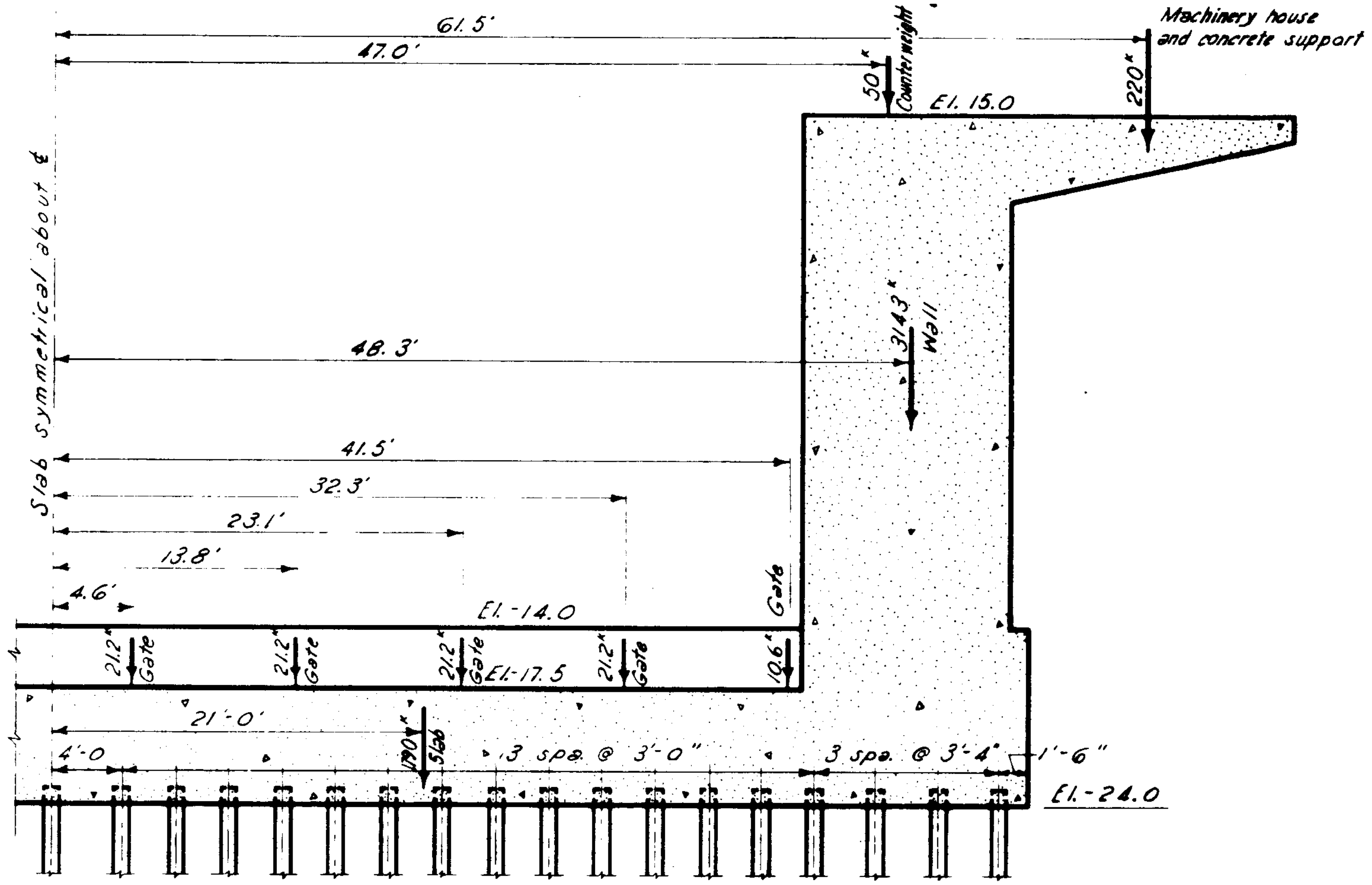
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.2 – DETAIL DESIGN
REACH BI – TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
MOMENT DIAGRAMS AND PILE REACTIONS FOR BASE SLAB

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970
REVISED OCTOBER 1971

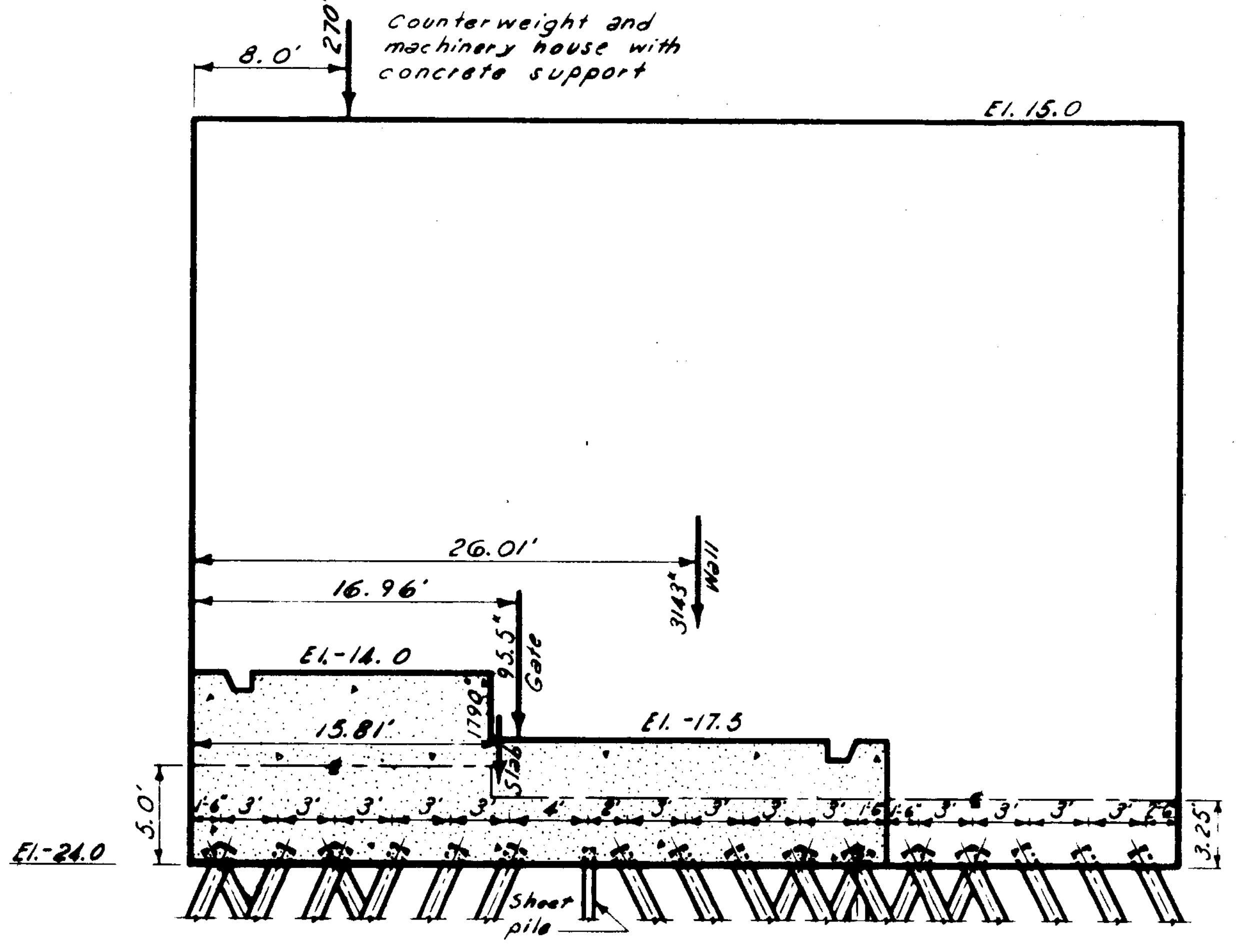
FILE NO. H-2-25048



LOADING DIAGRAM

TRANSVERSE SECTION

Scale: 1" = 5'



LOADING DIAGRAM

LONGITUDINAL SECTION

Scale: 1" = 5'

COMPUTED PILE LOADS BY HRENNIKOFF METHOD							
Pile row from protected side	Dist from protected side (Ft.)	CASE VIII					
		No. Piles	Load/pile Group A	No. Piles	Load/pile Group B	No. Piles	Load/pile Group C
1	1.5	10.5	57.09	4.0	43.26	0	0.0
2	4.5	4.0	57.52	0	0.0	0	0.0
3	7.5	10.5	57.95	4.0	44.09	0	0.0
4	10.5	4.0	58.38	0	00	0	0.0
5	13.5	10.5	58.81	0	0.0	0	0.0
6	16.5	4.0	59.24	0	0.0	0	0.0
7	22.5	0	0.0	8.5	46.16	0	0.0
8	25.5	0	0.0	2.0	46.57	0	0.0
9	28.5	0	0.0	8.5	46.99	0	0.0
10	31.5	2.0	61.39	2.0	47.40	0	0.0
11	34.5	2.0	61.82	8.5	47.82	3	60.75
12	37.5	2.0	62.25	2.0	48.23	0	0.0
13	40.5	2.0	62.68	2.0	48.64	0	0.0
14	43.5	0	0.0	4.0	49.06	0	0.0
15	46.5	0	0.0	4.0	49.47	0	0.0
16	49.5	0	0.0	4.0	49.89	0	0.0

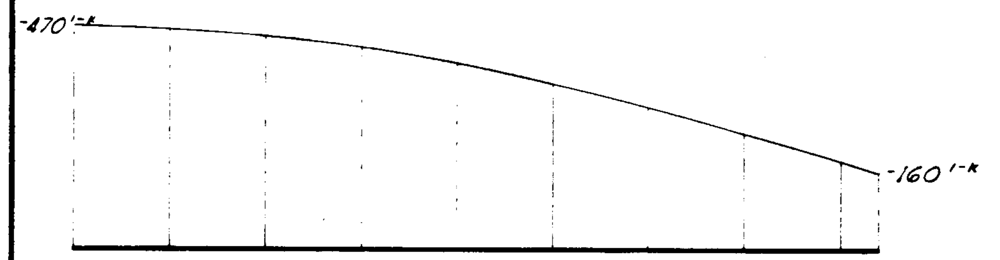
Notes:

Elevations are expressed in feet and refer to mean sea level.

Loads shown are for one-half of the structure.

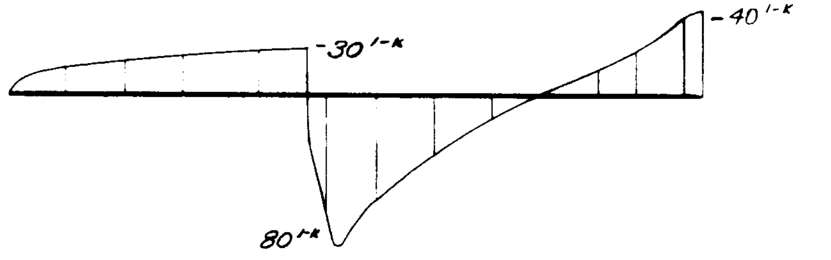
Moments shown are for a one foot wide strip.

Case VIII: Construction condition, no water, no uplift.



MOMENT DIAGRAM

Scale: 1" = 200'-k



MOMENT DIAGRAM

Scale: 1" = 50'-k

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 – DETAIL DESIGN
REACH B1 – TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

MOMENT DIAGRAMS AND PILE REACTIONS FOR BASE SLAB

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970
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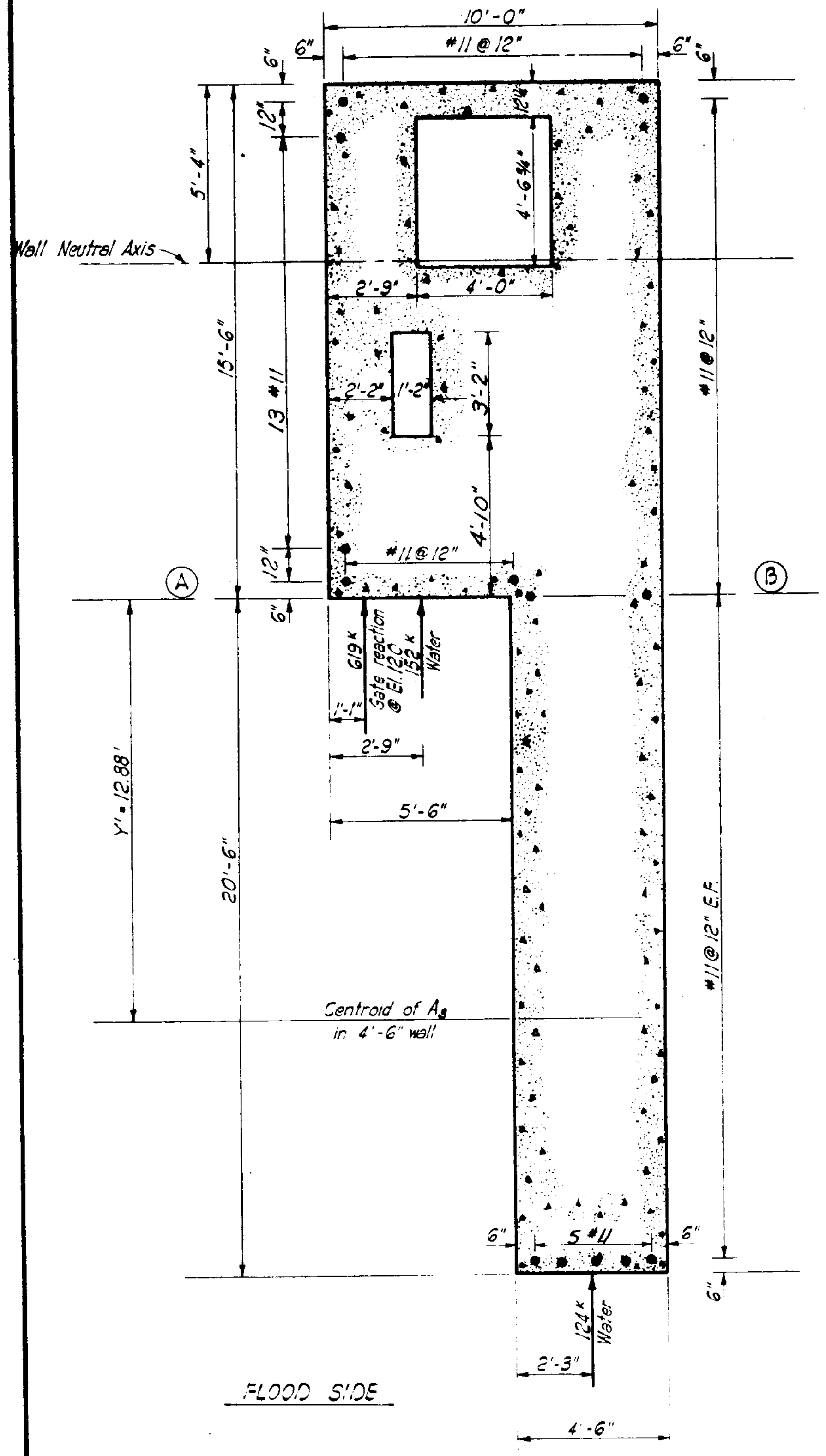
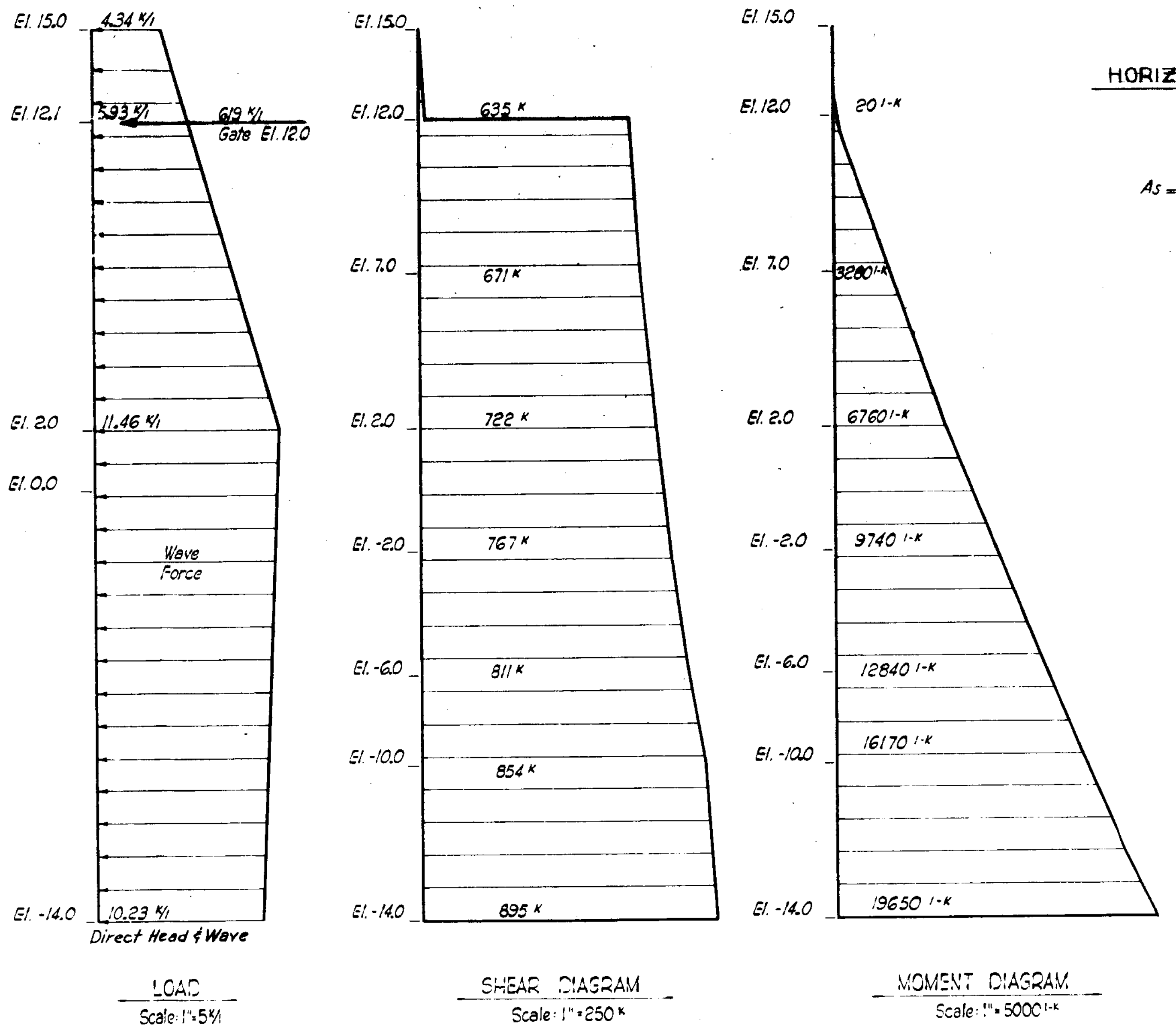
PROTECTED SIDE



FLOOD SIDE

PLAN OF WALL AT EL. -14.0

Scale: 3/8" = 1'-0"



LOAD

Scale: 1" = 5 K/I

SHEAR DIAGRAM

Scale: 1" = 250 K

MOMENT DIAGRAM

Scale: 1" = 5000 I-K

WALL

Scale: 3/8" = 1'-0"

CASE III CRITICAL LOADING

Flood with wave; gate closed. SWL @ +12.1 on flood side and +2.0 on protected side, 100% uplift. Group Z loading 1.33% increase in allowable stresses.

HORIZ. LONG. REINFORCEMENT @ A-B

$\Sigma M_{A-B} = y' \Sigma f_s A_s$
$= 12.88' \times 682.03^K$
$= 8788^{I-K}$

$A_s = \dfrac{M}{f_s \times jd} = \dfrac{8788 \times 12}{24 \times 0.9 \times 336} = 14.4$ sq. in.

MOMENT @ EL-14.0

10.23 x 16 x 8	= 1310 I-K
.5 x 16 x 123 x 10.67	100 I-K
5.93 x 10.1 x 21.05	= 1260 I-K
5.53 x 10.1 x 5 x 19.37	= 540 I-K
4.34 x 2.9 x 27.55	= 350 I-K
1.59 x 2.9 x 5 x 27.07	= 60 I-K
619 x 26	= 16100 I-K
ΣM_{-14}	= 19720 I-K

$I_{total} = I_{concrete} + I_{steel}$
$= 8,130,400 in^4 + 45,424,000$
$= 53,554,400 in^4$

f_c Max. $= \dfrac{19720 \times 12 \times 64}{53,554,400}$
$= 283$ PSI

f_s Max. $= \dfrac{19720 \times 12 \times 362 \times 9}{53,554,400}$
$= 14,400$ PSI

$f_c = 3000 \times 1.33 = 4000$ PSI
$f_c = 1050 \times 1.33 = 1400$ PSI
$f_s = 18,000 \times 1.33 = 24,000$ PSI

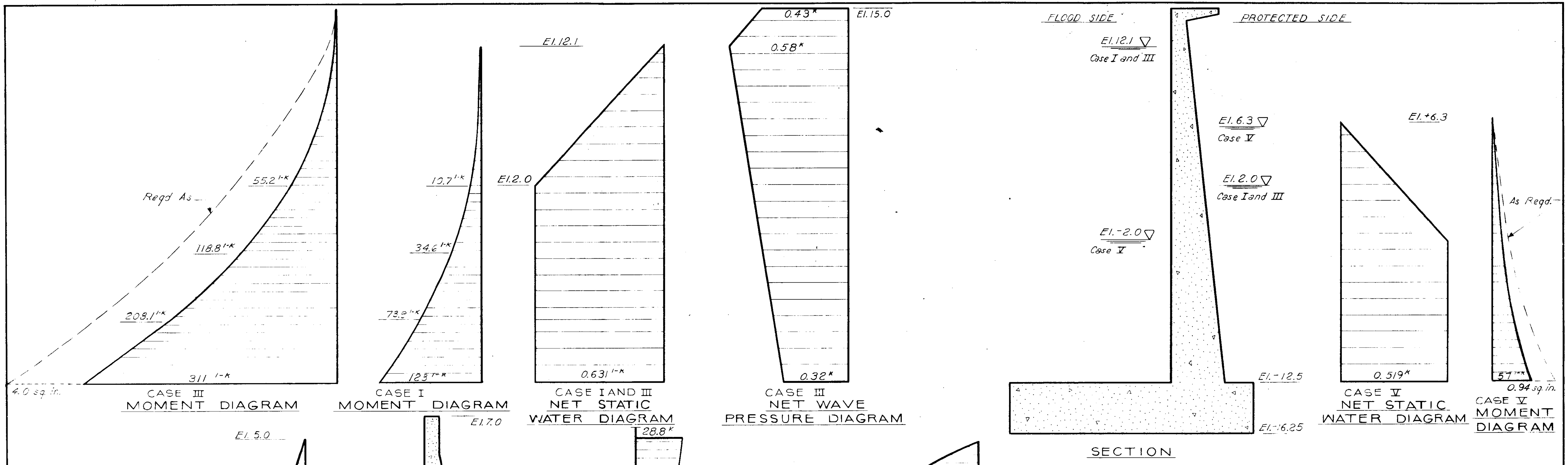
Notes:
Elevations are expressed in feet and refer to mean sea level.
Forces shown are for entire 10' width.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
WALL DESIGN ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

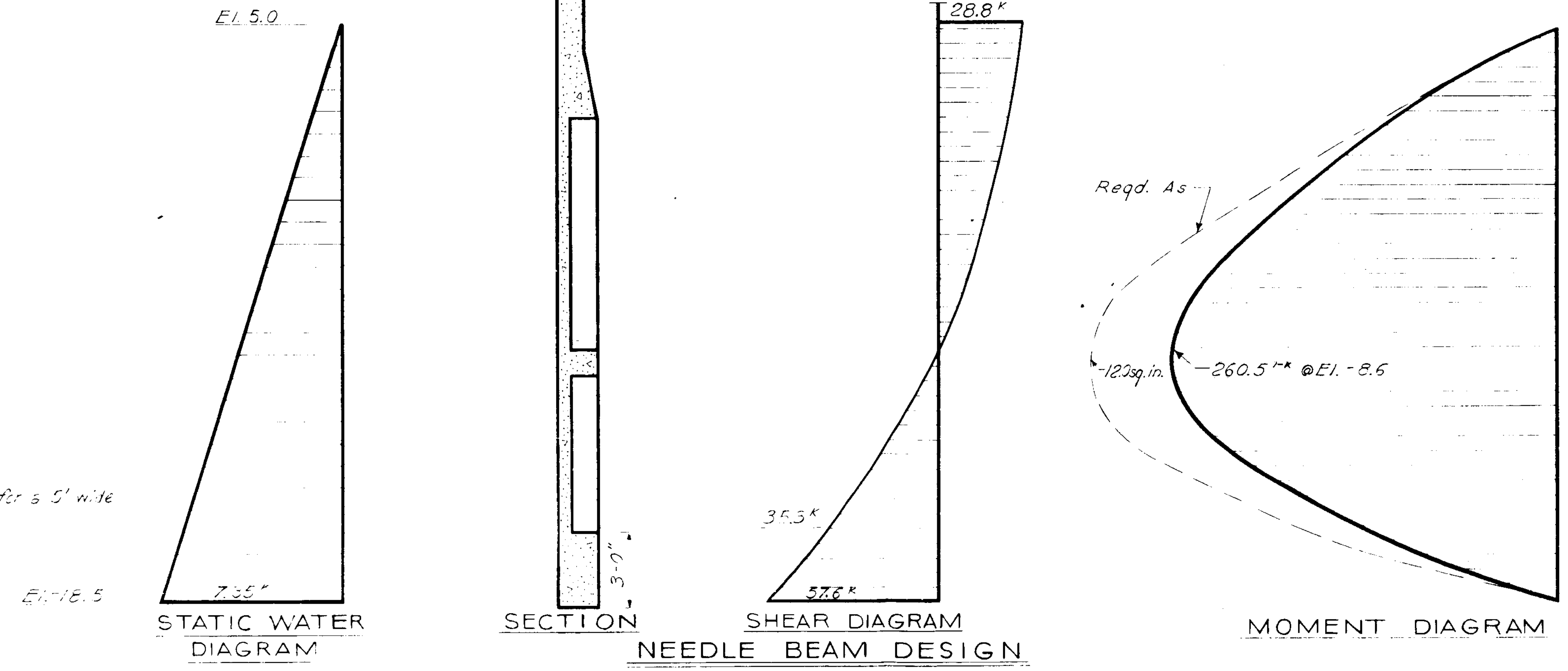
OCTOBER 1970 FILE NO. H-2-25048



T-WALL DESIGN

Scales: 1" = 3'
1" = 0.20 K
1" = 50 1-K
1" = 0.50 sq. in.

Notes:
Elevations are expressed in feet and refer to mean sea level.
All figures shown are for a 1' wide section.
Moments for CASES I and II are equal.
* Moments for CASES III and IV are equal.
Moments for CASES V and VI are equal.
* CASE III-Group 2 loading 133% increase in allowable stresses.



Note:
All figures are for a 5' wide needle section.

NEEDLE BEAM DESIGN

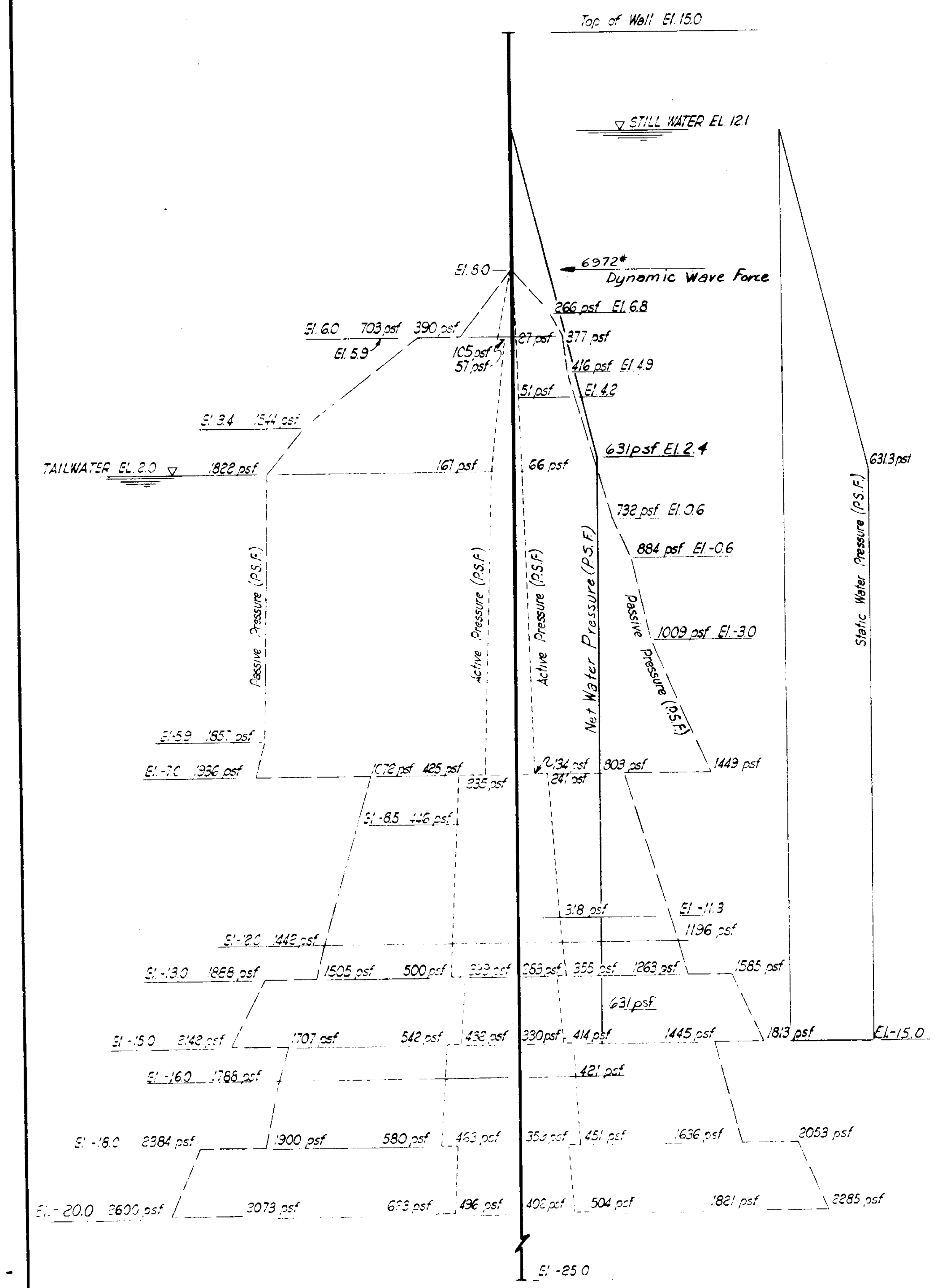
Scales: 1" = 3' Linear 1" = 50 1-K Moment 1" = 25 K Shear Diagram
1" = 2 sq. in. As 1" = 3 K Load

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN
REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE T-WALL STEM AND NEEDLE BEAM ANALYSIS

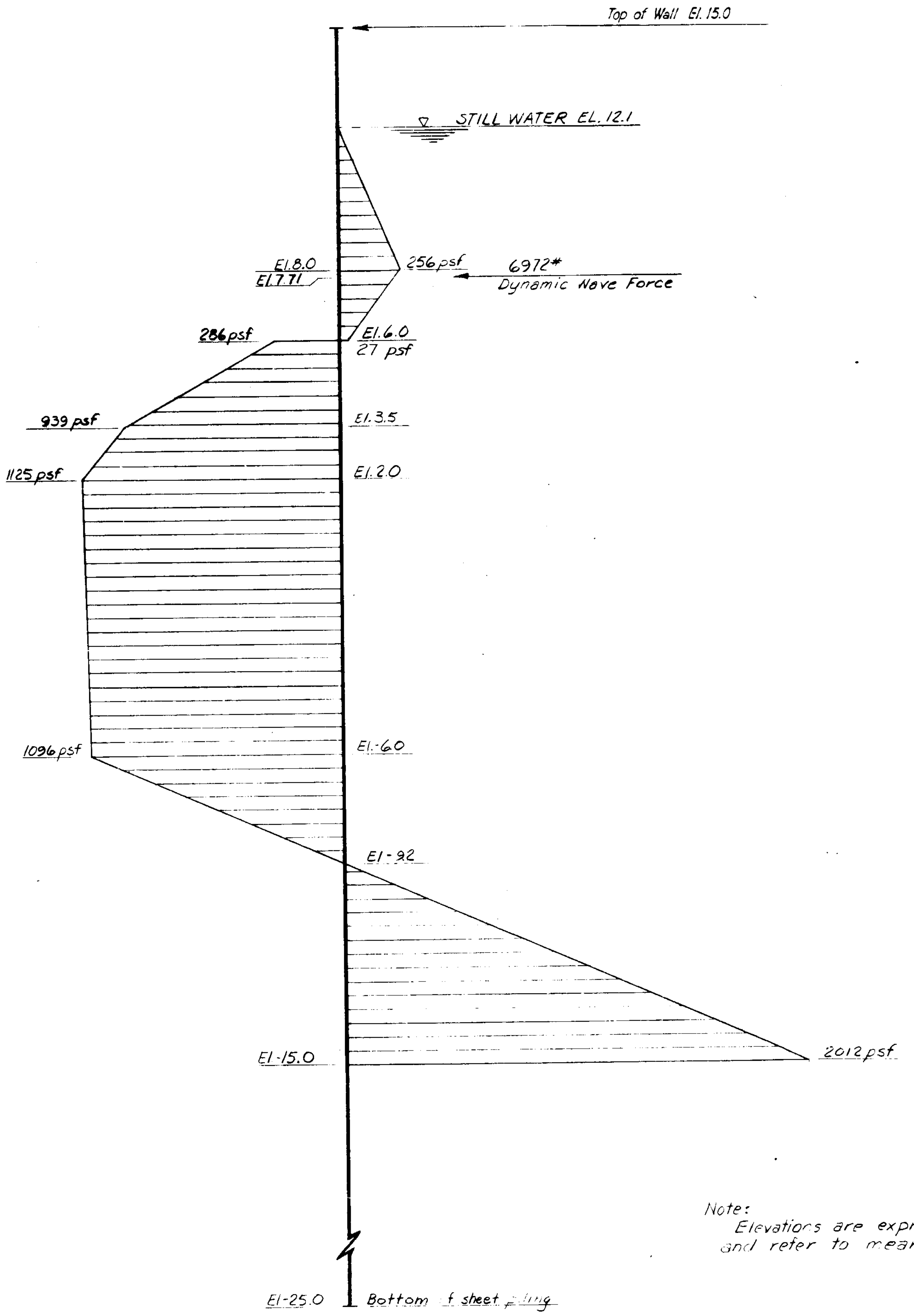
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048



PRESSURE DIAGRAM (F.S. = 1.25 - S CASE)

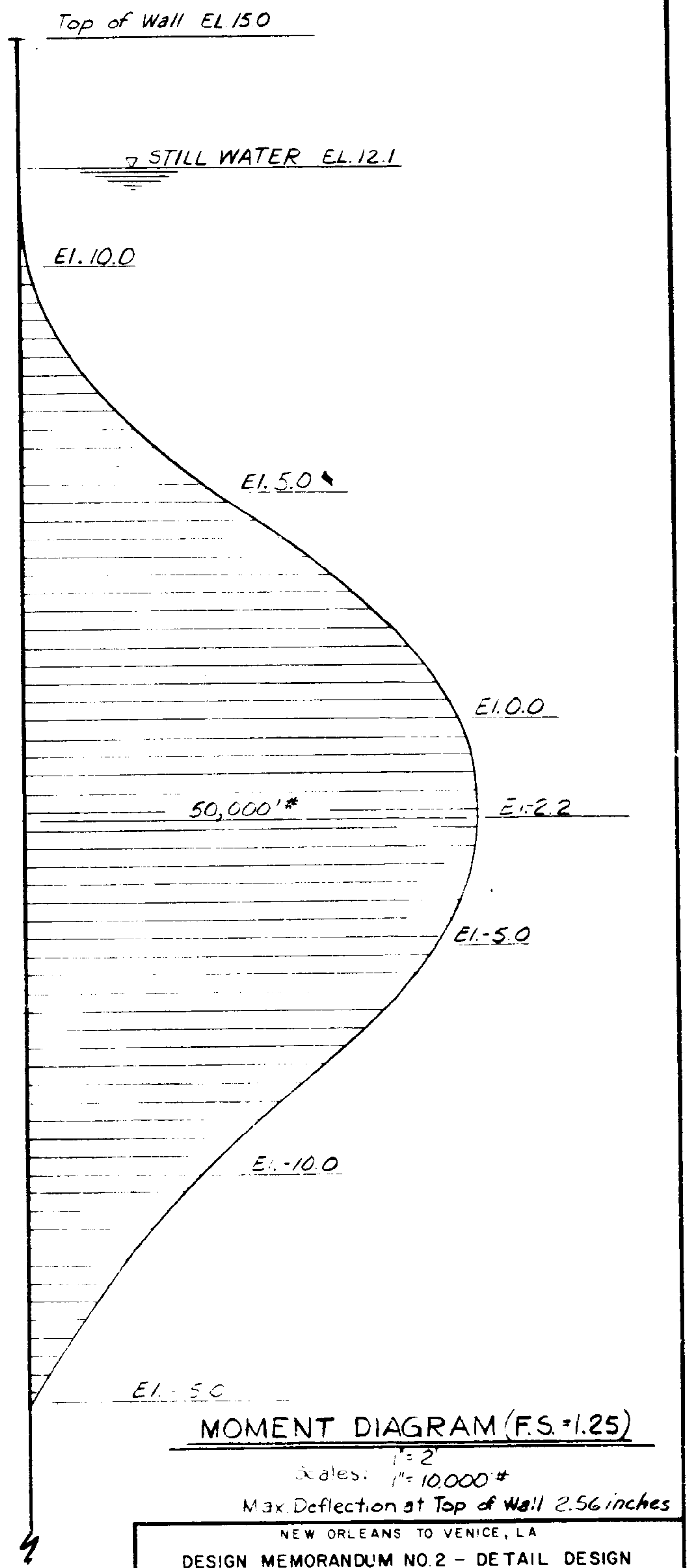
Scales: 1" = 2' ; 1" = 500 psf



NET PRESSURE DIAGRAM (F.S. = 1.25)

Scales: 1" = 2' ; 1" = 500 psf

Note:
Elevations are expressed in feet and refer to mean sea level.



MOMENT DIAGRAM (F.S. = 1.25)

Scales: 1" = 2' ; 1" = 10,000'#

Max Deflection at Top of Wall 2.56 inches

NEW ORLEANS TO VENICE, LA

DESIGN MEMORANDUM NO. 2 - DETAIL DESIGN

REACH B1 - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

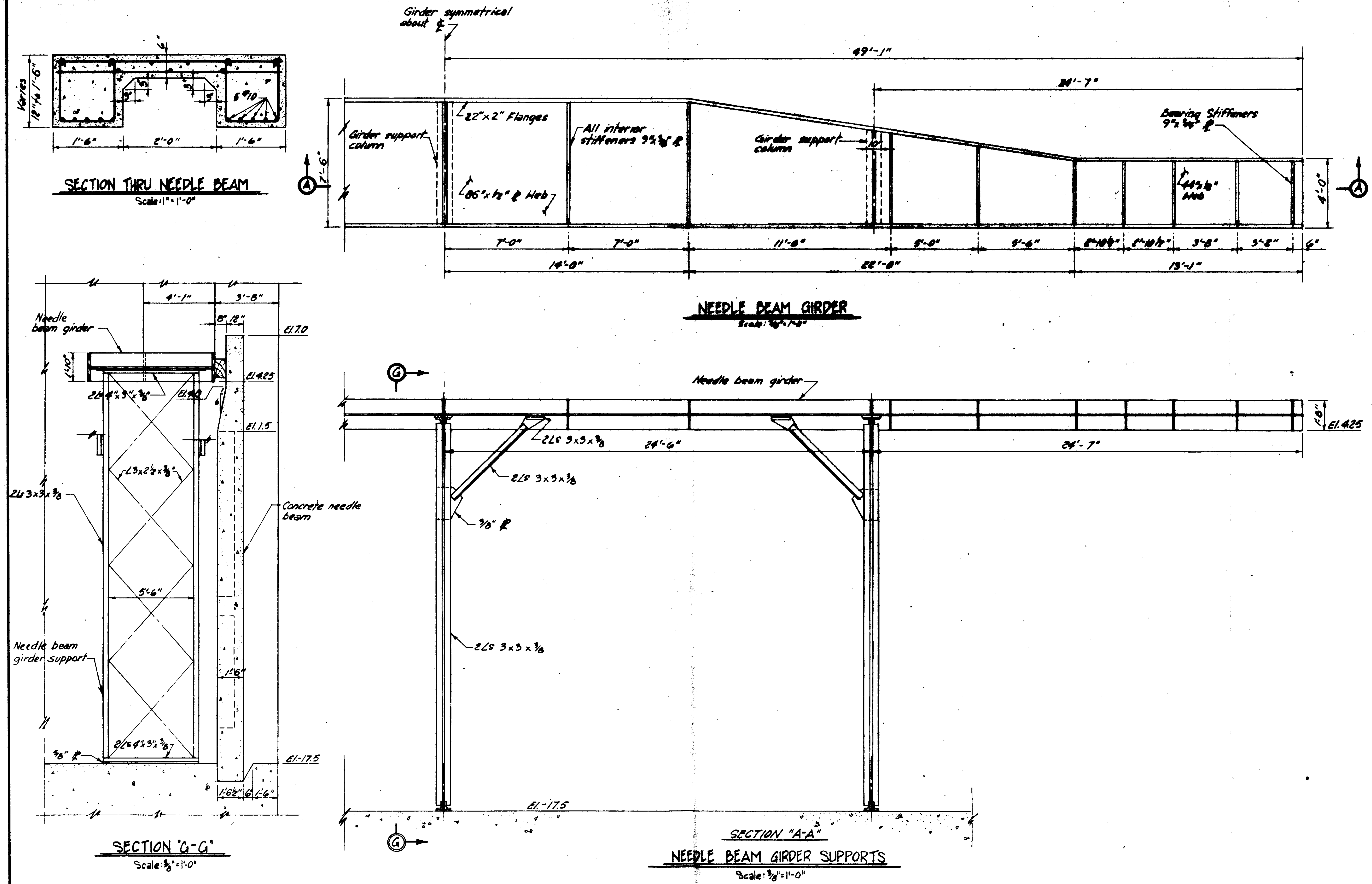
I-WALL DESIGN ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970

FILE NO. H-2-25048

PLATE III-31



Notes:

Elevations are expressed in feet and refer to mean sea level.

Drill drain holes in web between all stiffners.

Timber bolted to needle girder flange not shown.

Details & design for 87'-2" needle girder on protected side will be similar the girder shown here.

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DESIGN MEMORANDUM NO. 2 – DETAIL DESIGN

REACH B I - TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE
NEEDLE BEAM GIRDER

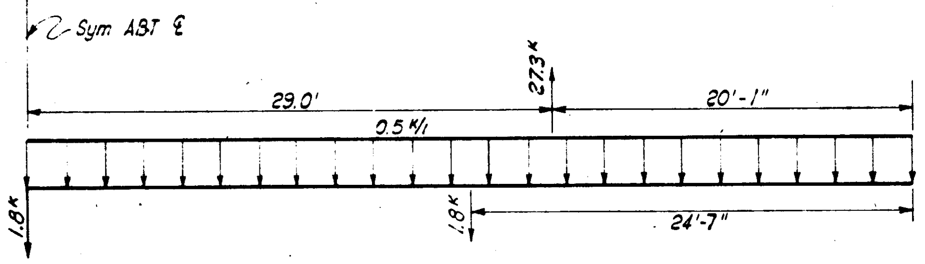
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970

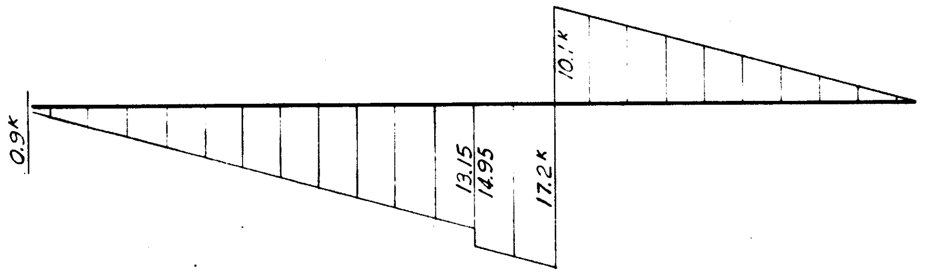
FILE NO. H-2-25048

Empire Floodgate — Needle Beam Girder

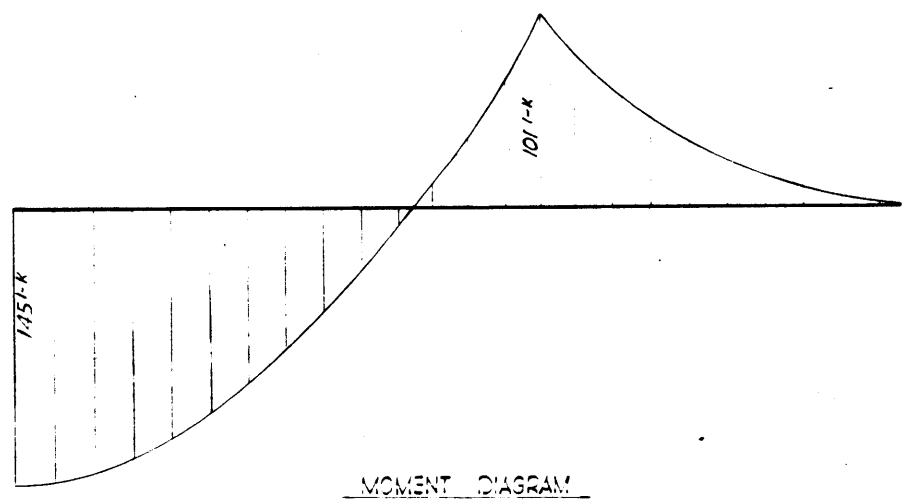
PLATE III-32



LIFTING LOAD DIAGRAM
Scale: 1" = 1K/1

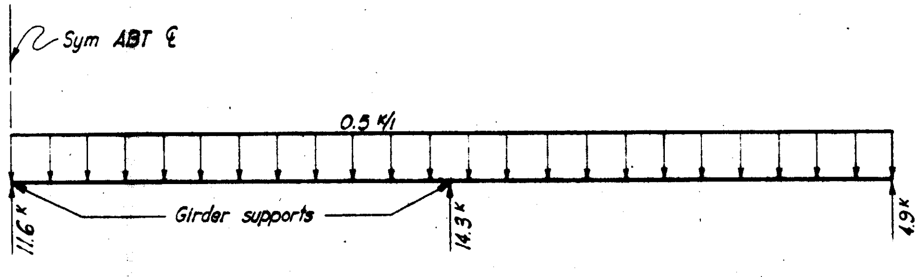


SHEAR DIAGRAM
Scale: 1" = 10K

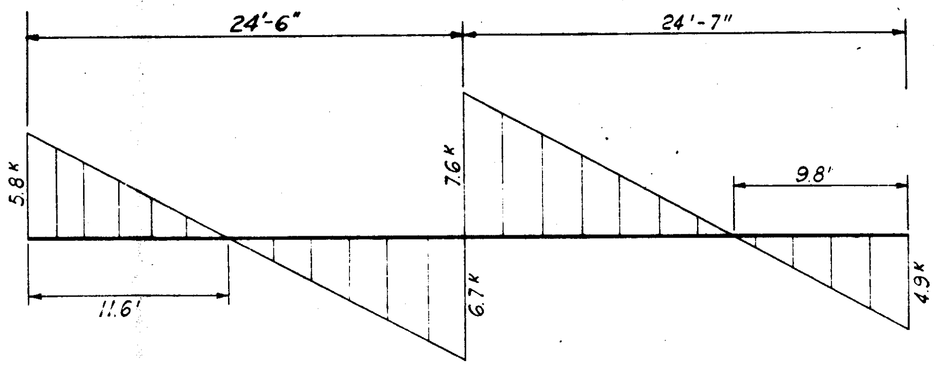


MOMENT DIAGRAM
Scale: 1" = 50'-K

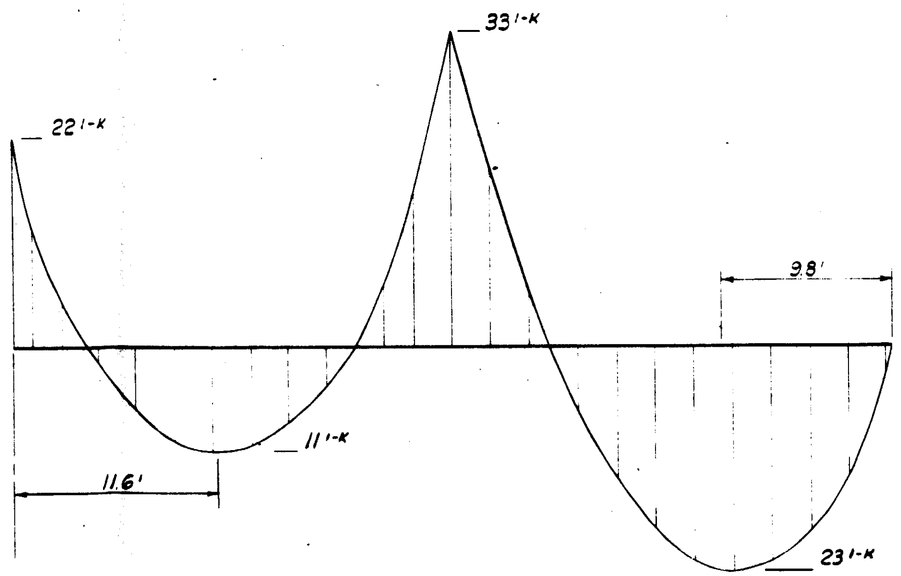
LIFTING LOAD ON GIRDER



DEAD LOAD DIAGRAM
Scale: 1" = 1K/1

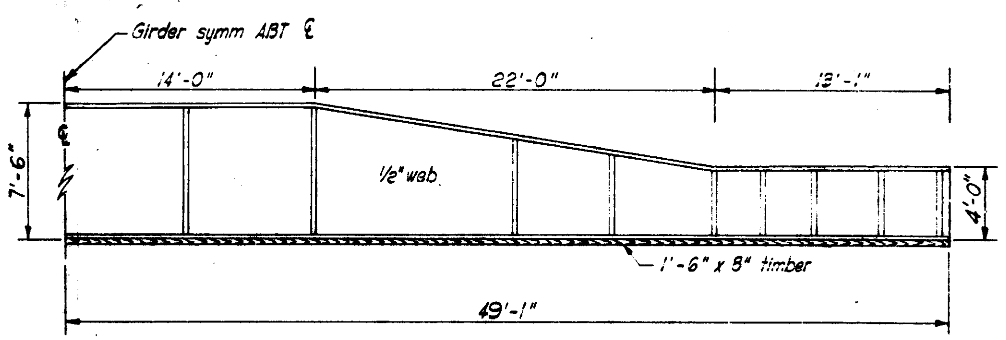


SHEAR DIAGRAM
Scale: 1" = 5K

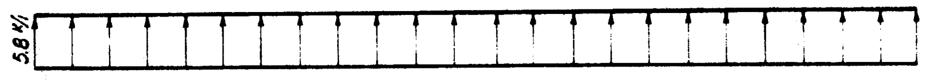


MOMENT DIAGRAM
Scale: 1" = 10'-K

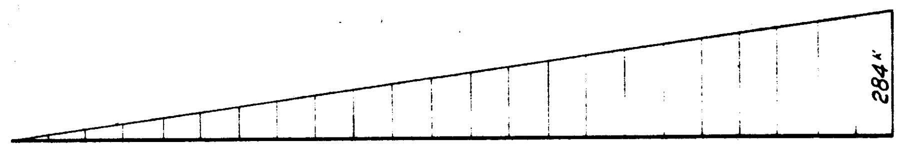
DEAD LOAD OF GIRDER



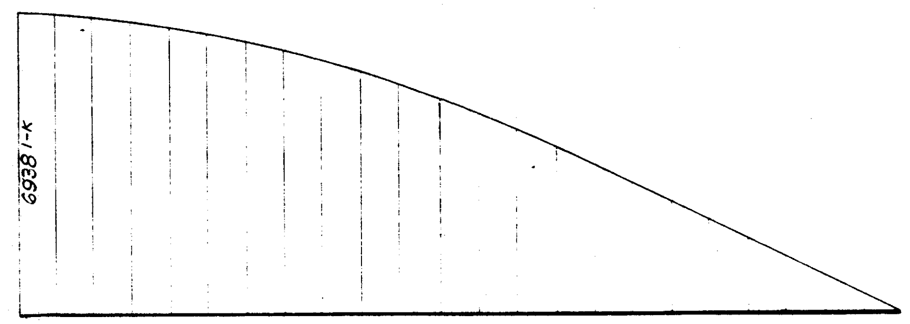
PLAN
Scale: 3/16" = 1'-0"



WATER LOADING DIAGRAM
Scale: 1" = 10 K/1



SHEAR DIAGRAM
Scale: 1" = 200K



MOMENT DIAGRAM
Scale: 1" = 2000'-K

WATER LOAD

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 2 – DETAIL DESIGN
REACH B1 – TROPICAL BEND TO FORT JACKSON

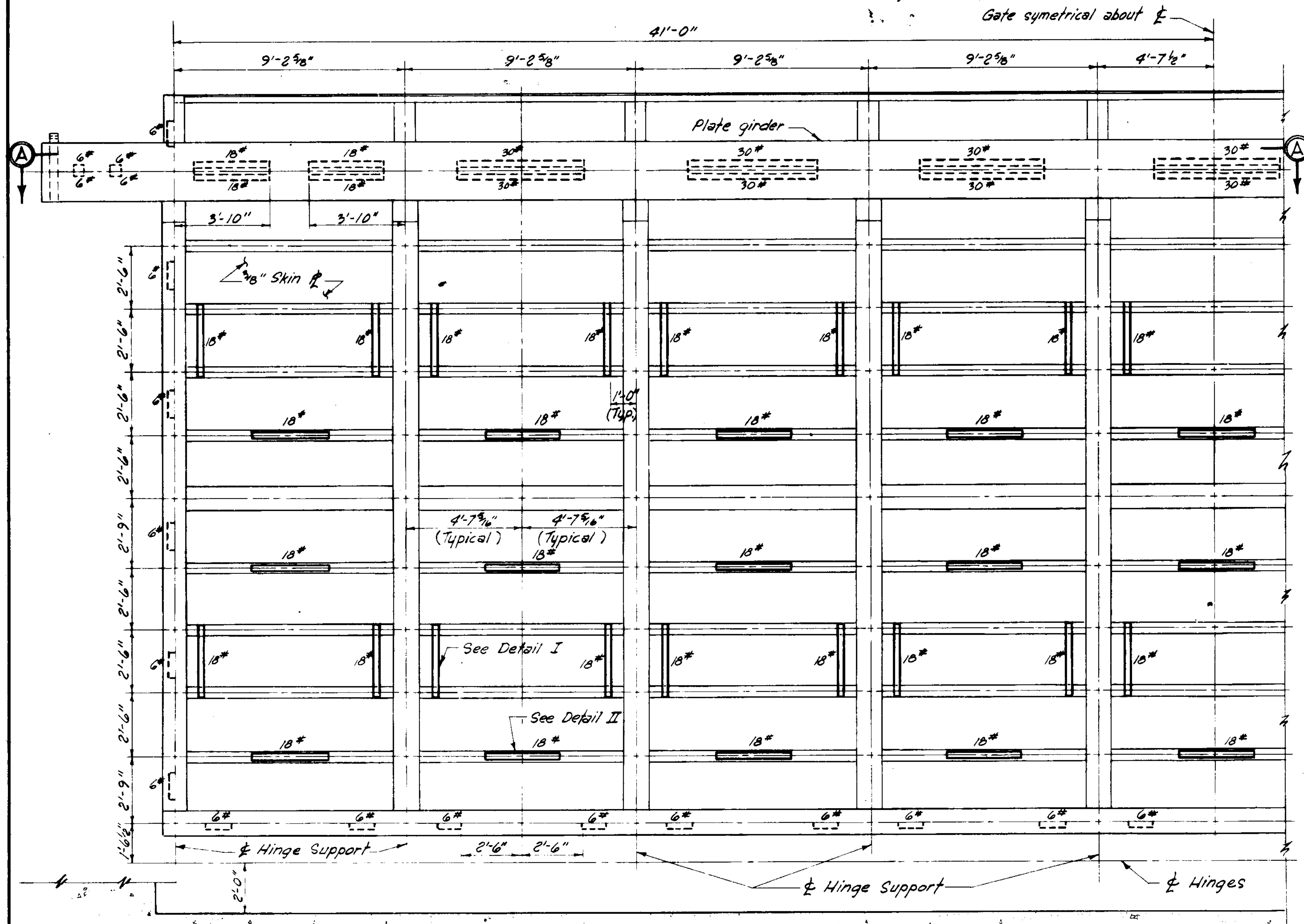
EMPIRE FLOODGATE

NEEDLE BEAM GIRDER ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 FILE NO. H-2-25048

PLATE III-33



GATE IN CLOSED POSITION

FLOOD SIDE ELEVATION

Scale: 3/16"=1'-0"

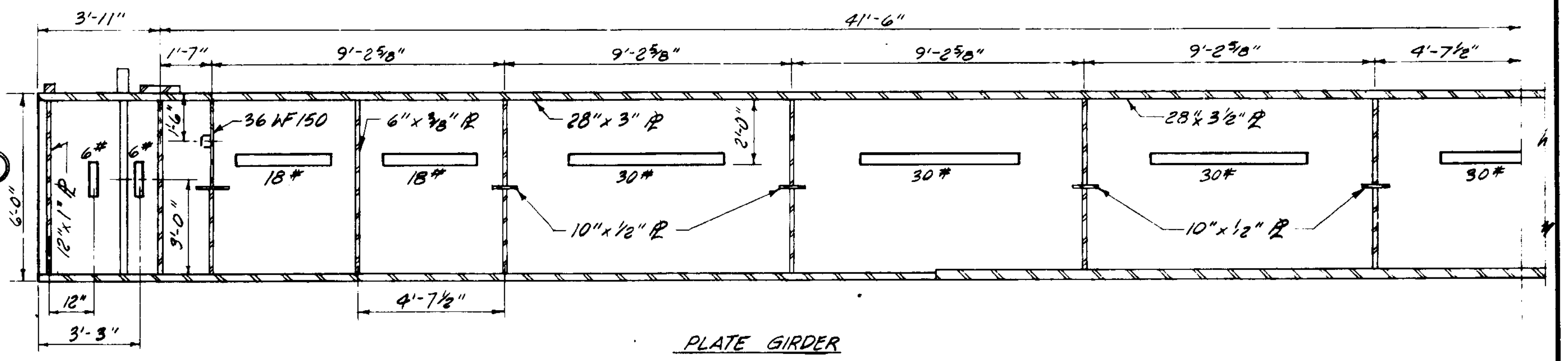
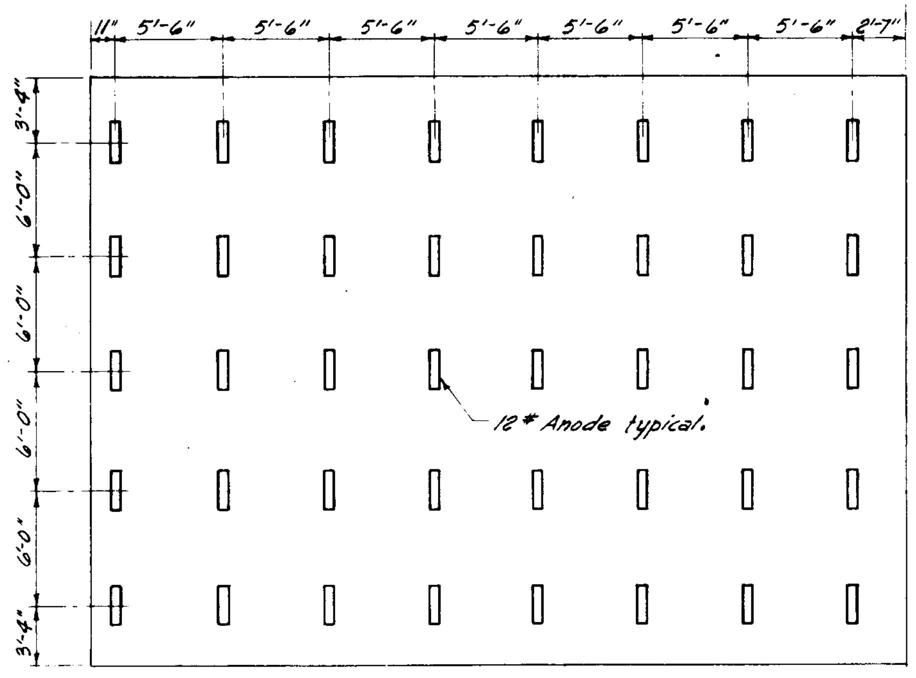


PLATE GIRDER

SECTION "A-A"

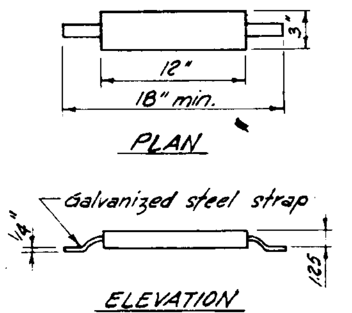
Scale: 3/16"=1'-0"



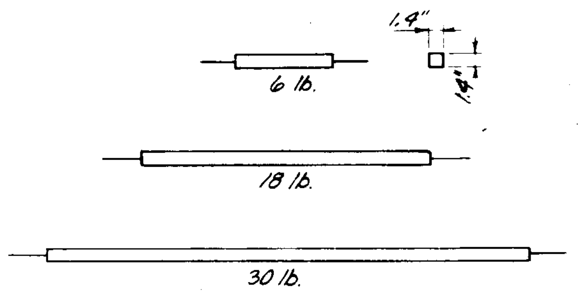
PROTECTED SIDE

SKINPLATE ANODE LAYOUT

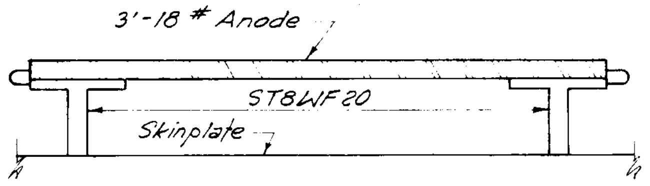
N.T.S.



12 lb. ZINC ANODE

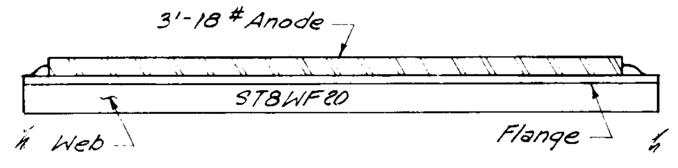


1.4"x1.4" ZINC ANODE



DETAIL I (Typical)

N.T.S.



DETAIL II (Typical)

N.T.S.

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO. 2 – DETAIL DESIGN

REACH B I – TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

CORROSION PROTECTION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

OCTOBER 1970 — FILE NO. H-2-25048

SECTION IV - CONSTRUCTION HISTORY

4-01 General. The Empire Floodgate is being constructed under contract No. DACW29-73-C-0151, awarded 30 Mar 73, by Rosiek Construction Co., Inc., Morrilton, Arkansas. Work was started on 1 May 1973 and at the time of inspection was approximately 95% complete. Contract completion is expected 31 Dec 75.

4-02 Construction sequence. Since starting on this job, the Contractor has observed the following construction sequences:

a. Perform initial excavation.

b. Construct closure dams and temporary dikes.

c. Install dewatering system.

d. Place shell to use as a dry work base.

e. Drive test piles and perform tests.

f. Drive steel sheet piling.

g. Drive concrete piles.

h. Place stabilization slab and base slab concrete.

i. Place gate bay wall concrete (except final lift).

j. Plact T-wall concrete.

k. Start placing semi-compacted fill and riprap.

l. Start installing gate.

m. Place final lift of gate bay wall concrete and install gate operating machinery.

n. Finish installing gate.

o. Place gate slab concrete and install gate seals.

p. Test gate.

q. Flood Excavation and remove closure dams.

r. Construct fender system and dolphins.

4-03 Sources of Materials.

a. Closure dams: Shell for the closure dams came from Lake Pontchartrain, supplied by Ayers Materials, Inc. Uncompacted fill came from initial excavation and Government furnished borrow areas in the channel north and south of the structure.

b. Semi-compacted fill and clay came from stockpiled material from initial excavation and borrow areas. Contractor also requested and was granted permission to use as borrow the stockpile area south of the baseline and east of the Waterway.

c. Riprap came from Reed Crushed Stone Co., Gilbertsvile, Ky.

d. Concrete material sources.

(1) Cement: Louisiana Industries Type II, produced at Midlothian, Texas.

(2) Aggregate: Louisiana Industries, Price, Washington Parish, La.

(3) Curing Compound: Hunt's Process-Southern, Ridgeland, Miss.

(4) Air Entraining Agent: Hunt's Process-Southern, Ridgeland, La. Concrete was batched at the job site.

4-04 Concrete Proportions and Control Procedures. The U. S. Army Waterway Experiment Station at Vicksburg, Miss., was requested to design the concrete mix and they recommended using 400 lbs. of cement, 1210.8 lbs. of fine aggregate, 1975.3 lbs. of coarse aggregate and 216.0 lbs. of water per cubic yard of mix. Design plans required a strength of 3,000 psi at 28 days.

The contractor started using the recommended mix at the beginning of concrete placing on 16 Aug 74. On 26 Aug 74, due to aggregate gradation problems the mix was changed to 415 lbs. of cement per cubic yard. 150 cu. yds. were placed this date on the right gate base slab. On 30 Aug 74, the mix was returned to 400 lbs. of cement per cu. yd. On 4 Sep 75, due to low test cylinder breaks, the mix was increased to 423 lbs. of cement per cu. yd. On 9 Oct 74, the mix was increased to 446.5 lbs. of cement per cu. yd. and on 18 Oct 74 it was increased to 470 lbs. of cement per cubic yard for the same reason. No other changes were made.

The contractor hired Shilstone Testing Lab, Inc., New Orleans, La., to perform the quality control and testing of materials for the concrete. The technicial was supervised by Government personnel. Government personnel also obtained the concrete cylinder samples for breaking at 7 and 28 days in the District's testing machine. Some cylinders were broken at ages ranging up to 90 days to check the possibility of slow setting concrete being used. The results were inconclusive.

Concrete strength has ranged from a low of about 2,336 psi to a high of about 5,593 psi at 28 days.

4-05 Instrumentation.

(1) The only instrumentation required during construction was the dewatering system. After some minor problems at the beginning, the contractor's dewatering has been performing well, keeping water levels below the required 4 feet below the bottom of the excavation.

(2) Settlement bolts have been installed on both sides of the structure, and the initial elevation measured.

SECTION V - INSPECTION

5-01 Inspection Team. The inspection of the structure was conducted on 4 Sep 75 by the following personnel:

LMVD

Mr. R. Dubuisson	Technical Engineering Branch
Mr. G. Cordes	Construction Branch

NOD

Mr. F. H. Spellmann	Inspection Coordinator
Mr. T. F. Mehrtens	General Engineering Section
Mr. D. J. Elquezabal	Construction Division
Mr. L. E. Dement	Hydraulics and Hydrology Branch
Mr. W. W. Gwyn	Foundations & Materials Branch
Mr. F. N. Johnson	Structural Design Section
Mr. D. C. Strecker	General Engineer - Mechanical
Mr. G. P. Jesclard	General Engineering - Electrical
Mr. V. A. Landry	Operations Div
Mr. R. P. Ziegler	Operations Division
Mr. C. J. Ashley	New Orleans Area Office

Department of Public Works

Messrs. Magner, Jr. and Simpson

Representatives of Plaquemines Parish Commission Council

Messrs. Petrovich, Brown, Beshel, Chison, Greco, Maites, and Kirby

5-02 Orientation. Prior to the inspection, the team members were given a brief orientation on the following features of the structure: Hydraulics and Hydrology, structural considerations, foundations, operating machinery and construction history.

5-03 Observations.

a. General. The structure construction was 95% complete and still in dewatered stage when the inspection was conducted, thus allowing the inspection team access to the areas that will be flooded when the approach channels are dredged. The following major items were not yet constructed at the time of the inspection: tie-in levees, breakwater dike, boat dock, timber guide walls and fenders.

Comments on observations made during the inspection follows.

b. Reinforced Concrete.

(1) Floodwalls. There were a few shrinkage and temperature cracks noted on top of the east and west walkways, but all exposed concrete surfaces were in satisfactory condition. The west end of the T-wall monolith T-L4 has settled slightly, causing a separation at the expansion joint between T-4L and T-3L. The separation at the joint between the walls was 0.40 inches on 25 July 75 and 0.70 inches on 31 Oct 75. Both the east and west floodwalls are being monitored for settlement and movement.

(2) Gatebay monoliths. Minor temperature and shrinkage cracks were visible on the outer sill for the flap gate and the vertical face of the base slab which faces the outer sill. The rest of the gatebay monolith and superstructure on top, including the control house and pump platform, appeared to be in good shape.

c. Flap gate.

(1) Condition. The major portion of the flap gate seemed to be in excellent condition. The lower parts of the flap gate, on the flood side, including hinge brackets, shim plates and anchor bolts, were rusting and needed touch-up painting. Also, some of the nuts on the flap gate hinge anchor bolts on the concrete sill were loose and appeared not to have been properly tightened during the initial installation. The cathodic protection system on the flap gate was all in place except for one missing anode on the bottom eastern edge of the flap gate.

(2) Non-Operation. The flap gate was not operated during the inspection because the electrical controls and associated wiring for the operation of the flap gate were not completely installed.

d. Operating Machinery. None of the machinery was operated due to the incomplete installation of the electrical panels and controls.

e. Approach Channels. The approach channels directly on each side of the structure had been excavated, shaped, and riprap placed in accordance with the construction drawings. However, there was a small depression in the riprap adjacent to the floodside of the gatebay monolith. After the structure has been watered, the remainder of the approach channels will be dredged and more riprap placed.

f. Steel sheet piling floodwall. The steel sheet piling floodwall extends from the "T"-type, reinforced concrete floodwall to the levee on each side of the structure. All of the exposed steel seem to be rusting. The steel sheet piling on the west side of the structure at approximate base line station 98+73 has settled from 1.50 to 2.00 feet. Settlement of the steel sheet piling decreases along the sheet pile wall to the extent that at station 99+78 it is approximately 6 inches. The steel sheet piling is being monitored for settlement and movement.

g. Instrumentation. At the time of the inspection, settlement reference marks have been installed on the west side of the structure but not on the east side. One permanent bench mark had been installed.

6-01 Remedial Actions Taken Subsequent to Inspection and Prior to Flooding.

a. Cathodic Protection. The missing cathodic protection anode was replaced at the bottom eastern edge of the flap gate on the flood side.

b. Flap gate painting. The lower portion of the flap gate was sandblasted and painted.

c. Anchor bolts tightened. All of the nuts on the flap gate hinge anchor bolts on the concrete sill were inspected and tightened as necessary.

d. Form work anchor bolts. Some exposed form work anchor bolts were visible on the channel side of the gate monolith wall near the outer sill. These exposed anchor bolts were burned off and the area patched with grout.

e. Instrumentation. Settlement reference marks were installed on the east floodwall to complete the instrumentation system.

f. Riprap. Riprap was placed in the depression adjacent to the flood side of the gatebay monolith to bring it up to design grade. Scour surveys will be taken to determine the effectiveness of the riprap around the structure and in the approach channels.

g. Electrical Controls. All electrical controls, panels and associated wiring for the operation of the flap gate, emergency generator, and pump were completely installed and all machinery is operational.

h. Flap Gate Test. On 12 Sep 75, representatives from NOD inspected and witnessed an operational test of the flap gate in the dry. The gate wal fully operational and performed satisfactorily except for a minor adjustment of the contacts which control the skew of the gate when one side is between 4 and 6 inches ahead of the other side. Adjustment of the contacts was made soon thereafter.

6-02 Proposed Remedial Actions. To insure the safety, stability, and operational capability of the structure, the following remedial action is proposed to be carried out by the present contractor at the site.

a. The placement of approximately 70 tons of riprap as shown on plates II-2 and II-3 in order to provide more erosion protection to the breakwater dike at its intersection with the flood side toe of the hurricane protection levee.

b. The gate locking device retainer plates are to be repositioned to correct the misalinement between the gate locking device and the bearing plate on the top girder flange on the gate. Also, two additional steel plate stiffners are to be installed at each end of the flap gate plate girder to reinforce the girder as shown on plate II-12.

c. In the gate chain hoist system, an idler drum or chain guide was added by contract modification in order to remove excessive slack in the chain. See plate II-25. The diameter of the idler drum was too small and the chain lengths wedged on the idler drum, thus causing the anchor bolts for the idler drum support to pull out of the concrete. This situation is to be corrected by increasing the diameter of the idler drum from 8 inches to 14 inches to eliminate the chain wedging and to provide sufficient anchorage for the idler drum support by welding it to the machinery base and wildcat support. See plate II-26.

d. The exposed bearing surface of each of the gate reactions grillages near the top of the gatebay monolith was recessed and skewed in the concrete such that the bearing plate on the top girder of the gate was bearing unevenly on the grillage concrete instead of the grillages. Concrete was chipped out in the vicinity of the grillage bearing surface in an unsuccessful effort to improve the seating of the girder bearing plate. The face of each of the flap gate bearing plates is to be sufficiently ground down to allow proper bearing against the reaction grillage bearing surface.

e. Two automatic tidal gages are to be installed on the structure for hydraulic analysis of head loss through the structure. One gage will be located on the pump platform and the other will be located near the outer edge of the southwest timber wall.

6-03 Engineering Data File. The data to be included in the Engineering Data File is being accumulated during the construction of the structure. When construction has been completed and the structure is turned over to the Plaquemines Parish Commission Council for operation and maintenance, one set of all the data in the file will be furnished to the parish commission council and one set will be retained in the NOD Engineering Division for use in future evaluations.

6-04 Conclusions. It is concluded that the finished portions of the structure are safe, stable and structurally sound, and the structure will serve its intended purpose.

6-05 Next Inspection. The next periodic inspection of the structure is scheduled for December 1976.

APPENDIX A - ALLOWABLE STRESSES

APPENDIX A - ALLOWABLE STRESSES

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Table I: Allowable Working Stresses for Steel	A-1
Table II: Allowable Working Stresses for Concrete	A-7

TABLE I

ALLOWABLE WORKING STRESSES FOR STEEL

Working stresses for structural steel are shown under two stress groupings for hydraulic structures. Numerical stress valves shown in table in parentheses are for A 36 steel.

	Group I Loading psi	Group II Loading psi
Basic stress:	0.50 Fy	0.67 Fy
Tension Stresses:		
Structural steel net section except at pin holes.	(18,000) 0.50 Fy	(24,000) 0.67 Fy
Net section at pin holes in eyebars, pin connected plates, or built-up members.	(13,500) 0.37 Fy	(18,000) 0.50 Fy
Shear Stresses:		
On the gross section of beam and plate girder webs.	(12,000) 0.33 Fy	(16,000) 0.45 Fy
Compression Stresses:		
On gross section of axially loaded compression member for (Kl/r) less than C_c. 1	083 K_1Fy	1.11 K_1Fy
For axially loaded column with l/r greater than C_c.	$\frac{124,000,000}{\frac{Kl^2}{r}}$	$\frac{165,000,000}{\frac{Kl^2}{r}}$
On secondary member, modify the above values by multiplying the following factor: 2	$\frac{1}{1.6-1/200_r}$	$\frac{1}{1.7-1/200_r}$
On gross area of plate girder stiffeners.	(18,000) 0.50 Fy	(24,000) 0.67 Fy
On web of rolled shapes at toe of fillet	(22,500) 0.62 Fy	(30,000) 0.83 Fy

TABLE I	Group I Loading psi	Group II Loading psi
<u>Bending Stresses</u>:		
Tension and compression on extreme fibers of rolled sections, plate girders and built-up members having axis of symmetry and meeting required dimension proportions.	(20,000) 0.55 Fy	(26,500) 0.73 FY
Tension and compression on extreme fibers of unsymmetrical members (with compression flange supported).	(18,000) 0.50 Fy	(24,000) 0.67 Fy
Tension and compression on extreme fibers of box type members not meeting required dimension proportions.	(18,000) 0.50 Fy	(24,000) 0.67 Fy
Tension on extreme fiber of other rolled shapes, built-up members and plate girders.	(18,000) 0.50 Fy	(24,000) 0.67 Fy
Compression on extreme fibers of rolled shapes, plate girders and built-up members having axis of symmetry in the plane of the web (Formula 4).	0.50 K_2Fy	-.67 K_2Fy
(Formula 5)	$\frac{10,000,000}{\frac{ld}{A_f}}$	$\frac{12,000,000}{\frac{ld}{A_f}}$
Use larger value computed by Formula 4 or 5 but not more than basic stress. Where l/r is less than 40, Formula 4 may be neglected.		
Compression on extreme fibers of channels. Value computed by Formula 5, but not more than:	(18,000) 0.50 Fy	(24,000) 0.67 Fy
Tension and compression on extreme fibers of large pins	(27,000) 0.75 Fy	(32,500) 0.90 Fy

TABLE I

	Group I Loading psi	Group II Loading psi
Tension and compression on extreme fibers of rectangular bearing plates.	(22,500) 0.62 Fy	30,500) 0.85 Fy
<u>Bearing Stresses</u>:		
Milled surfaces and pins in reamed, drilled or bored holes.	(27,000) 0.75 Fy	(32,500) 0.90 Fy
Finished stiffeners.	(24,000) 0.67 Fy	(29,000) 0.80 Fy
Expansion rollers and rockers (lbs/lin. inch)[4]	0.83 K_3d	1.11 K_3d
<u>Bolts (Tension Stresses)</u>:		
A307 bolts	11,500	15,500
A325 bolts	33,500	44,500
A490 bolts	50,000	66,000
<u>Bolts (Shear Stresses, Bearing Type Connections)</u>:		
A307 bolts	8,500	11,000
A325 bolts when threading is not excluded from shear planes	12,500	16,500
A325 bolts when threading is excluded from shear planes.	18,500	24,500
A490 bolts when threading is not excluded from shear planes.	18,600	25,000
A490 bolts when threading is excluded from shear planes	26,600	35,500
<u>Bolts (Shear Stresses, Friction Type Connections)</u>:		
A325 bolts	12,500	16,500
A490 bolts	18,600	25,000
<u>Bolts (Bearing Stresses, Bearing Type Connections)</u>:		
Bearing on projected area	1.13 Fy	1.35 Fy
<u>Weld Stresses</u>:		
Fillet, plug, slot and partial penetration groove welds using A233 Class E-60 electrodes or submerged arc Grade SAW-1.	11,500	15,000
Fillet, plug, slot and partial penetration groove welds using A233 Class E-70 electrodes or submerged arc Grade SAW-2.	13,000	17,500

Complete penetration groove welds shall have the same allowables for tension, compression, bending, shear and bearing stresses as those

TABLE I

allowed for the connected material.

Combined Stresses:

(1) Axial Compression and Bending. Members subject to both axial compression and bending stresses shall be proportioned to satisfy the following requirements:

(a) When f_a/F_a __ 0.15

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} \quad \_\_ 1$$

(b) When f_a/F_a 0.15[5]

$$\frac{f_a}{F_a} + \frac{C_m f_b}{\dfrac{1 \;\; f_a}{K_4 F'_e \;\; F_b}}$$

(c) At points braced in the plane of bending,[6]

$$\frac{f_a}{K_5 F_y} + \frac{f_b}{F_b} \quad \_\_\_ 1$$

(2) Shear and Tension. Bolts subject to combined shear and tension shall be proportioned so that the tension stress from the force applied to the connected part does not exceed the following:

For A307 bolts . . . . $.F_t$=15,000-1.6 f_v __ 10,500
For A325 bolts in bearing type joints. . . . . . . $.F_t$=37,500-1.6 f_v __ 30,000
For A490 bolts in bearing type jionts. . . . . . . $.F_t$=45,000-1.6 f_v __ 37,500

where f_v, the shear produced by the same force, shall not exceed the value for shear given in section g and h of this paragraph.

For bolts used in friction type joints, the allowable shear stresses shall be reduced to meet the following:

For A325 bolts . . . . $.F_v$_ 11,000 $(1-f_t A_b/T_b)$
For A490 bolts . . . . $.F_v$_ 15,000 $(1-f_t A_b/T_b)$

T_b=the proof load of the bolt.

TABLE I

TABLE OF FOOTNOTES

Footnote #1:

$$1- \frac{(Kl/r)^2}{2C_c^2} \quad \text{where;} \quad C_c = \frac{2r^2E}{Fy}$$

$$K_1 = \frac{\rule{5cm}{0.4pt}}{F.S.}$$

K-effective length factor

$$F.S. = \frac{5}{3} + \frac{3}{8}\frac{(Kl/r)}{C_c} - \frac{(kl/r)^3}{8C_c^3}$$

Footnote #2:

This modification factor is applied to secondary members for l/r__ 150. For l/r between C_c and 150, a factor of 1.0 is applied.

Footnote #3:

$$K_2 = 1 - \frac{(l/r)^2}{2C_c^2C_b}$$

$C_b = 1.75 - 1.05 \frac{M_1}{M_2} + 0.3 \frac{M_1}{M_2}^2$, but not more than 2.3

M_1 is the smaller and M_2 the larger bending moment at the ends of the unbraced length.

Footnote #4:

$$K_3 = \frac{Fy-13,000}{20,000} \quad 660$$

d=diameter of roller or rocker in inches.

Footnote #5:

F'e = Euler stress divided by factor of safety

$$F'e = \frac{149,000,000}{\frac{Kl_b}{r_b}^2}$$

TABLE I

Footnote #6:

Where K_4=0.83, and 1.11 respectively, for the included basic stresses.
K_5=0.50, and 0.67 respectively, for the included basic stresses.

TABLE II

ALLOWABLE WORKING STRESSES FOR CONCRETE

Concrete which will be subjected to submergence, wave action, and spray will be designed with working stresses in accordance with ACI Building Code with the following modifications:

Compressive stresses (28 day), f'_c	3,000 psi
Flexure stresses (f_c):	
Extreme fiber stress in compression	$0.35\ f'_c$
Extreme fiber stress in tension (plain concrete for footings and walls but not for other portions of gravity section)	$1.2\sqrt{f'_c}$
Extreme Fiber stress in tension (for other portions of gravity sections)	$0.6\sqrt{f'_c}$

Types of structures to which those modifications apply are:

Floodwalls

Lock walls, guide, and guard walls

Retaining walls subject to contact with water

Allowable stresses in reinforcement will be in accordance with the ACI Building Code excpet for tension in deformed bars with a yield strength of 60,000 p.s.i. or more, the stress shall not exceed 20,000 p.s.i. based upon Group 1 loading.

For Group 2 loading the above stresses may be increased by 33 1/3%.

TABLE II (cont'd)

Minimum tensile reinforcement. The minimum area of tensile reinforcement steel should be .0025 bd, with a maximum of #9 bars at 12 inches.

Minimum temperature reinforcement. The minimum area of temperature reinforcement steel should be .0020 bt, half in each face, with a maximum of #6 bars at 12 inches.