TC202
N46L3P6
no.2
suppl.9
1973

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE SOUTH POINT TO G.I.W.W.

GUST, 21SP, 20SP, 2USP etc

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

January 1973

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Serial No. 19

32603626

TC202
N46L3P6
no.2
suppl. 9
1973

LMVED-TD (NOD 19 Jan 73) 1st Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 8 Mar 73

TO: HQDA (DAEN-CWE-B) WASH DC 20314

The subject design memorandum was submitted simultaneously to your office pursuant to para 20a, ER 1110-2-1150. Approval is recommended subject to the following comments:

a. Para 23, Page 10. The fifth sentence mentions seepage and uplift problems south of Bayou Sauvage. The foundation design portion of the text should mention this problem area and the considerations given it in the design of this reach of the levee.

b. Para 31b(2), Page 14. The fourth sentence states "the existing culverts were analyzed for the condition of water to el -3.0 on both sides...." The section and soil profile depicted on Plate 48 should also be analyzed for water to el 11.5 on the flood side and failure toward the protected side.

c. Para 33b(1), Page 18. The exposed portion of the existing steel sheet piling mentioned in this paragraph should be inspected before the wall is capped. If the sheet piling is deteriorated, it should be pulled and replaced.

d. Para 33c, Page 18. (1) The design lengths of the foundation piles should be given.

(2) The factors of safety given in this paragraph are too low since load tests are not being conducted. Factors of safety of 3, based on static equation should be used as per EM 1110-2-2906, dated July 1969, unless there are load tests in similar soils available to substantiate the computed ultimate loads.

e. Para 36, Page 21. This paragraph states that the levee fill will be obtained from the borrow area in Lake Pontchartrain near Howze Beach. The condition of the material adjacent to the levee is, however, not stated nor is there any mention of consideration of this material for levee fill. The use of opposite borrow should be considered.

f. Paras 41 & 42, Page 24. The alternative of providing the required protection by constructing an I-wall on the existing levee in lieu of the proposed levee enlargement should be investigated if this has not been done.

g. Plate 64. The flare of the training walls for the inlet and outlet structures should be no greater than 1 on 4 in order to limit flow separation and attendant eddy action as much as practicable. Also, consideration should be given to providing riprap protection in the bend on the south bank of the outlet ditch. The jet issuing from the culvert barrels will still be concentrated and could produce considerable attack on the south bank. This applies to both structures.

h. Plate 68. See para 8 above relative to the flaring of training walls for the inlet and outlet structures.

i. Plate 71. Section F-F shows the existing sheet piling to el -4.0 while Plate 77 shows the sheet piling to el -5.5. This discrepancy should be rectified.

j. Appendix C. (1) Para 2b, Page C-2. The 1 foot of freeboard above the maximum wind-tide level is concurred in. Hurricane protection levees are usually designed to be overtopped by waves greater than the significant wave; therefore, in terms of freeboard, there is usually none. Also, the duration of surge against the levee is a matter of only a few hours. To provide for higher freeboard requirements would greatly increase the cost of the project and require greater right-of-way limits. Experience in the NOD has been that considerable overtopping can take place before the levee section is severely eroded. Considering the above, the 1 foot of freeboard is adequate.

(2) Para 2a(2), Page C-2. A copy of the Plates showing SPH isovel patterns and critical path for Tracks A and F should be included.

(3) Plates showing wind direction and speed at the critical hour for the two parts of the protective structure (South Point to U.S. Highway 90 and GIWW to U.S. Highway 90) should also be included. Data similar to Plate 3 of information furnished in response to ENGCW-EZ 2d Ind, dated 25 Feb 69, subject: Lake Pontchartrain, Louisiana & Vicinity, Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part III - Lakeshore, would be sufficient.

(4) Para 7, Page C-4, and Plates C-1, C-2, and C-3. EM 1110-2-1602, Paras 6c and 6d, indicate loss coefficients of 0.5 and 0.01, respectively, for square-edged entrance and gate slot wells. Para 6a of above EM indicates that loss coefficients are applicable to the velocity head in

LMVED-TD (NOD 19 Jan 73) 1st Ind 8 Mar 73
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW

the conduit for pressure flow with entrance submerged. The "C" values should be recomputed, using the above, and corrections made to the rating curves on referenced plates.

FOR THE DIVISION ENGINEER:

for Robert J. Kaufman
HOMER B. WILLIS
Chief, Engineering Division

wd incl

CF:
LMNED-MP

DAEN-CWE-B (LMNED-MP, 19 Jan 73) 2nd Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW

DA, Office of the Chief of Engineers, Washington, D.C. 20314 1 May 1973

TO: Division Engineer, Lower Mississippi Valley, ATTN: LMVED-TD

1. Reference 4th indorsement DAEN-CWE-B, 14 March 1973 on letter LMNED-PP, 20 June 1972, subject: "Lake Pontchartrain, Louisiana and Vicinity, Lake Ponchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5B, New Orleans East Lakefront Levee, Paris Road to South Point".

2. Approved, subject to the comments of the Division Engineer and to the comments furnished in the following paragraphs. As indicated in the 4th indorsement referenced above, submission of the overall economic analysis for the Lake Pontchartrain Barrier Plan and the incremental economic analysis for the New Orleans East area are not required prior to initiating construction on the subject project feature; however, preparation of these analyses as well as a fully coordinated environmental impact statement should be expeditiously pursued.

3. 1st Indorsement.

a. Paragraph j(1); main text, paragraphs 14, 15 and 38; and Appendix C, paragraph 2. Levee grades are acceptable since they are consistent with past approvals. However, the hydrologic engineering criteria used to establish the height of the net levee grade above the design hurricane surge height should not be considered as establishing a precident. The hydrologic engineering design of hurricane protection net levee grades involves numerous considerations with various degrees of uncertainty and simple solutions (criteria) are usually inadequate. Therefore, in the future, the net levee grade should be established for each project only after a careful consideration of all pertinent factors.

b. Paragraph j(4); and Appendix C, paragraph 7. The suggested loss coefficients are not adequate. Attached as Inclosure No. 2 is a set of check computations with a suggested procedure and referenced loss coefficients. The orifice equation may be used if transposed to solve for H instead of Q in order not to mask the magnitude of losses that vary with discharge.

4. Paragraph 8. The authority of the Governor of the State of Louisiana to execute formal assurances on behalf of the St. Tammany Parish Police Jury should be more fully discussed with reference to specific statutory language and case law, if any. The "additional legal action" required

by the State before such assurances can be accepted by the Federal Government should be further explained setting forth the nature of the legal problems and the suggested remedial action required. Finally, it is observed that although the Governor, under pertinent statutes, may have the authority to execute formal assurances on behalf of St. Tammany Parish Police Jury, this paragraph is silent as regards the authority of the Governor to require St. Tammany Parish Police Jury to provide the required share of local contribution, i.e., money. In other words, it should be ascertained whether the assurances executed by the Governor are meaningful, in a practical sense, if the local interests refuse or are unable to provide their share of local costs. All the above should be fully analyzed and set forth with appropriate conclusions and recommendations in a supplemental Attorney's Report.

5. Paragraph 31c. Consideration should be given to providing 1.5 feet to 2.0 feet of overbuild for long-term settlement and lateral yielding.

6. Paragraphs 34b and 67b; Plates 64 and 67; and 1st indorsement, paragraphs g and h. In regard to the riprap around the sluice gate well structures, consideration should be given to placing the riprap sufficiently below grade so that soil cover can support grass cover. This would eliminate an unsightly riprap patch and allow easier maintenance in this area of infrequent attack. Other riprapped areas subject to infrequent attack should be similarly considered. Waterways Experiment Station Research Report H-70-2, and Miscellaneous Reports H-71-5 and H-72-5 should be considered in the design of exit channels and riprap.

7. Table 1, page 33. It is suggested that the table be broken down so as to distinguish between Federal and non-Federal costs.

FOR THE CHIEF OF ENGINEERS:

for JOSEPH M. CALDWELL
Chief, Engineering Division
Directorate of Civil Works

1 Incl
wd incl 1
Added 1 incl
2. as (dupe)

SOUTH POINT TO GIWW

ACC. NO.

SHEET 1 TOT. IN COMP.

COMPUTER SBP CHECKED BY DATE 21 MAR '73

REF. PLATE 64 & C-1:

RATING CURVE FOR:

3 CMP 42" Ø

L = 160 FT A = 3 × 9.62 = 28.86 □'

HEAD LOSS COEF. IN TERMS OF CONDUIT VEL. HEAD

ENTRANCE

$K_e = 0.40$ (SEE SHT 5, K_e ESTIMATED AS TABLE DATA FOR SINGLE PIPE INSTALLATION)

GATE WELL

$K_w = 0.20$ (REF. "PRESSURE CHANGES AT STORM DRAIN JUNCTIONS" BY W. M. SANGSTER, ENGR. SERIES BUL. NO. 41, UNIV. OF MISSOURI, 15 OCT. 1958)

DISCHARGE = 100 CFS

$V = 100/28.86 = 3.47$

$V^2/2g = 0.19$

FLAP GATE

$K_G =$ —— (USAEWES HDC 340-1)

FRICTION

$R_e = \frac{VD}{\nu} = \frac{3.47 \times 3.5}{1.4 \times 10^{-5}} = 8.1 \times 10^5$

$f = 0.075$ (USAEWES HDC 204-1/2

$K_f = \frac{fL}{D} = \frac{0.075 \times 160}{3.5} = 3.42$

U.S. GOVERNMENT PRINTING OFFICE : 1983—O-786-921

SUBJECT: SOUTH POINT TO GIWW

FILE NO.

ACC. NO.

SHEET 2 TOT. IN COMP.

COMPUTER: SBP CHECKED BY: DATE: 21 MAR '73

DISCHARGE = 200 CFS

$V = 200/28.86 = 6.94$

$V^2/2g = 0.75$

FLAP GATE

$K_G =$ ——

FRICTION

$Re = \frac{6.94 \times 3.5}{1.4 \times 10^{-5}} = 1.7 \times 10^6$

$f = 0.025$

$K_f = \frac{0.025 \times 160}{3.5} = 3.42$

DISCHARGE = 300 CFS

$V = 300/28.86 = 10.4$

$V^2/2g = 1.68$

FLAP GATE

$K_G = 0.01$

FRICTION

$Re = \frac{10.4 \times 3.5}{1.4 \times 10^{-5}} = 2.6 \times 10^6$

$f = 0.022$

$K_f = \frac{0.022 \times 160}{3.5} = 3.30$

EXIT

$K_x = 1.00$

U.S. GOVERNMENT PRINTING OFFICE : 1965—O-7

SUBJECT NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

FILE NO.

ACC. NO.

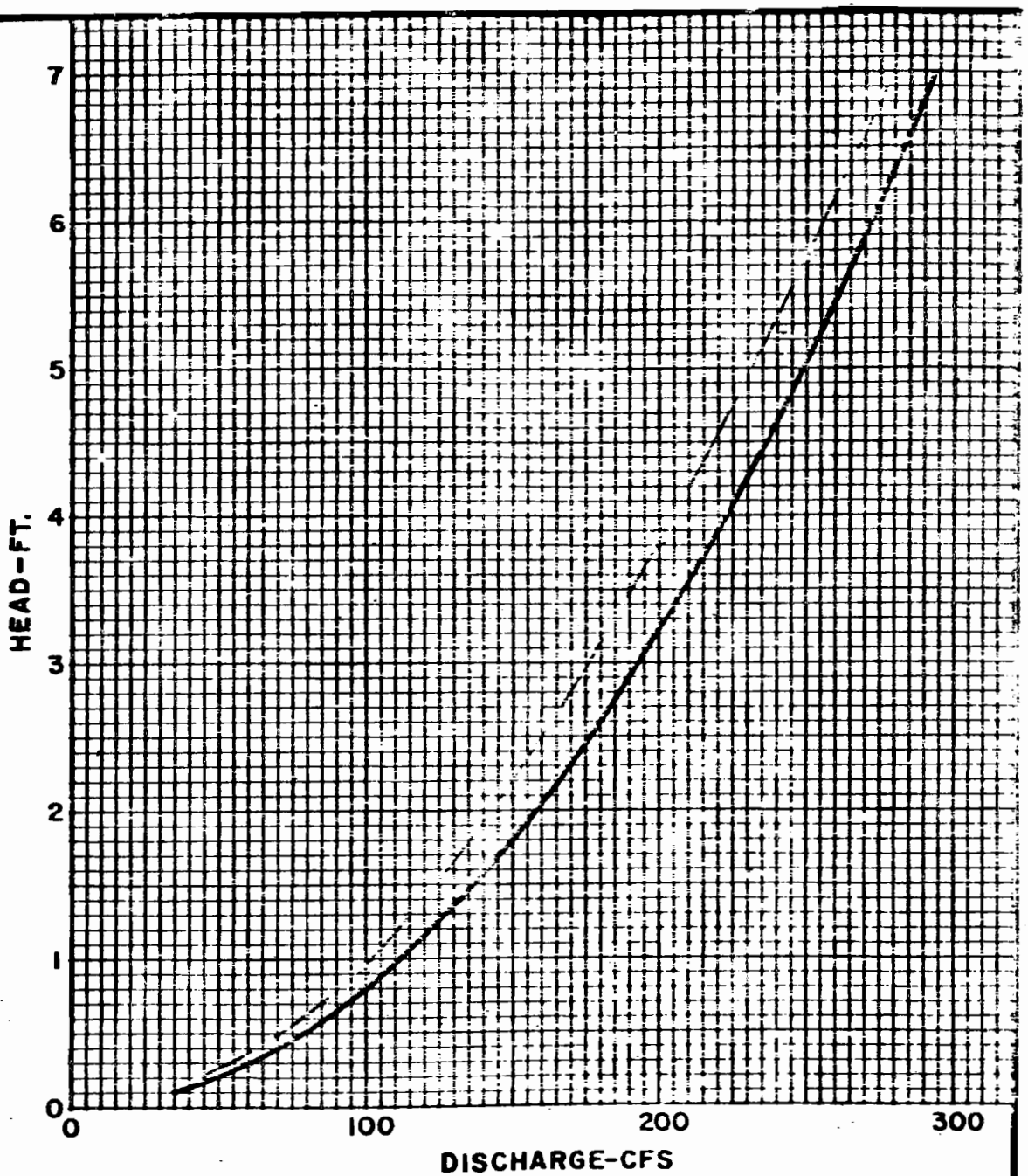
SHEET 3 TOT. IN COMP.

COMPUTER SBP CHECKED BY DATE 21 MAR '73 19

TOTAL	Q=	100	200	300	250
	K_e	0.40	0.40	0.40	0.40
	K_w	0.20	0.20	0.20	0.20
	K_G	—	—	0.01	—
	K_F	3.42	3.42	3.30	3.36
	K_X	1.00	1.00	1.00	1.00
	K_T	5.02	5.02	4.91	4.96
	$V^2/2g$ =	0.19	0.75	1.68	1.16
	$H_L = K_T V^2/2g$ =	0.95	3.87	8.45	5.78

PLOTTED AS DASHED LINE ON SHT 4

U.S. GOVERNMENT PRINTING OFFICE: 1969—O-788-4



SHT 4

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 - GENERAL DESIGN
SUPPLEMENT No. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW
RATING CURVE
DRAINAGE STRUCTURE - STA. 799 + 00
3-42" Ø CMP LENGTH 160'
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973

PLATE C-

SOME IMPORTANT FACTORS OF CULVERT DESIGN

By Dasel E. Hallmark*

*Hydraulic Engineer, Water Resources Bureau, Portland Cement Association. Presented at the 13th Annual Maine Highway Conference, October 26-27, 1962; Orono, Maine.

TABLE I

COEFFICIENTS FOR HYDRAULIC DESIGN OF INLETS

ENTRANCE SHAPE	Head loss Coefficient K_e	Discharge Coefficient C_d
With Headwall		
Groove edge	.19	.734
Round (.15 D Radius)	.15	.775
Round (.25 D Radius)	.10	.860
Square edge	.43	.625
Headwall & 45° wingwalls		
Groove edge	.20	.731
Square edge	.35	.651
Headwall & Parallel Wingwall		
Groove edge	.30	.691
Square edge	.40	.634
Miter		
2:1 embankment slope	.62	.580
Projecting entrance		
Groove edge	.25	.70
Square edge (Thick wall)	.46	.614
Thin edge	.92	.525

SHT 5

LMVED-TD (NOD 19 Jan 73) 3d Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 24 May 73

TO: District Engineer, New Orleans, ATTN: LMNED-MP

1. Referred to note approval and for necessary action to resolve comments in previous indorsements.

2. In regard to para 3a 2d Ind, it is our view that you have always given careful consideration to all pertinent factors in establishing levee grades and we expect you to continue that policy in the future.

3. We interpret para 4 as a question of the adequacy of the assurances that were prepared for signature and not to question the intent of the Governor.

4. Para 6, 2d Ind. We do not consider it advisable to provide soil cover for riprap. If the riprap is necessary, it should be left exposed as is our normal practice.

FOR THE DIVISION ENGINEER:

Robert J. Kaufman
for HOMER B. WILLIS
Chief, Engineering Division

1 Incl
wd 1 cy incl 2

CF:
DAEN-CWE-B

LMNED-MP (19 Jan 73) 4th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 1, Supplement No. 9, New Orleans East Levee, South Point to GIWW

DA, New Orleans District, Corps of Engineers, PO Box 60267, New Orleans, LA 70160 24 July 1973

TO: Division Engineer, Lower Mississippi Valley, ATTN: LMVED-TD

1. The proposed disposition of comments in the 1st, 2d, and 3d indorsements of this chain of correspondence is as follows (paragraph numbers refer to like-numbered paragraphs in the respective indorsements):

2. 1st Indorsement.

a. Para a. The area in question was analyzed for seepage and uplift during the design of the subject levee, and the minimum factor of safety relative to heave at the protected side toe of the levee was found to be 1.45. The fifth sentence of para 23, page 10, should be revised to read "Seepage and uplift considerations are limited to the area immediately south of Bayou Sauvage where the base of the levee fill is in contact with Holocene silt and sand strata which directly overlie Pleistocene sand. However, foundation analyses indicate there are no problems relative to seepage and uplift."

b. Para b. The levee was analyzed for the condition of water to elevation 11.5 on the flood side and water to elevation 0.0 on the protected side with assumed failure toward the protected side and the resulting minimum factor of safety is 1.44. Only the more critical analysis was presented in the subject supplement.

c. Para c. Concur. The existing steel sheet piling has been inspected recently and appears to be in good condition. Any sheet piling found to be unsuitable during construction will be replaced.

d. Para d(1). The concrete piles will be driven to a tip elevation of -55.0 m.s.l.

e. Para d(2). The tip penetration required for a factor of safety of 3 is elevation -51.0 m.s.l.; however, the piles will be driven to elevation -55.0 m.s.l. to provide a 5-foot penetration into the sand stratum.

f. Para e. The use of opposite borrow was considered during the preparation of the subject supplement; however, discussion thereof was inadvertently omitted from the text. The opposite borrow areas would have to be stripped to approximate elevation -10.0 m.s.l. and the borrow material would have to be stockpiled and processed to be used as semi-compacted fill. This stockpiling would require

additional rights-of-way. Since all opposite borrow on either side of existing levee is marshland, the stripping and stockpiling of levee fill would involve retaining dikes, a ponding area, associated drainage problems of dredge waste water, and additional rights-of-way. The environmental restrictions are severe in this area for dredging and, since only 300,000 cubic yards of material is needed, Howze Beach was chosen as the borrow site. Even with the maximum practicable effort, the processed opposite borrow material would not be equal to the firm Pleistocene clay available in the Howze Beach borrow area. Further, a firm clay material is required for the subject levee between U. S. Highway 90 and the GIWW to form a base for the access road to be constructed on the levee crown. Consequently, the Howze Beach borrow material is considered a superior fill material and was selected for use instead of opposite borrow.

g. Para f. A cost comparison between I-wall and levee enlargement was performed. The levee enlargement was more economical and therefore recommended.

h. Para g. The flare of the training walls has been changed in the plans and specifications. The revised rates of flare on the drainage structures are 1 on 2 for the inlet basin walls and 1 on 6 for the outlet basin walls. Hydraulic calculations indicate that the inlet and outlet basins as modified are adequate, and that turbulence will not be a problem on either side of the structures. Twelve inches of riprap will be placed on the south bank of each outlet basin channel to prevent scour due to jetting action.

i. Para h. Refer to reply in para 2h above.

j. Para i. The correct tip elevation for the existing sheet piling is -5.5 m.s.l.

k. Para j(1). No response required.

l. Para j(2) and j(3). Plates depicting the SPH isovel patterns, wind directions at the critical hour, and critical paths for Tracks A and F are inclosed herewith as inclosures 3 and 4, respectively.

m. Para j(4). Paragraph 7, page C-4 of Appendix C should be deleted and the following substituted in its place.

> "Hydraulic computations. Rating curves for the new drainage structures were computed using the continuity equation, $Q=AV$, where Q is the discharge in cubic feet per second, A is the

cross-sectional area in square feet, and V is the average velocity in the culvert. For the determination of entrance, gate well and exit losses, values of 40%, 20% and 100% of the velocity head with the culvert flowing full were used, respectively. Friction losses were computed according to the Darcy-Weisbach equation, $H_f = f \frac{L}{D} \frac{V^2}{2g}$

in which H_f = head loss due to friction, ft.

f = friction factor
L = length of culvert, ft.
D = diameter of culvert, ft.
V = average velocity, ft./sec.
g = acceleration of gravity, ft./sec.^{2}

The discharge rating curve for each replacement structure is equivalent to the rating curve for the existing structure it replaces." The discharge curves derived are shown on revised plates C-1, C-2, and C-3 included herewith as inclosures 5, 6, and 7.

3. 2d Indorsement.

a. Para 3a. Refer to response in 3d Indorsement para 2.

b. Para 3b. Refer to response in para 2m above.

c. Para 4. An attorney's report, now being formulated will be submitted by separate correspondence at a later date.

d. Para 5. Do not concur. The existing levee has been in place since 1956, and with only 2 to 3 feet of fill being placed on the levee, overbuilding the levee 1.5 to 2.0 feet for long term settlement and lateral yielding is not required. The 1.0-foot overbuild referred to in the GDM is adequate to cover long term settlement and lateral yielding.

e. Para 6. Refer to response in 3d Indorsement para 4.

LMNED-MP (19 Jan 73) 4th Ind 24 July 1973
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 1, Supplement No. 9, New Orleans East Levee, South Point to GIWW

f. Para 7. Noted. Future submissions will reflect a Federal and non-Federal cost breakdown.

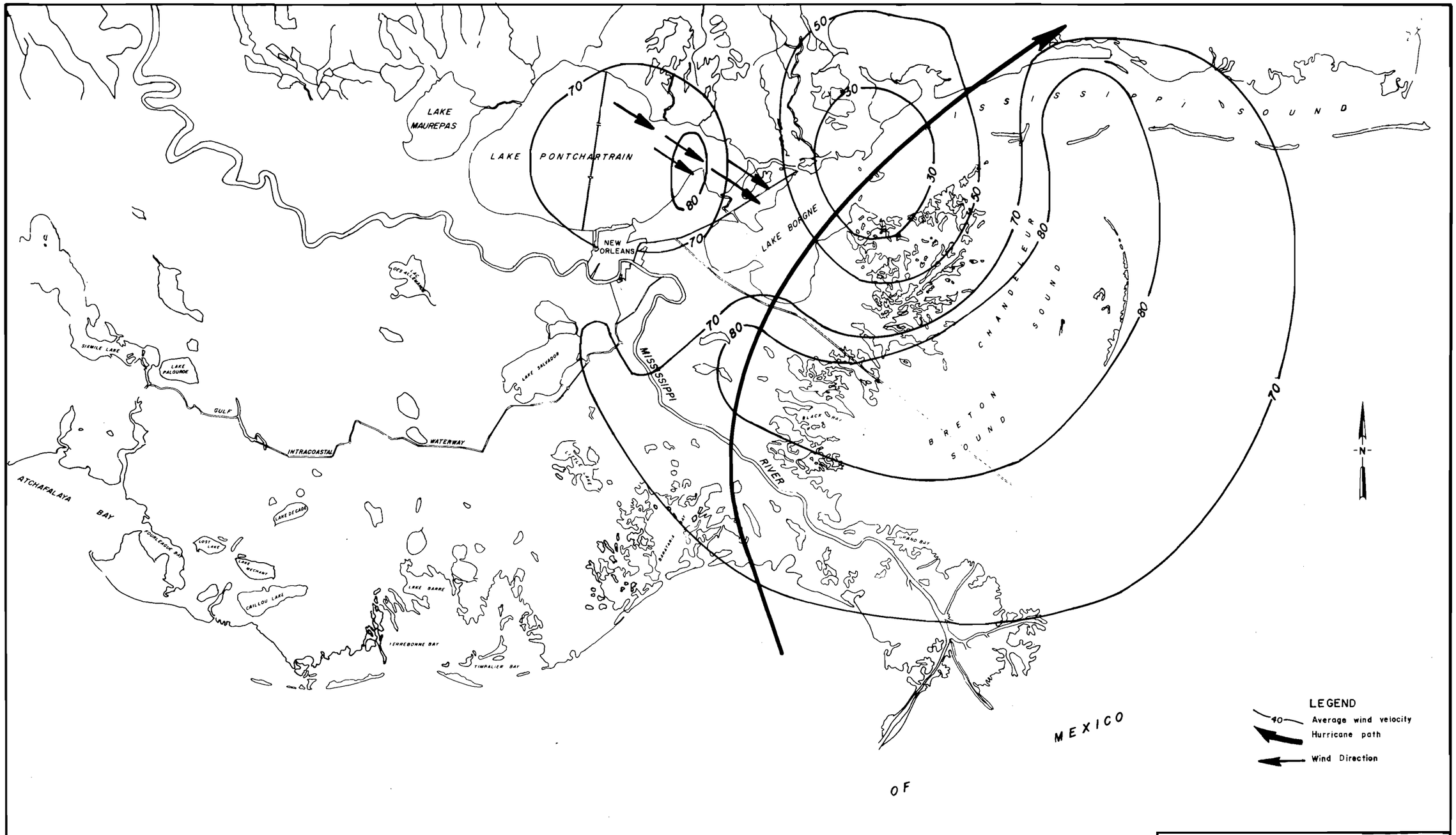
4. 3d Indorsement. No responses required.

5. It is requested that the foregoing disposition of comments be approved as presented.

FOR THE DISTRICT ENGINEER

Walter S Mask
for JEROME C. BAEHR
Chief, Engineering Division

6 Incl
2. 1 cy incl 2 wd
Added 5 incl
3. Isovel patterns & wind directions - Track A
4. Isovel patterns & wind directions - Track F
5. Rating curve
6. Rating curve
7. Rating curve

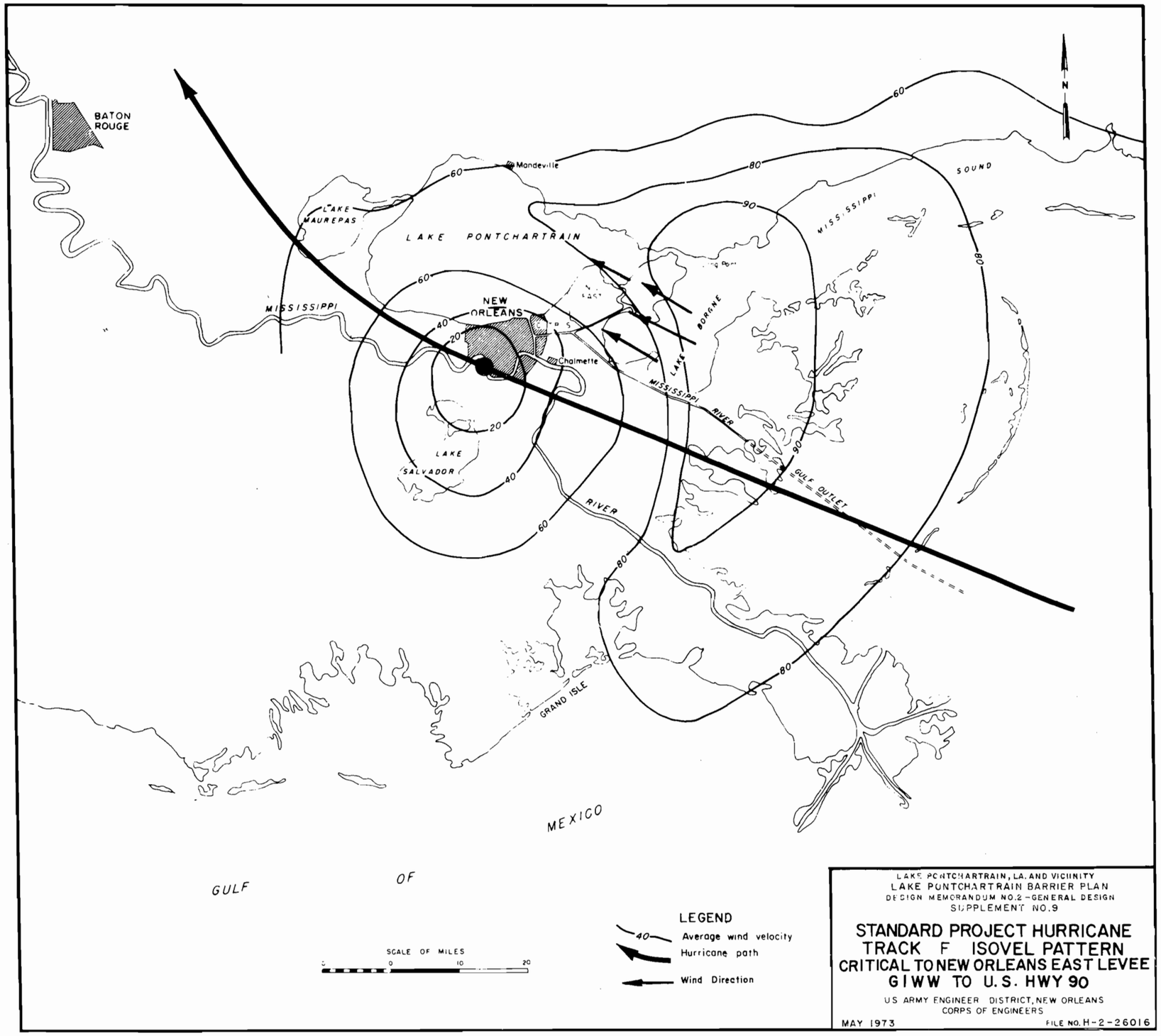


LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

STANDARD PROJECT HURRICANE TRACK A ISOVEL PATTERN CRITICAL TO NEW ORLEANS EAST LEVEE SOUTH POINT TO U.S. HWY 90

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

MAY 1973 FILE NO. H-2-26016



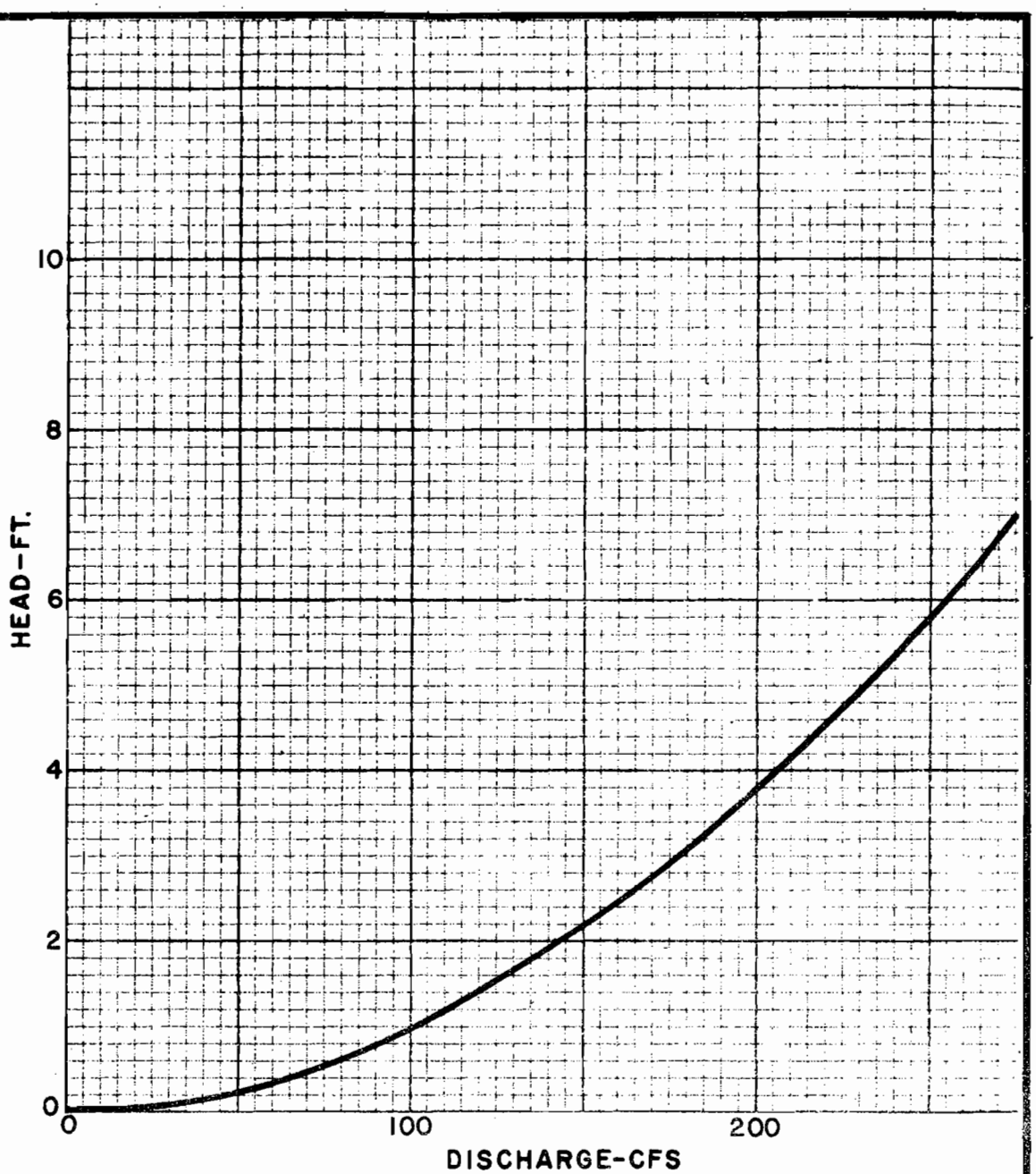
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 - GENERAL DESIGN
SUPPLEMENT NO.9

STANDARD PROJECT HURRICANE TRACK F ISOVEL PATTERN CRITICAL TO NEW ORLEANS EAST LEVEE GIWW TO U.S. HWY 90

US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1973

FILE NO. H-2-26016



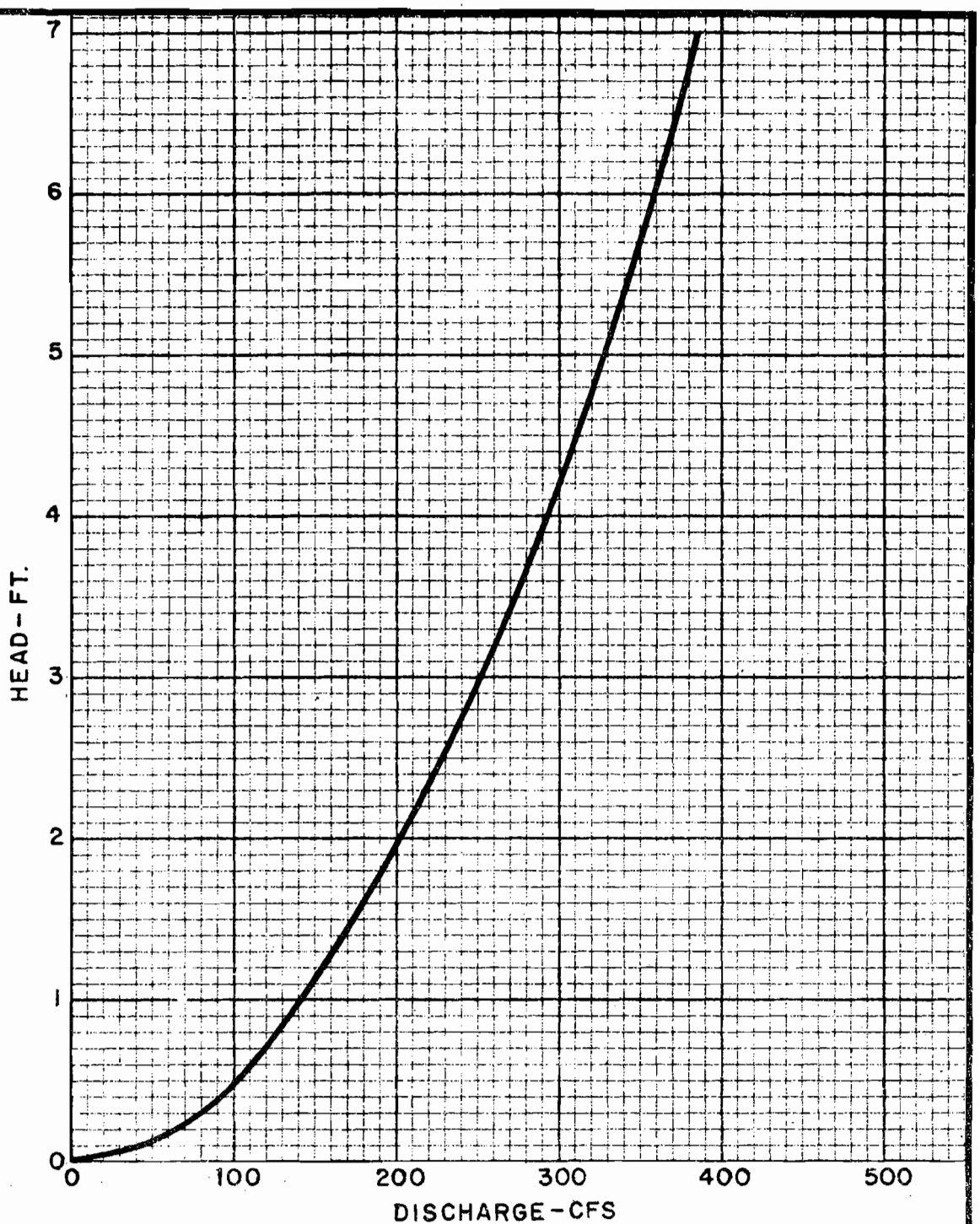
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

RATING CURVE
DRAINAGE STRUCTURE-STA. 799+00
3-42" Ø CMP LENGTH 160'

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

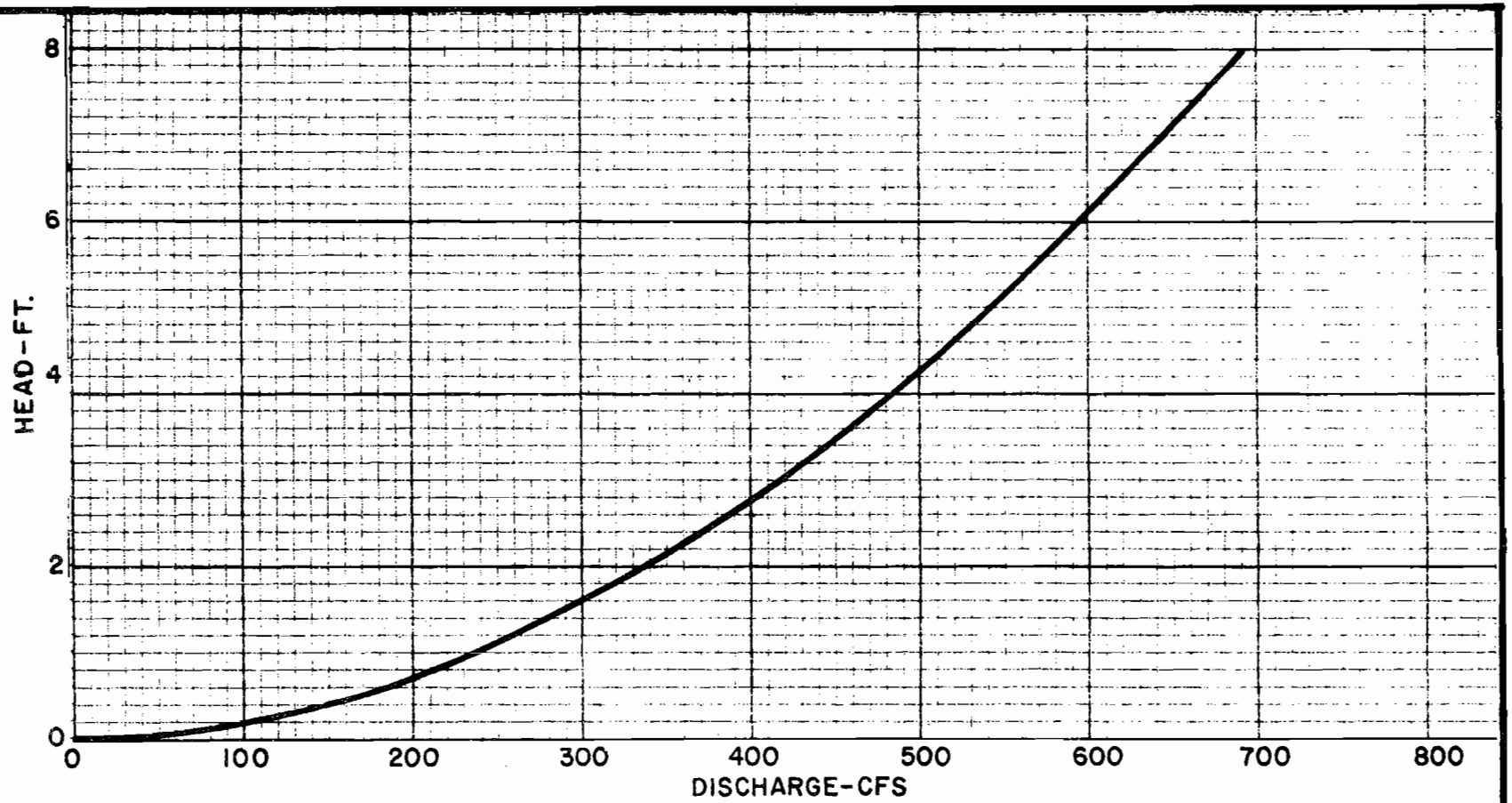
JANUARY 1973 FILE NO. H-2-26016

REVISED JUNE 1973 PLATE C-1



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
RATING CURVE
DRAINAGE STRUCTURE-STA. 927+00
3-48"Ø CMP LENGTH 160'
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-26016
REVISED JUNE 1973

PLATE C-2



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
RATING CURVE
DRAINAGE STRUCTURE-STA. 1054+00
4-54" Ø CMP LENGTH 192'

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-26018

REVISED JUNE 1973

PLATE C-3

LMVED-TD (NOD 19 Jan 73) 5th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 1, Supplement No. 9, New Orleans East Levee, South Point to GIWW

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 22 Aug 73

TO: District Engineer, New Orleans, ATTN: LMNED-MP

The information furnished and actions described in the 4th Ind are satisfactory. The attorney's report discussed in sub para 3c of the 4th Ind should be submitted as an indorsement to this chain of correspondence.

FOR THE DIVISION ENGINEER:

Robert I. Kaufman

wd all incl

ROBERT I. KAUFMAN
Acting Chief, Engineering Division

CF:
DAEN-CWE-B (14 cy)
w 4th Ind and Incl

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

IN REPLY REFER TO
LMNED-MP

19 January 1973

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject supplement is submitted herewith for review and approval, and has been prepared generally in accordance with the provisions of ER 1110-2-1150 exclusive of the Phase I--Phase II planning procedure.

2. In accordance with paragraph 20a, ER 1110-2-1150, change 2, dated 29 August 1972, 14 copies of this report are being simultaneously forwarded to the office of the Chief of Engineers.

3. Approval of this supplement is recommended.

Richard L. Hunt

RICHARD L. HUNT
Colonel, CE
District Engineer

1 Incl (16 cys) fwd sep
GDM No. 2, Supp. No. 9

CF: w 14 cys incl
HQDA (DAEN-CWE-B)

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

STATUS OF DESIGN MEMORANDUMS

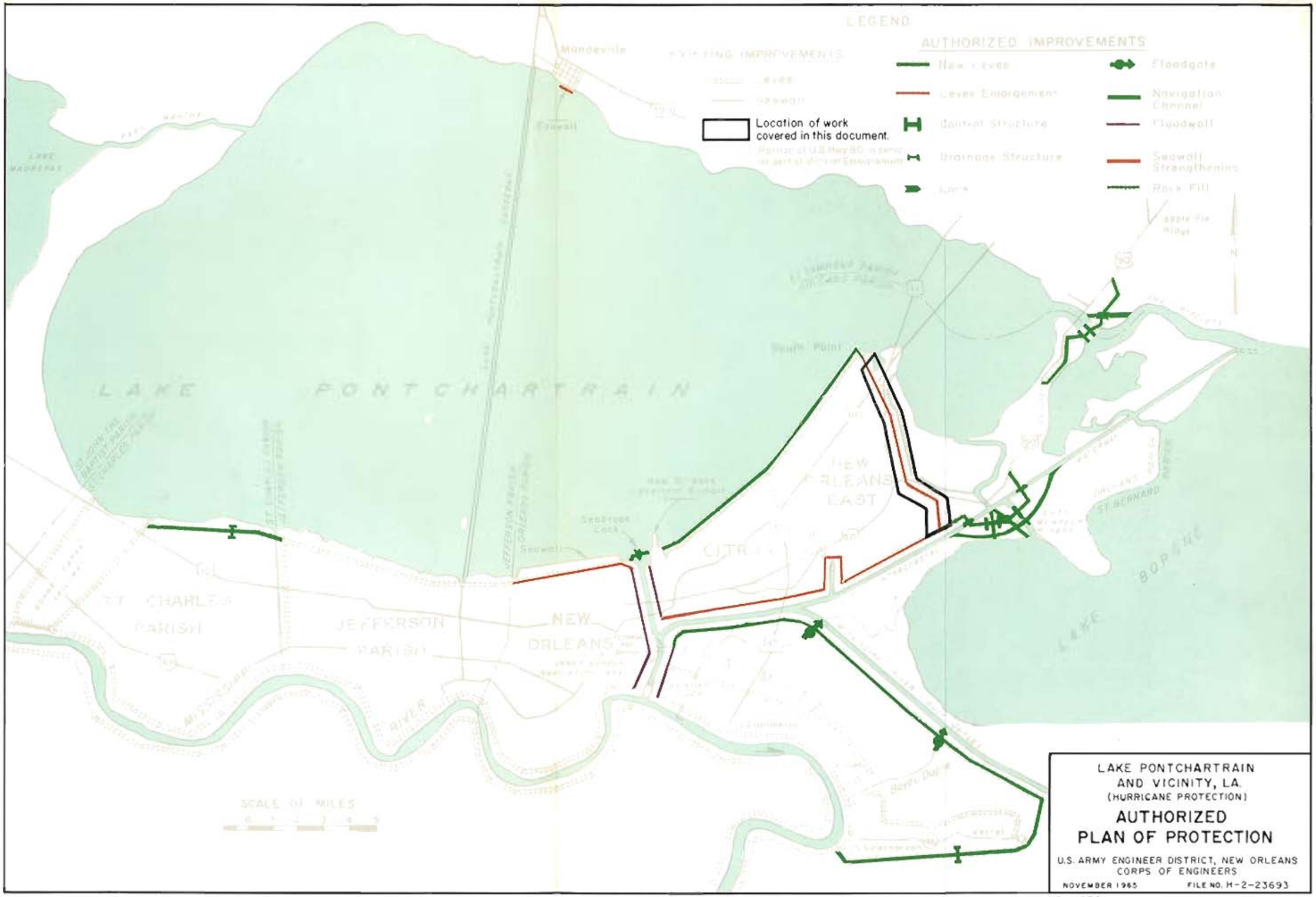
Design Memo No.	Title	Status
1	Hydrology and Hydraulic Analysis	
	Part I - Chalmette	Approved 27 Oct 66
	Part II - Barrier	Approved 18 Oct 67
	Part III - Lakeshore	Approved 6 Mar 69
	Part IV - Chalmette Extension	Approved 1 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Advance Supplement, Inner Harbor Navigation Canal Levees	Approved 31 May 67
2	Lake Pontchartrain Barrier Plan, GDM, Citrus Back Levee	Approved 29 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 1, Lake Pontchartrain Barrier, Rigolets Control Structure, Closure Dam, and Adjoining Levees	Approved 10 Nov 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 2, Lake Pontchartrain Barrier, Rigolets Lock and Adjoining Levees	Approved 19 Oct 71
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 3, Lake Pontchartrain Barrier, Chef Menteur Pass Complex	Approved 19 Sep 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 4, New Orleans East Back Levees	Approved 18 Aug 71
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5, Orleans Parish Lakefront Levees - West of IHNC	Scheduled Oct 73

STATUS OF DESIGN MEMORANDUMS (cont'd)

Design Memo No.	Title	Status
2	Lake Pontchartrain Barrier Plan, GDM, Supplement 5A, Citrus Lakefront Levees - IHNC to Paris Road	Scheduled May 73
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5B, New Orleans East Lakefront Levee - Paris Road to South Point	Approved 5 Dec 72
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5C, Orleans Parish Outfall Canals - West of the IHNC	Scheduled May 74
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 6, St. Charles Parish Lakefront Levees	Approved 4 Nov 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 7, St. Tammany Parish, Mandeville Seawall	Indefinite
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 8, IHNC Remaining Levees	Approved 6 Jun 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 9, New Orleans East Levee from South Point to GIWW	Submitted 19 Jan 73
3	Chalmette Area Plan, GDM	Approved 31 Jan 67
3	Chalmette Area Plan, GDM, Supplement No. 1, Chalmette Extension	Approved 12 Aug 69
4	Lake Pontchartrain Barrier Plan, and Chalmette Area Plan, GDM Florida Avenue Complex, IHNC	Scheduled Jul 73
5	Chalmette Area Plan, DDM, Bayous Bienvenue and Dupre Control Structures	Approved 29 Oct 68

STATUS OF DESIGN MEMORANDUMS (cont'd)

Design Memo No.	Title	Status
6	Lake Pontchartrain Barrier Plan, DDM, Rigolets Control Structure and Closure	Scheduled May 73
7	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Control Structure and Closure	Scheduled Jun 73
8	Lake Pontchartrain Barrier Plan, DDM, Rigolets Lock	Scheduled Jul 73
9	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Navigation Structure	Scheduled Feb 74
10	Lake Pontchartrain Barrier Plan, Corrosion Protection	Approved 21 May 69
12	Sources of Construction Materials	Approved 30 Aug. 66
1	Lake Pontchartrain, Louisiana and Vicinity, and Mississippi River-Gulf Outlet, Louisiana, GDM, Seabrook Lock	Approved 4 Nov 70
2	Lake Pontchartrain, Louisiana and Vicinity, and Mississippi River-Gulf Outlet, Louisiana, DDM, Seabrook Lock	Scheduled Aug 73



LAKE PONTCHARTRAIN
AND VICINITY, LA.
(HURRICANE PROTECTION)

AUTHORIZED
PLAN OF PROTECTION

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

NOVEMBER 1965 FILE NO. H-2-23693

REV. DEC. 1970

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

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PERTINENT DATA

Location of project	Southeastern Louisiana in Orleans Parish
Hydrologic data	
Temperature: Maximum monthly	87.1° Fahrenheit
Minimum monthly	43.0° Fahrenheit
Average annual	69.7° Fahrenheit
Annual precipitation: Maximum	85.73 inches
Minimum	31.07 inches
Average	60.58 inches
Hydraulic design criteria--tidal	
Design hurricane--Standard Project Hurricane (SPH)	
Frequency	1 in 300 yrs--S.Point to Hwy 90 1 in 200 yrs--Hwy 90 to GIWW
Central Pressure Index (CPI)	27.4 inches of mercury
Maximum 5-min. average wind	100 m.p.h.
Levee	
Method of construction	Hauled, semi-compacted clay fill
Levee length	8.3 miles
Elevation, varies	12.5[1] to 14.0
Crown width	10 feet
Drainage structures	
Location: Station 799+00	Flap-gated gravity structure with positive cutoff, three 42" Ø CMP culverts
Station 927+00	Flap-gated gravity structure with positive cutoff, three 48" Ø CMP culverts
Station 1054+00	Flap-gated gravity structure with positive cutoff, four 54" Ø CMP culverts
Railroad gate	
Description	Steel swing type in concrete monolith

[1]Elevations contained herein are in feet referred to mean sea level unless otherwise noted.

PERTINENT DATA (cont'd)

Rights-of-way	
Permanent rights-of-way	63 acres
Construction easements	44 acres
Estimated first cost	
Levees and floodwalls	$1,620,000
Engineering and design	178,000
Supervision and administration	162,000
Relocations	1,120,000
Lands and damages	161,000
Total	$3,241,000

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

PROJECT AUTHORIZATION

1. Authority.

a. Public Law. Public Law 298, 89th Congress, 1st Session, approved 27 October 1965, authorized the "Lake Pontchartrain, Louisiana and Vicinity," hurricane protection project, substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 231, 89th Congress, 1st Session, except that the recommendations of the Secretary of the Army in that document shall apply with respect to the Seabrook Lock feature of the project.

b. House Document. The report of the Chief of Engineers dated 4 March 1964 printed in House Document No. 231, 89th Congress, 1st Session, submitted for transmission to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers and the concurring report of the Mississippi River Commission for those areas under its jurisdiction. The report of the Board of Engineers for Rivers and Harbors stated: "For protection from hurricane flood levels, the reporting officers find that the most suitable plan would consist of a barrier extending generally along U. S. Highway 90 from the easternmost levee to high ground east of the Rigolets, together with floodgates and a navigation lock in the Rigolets, and flood and navigation gates in Chef Menteur Pass; construction of a new lakeside levee in St. Charles Parish extending from the Bonnet Carre' Spillway guide levee to and along the Jefferson Parish line; extension upward of the existing riprap slope protection along the Jefferson Parish levee; enlargement of the levee landward of the seawall along the 4.1 mile lakefront, and construction of a concrete-capped sheet-pile wall along the levee west of the Inner Harbor Canal in New Orleans; raising the rock dikes and landward gate bay of the planned Seabrook Lock; construction of a new levee lakeward of the Southern Railway extending from the floodwall at New Orleans Airport to South Point; enlargement of the existing levee extending from U. S. Highway 90 to the Gulf Intracoastal Waterway, thence westward along the waterway to the Inner Harbor Canal, together with riprap slopes along the canal; construction of a concrete capped sheet-pile wall along the east levee of the Inner Harbor Canal between the Gulf Intracoastal Waterway and the New Orleans Airport...."

c. BERH recommendation. The report of the Chief of Engineers stated: "...The Board [of Engineers for Rivers and Harbors] recommends authorization for construction essentially as planned by the reporting officers...I concur in the recommendation of the Board of Engineers for Rivers and Harbors."

2. Purpose and scope. This memorandum presents the essential data, assumptions, criteria, and computations for developing the plan, design, and cost for the project levee feature from South Point, Louisiana, to the GIWW (Gulf Intracoastal Waterway) in New Orleans East. Its purpose is to present sufficient detail to provide an adequate basis for preparing plans and specifications for the levee and appurtenant structure construction without additional design analysis, and is accordingly presented in feature design memorandum scope.

3. Local cooperation. The conditions of local cooperation pertinent to this supplement and as specified in the report of the Board of Engineers for Rivers and Harbors and concurred in by the report of the Chief of Engineers are as follows: "...That the barrier plan for protection from hurricane floods of the shores of Lake Pontchartrain...be authorized for construction,...Provided that prior to construction of each separable independent feature local interests furnish assurances satisfactory to the Secretary of the Army that they will, without cost to the United States:

"(1) Provide all lands, easements, and rights-of-way, including borrow and spoil disposal areas, necessary for construction of the project;

"(2) Accomplish all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures, and other facilities made necessary by the construction works;

"(3) Hold and save the United States free from damages due to the construction works;

"(4) Bear 30 percent of the first cost, to consist of the fair market value of the items listed in subparagraphs (1) and (2) above and a cash contribution presently estimated at $14,384,000 for the barrier plan...to be paid either in a lump sum prior to initiation of construction or in installments at least annually in proportion to the Federal appropriation prior to start of pertinent work items, in accordance with construction schedules as required by the Chief of Engineers, or, as a substitute for any part of the cash contribution, accomplish in accordance with approved construction schedules items of work of equivalent value as determined by the Chief of Engineers, the final apportionment of costs to be made after actual costs and values have been determined;

"(5) For the barrier plan, provide an additional cash contribution equivalent to the estimated capitalized value of operation and maintenance of the Rigolets navigation lock and channel to be undertaken by the United States, presently estimated at $4,092,000, said amount to be paid either in a lump sum prior to initiation of construction of the barrier or in installments at least annually in proportion to the Federal appropriation for construction of the barrier;

"(6) Provide all interior drainage and pumping plants required for reclamation and development of the protected areas;

"(7) Maintain and operate all features of the works in accordance with regulations prescribed by the Secretary of the Army, including levees, floodgates and approach channels, drainage structures, drainage ditches or canals, floodwalls, seawalls, and stoplog structures, but excluding the Rigolets navigation lock and channel and the modified dual purpose Seabrook Lock; and

"(8) Acquire adequate easements or other interest in land to prevent encroachment on existing ponding areas unless substitute storage capacity or equivalent pumping capacity is provided promptly;

"Provided that construction of any of the separable independent features of the plan may be undertaken independently of the others, whenever funds for that purpose are available and the prescribed local cooperation has been provided...."

INVESTIGATIONS

4. Project document investigations. Studies and investigations made in connection with the report on which authorization is based (H.D. No. 231, 89th Congress, 1st Session) consisted of: research of information which was available from previous reports and existing projects in the area; extensive research in the history and records of hurricanes; damage and characteristics of hurricanes; extensive tidal hydraulics investigations involving both office and model studies relating to the ecological impact of the project on Lakes Pontchartrain and Borgne; an economic survey; and survey-scope design and cost studies. A public hearing was held in New Orleans on 13 March 1956 to determine the views of local interests.

5. Investigations made subsequent to project authorization. Surveys and studies made subsequent to project authorization for this reach of levee include:

a. Alternate plan studies to include alternative alinement studies and alternative construction method studies;

b. Aerial and topographic surveys;

c. Soils investigations including general and undisturbed type borings and associated laboratory evaluations;

d. Detailed design studies for levee and gap closure construction including levee section stability determinations;

e. Tidal hydraulic studies required for establishing design grades for protective works based on revised hurricane parameters furnished subsequent to project authorization by the National Weather Service.

f. Real estate requirements and appraisals;

g. Cost estimates for the levee, the relocated drainage structures, railroad gap closure, access road, and road ramp and utility relocations.

h. Environmental effect and evaluations.

6. Planned future investigations. The recommended method of construction will allow all construction to be accomplished under initial contract. Upon completion of this contract, this feature will be turned over to local interests. Accordingly, any future investigations would be performed by local interests and no future investigations will be required by and/or for the Government.

LOCAL COOPERATION

7. Local cooperation requirements. The conditions of local cooperation as specified in the authorizing laws are quoted in paragraph 3.

8. Status of local cooperation.

a. On 5 March 1971, the Governor of the State of Louisiana, by executive order, designated the State of Louisiana, Department of Public Works (DPW) as the local coordinating agency for the Lake Pontchartrain Barrier Plan. The U. S. Army Corps of Engineers, on behalf of the United States Government, has contacted the DPW and requested that agency to obtain the necessary assurances for cooperation and cost sharing from local interests. To date, formal assurances have been received from the Board of Levee Commissioners of the Orleans Levee District (OLD) and the Board of Commissioners of the Pontchartrain Levee District. The St. Tammany Parish Police

Jury is reluctant to grant the assurances providing for its participation in the project. However, on 8 May 1972 Governor John J. McKeithen executed formal assurances on behalf of the Police Jury by virtue of his authority under Section 81 et seq of title 38 of Louisiana Revised Statutes of 1950, as amended. Such assurances are binding on the St. Tammany Parish Police Jury. Acceptance of all assurances is pending receipt of pertinent supporting documents. The principal officers currently responsible for the fulfillment of the conditions of local cooperation are as follows:

Mr. Roy Aguillard, Director
State of Louisiana
Department of Public Works
P. O. Box 44155, Capitol Station
Baton Rouge, Louisiana 70804

Mr. Guy F. LeMieux, President
Board of Levee Commissioners of the
Orleans Levee District
Room 200, Wild Life and Fisheries Building
418 Royal Street
New Orleans, Louisiana 70130

Mr. John L. Lauricella, Jr., President
Board of Commissioners of the
Pontchartrain Levee District
P. O. Box 426
Lutcher, Louisiana 70071

Mr. Wilbert N. Abney, President
St. Tammany Parish Police Jury
P. O. Box 628
Covington, Louisiana 70433

b. The Orleans and Pontchartrain Levee Districts have executed the local assurances which incorporate the requirements of Public Law 91-646 (the "Uniform Relocation and Real Property Acquisition Policies Act of 1970"), and are now legally empowered and required to comply with its provisions. The assurance executed by Governor McKeithen on behalf of St. Tammany Parish Police Jury also incorporates the requirements of this act. However, additional legal action is required by the state before these assurances for St. Tammany Parish can be accepted by the Government.

c. Section 221 of the Flood Control Act of 1970 (Public Law 91-611) is not applicable to this project since construction of the Lake Pontchartrain, Louisiana and Vicinity, project commenced prior to 1 January 1972 and since the proposed work described in this supplement is not a new increment to, but rather a dependent part of the overall plan of protection included in the report of the Chief of Engineers dated 4 March 1964.

9. Views of local interests. The OLD is the agency responsible for providing local interest assurances for this feature of the project. The plan presented herein was coordinated in detail with the OLD engineering staff and bears the approval of that agency. The intention and capability of this sponsor to provide the required non-Federal contribution for this feature have been amply demonstrated; in fact, considerable work on other completed features of the overall project has already been accomplished by this sponsor.

LOCATION OF PROJECT AND TRIBUTARY AREA

10. Project location. The South Point to GIWW levee segment of the Lake Pontchartrain, Louisiana and Vicinity hurricane protection project, as shown on plate 1, is located in southeastern Louisiana in New Orleans East. The project area covered in this memorandum is located in Orleans Parish.

11. Tributary area. The tributary area of Lake Pontchartrain varies in character from flat tidal marsh at or near sea level to upland areas of significant relief with natural ground elevations as high as 250 feet above m.s.l. (mean sea level).[1] Runoff from within the project area drains into either Lake Borgne or Lake Pontchartrain, generally by pumping from within the protected areas, although some developed areas located on alluvial ridges in St. Charles, St. Bernard, and St. Tammany Parishes are drained by gravity. In addition to runoff from the project area, Lake Pontchartrain receives the runoff of 4,700 square miles located to the north and west of the lake. During major floods on the Mississippi River and its tributaries, floodflows may be diverted from the Mississippi River to Lake Pontchartrain through the Bonnet Carre' Spillway, a controlled overbank floodway constructed under the Flood Control, Mississippi River and Tributaries project.

PROJECT PLAN

12. General. The project, as shown on the flyleaf map, consists of two separate and distinct major features--the Chalmette Area Plan and the Lake Pontchartrain Barrier Plan. This memorandum is concerned only with a segment of the latter, the New Orleans East levee from South Point to the GIWW. The overall Lake Pontchartrain Barrier Plan is described in GDM No. 2, Citrus Back Levee, approved 29 December 1967.

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[1]Elevations contained herein are in feet referred to mean sea level datum unless otherwise noted.

13. New Orleans East levee, South Point to GIWW. This levee is located in eastern New Orleans and extends from its junction with the New Orleans East lakefront levee just southward of South Point to its junction with the New Orleans East back levee and the Chef Menteur Pass barrier embankment at the GIWW. The project plan presented herein provides for enlargement of the existing levee with a hauled clay material. This clay will be obtained from a borrow pit on the bottom of Lake Pontchartrain in the vicinity of Howze Beach on the north shore of the lake. Drainage for the lands on the protected side of the levee will be provided by means of three new gravity drainage structures. These structures will replace-in-kind the drainage culverts now serving the project area. Each of the relocated structures will include flap gates for automatic operation and sluice gates for positive cutoff against floodwaters. Inasmuch as the new levee is not directly exposed to wave attack and erosion, no stone slope protection is required. The plan also includes the relocation of a 12-inch water line, an 8-inch high pressure gas line, a 2-inch television cable, a 4-inch communication cable, a 4 1/2-inch oil pipeline, and the raising of the U. S. Highways 11 and 90 road ramps. A steel swing gate will be constructed where the Louisville and Nashville (L&N) Railroad track crosses the levee.

14. Departures from project document plan. The project document plan contemplated enlargement of the existing levee from U. S. Highway 90 to the GIWW, said enlargement to provide a grade of 16.0 with a 10-foot wide levee crown. At that time, it was felt that the existing levee from South Point to U. S. Highway 90 was to an adequate protective grade. The most predominant departure from the project document plan is to enlarge that levee reach from South Point to U. S. Highway 90, to provide a net protective grade of 12.5 over a 10-foot wide crown. The levee grade from U. S. Highway 90 to the GIWW varies from elevations 13.0 to 14.0 over a 10-foot wide crown. This departure was previously reported in paragraph 14 of GDM No. 2, Supplement No. 4, New Orleans East Back Levee. In association with this work, relocation of three drainage structures, road ramps, and several utilities, and construction of a railroad gap closure is necessary, whereas the project document contemplated only construction of the railroad closure. These deviations from project document plan evolved from the results of tidal hydraulic studies utilizing more severe hurricane parameters developed by the National Weather Service subsequent to project authorization; from a readjustment of datum by the U. S. Coast and Geodetic Survey (now the National Ocean Survey); and by more detailed design. Bases for the revisions to the levee grade are discussed in appendix C of this report, and the levee construction, including all appurtenant works, is discussed in detail later in this memorandum.

HYDROLOGY AND HYDRAULICS

15. General. The Hydrology and Hydraulic Analysis design memorandum for the Lake Pontchartrain Barrier Plan was presented in a series of three separate reports entitled Design Memorandum No. 1 and subtitled Part I - Chalmette, Part II - Barrier, and Part III - Lakeshore. Part I - Chalmette was approved on 27 October 1966; Part II - Barrier was approved on 18 October 1967; and Part III - Lakeshore was approved on 6 March 1969. These documents present detailed descriptions and analyses of the tidal hydraulic methods and procedures used in the tidal hydraulic design of the features for the plan and include the essential data, assumptions, and criteria used and results of studies which provide the bases for determining surges, routing, wind tides, runup, overtopping, and frequencies. The criteria applicable to this levee feature and the hydraulic design of the drainage facilities in this levee reach are presented in appendix C of this memorandum.

GEOLOGY

16. Physiography. The project area is located on the extreme eastern flank of the Mississippi River deltaic plain. The dominant physiographic features of the project area include Lake Pontchartrain, Lake Borgne, many smaller lakes and ponds, lagoons, bayous, canals, abandoned distributaries, small natural levee ridges, and extensive flat marshland. Relief in the area is very slight with elevations ranging from a few feet above mean sea level, along the natural levees of the abandoned distributaries to a few feet below mean sea level in the intervening marshlands.

17. General geology. Only the geologic history since the end of the Pleistocene epoch is relevant to this project. At that time, with sea level about 400-450 feet below its present level, the Mississippi River began to aggrade the entrenched valley it had cut to the west of the project area. As sea level neared its present stand, the river began to migrate laterally back and forth across the alluvial valley. Delta lobes of the Mississippi River system began a series of progradations to the south of the project area with the initiation of the St. Bernard delta complex, about 4,700 years ago. About 1,900 years ago, as the river continued to shift to steeper gradient courses, the Metairie Bayou - Bayou Sauvage distributary diverted flow northeastward from the existing Mississippi River course, initiating formation of the Bayou Sauvage subdelta and becoming the primary source of sediments in the project area. Deposition at first was concentrated in the depression between the older St. Bernard delta lobes to the south and Pine Island, an east-west trending relict beach, to the north. Pine Island was ultimately buried by deltaic deposits of Bayou Sauvage and its minor distributaries and these eventually crossed the beach trend to the north and deposited sediments in the northern

portion of the project area. Deposition from this source continued until about 700 years ago. By this time, the major stream course had shifted back south and west to the Plaquemines -Modern and Lafourche delta complexes and deposition of sediments into the project area was reduced. Construction of the levee systems along the Mississippi River has eliminated the annual sediment supply formerly introduced into the project area. As a result, the land masses within the project area are presently in a state of retreat and deterioration.

18. Subsidence and erosion. The project area lies in a region of active subsidence and downwarping, which has been occurring since the end of the Pleistocene epoch. The Pleistocene surface has been downwarped toward the south and west from zero at the Pleistocene outcropping on the north shore of Lake Pontchartrain to about 500 feet near the edge of the continental shelf, about 80 miles south of New Orleans. The overall rate of regional subsidence has been about 0.39 foot per century. Local subsidence within the project area is greatest along the abandoned distributaries where local drainage has been interrupted and the small natural levee ridges are slowly subsiding into the surrounding marshland. Local subsidence is at a minimum in areas where a high-water table is maintained along with some of the natural drainage features within the marshlands. Rates of erosion along the northern end of the project area at South Point is greater than at any other area in the eastern portion of the Pontchartrain Basin. These high rates of erosion may be attributed to the relatively young unconsolidated sediments forming this area, and to the location and configuration of the land area with respect to wave and current attact. The rate of shoreline erosion on the northern (Lake Pontchartrain) end of the project varies from about 7 to 13 feet per year, while on the southern (Lake Borgne) end, the rate of erosion is approximately 4 feet per year.

19. Investigations performed. General type and 5-inch undisturbed borings to a maximum depth of about 100 feet were made for this project. In addition, logs of borings made in conjunction with other projects as well as geologic information were available for the interpretation of the subsurface geology and foundation conditions of the area.

20. Foundation conditions. The subsurface along the project alinement is represented by the soil and geologic profiles on plates 36-40. The legend on plate 36 describes the various geologic environments of deposition and the general nature of the soils contained within each environment. Generally, the area consists of Holocene deposits varying in thickness from about 20 feet on the northern end of the project to about 55 feet on the southern end. These Holocene deposits are overlain by artificial levee fill which varies in elevation from 13 to 7 feet above mean sea level along the crown. The entire sequence of Holocene deposits

is underlain throughout the project area by older, more durable sediments of Pleistocene age. These materials, although deposited under deltaic conditions similar to the younger overlying Holocene sediments, are generally much firmer and more resistant as a result of considerable weathering, oxidation, and consolidation. As a result, the Pleistocene deposits provide the best load bearing formation in the area.

21. Mineral resources. Oil and gas production, common to other areas around New Orleans, is not presently found in the immediate vicinity of the project area; however, pipelines originating in other areas cross portions of the project alinement. Any future exploration or production of oil and gas resources will not be adversely affected by the project, nor will the project be adversely affected by exploration and production of these natural resources.

22. Sources of construction materials. Design Memorandum No. 12, Lake Pontchartrain, Louisiana and Vicinity, Sources of Construction Materials, approved 30 August 1966, documents available sources of sand, gravel, shell, and stone. Borrow material is available from a borrow pit on the bottom of Lake Pontchartrain in the vicinity of Howze Beach on the north shore of the lake. See plate 7.

23. Conclusions. The subsurface investigations and analyses of all existing and new data indicate that geologic conditions for enlarging the existing levee are generally favorable. Most of the highly compressible organic marsh materials normally found near the natural ground surface were removed before construction of the existing earth levee. Areas consisting of interdistributary clays, which are normally highly compressible, should now be compressed and and consolidated under the load of the existing levee to the extent that only minimal settlement can be expected with the relatively small increased load. Of more immediate concern will be the workability and placement of available borrow materials under varying moisture conditions. Seepage and uplift problems will be limited primarily to those areas immediately south of Bayou Sauvage where the base of the levee fill is in contact with Holocene silt and sand strata which directly overlie Pleistocene sands. Most of the remaining area is separated hydraulically from any massive sands by various thicknesses of impervious clay strata.

FOUNDATIONS INVESTIGATION AND DESIGN

24. General.

a. This section covers the soil and foundation investigations and design for the New Orleans East levee extending from the eastern end of the New Orleans East lakefront levee at station

666+00 (South Point) southward to station 1102+98 at the intersection of the New Orleans East back levee and the Chef Menteur Pass barrier embankment (see plate 1).

b. There is an existing levee along this alinement which was constructed in 1956 by the OLD. The initial construction consisted of demucking the organic clay along the levee centerline, constructing retaining dikes, pumping hydraulic fill between the retaining dikes, and shaping the in-place fill to elevation 11.5 with a 10-foot crown and 1 on 5 side slopes. After consolidation of the initial hydraulic fill, the OLD added a second lift of hauled fill as follows: between station 666+00 (South Point) and station 939+29 (U.S. Highway 90), the levee grade was raised to approximate elevation 11.0 in 1970; and between station 939+29 and station 1102+98, the levee grade was raised to approximate elevation 11.5 in 1966.

c. Soil and foundations coverage for other features of the Lake Pontchartrain barrier plan are included or will be included in the various supplements to the basic design memorandum.

25. Field exploration. Undisturbed borings 5 inches in diameter extending between approximate elevations -50.0 and -90.0 were made at 12 locations (borings 1-USP thru 9-USP, 1-USPT, 4-USPT, and 6-USPT) along the levee alinement. The logs and results of laboratory soils tests of these borings are shown on plates 12 through 23. General type core borings 1 7/8 inches I.D., extending between approximate elevations -50.0 and -70.0 were made at 22 locations (borings 1-SP thru 21-SP and 18-E) along the levee alinement. The soil boring logs for the general type borings, as well as the undisturbed borings are shown on plates 8 through 11. All borings are depicted in plan on plates 2 through 5.

26. Laboratory tests. Visual classifications were made for all samples obtained from the borings. Water content determinations were made on all cohesive soils samples. Unconfined compression (UC), unconsolidated-undrained (Q), consolidated-undrained (R), and consolidated-drained (S) shear tests, and consolidation (C) tests were performed on representative soil samples from the undisturbed borings. Liquid and plastic limits were also determined for these test samples. The logs of the undisturbed borings and the results of the soil tests are shown on plates 12 through 23. The detail shear strength data sheets for borings 1-USP through 9-USP, 1-USPT, 4-USPT, and 6-USPT are shown on plates 24 through 35.

27. Foundation conditions. The subsurface along this project consists generally of 16 to 20 feet of artificial levee fill. Below this artificial fill between station 666+00 and station 939+60 exist 13 to 22 feet of Recent deposits of clays, silts, and sands with a Pleistocene deposit encountered at approximate

elevations -23.0 to -32.0. Also contained in this area are two abandoned distributaries. Between station 939+60 and station 1102+98 underneath the artificial fill exist 6 to 40 feet of recent deposits of clay with layers and lenses of silt and sand which are underlain by a sand deposit at approximate elevations -14.0 to -50.0. A generalized soil and geologic profile is shown on plates 36 through 40 and the detail soils conditions are shown on plates 8 through 11.

28. Design and construction problems. The required enlargement of the existing levee, highway and railroad track crossing, utility relocations, and interior drainage culvert replacements with drainage structures combine to produce design and construction problems in the following areas:

a. Levee enlargement
b. Ramps (highway, access road, R/R gate, and utility relocations)
c. Structures (drainage and R/R gate)
d. Erosion protection (structures)
e. Access road
f. Sources of borrow material
g. Methods of construction

29. Types of protective works. The South Point to GIWW levee will be straddle enlarged over its entire length with hauled clay fill (see plate 42). The centerline of the new levee will be coincident with the levee which now exists over the entire reach. The project plan will include construction of a gated closure of the L&N Railroad tracks and enlargement and construction of highway, access, and relocations ramps.

30. Types of drainage works.

a. Existing drainage structures. The existing drainage structures consist of four 36-inch Ø CMP culverts 120 feet in length at station 797+30, four 42-inch Ø CMP culverts 143 feet in length at station 925+27, and six 42-inch Ø CMP culverts 120 feet in length at station 1055+74. All culverts in these structures have a flap gate on the discharge end. These structures do not meet current design criteria for such works in that they do not include positive cutoff, drainage fill around the pipe on the landside or seepage collars, culvert lengths are too short to extend beyond the enlarged embankment, and they are in a bad need of repair. These structures cannot be modified to meet current standard design criteria, and accordingly, it is necessary to provide new structures to replace-in-kind those now serving the drainage area. The existing structure will remain in operation throughout the construction period of the levee enlargement and new drainage structures. The existing culverts will then be removed and the levee backfilled. It is not considered prudent to plug and fill the existing culverts in lieu of removal.

b. Proposed replacement drainage structures. Since the existing drainage structures cannot be used, replacement drainage structures will be constructed. These structures will hydraulically replace-in-kind the existing structures and will be placed at the same invert elevations. The new structures can be constructed in the dry with temporary protection dikes to elevation 6.0 surrounding the excavations (see plates 62, 65, and 67); accordingly, the schedule for constructing the new structure dictates that the construction period not extend into hurricane season (June through November). The sequence of construction (refer to paragraph 37) is such that these new structures can be constructed coincident with or independent of the levee enlargement.

(1) Drainage structure at station 799+00. A new drainage structure will be constructed at station 799+00 to replace the existing structure at station 797+30. The new structure will consist of three 42-inch Ø CMP culverts 160 feet in length. The invert elevation will be -2.0. This structure will include sluice gates for positive cutoff, seepage collars around the culverts, a trash rack on the inlet side, and flap gates on the outlet end. Details of this structure are shown on plates 62, 63, and 64.

(2) Drainage structure at station 927+00. A new drainage structure will be constructed at station 927+00 to replace the existing structure at station 925+27. The new structure will consist of three 48-inch Ø CMP culverts 160 feet in length. The invert elevation will be -2.0. This structure will include sluice gates for positive cutoff, seepage collars around the culverts, a trash rack on the inlet side, and flap gates on the outlet end. Details of this structure are shown on plates 64, 65, and 66.

(3) Drainage structure at station 1054+00. A new drainage structure will be constructed at station 1054+00 to replace the existing structure at station 1055+74. The new structure will consist of four 54-inch Ø CMP culverts 192 feet in length. The invert elevation will be at -2.0. This structure will include sluice gates for positive cutoff, seepage collars around the culverts, a trash rack on the inlet side, and flap gates on the outlet end. Details of this structure are shown on plates 67, 68, and 69.

c. Excavation backfilling. After the new drainage structures have been constructed the excavations for these structures will be backfilled to grades and sections shown on plate 42, and removal of the existing structures can commence. After removal of the existing structures, the levee gaps from station 796+98 to station 797+62, station 924+96 to station 925+58, and station 1055+21 to station 1056+27 will be backfilled to the grades and sections shown on plates 48 and 49.

31. Levee.

a. General. The protective works for the project consist of a conventional earthen levee, which crosses three interior drainage facilities described above, earth ramps at U. S. Highways 11 and 90, and a swing gate supported on 12-inch by 12-inch prestressed concrete piles with connecting I-type floodwalls at the L&N Railroad track. The project levee will be constructed by straddle enlarging the existing levee, as discussed in paragraph 24, with semicompacted earthfill to the design grades and sections shown on plate 42. Interim gaps will be left in the levee enlargement between station 796+50 and station 800+00, station 924+50 and 928+00, and station 1052+50 and station 1059+50, as noted on plate 43. Within the above-mentioned gaps, existing culverts cross the levee at three locations (station 797+30, station 925+27, and station 1055+74). These gaps also include the excavations for the replacement drainage structures. The L&N Railroad crosses the levee at station 1057+99.5. The railroad gate will be constructed in the dry with the railroad being supported on falsework and the railroad embankment being excavated from underneath the tracks (see plate 70). This construction, like the replacement drainage structures, must be scheduled for a period which does not extend into the hurricane season. The levee gap containing the railroad gate will be backfilled to gross grade (see plate 77).

b. Shear stability.

(1) General. Using available geologic and soil boring test data, shear strength trends were assigned to each reach as shown on plate 41.

(2) Station 666+00 to station 939+60. The recommended levee between station 666+00 and station 939+60 was designed, using cross sections representative of existing conditions along the levee alinement, for the condition of water to elevation 0.0 on both sides of the levee and assumed failure toward the flood side (see plate 44), and for the condition with water to elevation 11.5 (WTL) on the flood side and to elevation 0.0 on the protected side and assumed failure toward the protected side (see plate 45). The stability of the levee was determined by the method of planes using the design (Q) shear strength trend assigned to the reach between station 747+50 and 770+00 (see plate 41) and applying a minimum factor of safety with respect to shear strength of approximately 1.3. Only the analysis based on the lowest shear strength trend is presented, inasmuch as the resulting minimum factor of safety is above the minimum of 1.3, the ultimate levee slope should be no steeper than 1 on 4 for levee maintenance purposes. Because of the existence of the inlet and outlet ditches at the existing culverts, station 797+30 and station 925+27; the recommended levee between station 796+98 and station 797+62 and between station 924+96 and station 925+58 was designed using cross sections

representative of the conditions at the existing culverts, the condition of water to elevation -3.0 on both sides, and an assumed failure toward the flood side (see plate 48). The analysis at the existing culverts in this reach was based on the most critical shear strength and stratification that exists at the culverts (see plate 41).

(3) Station 939+60 to station 1101+90. The recommended levee between station 939+60 and station 1101+90 was designed, using cross sections representative of existing conditions along the levee alinement, for the condition of water to elevation 0.0 on both sides of the levee and assumed failure toward the flood side (see plate 46), and for the condition with water to elevation 12.8 (WTL) on the flood side and to elevation 0.0 on the protected side and assumed failure toward the protected side (see plate 47). The stability of the levee was determined by the method of planes using the design (Q) shear strength trend assigned to the reach between station 965+00 and station 1101+90 (see plate 41) and applying a minimum factor of safety with respect to shear strength of approximately 1.3. The net levee grade from station 939+60 to station 1101+90 varies from elevation 13.0 to elevation 14.0. However, only the analyses of the levee to elevation 14.0 (the most critical) are presented. Because of the existence of the inlet and outlet ditches at the existing culvert, station 1055+74; the recommended levee between station 1055+21 and station 1056+27 was designed using cross sections representative of the conditions at the existing culvert, the condition of water to elevation -2.0 on both sides, and an assumed failure toward the flood side (see plate 49). The analysis at the existing culvert in this reach was based on the most critical shear strength and stratification that exists at the culvert (see plate 41).

c. Settlement. Results of the settlement computations indicate that a long-term settlement of approximately 1 foot can be expected along the total length of the levee subsequent to the levee enlargement. To compensate for this settlement, the levee crown over the entire reach will be overbuilt or "grossed" 1 foot above net grade to the gross grades shown on plate 42. Stability analyses were performed on the levee at gross grades and the resulting factors of safety are above the minimum 1.3.

32. Ramps.

a. General. Ramps will be provided at the U. S. Highways 90 and 11 levee crossings, at the access road tie-in at Interstate Highway 10, at the levee junction with the New Orleans East back levee and the Chef Menteur Pass barrier embankment, at the access road bypass at the L&N Railroad gate, and at utility crossings.

b. Shear stability. Refer to paragraph 31b(1) for the general discussion of applicable strengths and stratifications. The strengths and stratifications used for the shear stability analyses at each ramp are taken from the reaches in which they are located but modified in part to be more representative of those found at each ramp location. Using cross sections representative of existing conditions at each ramp, the following ramps were designed for the most critical conditions with the shear stability being determined by the method of planes and a miniumum factor of safety of approximately 1.3 being applied with respect to shear strength.

(1) Highway ramps.

(a) U. S. Highway 11 ramp. The levee and ramp side slopes at the intersection of the levee and the highway ramp (see section A-A, plate 52) were designed for the conditions of water to elevation 0.0 on the protected side and water to elevation -5.0 on the flood side and an assumed failure toward the flood side (see plate 53). The ramp stability was also determined for the condition of water to elevation 0.0 on both sides and an assumed failure toward the GIWW (south) side (see section B-B, plates 52 and 54). Analysis shows a factor of safety above the minimum 1.3 because no slope steeper than 1 on 4 is allowed for ramp side slopes.

(b) U. S. Highway 90 ramp. This ramp was designed for the conditions of water to elevation 0.0 on the GIWW side and water to elevation -2.0 on the Lake Pontchartrain side and an assumed failure toward the Lake Pontchartrain side (see section B-B, plates 55 and 57). As stated above, analysis shows a factor of safety above the minimum 1.3 with the 1 on 4 slopes required for ramp side slopes.

(2) Access road ramps.

(a) Access road ramp at I-10. The access road ramp immediately north of the Interstate 10 intersection with the levee was designed for the condition of water to elevation 0.0 on both sides and an assumed failure toward the protected side (see section A-A, plates 50 and 51).

(b) Chef Menteur Pass Complex service road ramp. The access road ramp at the levee tie-in with the New Orleans East back levee and the Chef Menteur Pass embankment was designed for the condition of water at elevation 0.0 on both sides and an assumed failure toward the protected side (see section A-A, plates 59 and 60).

(3) Railroad gate ramp. The access road ramp bypassing the L&N Railroad gate on the protected side was designed for the condition of water at elevation 0.0 on the protected side and elevation 12.5 (WTL) on the flood side and an assumed failure toward the protected side (see section E-E, plate 77).

(4) Utility relocation ramps.

(a) Water main and high pressure gas pipeline ramp, vicinity station 938+13. The 12-inch water main and 8-inch high pressure gas pipeline relocation ramp over the levee in the vicinity of station 938+13 was designed for the conditions of water to elevation 0.0 on the protected side and to elevation -2.0 on the flood side and an assumed failure toward the flood side (see section A-A, plates 55 and 56).

(b) Telephone and communications cables ramp, vicinity station 940+55. The 2-inch telephone and 4-inch communications cables relocation ramp over the levee in the vicinity of station 940+55 was designed for the conditions of water to elevation 11.5 (WTL) on the flood side and to elevation 0.0 on the protected side and an assumed failure toward the protected side (see section C-C, plates 55 and 58).

(c) Oil products pipeline ramp, vicinity station 1056+64. The 4 1/2-inch oil products pipeline relocation ramp over the levee in the vicinity of station 1056+64 was designed for the conditions of water to elevation 12.5 (WTL) on the flood side and to elevation 0.0 on the protected side and an assumed failure toward the protected side (see section B-B, plates 59 and 61).

33. Structures.

a. Shear stability.

(1) Railroad gate. The slopes and berm distances for the earthen levee adjacent to the railroad swing gate were designed for the following conditions: water level to elevation 0.0 on both sides of the levee and assumed failure toward the flood side and water level to elevation 12.5 (WTL) on the flood side, to elevation 0.0 on the protected side, and assumed failure toward the protected side (see plate 71). The stability of the levee was determined by the method of planes using the design (Q) shear strengths shown on plate 41.

(2) Drainage structures. The slopes and berm distances for the levee crossing the three replacement drainage structures were designed for the following conditions: water to elevation 0.0 on the protected side; water to elevation -2.0 on the flood side and assumed failure toward the flood side and

hurricane floodwater to WTL elevations on the flood side; water to elevation 0.0 on the protected side, and assumed failure toward the protected side (see plates 63, 66, and 69). The stability of the levee was determined by the method of planes using the design (Q) shear strengths shown on plate 41 and applying a minimum factor of safety with respect to shear strength of approximately 1.3.

b. Seepage control.

(1) Sheet pile cutoff. A steel sheet pile cutoff wall will be used beneath the railroad gate to provide protection against seepage. The existing steel sheet piling, which was installed for interim protection by the OLD, will be left in place and used as the seepage cutoff wall.

(2) Seepage collars and filters. In accordance with ETL 1110-2-126 dated 28 June 1971, seepage collars and drainage sandfill blankets around each culvert will be provided at the three replacement drainage structures as shown on plates 64 and 68.

(3) Construction control. Conventional sumps and pumps will be utilized to collect and dispose of surface water during construction.

c. Pile foundation. Design compression and tension capacities vs. tip elevations were developed for 12-inch square prestressed concrete piles. The piles will support the railroad swing gate monolith. Design data were determined for the (Q) and (S) shear strengths. In compression, a factor of safety of 1.75 was applied to the shear strengths and a conjugate stress ratio (ko) = 1.0 was used in the (S) case 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 conjugate stress ratio (ko) = 0.70 was used in the (S) case. The (Q) case governed for design. The results of pile design loads vs. tip elevations analysis for the (Q) case and bearing pile subgrade moduli are shown on plate 72.

d. I-type floodwalls. I-type floodwalls will tie the railroad swing gate monolith to the earthen levee. The stability and the required penetration of the steel sheet piles below the earth surface were determined by the method of planes using the (S) shear strength, i.e., c=o, $\emptyset a=23°$. A factor of safety of 1.5 was applied to the friction angle as follows:

$\emptyset\, d = \tan^{-1} \frac{\tan \emptyset \text{ available}}{\text{factor of safety}}$. The developed friction angle was

used to determine K_a and K_p values as follows: $K_a = \tan^2 (45° - \frac{\phi d}{2})$, $K_p = \tan^2 (45° + \frac{\phi d}{2})$. Using K_a and K_p values and the effective unit weights, net horizontal water and earth pressure diagrams were determined for movement toward each side of the sheet pile. The sum of the horizontal forces on the protected side of the sheet pile was equated to the sum of the horizontal forces on the flood side for various tip penetrations. At these penetrations, summations of overturning moments about the tip were determined. The required depth of penetration was established as that where the summation of moments was equal to zero. The resulting analysis is presented on plate 71.

e. Unbalanced waterload on sheet pile cutoff. The existing sheet pile will be utilized under the railroad gate as a seepage cutoff wall. Unbalanced waterload analyses were performed on the existing sheet pile. The results are presented on plate 71. The net pressure diagram indicates 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 resulting from water pressure acting on the sheet pile cutoff.

f. Settlement.

(1) Railroad gate. The I-type floodwalls will be overbuilt 0.5 foot (to elevation 14.0) above net grade to compensate for long-term settlement indicated by settlement calculations.

(2) Drainage structures. After the levee is enlarged to the project design grades across the replacement drainage structures, settlement calculations indicate that the levee crown will settle an additional foot. To compensate for this long-term settlement, the levee crown will be overbuilt to 1 foot above net grade. Stability analyses of the levee at the replacement drainage structures, including inlet and outlet basins as a surcharge, indicate that the overbuilt levee shear stability equals or exceeds the miminum factor of safety of 1.3 (see plates 63, 66, and 69).

g. Structure excavation.

(1) Railroad gate. The existing levee at the L&N Railroad will be excavated as shown on plate 70 for the construction of the railroad gate. The falsework and the sheeting will be accomplished by, and will be the responsibility of the L&N Railroad Company. The excavated material will be stockpiled on both sides of the railroad embankment along the protected side toe of the existing levee and used for backfill. The minimum elevation of the existing levee along the perimeter of the excavation will be approximately elevation 6.0. Accordingly, the schedule for constructing the railroad gate will dictate that the construction period not extend into the hurricane season.

(2) Drainage structures. The replacement drainage structures at stations 799+00, 927+00, and 1054+00 will be constructed in the dry with temporary protection dikes to elevation 6.0 surrounding the excavations (see plates 62, 65, and 67). Accordingly, the schedule for constructing the drainage structures will dictate that the construction period not extend into the hurricane season.

(3) Removal of existing culverts. After the replacement drainage structures are in place and operating, the existing levee will be degraded to the elevation and slopes shown on plate 43 and the existing drainage culverts will be removed. The degraded material will be stockpiled along the toe of the levee and used for backfilling the levee.

h. Structure backfill.

(1) Railroad gate. The area along the railroad track will be backfilled with ballast to the height and configuration of the existing railroad embankment. The area along the levee alinement will be backfilled with semicompacted earthfill to the slopes and grades shown on plate 77.

(2) Drainage structures. The degraded levee at the replacement drainage structures will be backfilled with semicompacted fill to the applicable design grades and sections shown on plates 63, 66, and 69. The protection dikes will be used as borrow material for backfilling around the replacement drainage structures.

(3) Removal of existing culverts. The degraded levee at the existing drainage culverts will be backfilled with semicompacted fill to the applicable design grades and sections shown on plates 48 and 49. The degraded levee material stockpiled at the toe of the levee will be utilized as backfill material.

34. Erosion protection.

a. Levee. Due to the short duration of hurricane flood stages and the resistant nature of clayey soils, no erosion protection other than grass cover is considered necessary on the levee slopes.

b. Structures. Riprap overlying a layer of shell will be used for protection around the RR gate structure and the sluice gate inclosures, outlet basins, and inlet basins at the replacement drainage structures (see plates 64, 68, and 77).

35. Settlement reference markers. Reference markers will be installed along the I-walls and gate monoliths at the L&N Railroad gate to obtain data relative to vertical and lateral

movement. Measurements of the settlement and relative movements of the structure walls will be made promptly after construction and yearly thereafter until settlement is essentially complete.

36. Sources of fill material. The levee will be enlarged with semicompacted hauled clay fill which will be obtained from borrow area of Pleistocene clays in the bottom of Lake Pontchartrain near Howze Beach along the north shore and transported to the project on barges. See plates 6 and 7 for the location and soil boring sections of this borrow area.

37. Method and sequence of construction.

a. General. The project has been designed such that any feature (levee, replacement drainage structures, or railroad gate), except removal of existing culverts, can be constructed independently of or coincident with other features.

b. Levee. The levee will be constructed in one phase by straddle enlarging the existing levee with semicompacted, hauled fill to the design grades and sections shown on plate 42.

c. Ramps. The ramp at U. S. Highway 11 has already been constructed by the OLD. The ramp at U. S. Highway 90 will be constructed by the contractor under the initial contract and the Government will be reimbursed for this relocation by local interests.

d. Railroad gate.

(1) The access road ramp which bypasses the railroad gate will be constructed of semicompacted fill to the elevations and configurations shown on plate 77. This access road will be surfaced with 9 inches of compacted shell and will be completed prior to construction of the railroad gate to allow construction access.

(2) The falsework and sheeting will be installed. This work will be accomplished by and will be the responsibility of the L&N Railroad Company.

(3) The existing levee and railroad embankment will be excavated to the slopes and elevations shown on plate 70. The excavated material will be stockpiled along the protected side toe of the levee on both sides of the railroad embankment. Conventional sumps and pumps will be utilized to collect and dispose of surface water during construction.

(4) The railroad gate and the connecting I-type floodwalls will be constructed.

(5) The tie-in levee will be constructed with semicompacted fill to the slopes and elevations shown on plate 77. Ballast material will be placed to the height and configuration of the existing railroad embankment as shown on plate 77. Shell and riprap protection will be placed at the locations shown on plates 71 and 77.

e. Drainage structures. The relocated drainage structures will be constructed as follows:

(1) Degrade the existing levee and use this material for the excavation protection dikes as shown on plates 62, 65, and 67. Conventional sumps and pumps will be utilized to collect and dispose of surface water during construction.

(2) Construct the replacement drainage structures to include the corrugated metal pipes, sluice gates, inlet and outlet basins and channels, seepage collars, and the drainage fill around the protected side one-third of the pipes (see plates 64 and 68).

(3) Backfill the levee with semicompacted fill to the applicable design grades and sections shown on plates 63, 66, and 69.

(4) Place shell and riprap protection at the locations shown on plates 64 and 68.

f. Removal of existing culverts. The existing culverts will be removed after completion of the new drainage structures and channels as follows:

(1) The existing levee will be degraded to the elevation and slopes shown on plate 43. The excavated material will be stockpiled along the toe of the levee and reused for backfilling the levee.

(2) The existing culverts will be removed.

(3) The excavation will be backfilled with semi-compacted fill to the grades and slopes shown on plates 48 and 49.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

38. Levee. The proposed levee construction will be accomplished by straddle enlarging the existing levee with barged and truck hauled clay fill. The levee will be enlarged over its entire reach from a point just below South Point, La. (station 666+00) southward approximately 8.3 miles to its junction with the New Orleans East back levee and the Chef Menteur Pass barrier embankment at the GIWW (station 1102+98). The levee centerline is contiguous with the centerline of the existing levee. The net design elevation varies from 12.5 at South Point to 14.0 at the GIWW over a 10-foot wide crown. The general location and alinement of the levee are shown on plate 1. The detailed alinement and profile of the levee are shown on plates 2-5. Typical levee design sections are shown on plate 42.

39. Drainage structures.

a. Existing drainage culverts. The existing drainage culverts located at stations 797+30, 925+27, and 1055+74 do not fulfill project design standards, are in bad need of repair, and require replacement by three new drainage structures.

b. Replacement drainage structures. Three new drainage structures will be constructed to replace the existing structures described above. The new structures consist of three 42-inch Ø CMP culverts, 160 feet in length at station 799+00, three 48-inch Ø CMP culverts, 160 feet in length at station 927+00, and four 54-inch Ø CMP culverts, 192 feet in length at station 1054+00. The new structures will include inlet and outlet basins (see plates 64 and 68 for layout). Each of the CMP culverts will be cambered 1 foot at the levee centerline to compensate for the 1-foot anticipated settlement. Four seepage collars will be equally spaced on each of the culverts in the three structures. Each structure will be equipped with flap gates, sluice gates for positive cutoff, and a trash rack on the inlet basin to prevent debris from passing through the structure jeopardizing proper operation. A stoplog support will be provided on the outlet basin to enable the flap gates to be periodically maintained. Complete details for each of the above-described structures are illustrated on plates 64, 68, 73, 74, 75, and 76. Stoplogs will not be furnished by the Government but will be supplied by local interests as the need arises.

40. Railroad swing gate. A steel swing gate will be constructed at station 1057+99 across the L&N Railroad tracks. The gate monolith will be tied into the levee with I-walls. To assure proper operation, the gate will be adjustable in both the horizontal and vertical directions as well as having adjustable side and bottom seals. After construction, the gate will be operated and maintained by local interests. Complete details of the swing gate are presented on plates 77, 78, 79, and 80.

OTHER PLANS CONSIDERED

41. Recommended construction plan. The plan recommended for construction consists of enlarging the existing levee with clay material. This plan also includes the relocation of three gravity drainage structures, utilities, road ramps, and construction of a gated railroad gap closure.

42. Alternate plans. The existing levee was constructed prior to project authorization and has been considered as permanent hurricane protection work. The existing levee grade was too low to provide the current design storm protective capability, and it was apparent that the most economical means of providing adequate protection was to enlarge the levee. Accordingly, the study of other plans of protection was not warranted; rather, study was applied to methods of constructing the enlargement to insure rapid, economical work.

ACCESS ROADS

43. Chef Menteur Complex service road. As discussed in GDM No. 2, Supplement No. 3, Chef Menteur Pass Complex, access from Highway 90 to the Chef Menteur Pass control structure and navigable floodgate will be provided along the South Point to GIWW levee and the Chef Menteur barrier embankment. Therefore, a 10-foot wide access road surfaced with 9 inches of compacted shell will be constructed on the project levee crown from U. S. Highway 90 (vicinity station 939+60) to the tie-in at the GIWW (vicinity station 1101+90). The access road will be ramped over the telephone and communications cables in the vicinity of station 940+55 (see plate 55), over the pipeline relocation at station 1056+64 (see plate 59), and ramped around the protected side of the L&N Railroad gate (see plate 77). The access road will be connected by a ramp to the crown of the Chef Menteur Pass barrier embankment (see plate 59). The levee tie-in shown on plate 59 is based on the net levee sections presented in the applicable supplements to the basic design memorandum. The levee tie-in and the access road ramp will be constructed at the time of the final shaping of the barrier embankment and will reflect the design sections based on the additional boring and testing required for the design of the various lifts of the New Orleans East back levee and the Chef Menteur Pass barrier levee.

44. Construction access. Vehicular access to the job site is available from the levee crossings at Interstate Highway 10, U. S. Highway 90, and U. S. Highway 11. Access is also available on the shell road on top of or adjacent to the existing levee over its entire length. Floating plant can reach the project area by Lake Pontchartrain, Bayou Sauvage Canal, and the GIWW. The L&N Railroad crosses the levee alinement at station 1057+99 (see plates 1 thru 5).

STRUCTURAL DESIGN

45. Criteria for structural design. The structural design presented herein complies with standard engineering practice and criteria set forth in engineering manuals for Civil Works construction published by the Office, Chief of Engineers, subject to modifications indicated by engineering judgment and experience to meet local conditions.

46. Basic data. Basic data relevant to the design of the relocated drainage structures and the swing gate are as follows:

a.	Water elevations	Elevations feet m.s.l.
	Wind tide level (WTL)	
	South Point to Highway 90	8.5-11.5
	Highway 90 to GIWW	11.5-12.8
	Landside of structure	0.0
b.	Unit weights.	Lb. per cubic foot
	Water	62.5
	Concrete	150
	Steel	490
	Earth	117
c.	Design loads.	
	Earth pressures (lateral)	
	Clay	90 p.s.f.
	Sand	65 p.s.f.
	Wind pressure (lateral)	50 p.s.f.

47. Allowable working stresses. The allowable working stresses for concrete and structural steel are in accordance with those recommended in "Working Stresses for Structural Design," EM 1110-1-2101 dated 14 April 1965. The basic minimum 28-day compressive strength for concrete will be 3,000 p.s.i. except for prestressed concrete piling where the minimum will be 5,000 p.s.i. Steel for steel sheet piling will meet the requirements of ASTM A328-69, "Standard Specification for Steel Sheet Piling." For convenient reference, pertinent allowable stresses are tabulated below:

a. Reinforced concrete.

f'_c	3,000 p.s.i.
f_c	1,050 p.s.i.
V_c (without web reinforcement)	60 p.s.i.
V_c (with web reinforcement)	274 p.s.i.
f_s	20,000 p.s.i.
Minimum tensile steel	0.0025 bd sq.in.
Shrinkage and temperature steel area	Varies, see appendix B

b. Structural steel (ASTM A-36).

Basic working stress	18,000 p.s.i.

48. Foundation. The results of subsurface exploration, soils tests, and foundation studies are presented in previous paragraphs. Locations of borings are shown on plates 1 through 5. The general type boring logs are shown on plates 8 through 11. Undisturbed boring logs and data are shown on plates 12 through 23.

49. Drainage structures. Three existing drainage structures consisting of four 36-inch drainage culverts located at station 797+30, four 42-inch drainage culverts located at station 925+27, and six 42-inch drainage culverts located at station 1055+74 do not fulfill project design standards, are in bad need of repair, and therefore will be removed. These structures will be replaced by new structures located at station 799+00, 927+00, and 1054+00. The new structures will have three 42-inch, three 48-inch, and four 54-inch corrugated metal pipe (CMP) culverts, respectively, complete with inlet and outlet basins. (See plates 64 and 68 for structure plan layouts.) Each of the CMP culverts will be cambered 1 foot at the levee centerline to compensate for the 1-foot anticipated settlement. The invert elevations on each of the culverts in the structures will be -2.0. Four seepage collars will be equally spaced on each of the culverts. The collars will be square; each side measuring 4 feet plus the diameter of pipe. These structures will be equipped with flap gates and sluice gates for positive structure closure and a trash rack on the inlet basin to prevent debris from passing through the structure and jeopardizing proper operation. A stoplog support will be provided on the outlet basin to enable the flap gates to be maintained periodically. No stoplogs will be furnished. Complete details of the above-described structures are illustrated on plates 64, 68, 73, 74, 75, and 76. The plan of construction is described in paragraph 37e of this memorandum. The design calculations are presented in appendix B.

50. Swing gate structure. A steel swing gate in a concrete monolith with I-wall tie-ins on each side will be constructed at station 1057+99 where the L&N Railroad crosses the levee. The gate structure and I-wall replace the levee between stations 1057+63.8 and station 1058+33.0. The gate will be closed by local interests when a hurricane approaches. To assure a proper seal, the gate will be constructed so that it can be adjusted in the horizontal and the vertical direction. The side and bottom seals can also be adjusted as alternate or supplemental means to assure that a proper seal is obtained. Plan, elevation, and details of the railroad gate are shown on plates 77 through 80. The design calculations are presented in appendix B. The gate monolith was designed for the following load conditions:

Case I - Water to top of wall at elevation 13.0, no wind, impervious soil.

Case II - Water to top of wall at elevation 13.0, no wind, pervious soil.

Case III - No water, no wind, one train wheel axle on edge of slab, flood side.

Case IV - No water, no wind, one train wheel axle on edge of slab, protected side.

Case V - No water, no wind, two train wheel axles on edge of slab, flood side.

Case VI - No water, no wind, two train wheel axles on edge of slab, protected side.

51. Corrosion control. No specific measures, other than painting those exposed ferrous metal components which are not galvanized or stainless steel with a five-coat vinyl paint system, are required for corrosion control

SOURCES OF CONSTRUCTION MATERIALS

52. Sources of construction materials. In addition to the information presented in this memorandum relative to borrow area location and materials, information relating to material sources is also contained in Design Memorandum No. 12, "Sources of Construction Materials," approved 30 August 1966.

REAL ESTATE REQUIREMENTS

53. General. All rights-of-way and construction easements required for construction of this levee will be acquired by the OLD and furnished without cost to the United States. There will be no acquisition by the United States. Rights-of-way and construction easement limits are shown on plates 2, 3, 4, and 5. Local interests are required to assume the cost of relocation assistance to persons and businesses displaced by such acquisition pursuant to the requirements of Public Law 91-646.

54. Required rights-of-way. Portions of the existing protective embankment were constructed prior to project authorization and such work was therefore considered as permanent hurricane protection works. The lands beneath such existing work will not be credited toward local interests' financial contribution for this project feature. Rather, only the additional lands required for this enlargement and for postauthorization work on the existing levee will be purchased for the United States and credited toward local interests' share of the project cost.

RELOCATIONS

55. General. Under the authorizing law, local interests are responsible for the accomplishment of "...all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures, and other facilities made necessary by the construction work;...." Included in the required modifications are road ramps, utilities, and drainage rectification work.

56. Drainage structures. As a result of constructing the proposed project levee, the existing drainage structures located at stations 797+30, 925+27, and 1055+74 will require relocation and major modifications. The new structures are fully described in paragraph 49 of this design memorandum and construction details are shown on plates 64, 68, and 73 through 76.

57. Highway ramps. U. S. Highways 11 and 90 will be raised to net elevations 12.5 and 13.3, respectively, to cross the levee. The vertical curves for these ramps were designed using the Louisiana Department of Highways "Road Design Manual" for nonpassing sight distances for 60 m.p.h. for U. S. Highway 11 and 70 m.p.h. for U. S. Highway 90. In order to obtain these sight distances the following grades and curves are required: a grade of 2.00 percent with 300-foot sag curves and a 640-foot crest curve for U. S. Highway 11; a grade 1.75 percent with 150-foot sag curves and a 900-foot crest curve for U. S. Highway 90. The U. S. Highway 11 ramp has been constructed by the OLD. Plans and profiles of these highway ramps are shown on plates 52 and 55. The junction of the levee and the Interstate Highway 10 embankment is shown on plate 81.

58. New Orleans Sewerage and Water Board waterline. At station 938+77, in the vicinity of U. S. Highway 90, one 12-inch waterline crosses over the existing levee. This line will be relocated by local interests and moved farther away from the centerline of the highway (see plate 55). The line will be installed according to criteria set forth for hurricane protection levee crossings. These criteria will be furnished to local interests.

59. New Orleans Public Service, Inc., pipeline. At station 938+86, one 8-inch high pressure gas line crosses the existing levee. This line will be relocated by local interests and raised above the new levee crown (see plate 55). The installation shall conform to criteria set forth for hurricane protection levee crossings. These criteria will be furnished to local interests.

60. American Telephone and Telegraph Company cable. At station 939+55, one 2-inch coaxial telephone cable crosses the existing levee. This line will be relocated and raised by local interests (see plate 55). The installation shall conform to criteria set forth for hurricane protection levee crossings. These criteria will be furnished to local interests.

61. South Central Bell Telephone Company communcations cable. At station 939+78, one 4-inch telephone communications cable crosses over the existing levee. This line will be raised and relocated by local interests (see plate 55). The relocation will conform to criteria set forth for hurricane protection levee crossings. These criteria will be furnished to local interests.

62. Barnwell Drilling Company oil products pipeline. At station 1056+64, one 4 1/2-inch oil products pipeline passes through the levee. This lire will be relocated by local interests and raised above the new levee crown (see plate 59). The installation shall conform to the criteria set forth for hurricane protection levee crossings. These criteria will be furnished to local interests.

63. New Orleans Public Service, Inc., powerline. The overhead electrical powerline located on the south side of and parallel to U. S. Highway 90, at approximate levee station 939+00, will be relocated as necessary to accommodate the levee enlargement and ramping of U. S. Highway 90. The powerline will be raised by local interests (see plate 55). The relocation shall conform to criteria set forth for hurricane protection levee crossings. These criteria will be furnished to local interests.

COORDINATION WITH OTHER AGENCIES

64. General. As previously mentioned, the State of Louisiana, Department of Public Works, was appointed project coordinator for the State by the Governor of Louisiana. This agency has functioned to coordinate the needs, desires, and interests of state agencies and the Corps of Engineers. The Orleans Levee District will provide the local cooperation for this feature of the hurricane protection project. The project plan presented herein is acceptable to both of the above agencies. The entire Lake Pontchartrain hurricane protection project, including this project feature, has been discussed at numerous public and private meetings since its authorization. Such meetings have been held before regional, state, local, community, social, and educational organizations and have served generally to inform the public of the proposed works, to explain project functions, and to solicit the public viewpoint. The project has also been described and discussed in press and by communications media, as well as by organizational and individual correspondence.

65. U. S. Department of the Interior, Fish and Wildlife Service. Extensive coordination with the U. S. Fish and Wildlife Service was accomplished during preauthorization studies and subsequent to authorization of the project. By letter dated 2 April 1968, the Regional Director, U. S. Fish and Wildlife Service, Atlanta, Georgia, was informed of the current layout for the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana and Vicinity, hurricane protection project and requested to furnish views and comments on the entire Lake Pontchartrain Barrier Plan. By letter dated 15 May 1968, the Acting Regional Director states "...We are of the opinion that hurricane control structures in the Rigolets and Chef Menteur tidal passes have little appreciable effect on salinities in Lakes Maurepas, Pontchartrain, and Borgne. Therefore, no adverse effects on fish and wildlife resources in these areas are expected." Any significant modifications to the current plan will be forwarded to the Regional Director for further review and comment. Copies of the above letter and the responses of the Acting Regional Director are included in appendix A.

66. U. S. Department of the Interior, Federal Water Pollution Control Administration (now Environmental Protection Agency).

a. Review and recommendations. By letter dated 8 April 1968, the Regional Director, Federal Water Pollution Control Administration, was informed of the current layout for the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana and Vicinity, hurricane protection project and requested to furnish views and comments on the project. The Regional Director requested in his letter of response dated 15 May 1968 that consideration be given to the following:

(1) Minimizing water quality degradation during construction.

(2) Minimizing the accidental spillage of petroleum products or other harmful materials and maintenance of sanitary facilities to adequately treat domestic wastes.

(3) Constructing and operating water quality control structures so as to insure that ecological conditions remain unchanged.

b. Project incorporation of recommendations. Provisions relative to water quality degradation during construction, control of accidental spillages, and maintenance of adequate sanitary facilities by construction contractors will be incorporated into the construction plans and specifications. The Seabrook lock will be operated to provide a desirable salinity regimen in Lake Pontchartrain to the end that deleterious alterations in the lake ecology will be avoided. The Regional Director has been advised of the action to be taken in connection with his comments. Copies of correspondence with the Regional Director are included in appendix A.

ENVIRONMENTAL ANALYSIS

67. Environmental quality.

a. General. The engineering treatment required for preserving and maintaining the environmental quality of the project has been considered during preparation of this memorandum. As indicated previously, extensive coordination has been accomplished with the appropriate agencies relative to effects of the project on fish and wildlife resources and water quality control during and subsequent to construction.

b. Enhancement. Construction of the protective works covered herein alters the existing terrain only to the extent of enlarging an existing earthen levee and appurtenances in a predominantly marshland area. All borrow material needed to construct the levee will come from a borrow pit in Lake Pontchartrain. Additional beautification measures beyond those normally associated with levee construction, i.e., grading and seeding, are not warranted. The logic behind this statement is that the adjacent area is privately owned and undeveloped marshland which precludes the commitment of public funds for beautification.

68. Environmental statement. The environmental statement for the entire Lake Pontchartrain, Louisiana and Vicinity, hurricane protection project will be made available to the President, Council

on Environmental Quality in about January or February 1973. This statement, in part, describes effects of the South Point to GIWW levee construction essentially as follows:

a. Most of the area in New Orleans East is partially drained marsh protected from normal flooding on the south, east, and west by levees along the GIWW and across the marsh, and on the north by the Southern Railway embankment. It is partially protected from tidal overflow and consists of low-lying undeveloped marshland with an average elevation of about 1.5 feet.

b. The Southern Railway embankment currently prevents detritus flow into Lake Pontchartrain. The proposed levee should have no effect on this environ. The project will provide drainage equal to that which presently exists. Willow thickets will continue to become abundant on the margins of the marsh and will result in conversion of wetland habitats and associated organisms to terrestrial environment.

c. Enlargement of the levees on the south and east of New Orleans East and construction of a levee along the lakeshore on the north will protect the people moving into this area from flooding by hurricanes. With proper flood protection, this area will be developed for residential, commercial, and industrial areas.

69. Historical and cultural environment. There are no known sites, structures, or objects of historical, architectural, or archeological significance in this project area which would fall within the provisions of Executive Order 11593, "Protection and Enhancement of the Cultural Environment."

ESTIMATE OF COST

70. General. Based on projected July 1973 price levels, the estimated first cost of construction of the New Orleans East levee, South Point to GIWW, is $3,241,000. This estimate consists of $161,000 for lands and damages, $1,120,000 for relocations, $1,620,000 for levees, $178,000 for engineering and design, and $162,000 for supervision and administration. The detailed estimate of first cost is shown on table 1.

71. Comparison of estimates As explained in paragraph 14 of this report, the project document did not specifically describe improvements proposed for the South Point to GIWW levee reach, since at the time of the survey report it was felt that the levee grade was adequate. Accordingly, costs for this work were not reported in either the project document or the latest approved PB-3, and thus eliminates the bases for a comparison of feature costs. The feature costs reported in table 1 will be included in the next PB-3 prepared after approval of this memorandum.

TABLE 1
LAKE PONTCHARTRAIN BARRIER PLAN
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

ESTIMATE OF FIRST COST
(Projected July 1973 price levels)

Cost acct. No.	Item	Estimated quantity	Unit	Unit price	Estimated amount
			$	$	$
CONSTRUCTION					
11	Levees and floodwalls				
	Embankment	[1]			
	Barge-haul fill(from North Shore)	300,000	c.y.	4.00	1,200,000
	Clearing	156	ac.	100.00	15,600
	Fertilizing & seeding	136	ac.	150.00	20,400
	Access road (Hwy 90 to GIWW)				
	Shell (haul)	9,000	c.y.	5.00	45,000
	Mobilization and demobilization	1	job	L.S.	20,000
	Environmental protection	1	job	L.S.	13,000
	Railroad swing gate(including Gate monolith & I-wall tie-in)				
	Structure excavation	130	c.y.	3.50	455
	Structure backfill	62	c.y.	4.00	248
	Timber	1	job	L.S.	1,200
	Prestressed concrete piles (12"x12")	585	l.f.	6.00	3,510
	Concrete in stabilization slab	3	c.y.	30.00	90
	Concrete in base slab	20	c.y.	50.00	1,000
	Concrete in walls, columns, sill beam & pedestals	10	c.y.	100.00	1,000
	Concrete in I-walls	14	c.y.	100.00	1,400
	Portland cement	360	CWT	1.40	504
	Steel reinforcement	4,830	lbs.	0.25	1,208
	L-type waterstop	18	ft.	15.00	270
	Expansion joint filler	36	s.f.	1.00	36
	Structural steel	3,300	lbs.	1.20	3,960

[1] 31,263 c.y. of this fill has already been placed by the OLD at a cost of approximately $108,000. This amount will be credited toward the local share of project cost after final determination of actual costs.

TABLE 1 (cont'd)

Cost acct. No.	Item	Estimated quantity	Unit	Unit price	Estimated amount
			$	$	$
	Steel sheet piling (PZ-27)	1,170	s.f.	4.80	5,616
	Miscellaneous metal work	1	job	L.S.	15,000
	Gate seals	27	l.f.	15.00	405
	Subtotal				1,349,902
	Contingencies, 20%±				270,098
	Subtotal, levees and floodwalls				1,620,000
30	Engineering and design 11%± (based on estimate of actual E&D required)				178,000
31	Supervision and administration 10%± (based on estimate of actual S&A required)				162,000
	TOTAL, CONSTRUCTION				1,960,000
LANDS AND DAMAGES					
01	Lands				
	Marshland	63	ac.	varies	112,400
	Easement (construction)	44	ac.	varies	20,000
	Subtotal				132,400
	Contingencies, 20%±				26,600
	Real estate hired labor (5 tracts)				500
	Acquisition costs by others (5 tracts)				1,500
	TOTAL, LANDS AND DAMAGES				161,000
RELOCATIONS					
02	Relocations				
	Pipelines & utilities				
	8-inch high pressure gas line	1	job	L.S.	15,000
	12-inch waterline	1	job	L.S.	19,000
	4 1/2-inch oil pipeline	1	job	L.S.	12,000
	4-inch communications cable	1	job	L.S.	6,000
	2-inch telephone cable	1	job	L.S.	25,000
	Overhead electrical powerline	1	job	L.S.	3,000
	Subtotal				80,000

TABLE 1 (cont'd)

Cost acct. No.	Item	Estimated quantity	Unit	Unit price	Estimated amount
			$	$	$
	Drainage structures				
	Excavation	15,150	c.y.	3.50	53,025
	Dewatering	1	job	L.S.	15,000
	Backfill	14,934	c.y.	4.00	59,736
	Sandfill	744	c.y.	10.00	7,440
	Shellfill	280	c.y.	8.00	2,240
	Riprap 12"	755	tons	15.00	11,325
	Steel sheet piling	1,792	s.f.	6.00	10,752
	Concrete slab	156	c.y.	50.00	7,800
	Concrete walls	189	c.y.	100.00	18,900
	Steel reinforcement	41,850	lbs.	0.25	10,463
	Miscellaneous metal	1	job	L.S.	15,000
	42-inch CMP culvert	468	l.f.	42.00	19,656
	48-inch CMP culvert	468	l.f.	48.00	22,464
	54-inch CMP culvert	608	l.f.	54.00	32,832
	Sluice gate, 42-inch	3	ea.	4,000.00	12,000
	Sluice gate, 48-inch	3	ea.	5,000.00	15,000
	Sluice gate, 54-inch	4	ea.	6,000.00	24,000
	Flap gate, 42-inch	3	ea.	800.00	2,400
	Flap gate, 48-inch	3	ea.	1,000.00	3,000
	Flap gate, 54-inch	4	ea.	1,200.00	4,800
	Remove existing culverts	1	job	L.S.	15,000
	Fertilizing & seeding	4	ac.	150.00	600
	Subtotal				363,433
	Ramp - U.S. Highway 11[2]				
	Clearing & grubbing	1	job	L.S.	1,000
	Removal of surfacing	490	s.y.	1.50	735
	Excavation	108.6	c.y.	3.00	326
	Earthfill	7,969	c.y.	4.00	31,876
	Compacted sand and shellfill	12,783	c.y.	7.30	93,316
	Clay core	166.7	c.y.	10.00	1,667
	Prime coat	600	gal.	0.20	120
	3 1/2-inch binder course	850	ton	11.80	10,030
	1 1/2-inch surface course	4,080	s.y.	1.06	4,325
	Misc. shaping & hauling	1	job	L.S.	835
	Sprigging & dressing	1	job	L.S.	1,800
	Subtotal				146,030

[2]This ramp has already been constructed by the OLD, and the costs shown for this item are actual costs, excluding engineering and design and supervision and administration.

TABLE 1 (cont'd)

Cost acct. No.	Item	Estimated quantity	Unit	Unit price	Estimated amount
			$	$	$
	Ramp - U.S. Highway 90				
	Shellfill	16,800	c.y.	8.00	134,400
	Clay core	50	c.y.	6.00	300
	10-inch concrete pavement	5,300	s.y.	12.00	63,600
	Asphalt shoulder	2,100	s.y.	4.00	8,400
	Subtotal				206,700
	Subtotal, relocations				796,163
	Contingencies, 20%± (excluding Hwy 11 ramp)				129,837
	Subtotal, relocations				926,000
	Engineering & design 11%± (based on estimate of actual work required)				102,000
	Supervision & administration 10%± (based on estimate of actual work required)				92,000
	TOTAL, RELOCATIONS				1,120,000
	TOTAL PROJECT COST				3,241,000

SCHEDULES FOR DESIGN AND CONSTRUCTION

72. Schedules for design and construction. The sequence of contracts and the schedules for design and construction are tabulated below:

Contracts	P&S Start	P&S Complete	Construction Advertise	Construction Award	Construction Complete	Estimated Construction Cost Includes Contingencies and 6%± S&I
Levee, sta. 666+00 to sta. 1102+98 (including drainage structures, Hwy 90 road ramp and railroad gate)	Jan 73	Apr 73	May 73	Jun 73	Dec 74	$2,442,410

73. Funds required by fiscal year. To maintain the schedules for design and construction of the New Orleans East levee, Federal funds[2] will be required by fiscal year as follows:

Funds required by FY	1973	$ 58,330
	1974	1,830,000
	1975	900,000
Total		$ 2,788,330

OPERATION AND MAINTENANCE

74. General. The drainage structures will be maintained and operated at the expense of local interests as a feature of local cooperation in the hurricane protection project. These structures will have an estimated life of 50 years but it is anticipated that local interests will replace the structures with pumping stations as the New Orleans East area develops. It is estimated that the flap gates will be replaced at 10-year intervals and the sluice gates and culvert pipes at 25-year intervals. The annual charge for these replacements is estimated to be $11,700. The annual operation and maintenance cost for the drainage structures is estimated to be $3,000. The annual maintenance cost for the levee is estimated to be $5,500. In addition, it is estimated that replacement of the railroad swing gate will be necessary at 30-year intervals. The annual charge for this replacement is estimated to be $650. The annual operation and maintenance cost for this structure is estimated to be $1,000.

PROJECT FORMULATION AND EVALUATION

75. Project formulation and evaluation. The New Orleans East levee is not a separable unit of Lake Pontchartrain Barrier Plan; therefore, an incremental justification and independent economic analysis is not practicable.

---

[2] Includes cost for enlarging levee, three drainage structures, ramp at U. S. Hwy 90, and railroad gap closure (including 20% contingencies), supervision & administration, and engineering & design. Approximately $828,000 will be reimbursed by local interests for construction, E&D, and S&A associated with the drainage structure and highway ramp relocations.

ECONOMICS

76. Economic justification. The current economic analysis for the entire Lake Pontchartrain, Louisiana and Vicinity, hurricane protection project, based on July 1972 PB-3 costs, indicates a benefit-cost ratio of 11.9 to 1. As stated in paragraph 75 above, an independent economic analysis for the project feature presented herein is not practicable. The cost of the New Orleans East levee protective works presented in this memorandum, since not previously presented in the current PB-3, will reduce the benefit-cost ratio for the entire project, though not significantly.

RECOMMENDATIONS

77. Recommendations. The plan of improvement presented herein consists of 8.3 miles of levee enlargement in eastern New Orleans from South Point to the GIWW. The plan includes suitable provision for replacement of drainage facilities, gap closures, and necessary relocations. This plan is considered to be the best means of accomplishing project objectives and is recommended for approval.

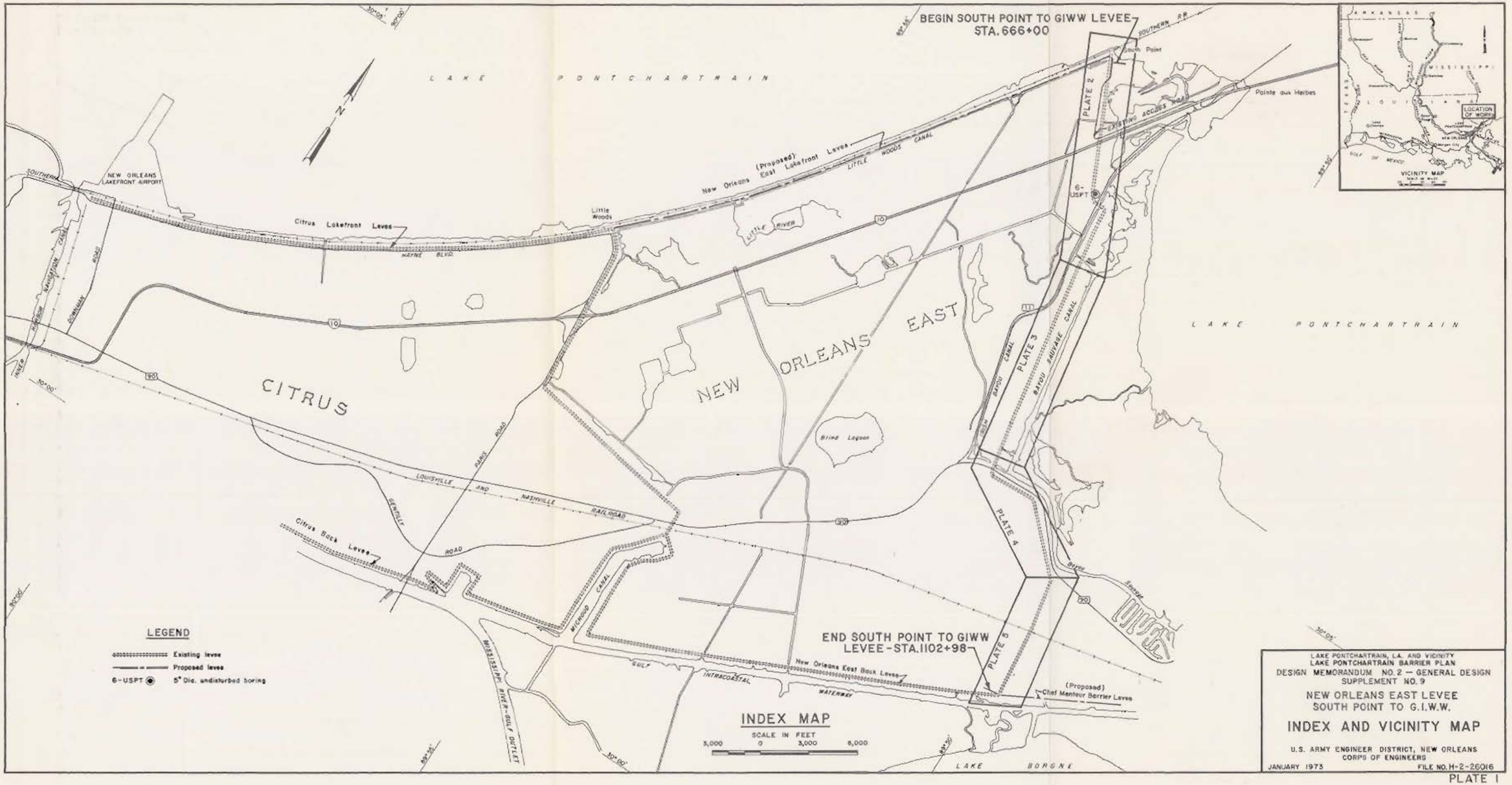

BEGIN SOUTH POINT TO GIWW LEVEE
STA. 666+00
LAKE PONTCHARTRAIN
NEW ORLEANS LAKEFRONT AIRPORT
Citrus Lakefront Levee
HAYNE BLVD.
Little Woods
New Orleans (Proposed) East Lakefront Levee
LITTLE WOODS CANAL
LITTLE RIVER
SOUTHERN RR
South Point
Pointe aux Herbes
EXISTING ACCESS ROAD
PLATE 2
6-USPT
CITRUS
NEW ORLEANS EAST
Blind Lagoon
PLATE 3
BAYOU SAUVAGE CANAL
PLATE 4
PLATE 5
LOUISVILLE AND NASHVILLE RAILROAD
PARIS ROAD
GENTILLY ROAD
Citrus Back Levee
MICHOUD CANAL
MISSISSIPPI RIVER-GULF OUTLET
GULF INTRACOASTAL WATERWAY
New Orleans East Back Levee
END SOUTH POINT TO GIWW
LEVEE-STA.1102+98
(Proposed) Chef Menteur Barrier Levee
LAKE BORGNE
LEGEND
Existing levee
Proposed levee
6-USPT 5" Dia. undisturbed boring
INDEX MAP
SCALE IN FEET
5,000 0 3,000 6,000
VICINITY MAP
LOCATION OF WORK
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 — GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
INDEX AND VICINITY MAP
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016

PLATE 1

New and Existing ℄ Curve 1 Data
Δ = 68° 54'
D = 16° 15'
T = 241.86'
L = 424.0'
R = 352.56'
PC = Sta. 753+33 ℄
PT = Sta. 757+57 ℄

New and Existing ℄ Curve 2 Data
Δ = 83° 18'
D = 17° 19'
T = 294.45'
L = 481.22'
R = 331.07'
PC = Sta. 763+22 ℄
PT = Sta. 768+03 ℄

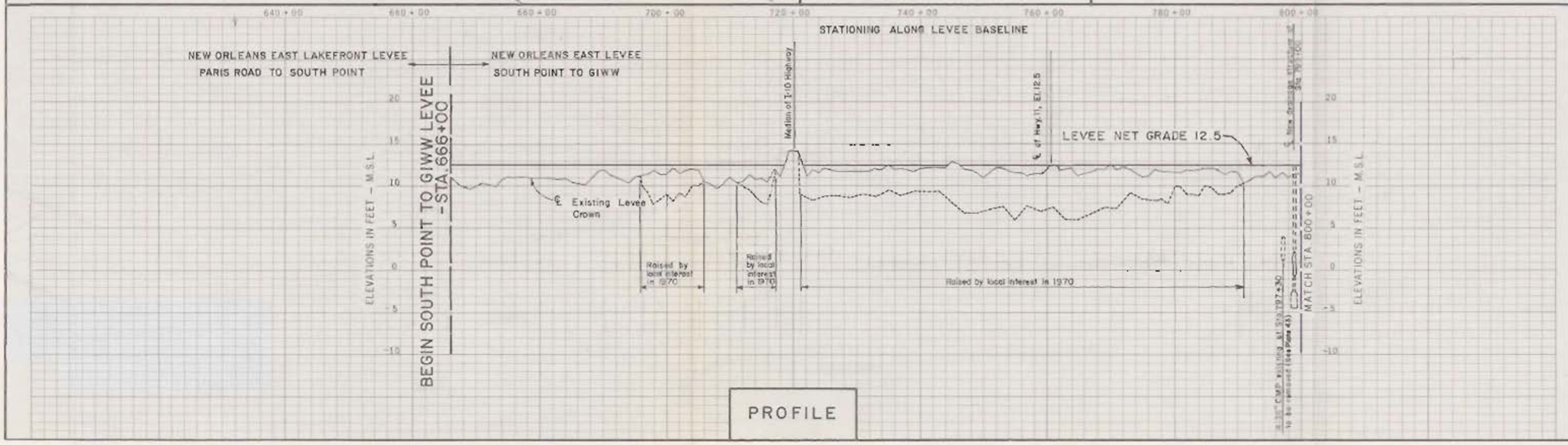
PLAN

SCALE IN FEET

500 0 500 1000 1500

Polyconic Projection — 1927 North American Datum

NOTE: For general type boring logs see Plates 8 & 9
Controlled mosaic File No. 3-20 prepared from aerial photos flown 30 October 1970.



PROFILE

LEGEND:
● 21-SP GENERAL TYPE BORING
◉ 8-USP UNDISTURBED BORING

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 — GENERAL DESIGN
SUPPLEMENT NO. 9

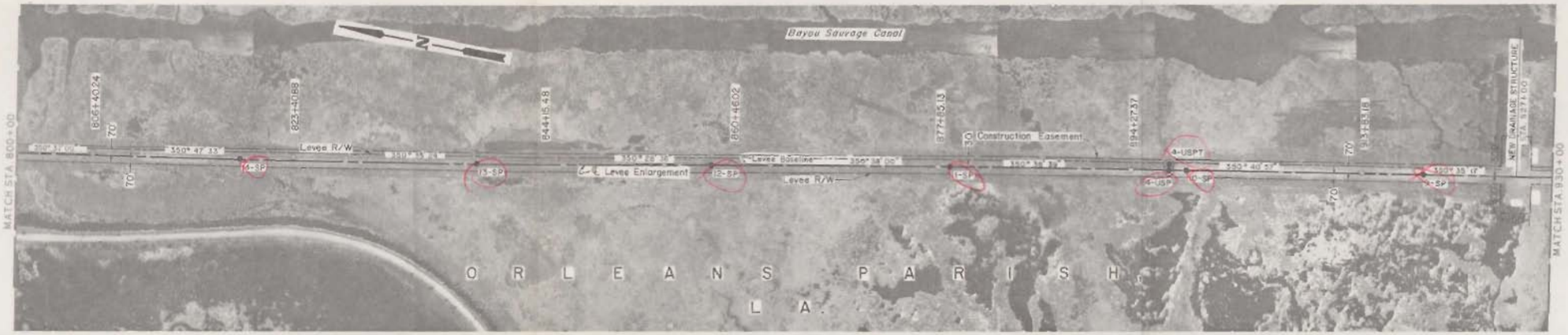
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN AND PROFILE

STA. 666+00 TO STA. 800+00

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

JANUARY 1973 FILE NO. H-2-26016



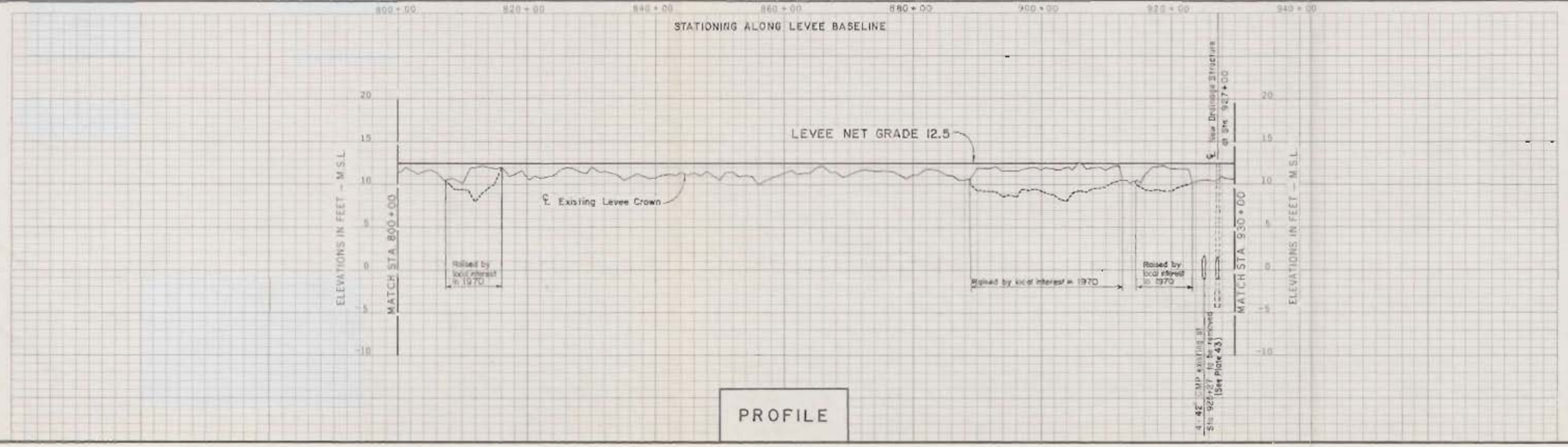
PLAN

SCALE IN FEET

500 0 500 1000 1500

Polyconic Projection — 1927 North American Datum

NOTE: For general type boring logs see Plates 9 & 10
Controlled mosaic File No. 3-20 prepared from aerial photos flown 30 October 1970



PROFILE

LEGEND:

- 14-SP GENERAL TYPE BORING
- 4-USP UNDISTURBED BORING

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 — GENERAL DESIGN
SUPPLEMENT NO. 9

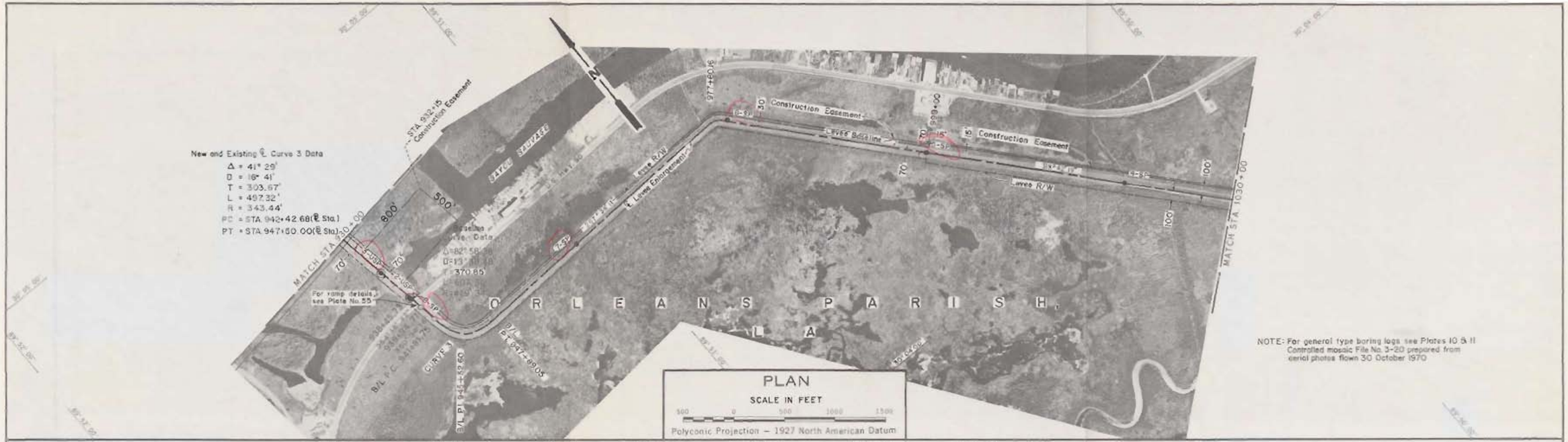
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

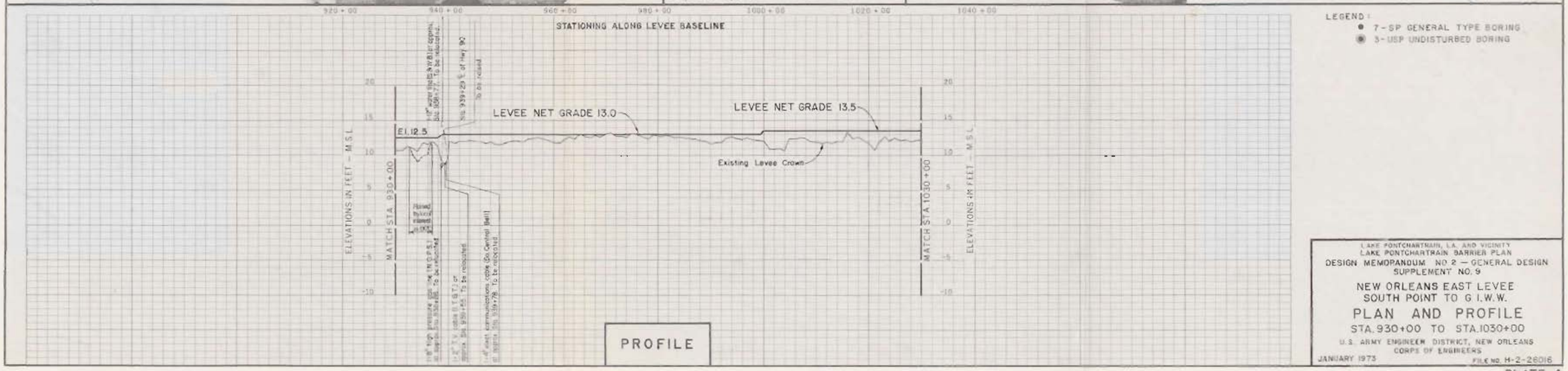
PLAN AND PROFILE

STA. 800+00 TO STA. 930+00

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

JANUARY 1973 FILE NO. H-2-26016





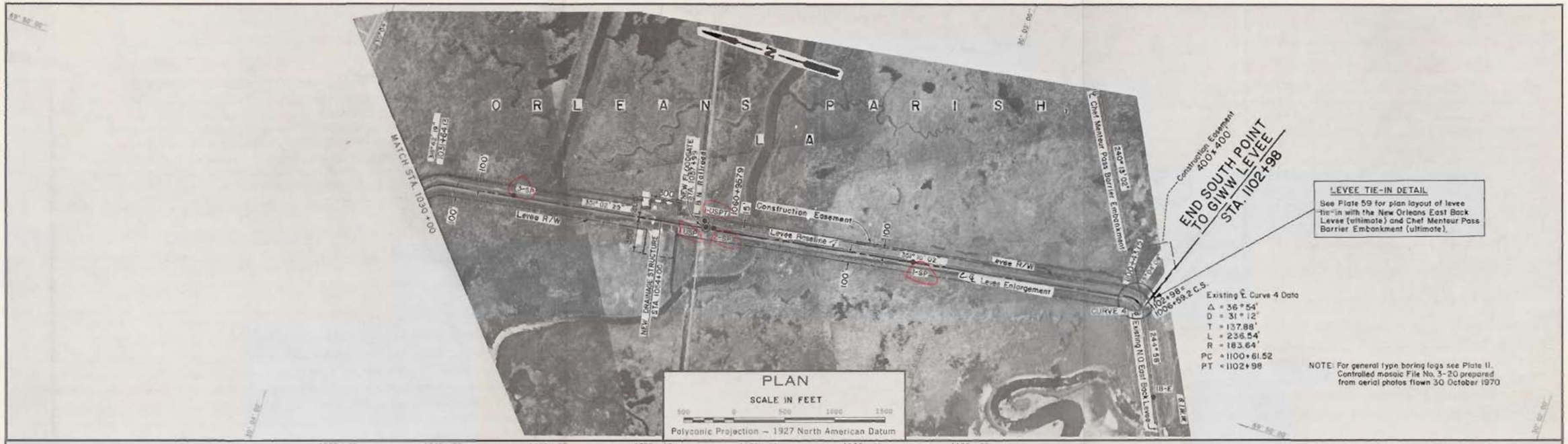
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 — GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN AND PROFILE
STA. 930+00 TO STA. 1030+00

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

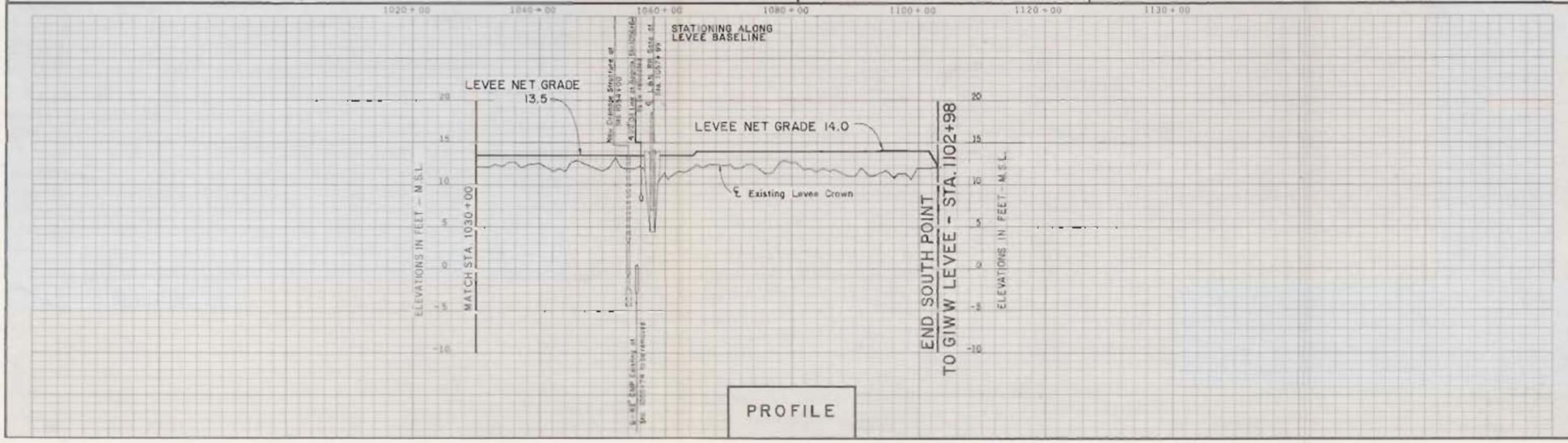
JANUARY 1973 FILE NO. H-2-26016



LEVEE TIE-IN DETAIL

See Plate 59 for plan layout of levee tie-in with the New Orleans East Back Levee (ultimate) and Chef Menteur Pass Barrier Embankment (ultimate).

NOTE: For general type boring logs see Plate 11. Controlled mosaic File No. 3-20 prepared from aerial photos flown 30 October 1970



LEGEND:

- 3-SP GENERAL TYPE BORING
- 1-USP UNDISTURBED BORING

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 — GENERAL DESIGN
SUPPLEMENT NO. 9

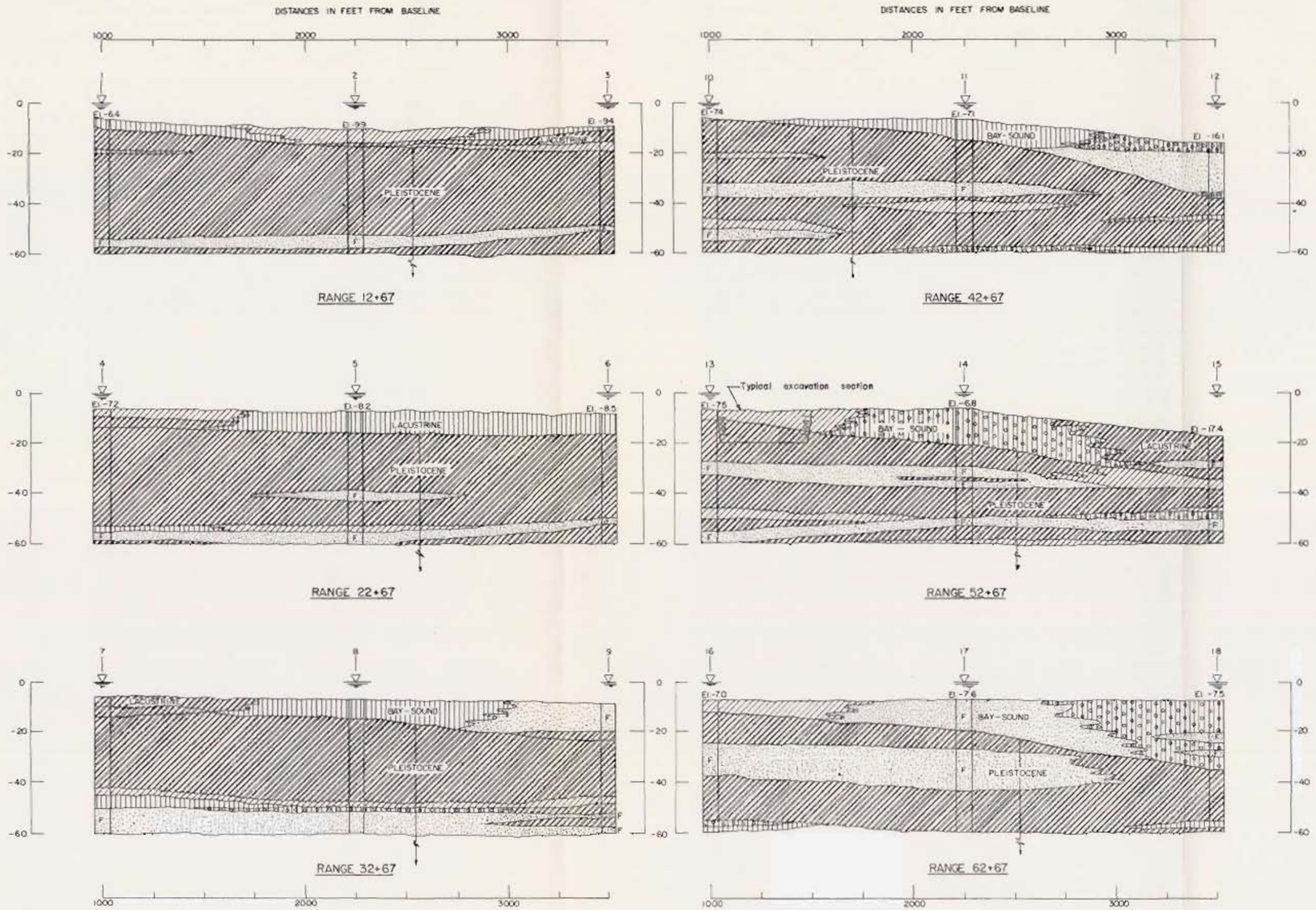
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN AND PROFILE

STA. 1030+00 TO STA. 1102+98

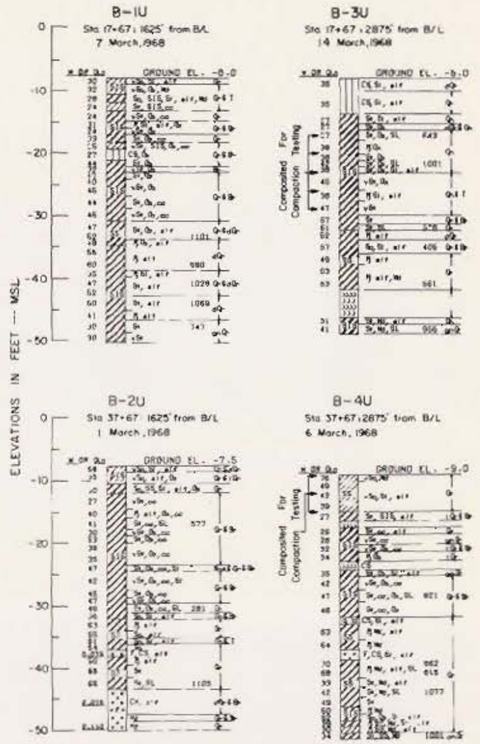
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973 FILE NO. H-2-26016



SOIL BORING SECTIONS

UNDISTURBED BORING



LEGEND (Soil Boring Sections)

- CH – Fat Clay
- CL – Lean Clay
- ML – Silt
- SM – Silty Sand
- SP – Fine Sand

RECENT
- Lacustrine – soft to very soft lean clay and fat clay with silty sand and sand, and with shell and shell fragments.
- Bay-Sound – silt, silty sand and sand with shell and shell fragments.

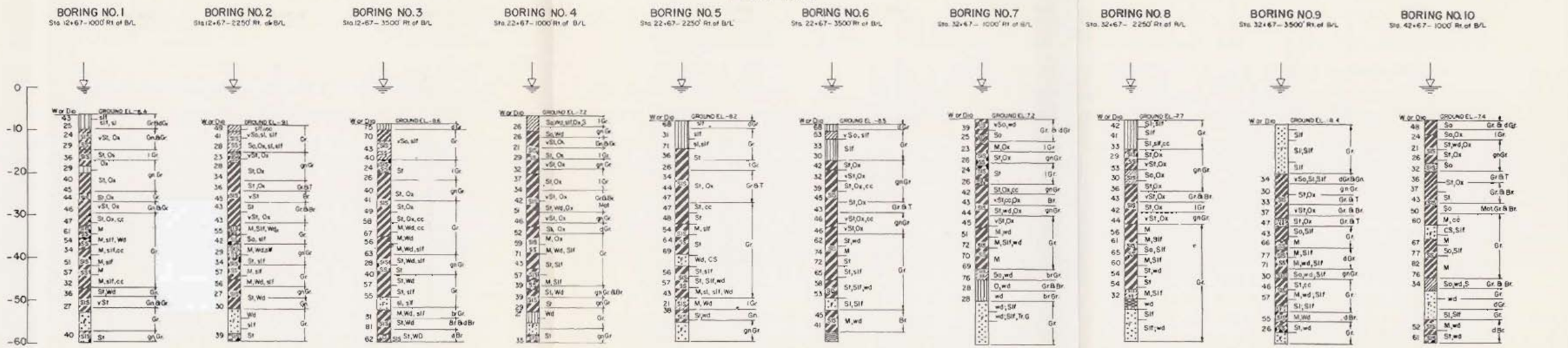
PLEISTOCENE – stiff to very stiff clays with layers and lenses silt and sand

Soil samples taken with 1 7/8 inch I.D. core barrel.
See PLATE A for soil boring legend.
See PLATE 7 for location of borings.

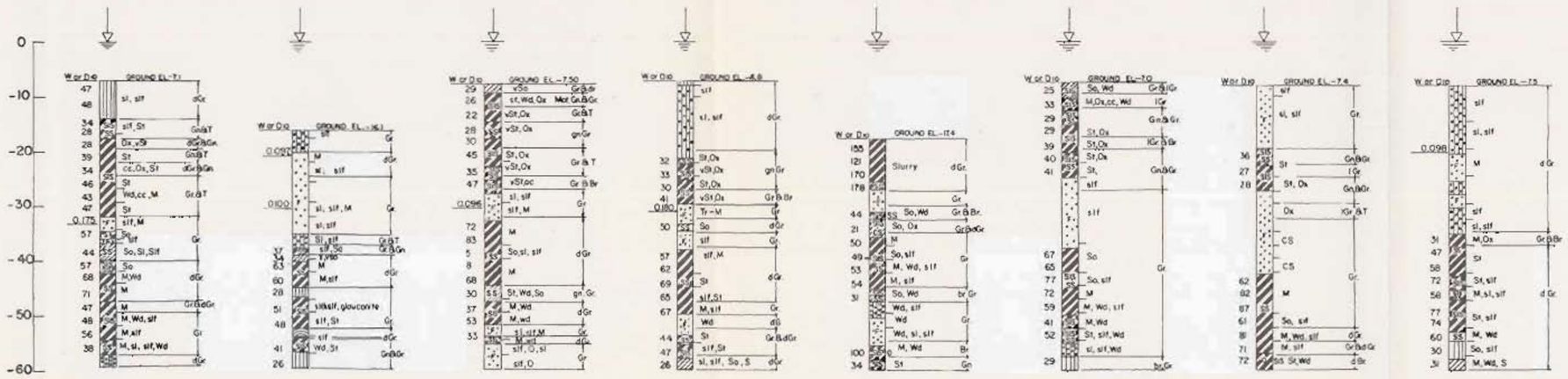
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W
BORROW DATA
PIT AREA IN LAKE PONTCHARTRAIN
ALONG NORTH SHORE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

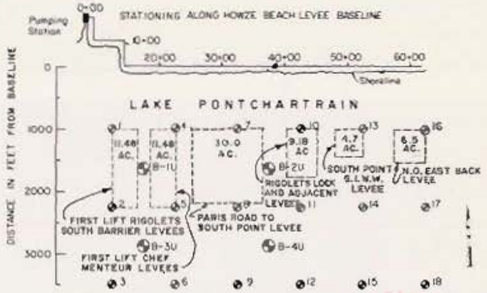
JANUARY 1973 FILE NO H-2-26016

PLOT NO. 4



PLOT NO. 4





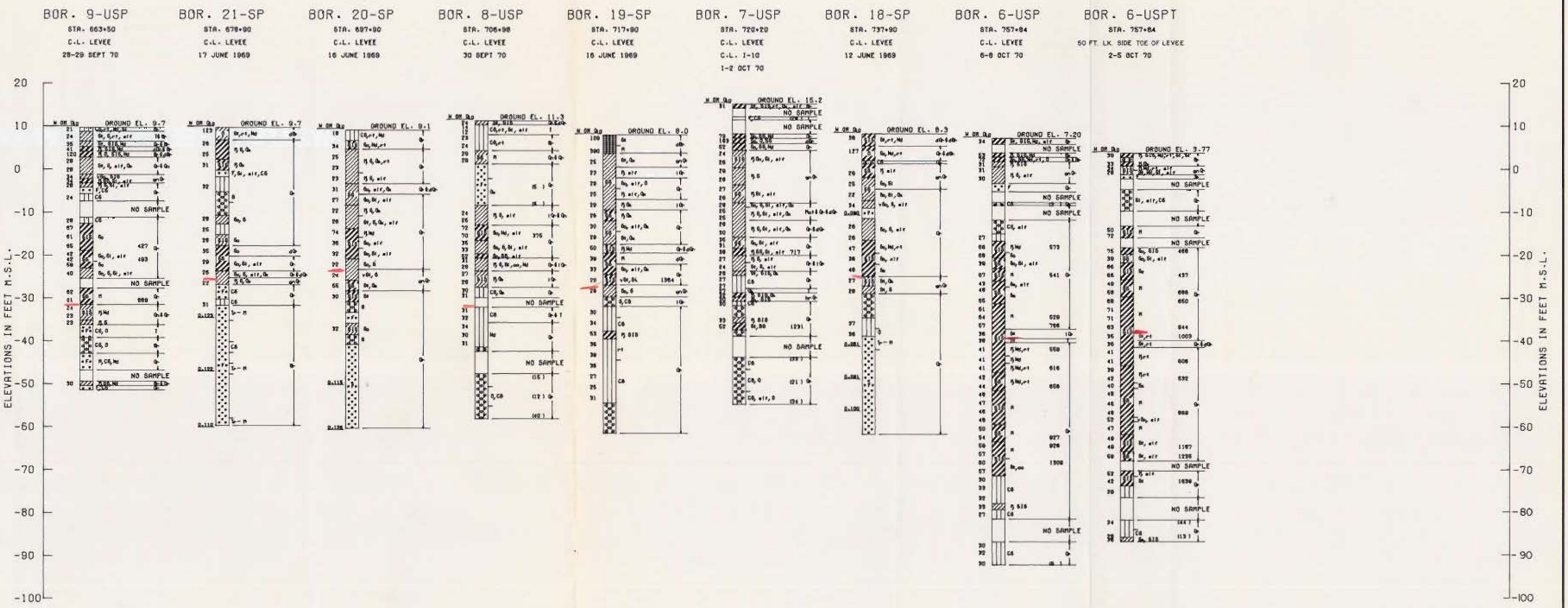
PROSPECTIVE BORROW AREAS
LAKE PONTCHARTRAIN ALONG NORTH SHORE
INDICATES BORING LOCATIONS

Not used

GENERAL NOTES:
FOR SOIL BORING LEGEND SEE PLATE A.
SOIL SAMPLES TAKEN WITH 1 3/8" I.D. CORE BARREL SAMPLER (BORINGS 1 THRU 18)
BORINGS B-1U THRU B-4U WERE TAKEN WITH A 5" DIAMETER STEEL TUBE PISTON TYPE SAMPLER.

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
BORROW DATA
PIT AREA IN LAKE PONTCHARTRAIN
ALONG NORTH SHORE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973 FILE NO. H-2-26016



NOTES:

General type borings were made with a 1 7/8" ID core barrel sampler.
Undisturbed type borings were taken with a 5" diameter steel tube piston type sampler.
For locations of borings see plate 2.
See plate 4 for boring legend.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

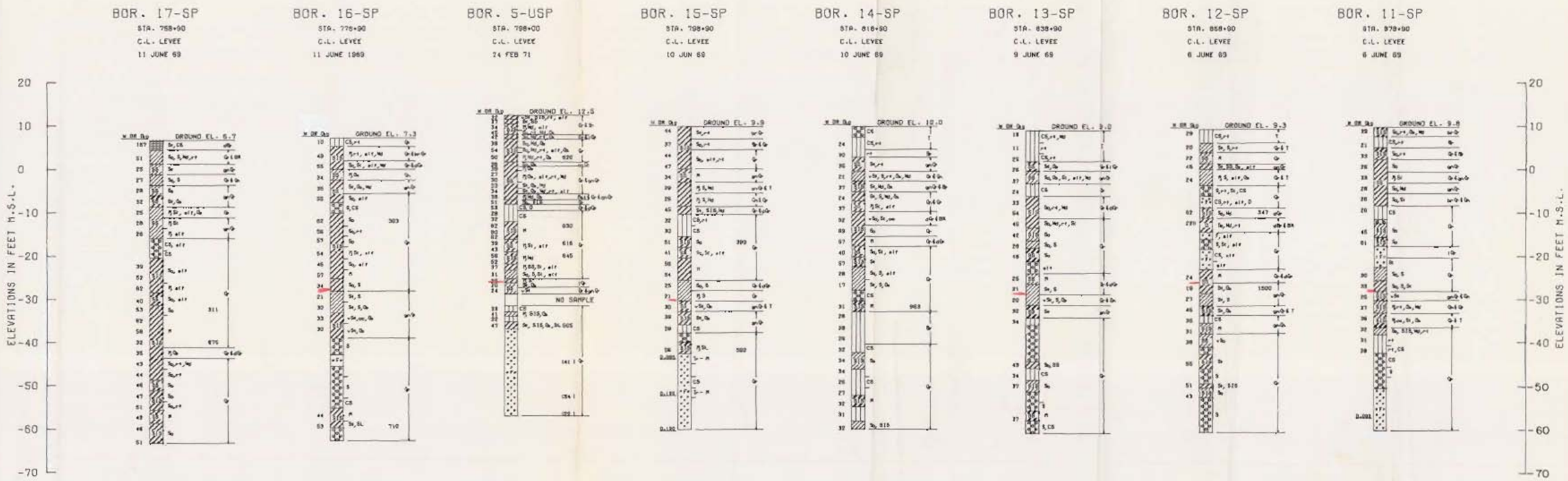
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

BORING LOGS ALONG LEVEE ALIGNMENT

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

JANUARY 1973

FILE NO. H-2-26016



GENERAL NOTES

For boring locations see plates 2 & 3.
For boring note see plate 8.

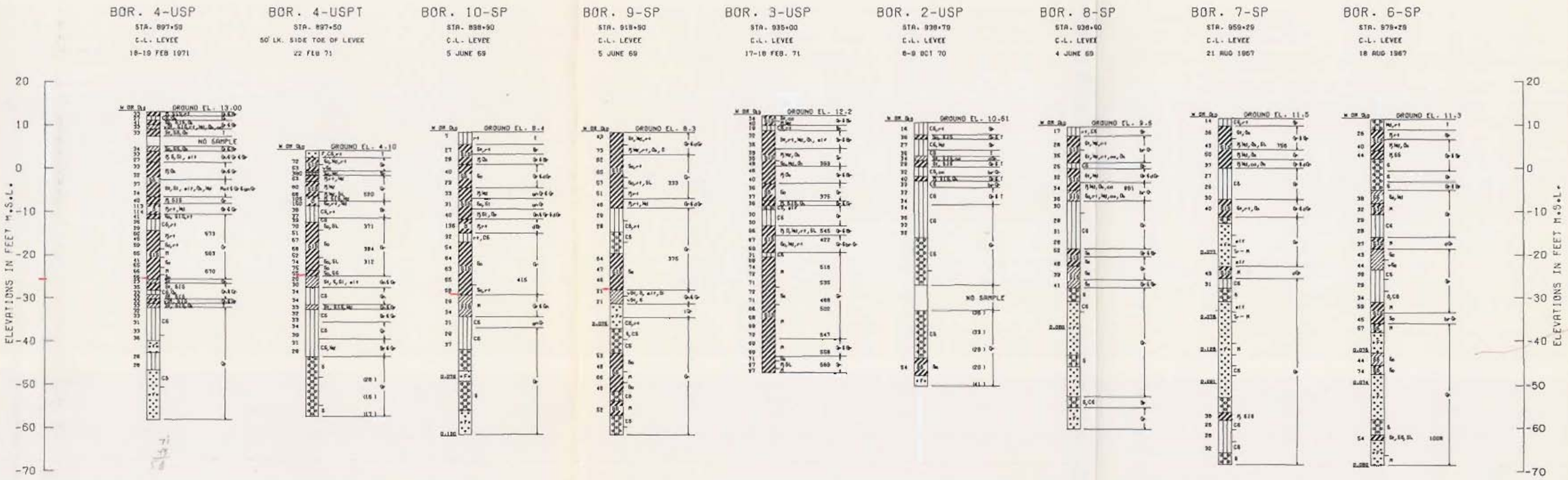
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
BORING LOGS
ALONG LEVEE ALIGNMENT

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

JANUARY 1973

FILE NO. H-2-26016



GENERAL NOTES

For boring locations see plates 3 & 4.
For boring note see plate 8.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

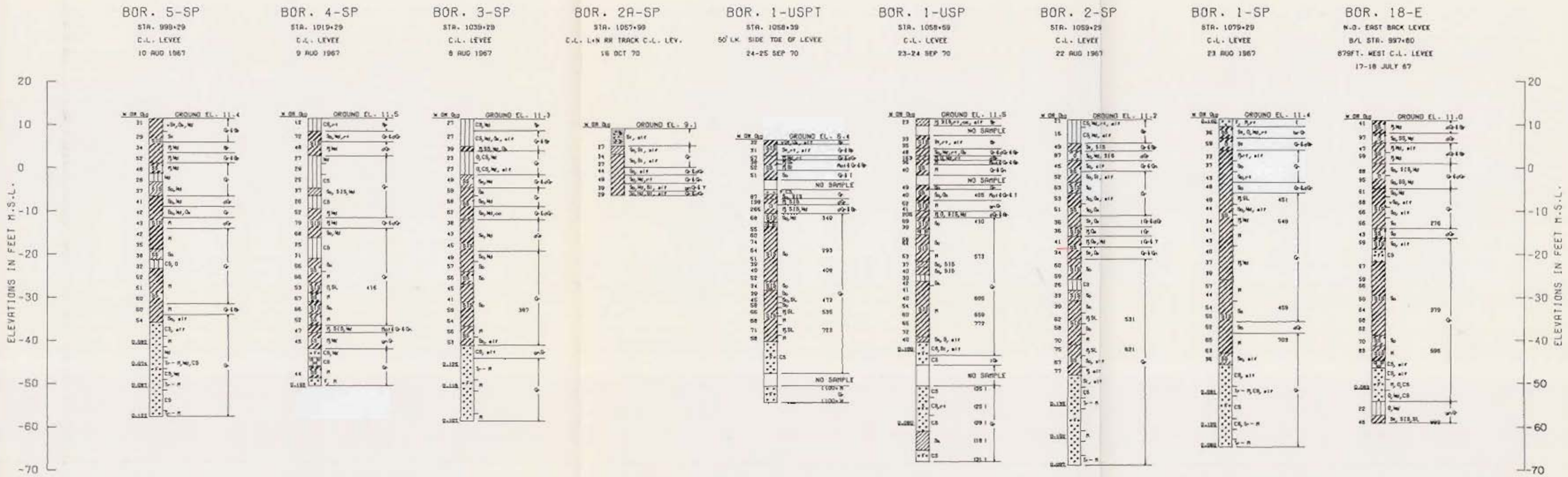
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

BORING LOGS ALONG LEVEE ALIGNMENT

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

JANUARY 1973

FILE NO. H-2-26016



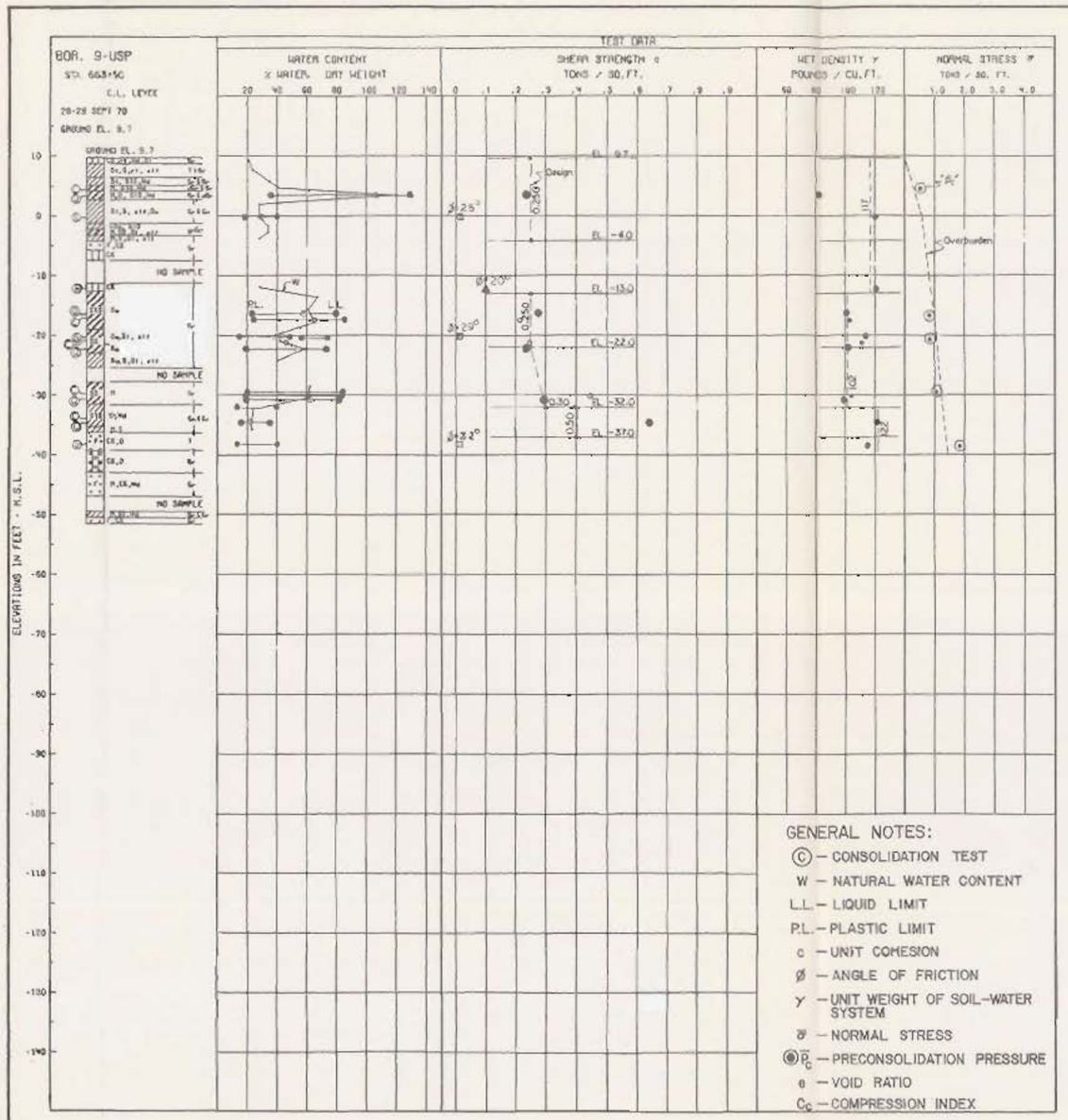
GENERAL NOTES

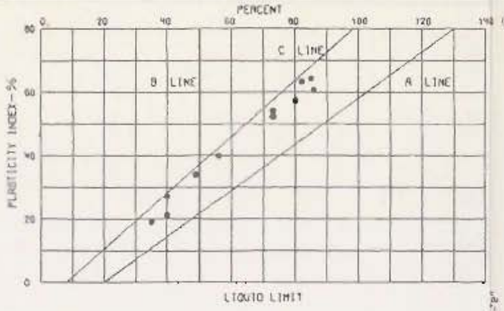
For boring locations see plates 4 & 5.
For boring note see plate 8.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

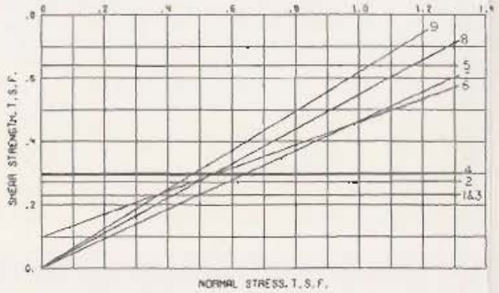
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
BORING LOGS
ALONG LEVEE ALIGNMENT

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FILE NO. H-2-26016





PLASTICITY CHART



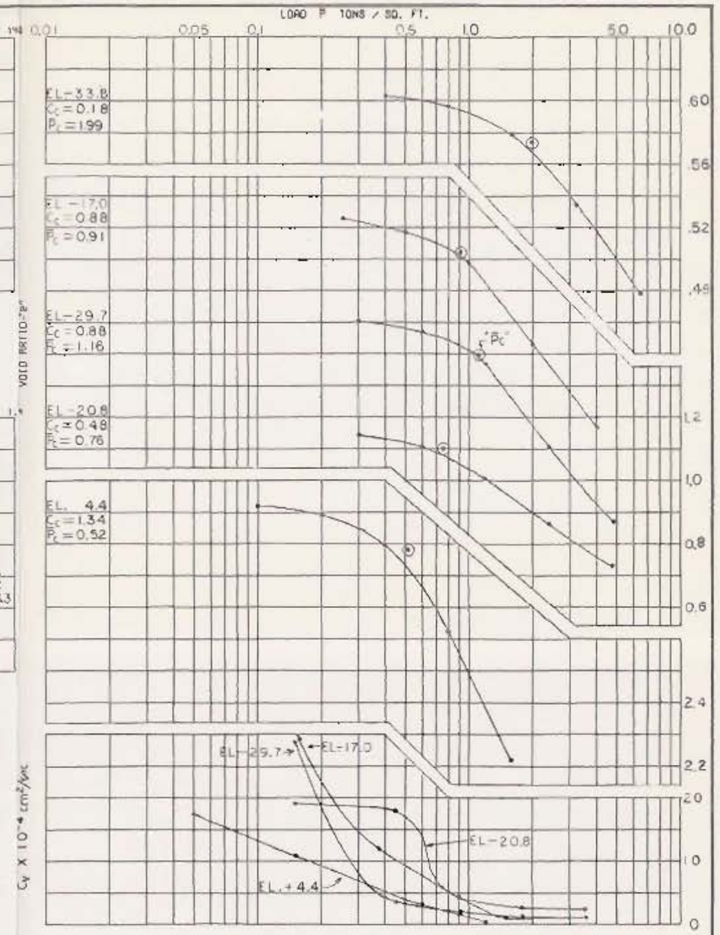
SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
9-USP	1	3.5	Q	0	.235	CH
	2	-16.3		0	.275	CH
	3	-22.2		0	.235	CH
	4	-30.8		0	.295	CH
	5	-34.7		0	.640	CL
	*6	-12.4	R	20	.100	ML
	7	-0.3		25	0	CL
	8	-20.1	S	29	0	CH
	9	-38.3		32	0	SP

*BASED ON (σ1 - σ3) AT MAXIMUM PORE PRESSURE

NOTES

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 656+00 AND STA. 687+50.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

○ - (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 2

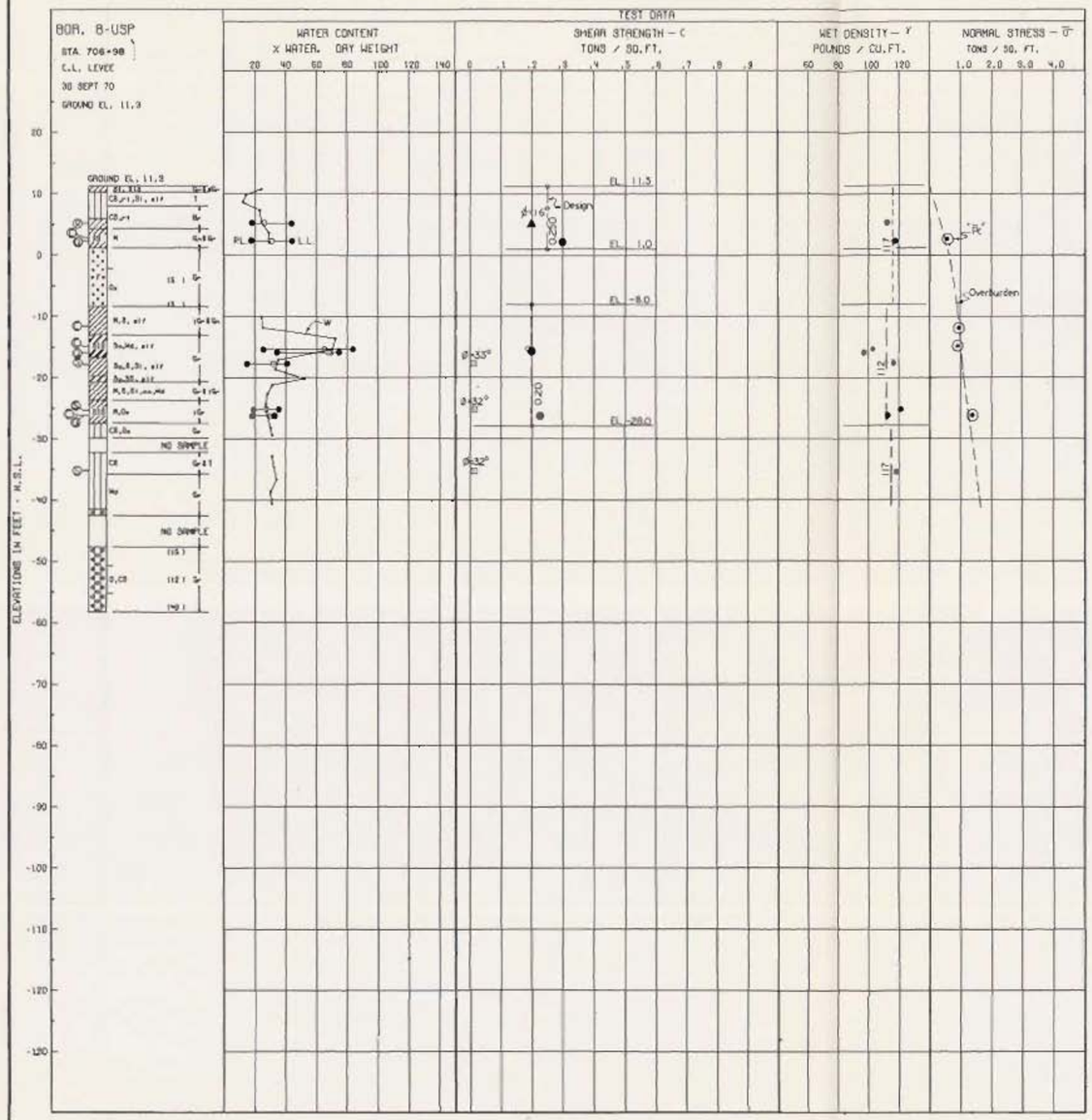
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 24

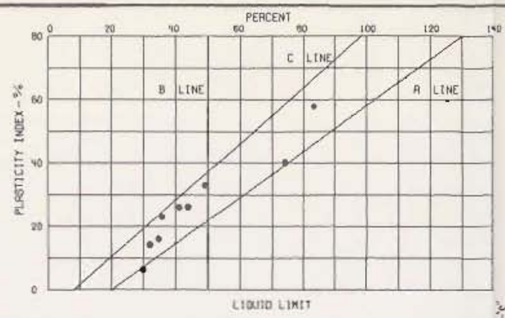
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

UNDISTURBED BORING 9-USP DATA

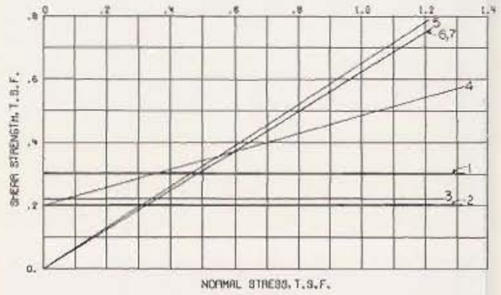
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JAN 73 FILE NO. H-2-26018





PLASTICITY CHART



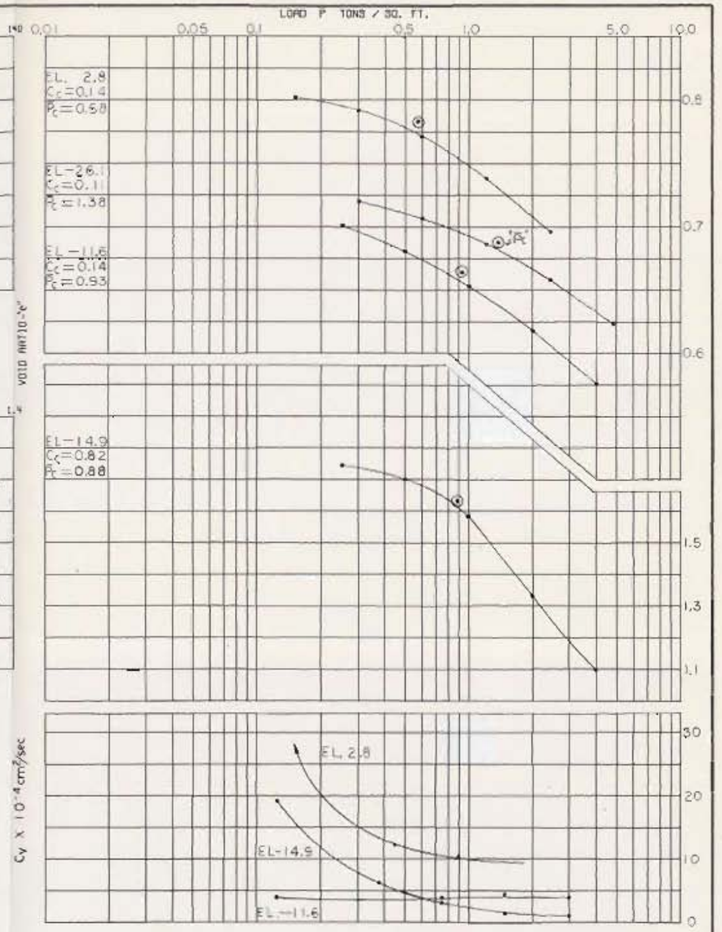
SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
8-USP	1	2.3	Q	0	.300	CL
	2	-15.8		0	.200	CH
	3	-26.1		0	.225	CL
	4*	5.3	R	16	.200	CL
	5	-17.9	S	33	0	CL
	6	-25.4		32	0	CL
	7	-34.8		32	0	ML

* BASED ON $(\sigma_1 - \sigma_3)$ AT MAXIMUM PORE PRESSURE

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 687+50 AND STA. 715+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

o - (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 2

FOR GENERAL NOTES SEE PLATE 12

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 25

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

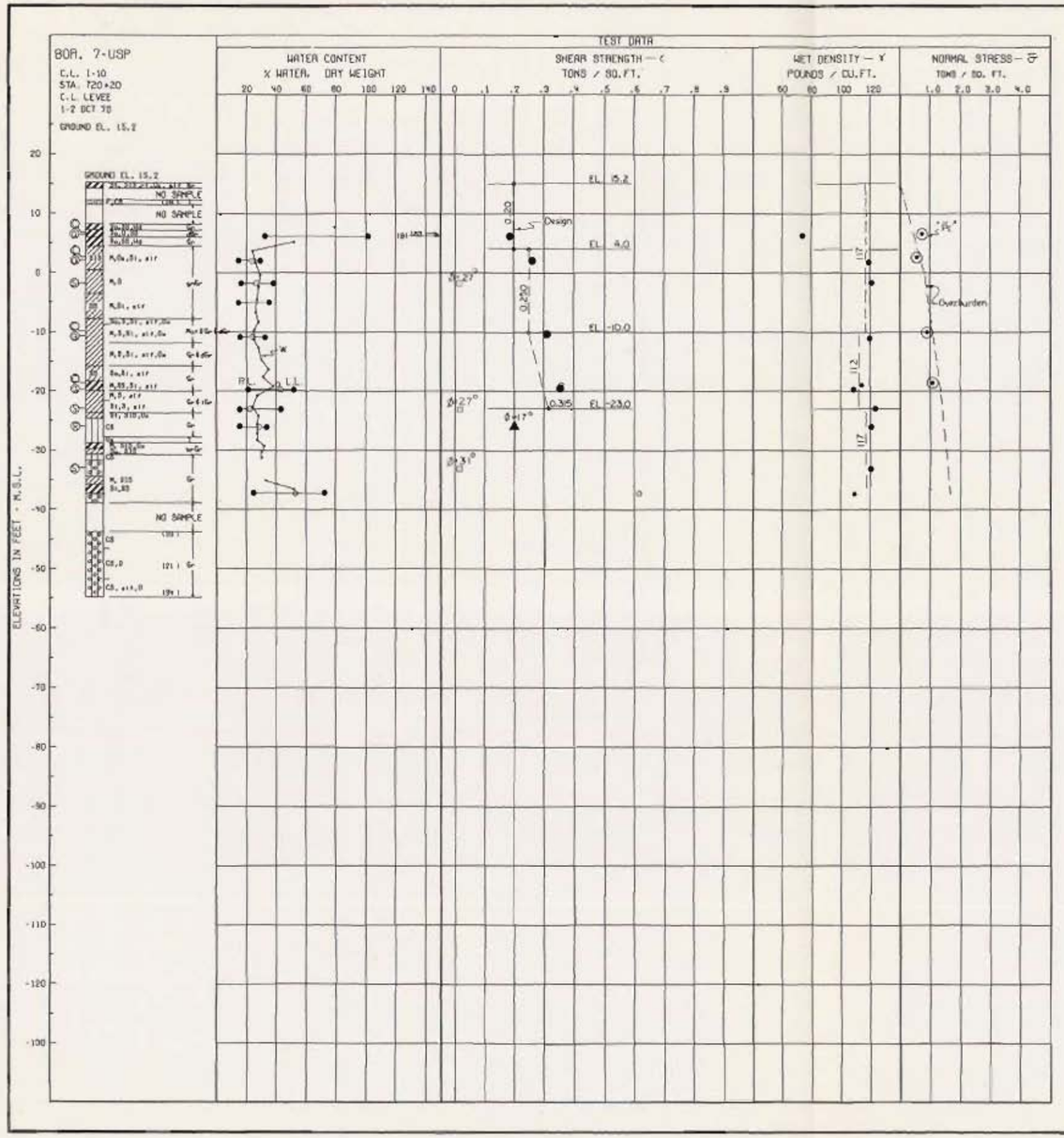
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

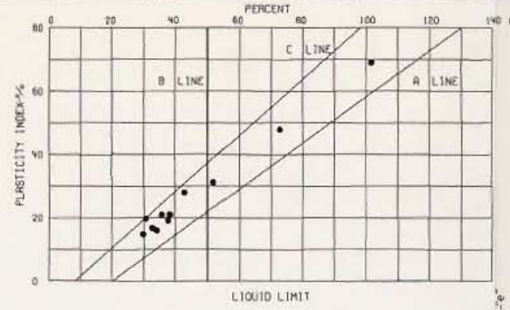
UNDISTURBED BORING
8-USP DATA

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

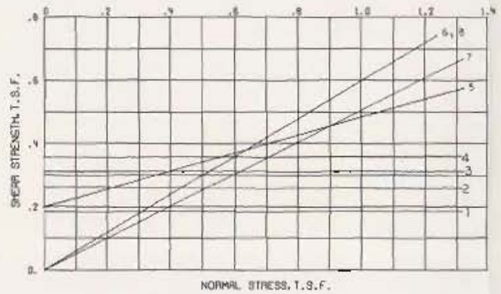
JAN 73

FILE NO. H-2-26016





PLASTICITY CHART



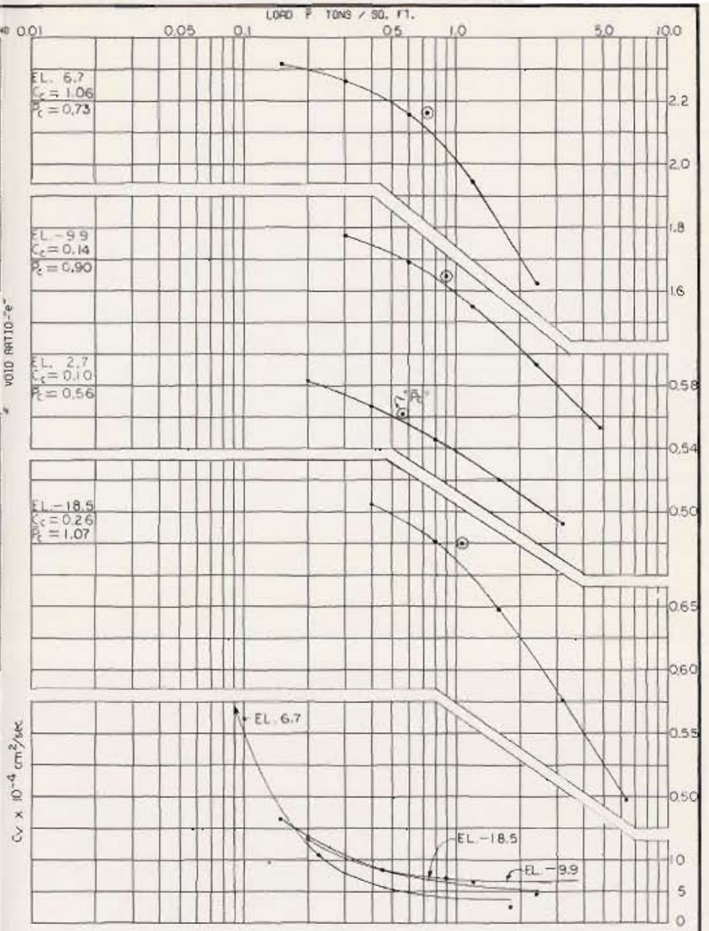
SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\phi°$	STRENGTH C - TSF	CLASS
7-USP	1	6.2	Q	0	.185	CH
	2	2.2		0	.260	CL
	3	-10.4		0	.310	CL
	4	-19.4		0	.355	CH
	5*	-26.0	R	17	.200	CL
	6	-18	S	27	0	CL
	7	-23.0		27	0	CL
	8	-33.1		31	0	SM

* BASED ON $(\sigma_1 - \sigma_3)$ AT MAXIMUM PORE PRESSURE

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 715+00 AND STA. 747+50.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

o - (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

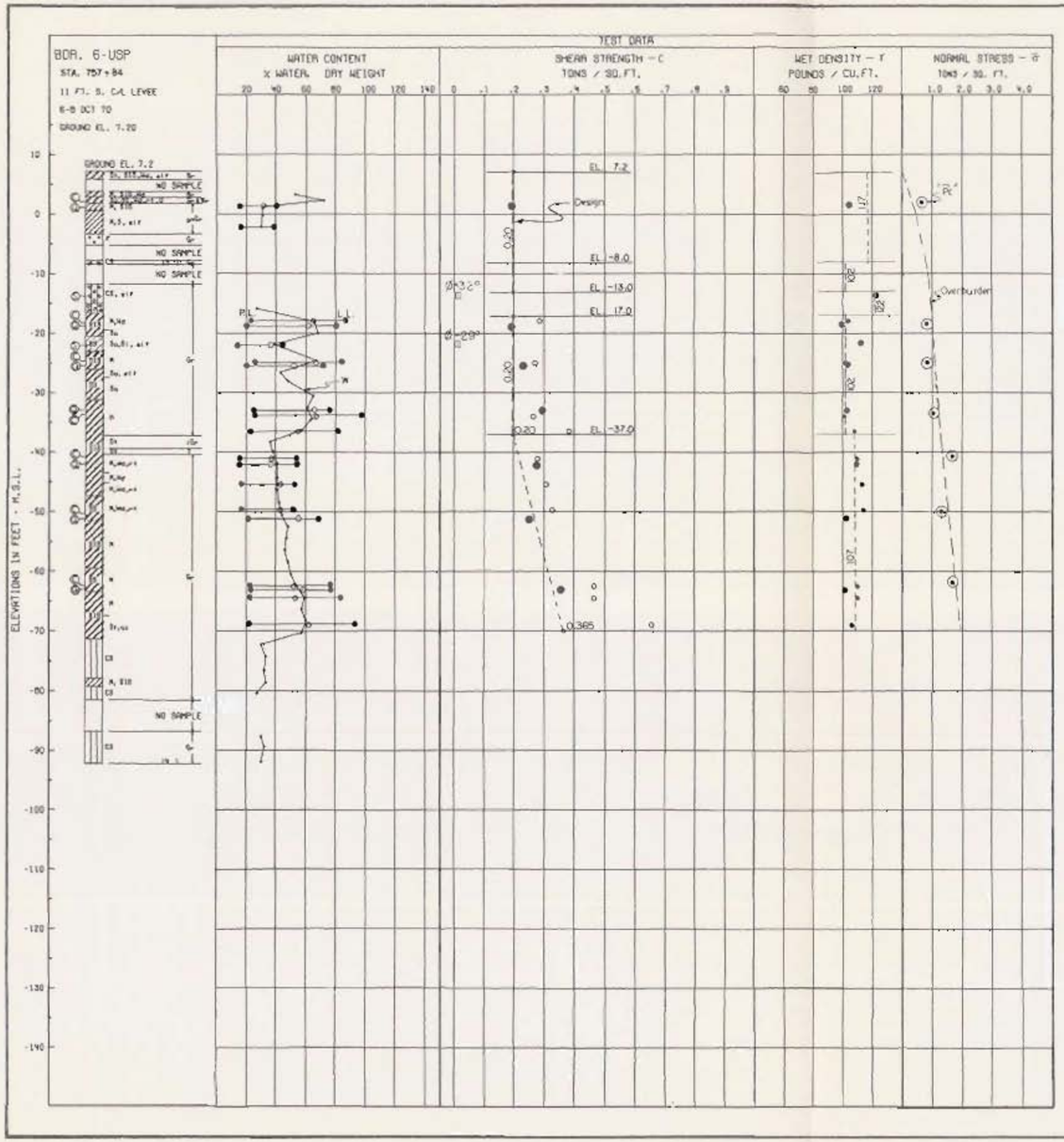
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 2
FOR GENERAL NOTES SEE PLATE 12
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 26

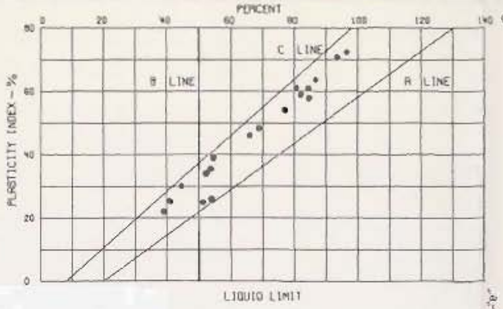
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

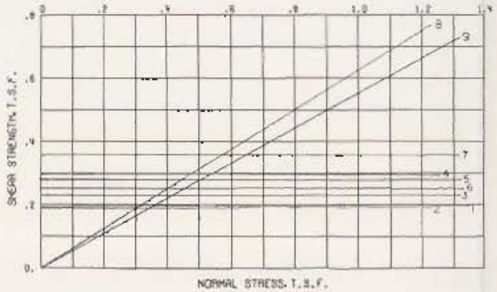
UNDISTURBED BORING
7 - USP DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JAN. 73
FILE NO. H-2-26016





PLASTICITY CHART

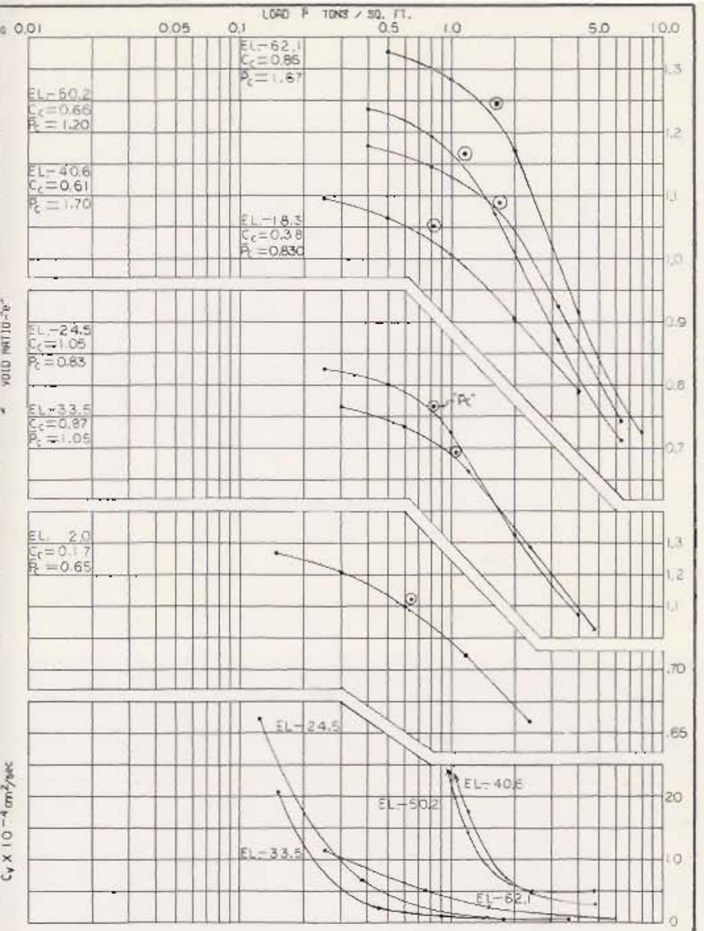


SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
6-USP	1	1.3	Q	0	.195	CL
	2	-18.8		0	.190	CH
	3	-25.4		0	.230	CH
	4	-33.1		0	.295	CH
	5	-42.0		0	.275	CH
	6	-51.1		0	.250	CH
	7	-63.0		0	.355	CH
	8	-13.7	S	32	0	SM
	9	-21.9		29	0	CL

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 747+50 AND STA. 770+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

- o - (UC) UNCONFINED COMPRESSION TEST
- ● - (D) 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 2

FOR GENERAL NOTES SEE PLATE 12

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 27

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 9

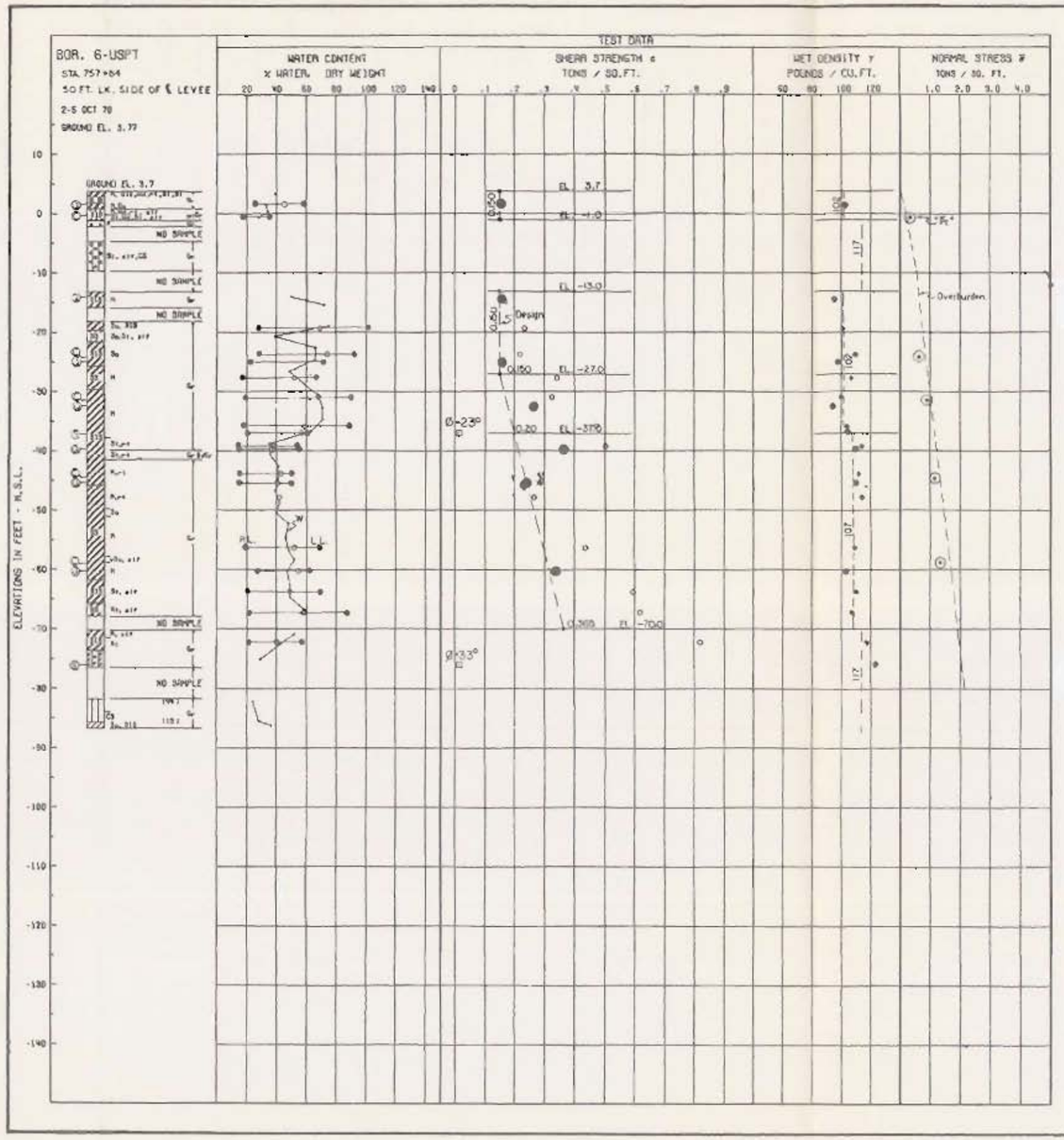
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

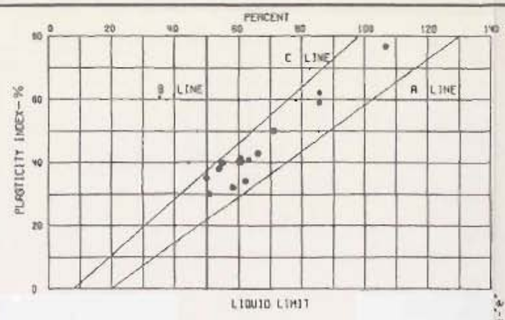
UNDISTURBED BORING
6 - USP DATA

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

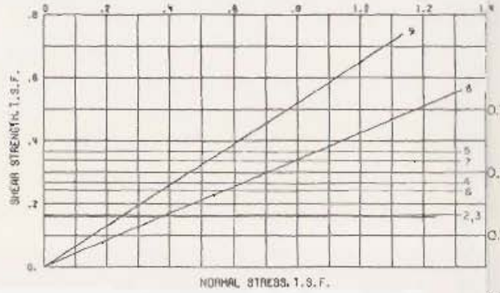
JAN. 75

FILE NO. H-2-26016





PLASTICITY CHART

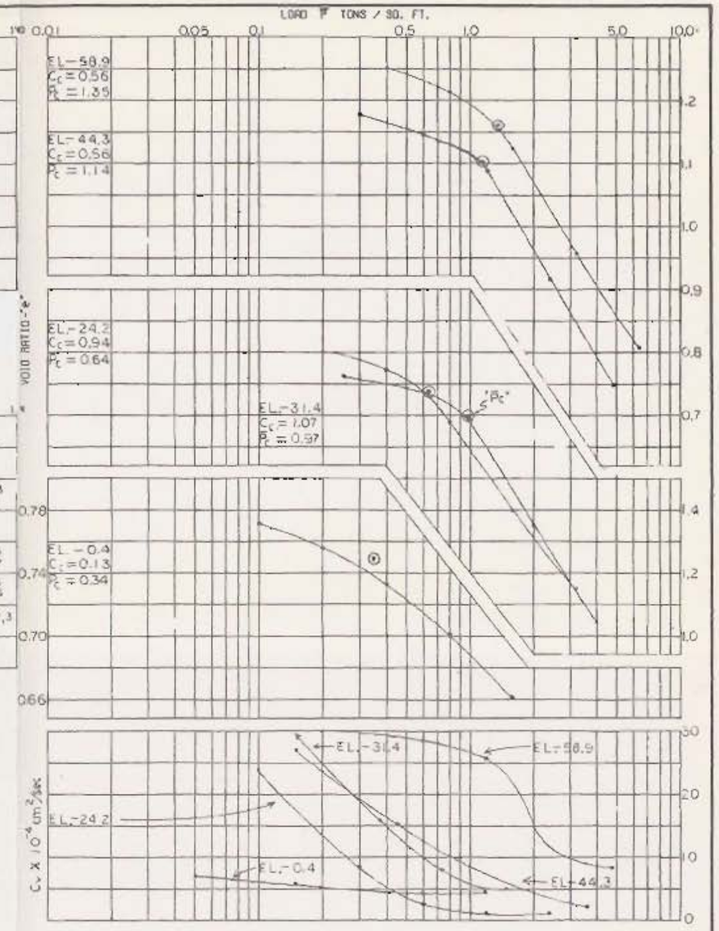


SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
6-USPT	1	1.7		0	.155	CH
	2	-14.0		0	.160	CH
	3	-25.1		0	.160	CH
	4	-32.3	Q	0	.265	CH
	5	-39.7		0	.365	CH
	6	-45.2		0	.240	CH
	7	-60.3		0	.335	CH
	8	-36.9	S	23	0	CH
	9	-76.0	S	33	0	SM

NOTES

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 666+00 AND STA. 770+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

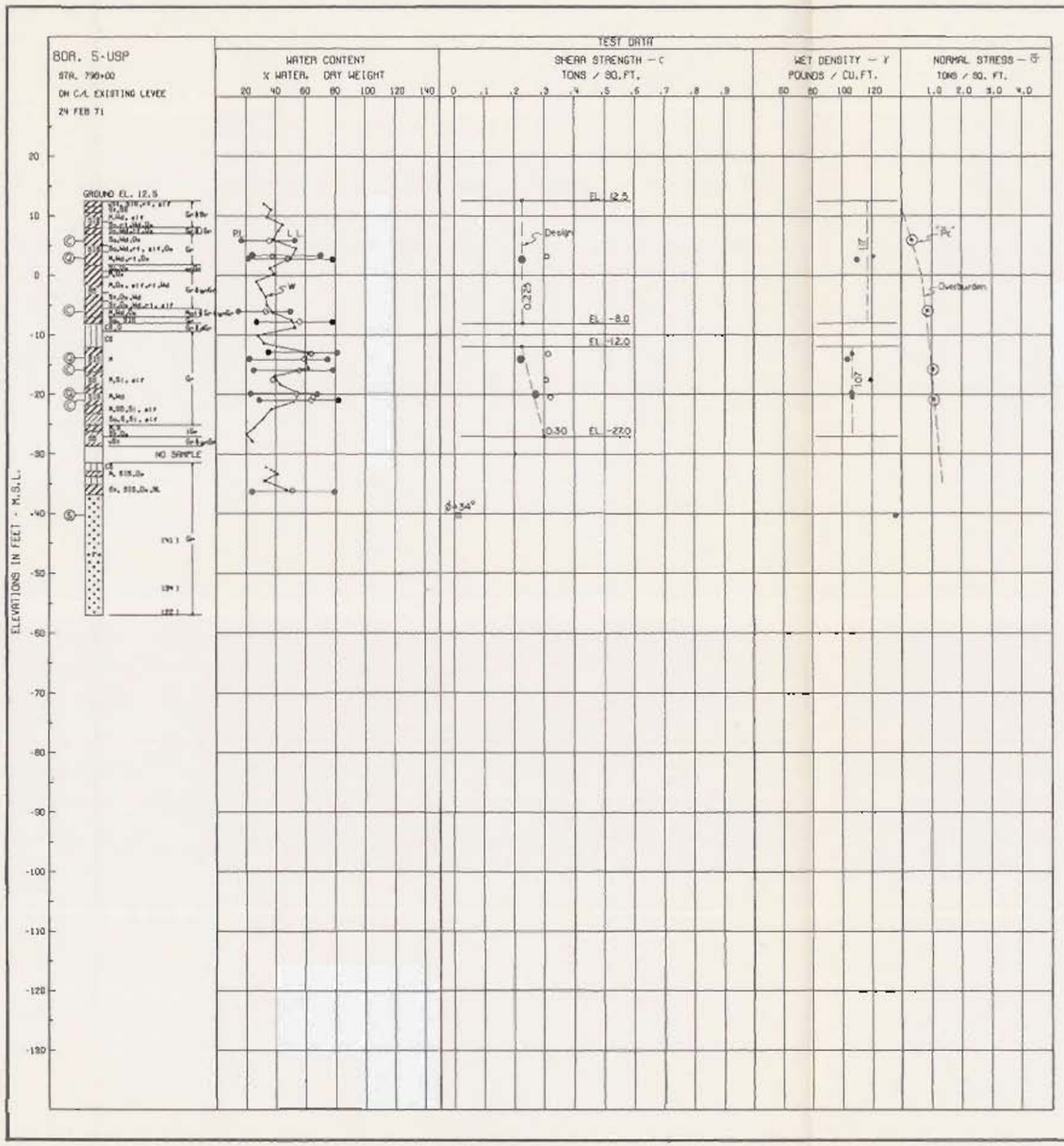
NOTES

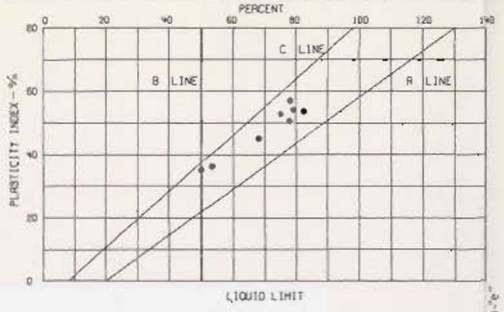
o - (UC) UNCONFINED COMPRESSION TEST
● - (U) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊠ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5-INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATE 2.
FOR GENERAL NOTES SEE PLATE 12
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 28.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

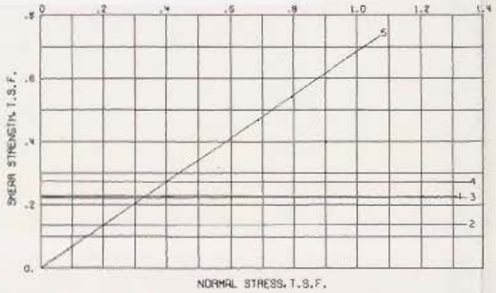
UNDISTURBED BORING 6-USPT DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JAN 73
FILE NO. H-2-26016





PLASTICITY CHART

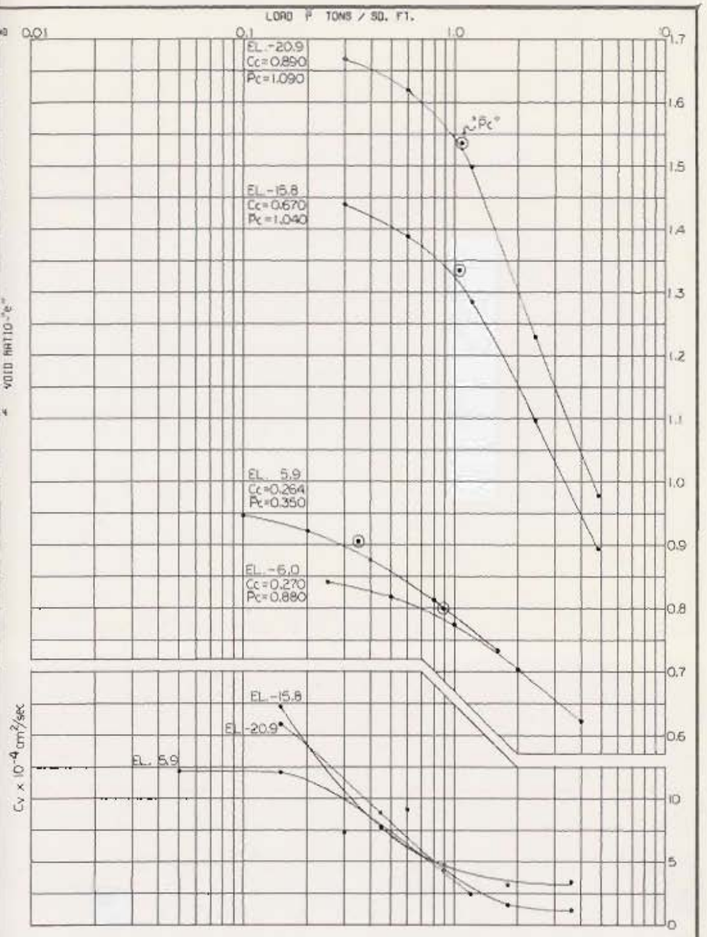


SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
5-USP	1	2.6	Q	0	0.227	CH
	2	-14.1		0	0.221	CH
	3	-19.9		0	0.272	CH
	4	-40.7	S	34	0.00	(SP)F

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 770+00 AND STA. 830+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

- ○ - (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 2

FOR GENERAL NOTES SEE PLATE 12

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 29

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

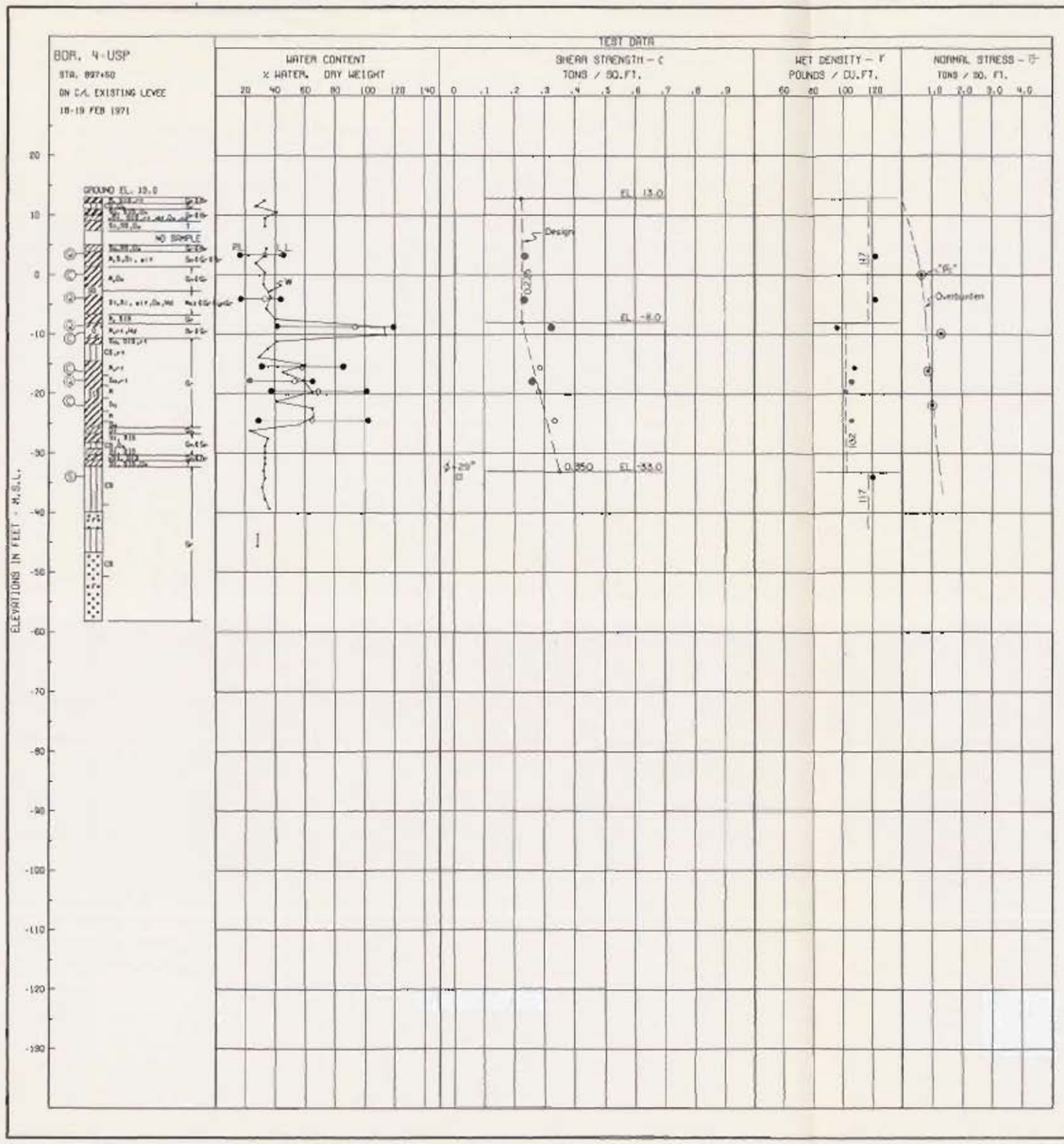
UNDISTURBED BORING

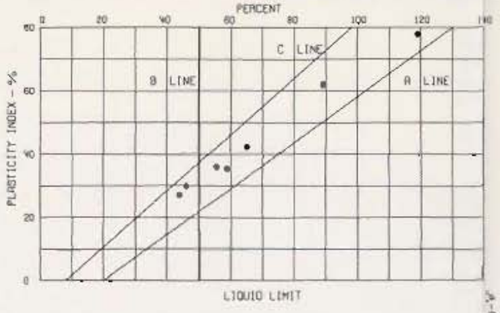
5-USP DATA

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

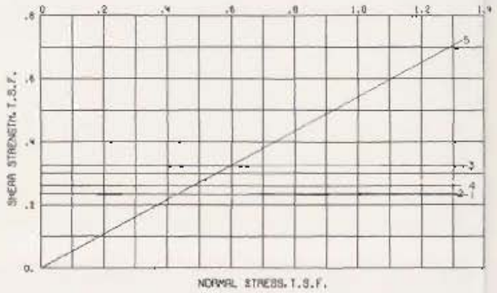
JAN. 73

FILE NO. H-2-26016





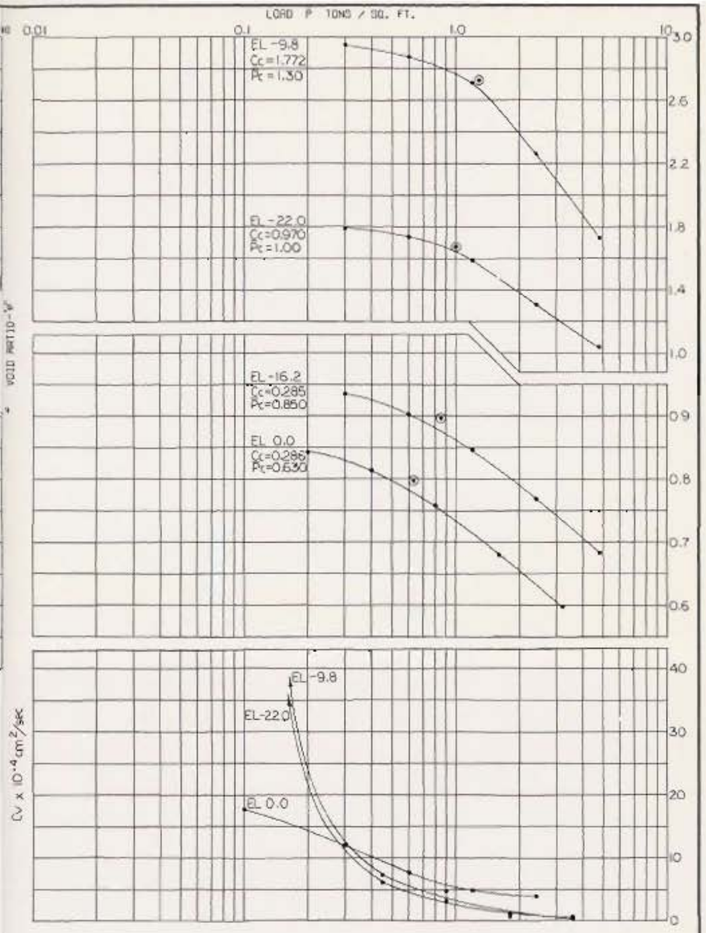
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH φ	STRENGTH c - TSF	CLASS
4-USP	1	3.1	Q	0	0.233	CL
	2	-4.2		0	0.235	CL
	3	-8.9		0	0.323	CH
	4	-18.0		0	0.260	CH
	5	-34.0	S	29	0.00	CL

NOTES:
1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 830+00 AND STA. 910+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

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

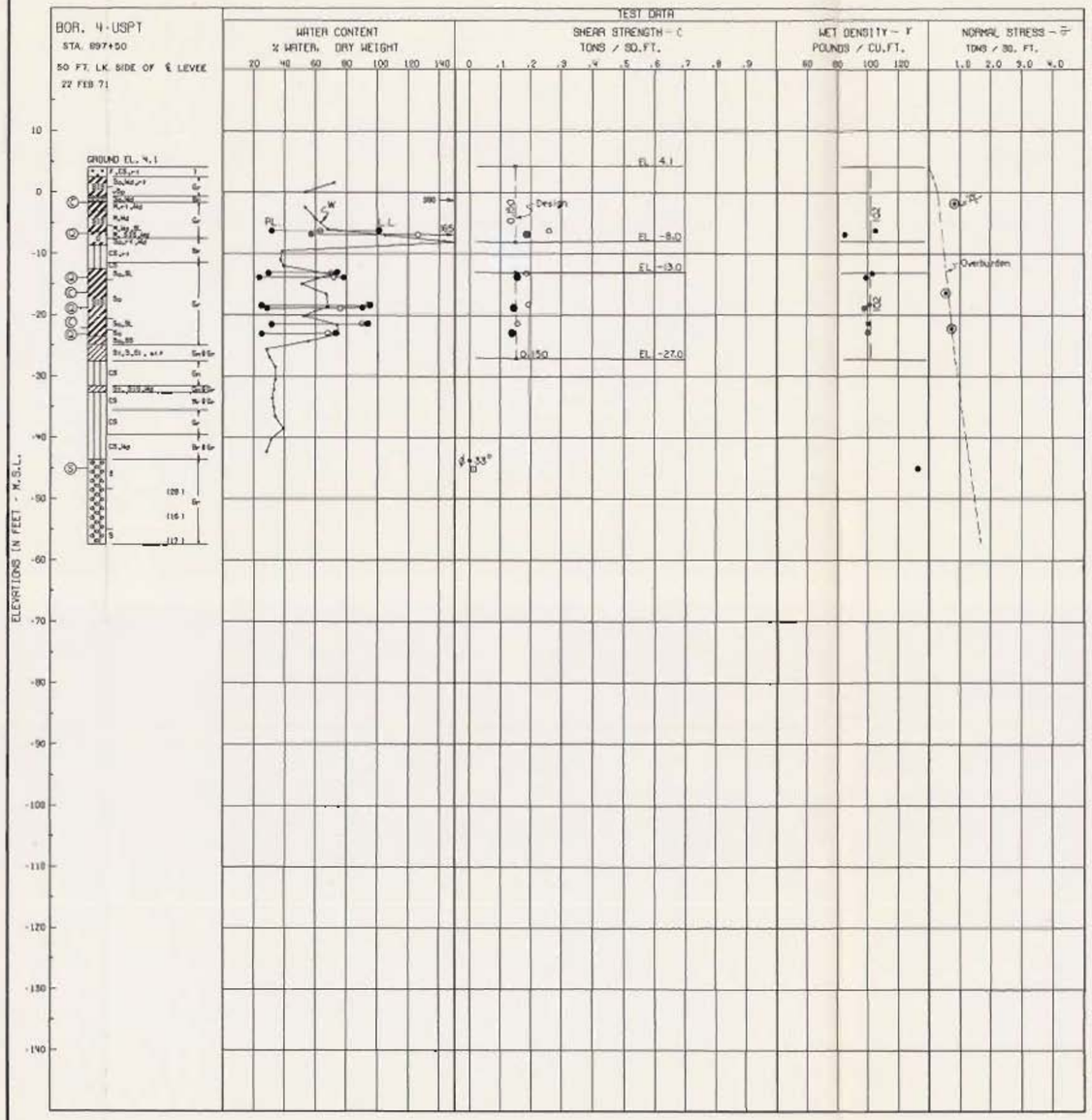
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

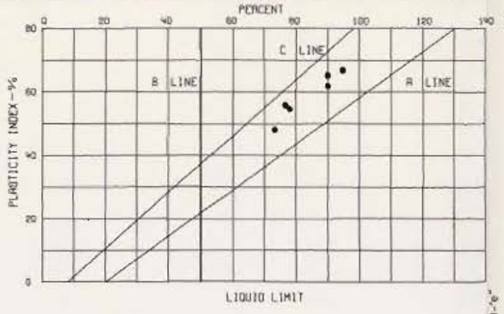
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 3
FOR GENERAL NOTES SEE PLATE 12
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 30

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

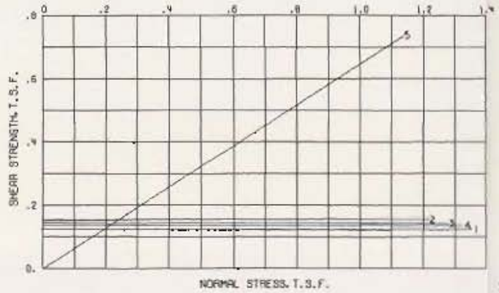
UNDISTURBED BORING
4-USP DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JAN. 73
FILE NO. H-2-26016





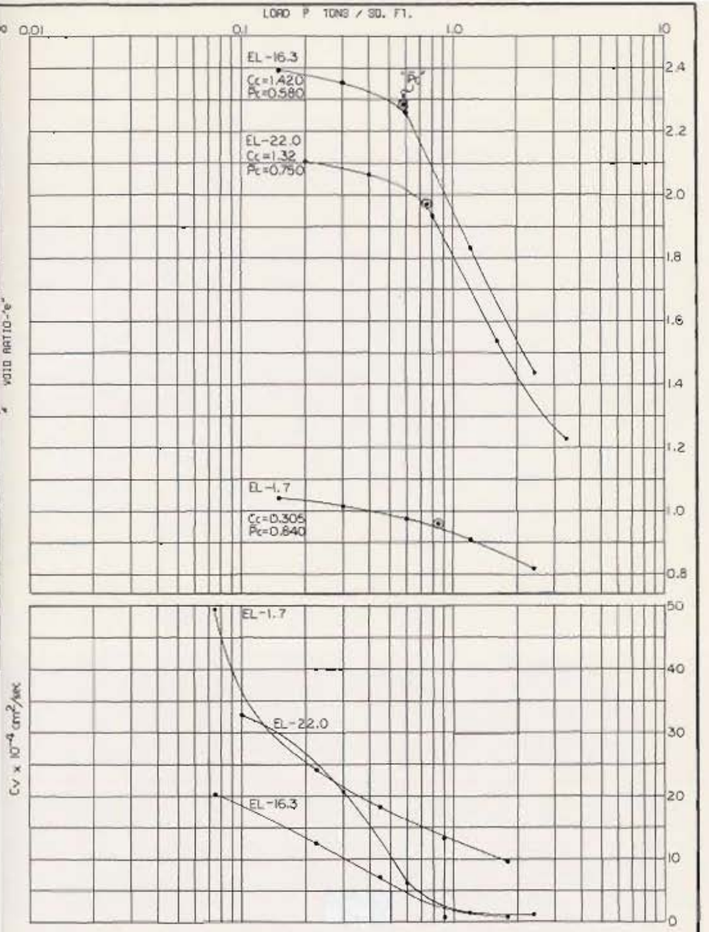
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
4-USPT	1	-6.8	Q	0	0.180	CH
	2	-13.8		0	0.155	CH
	3	-18.8		0	0.143	CH
	4	-22.9		0	0.138	CH
	5	-45.0	S	33	0.00	SM

NOTES:
1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 770+00 AND STA. 965+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

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

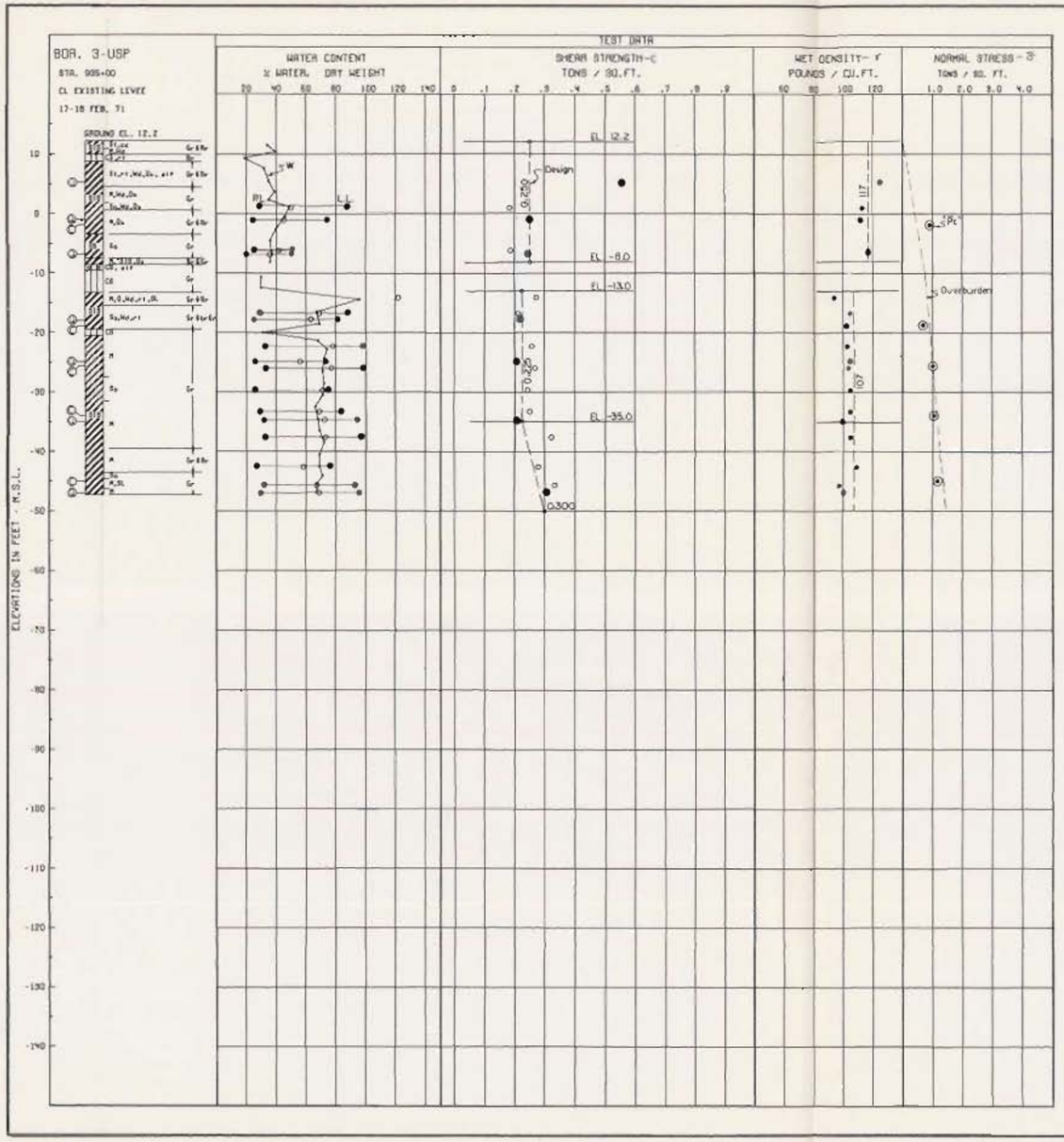
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 3
FOR GENERAL NOTES SEE PLATE 12
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 31

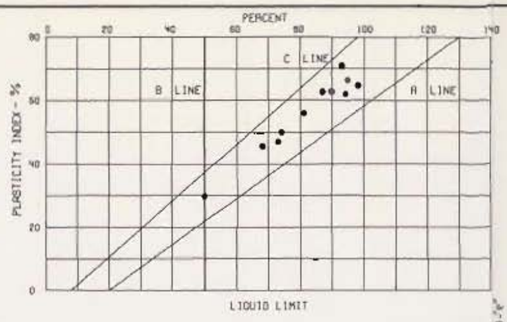
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

UNDISTURBED BORING

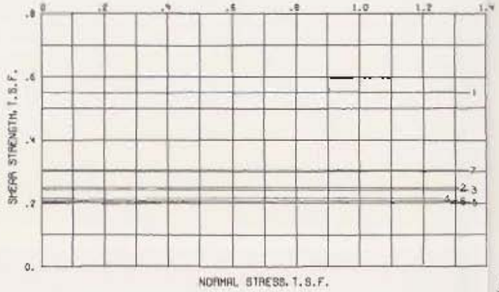
4-USPT-DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JAN. 73
FILE NO. H-2-25015





PLASTICITY CHART

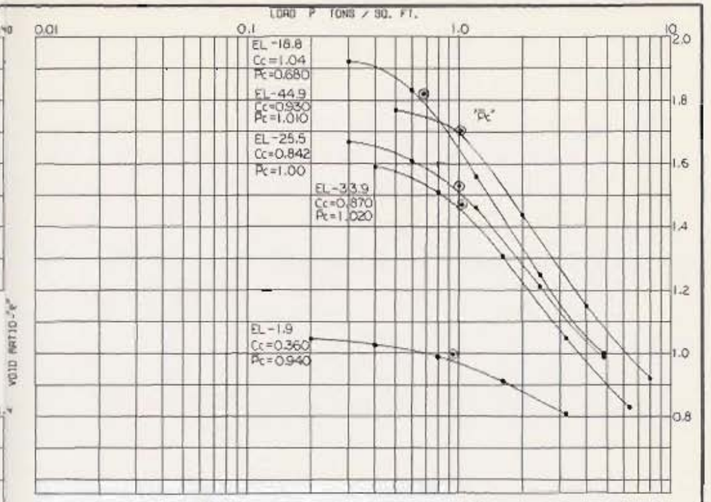


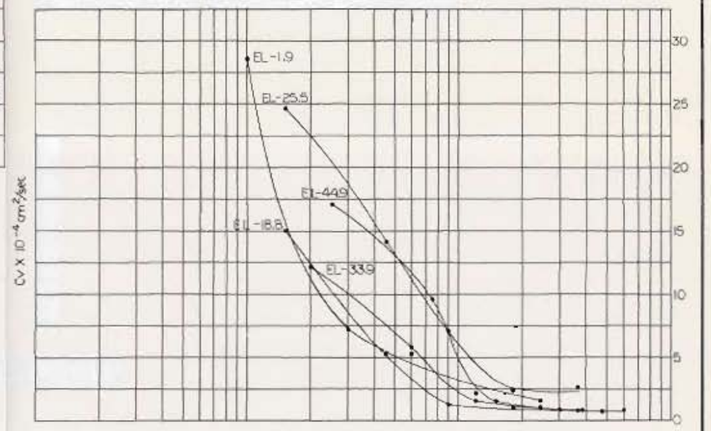
SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH ϕ''	STRENGTH c - TSF	CLASS
3-USP	1	5.2	Q	0	0.555	CH
	2	-1.0		0	0.250	CH
	3	-6.8		0	0.243	CH
	4	-17.9		0	0.217	CH
	5	-24.8		0	0.205	CH
	6	-34.8		0	0.207	CH
	7	-46.8		0	0.305	CH

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 910+00 AND STA. 965+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.





CONSOLIDATION DATA

NOTES

○ - (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 8
FOR LOCATION OF BORINGS SEE PLATE 4
FOR GENERAL NOTES SEE PLATE 12
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 32

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

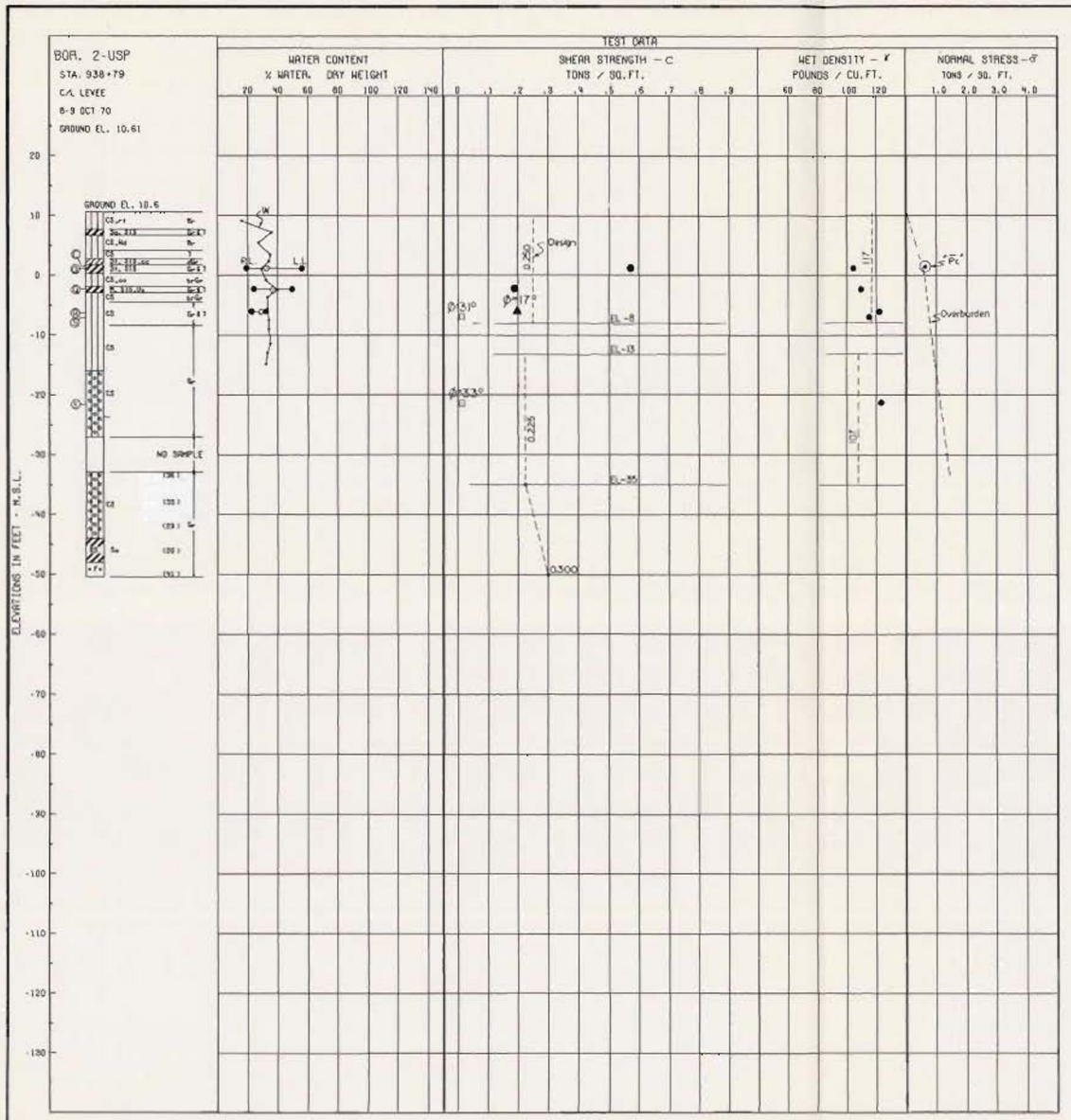
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

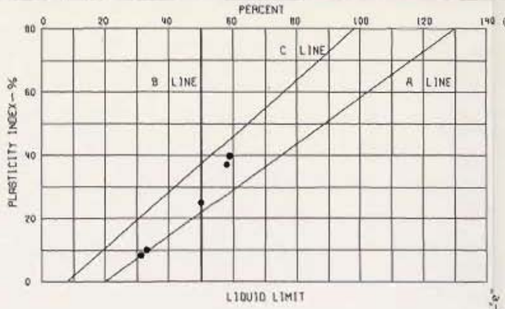
UNDISTURBED BORING

3-USP DATA

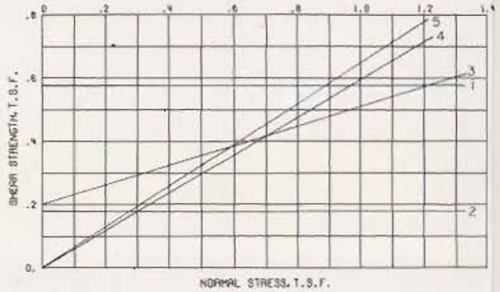
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JAN. 73 FILE NO. H-2-25015





PLASTICITY CHART



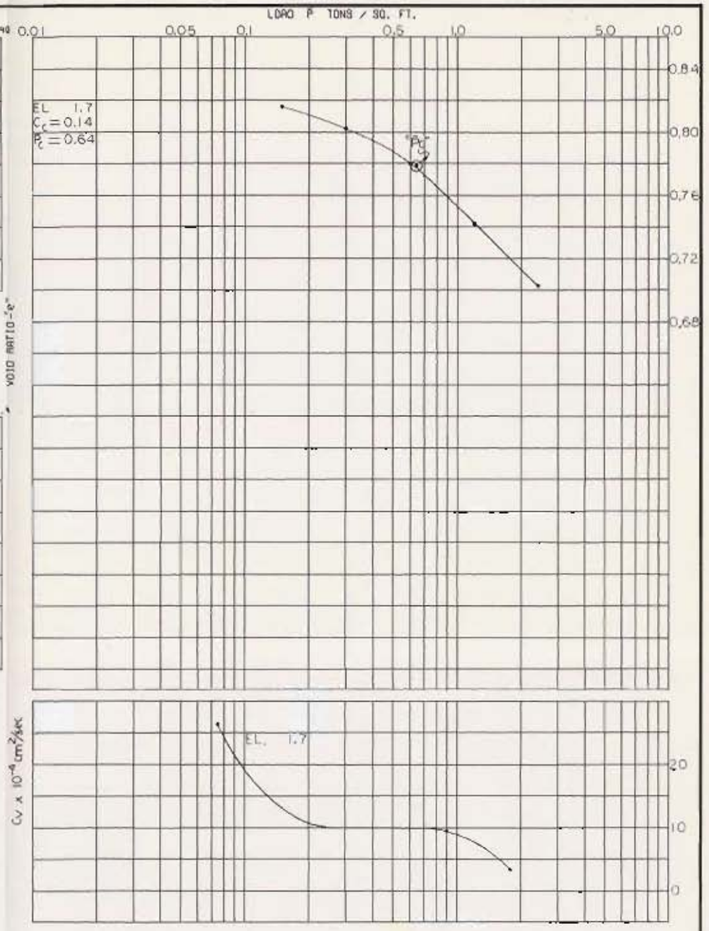
SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\phi°$	STRENGTH C - TSF	CLASS
2-USP	1	1.2	Q	0	.575	CH
	2	-2.4	Q	0	.180	CH
	3*	-6.1	R	17	.200	ML
	4	-7.0	S	31	0	ML
	5	-21.6	S	33	0	SM

* BASED ON $(\sigma_1 - \sigma_3)$ AT MAXIMUM PORE PRESSURE

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 910+00 AND STA. 965+00.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

○ - (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 4

FOR GENERAL NOTES SEE PLATE 12

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 33

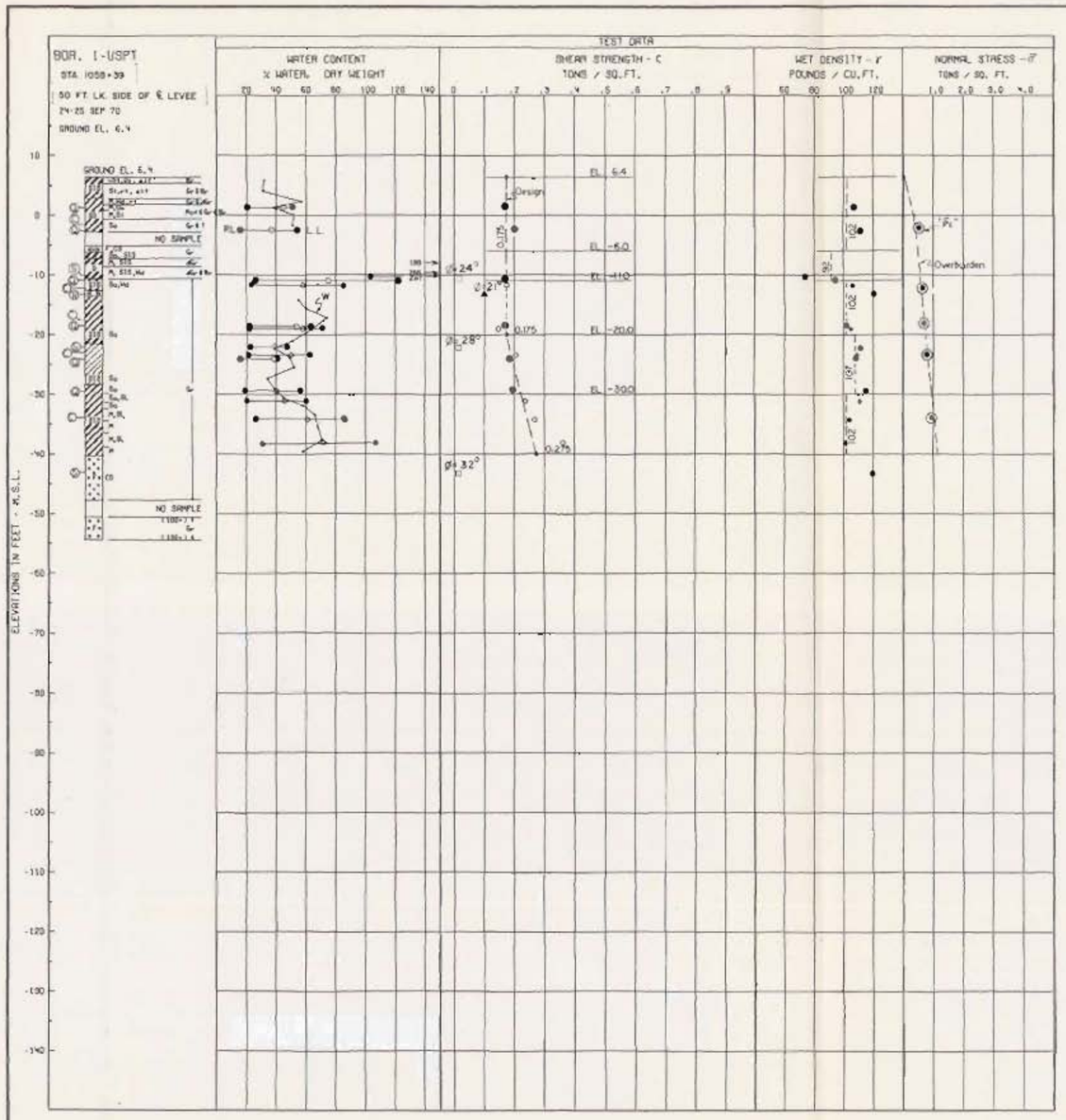
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

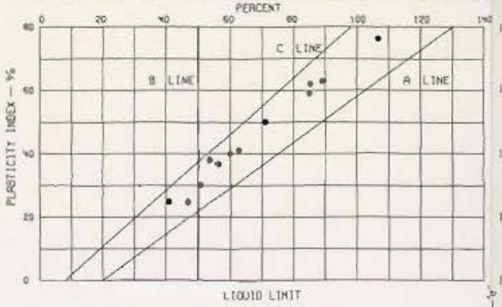
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

UNDISTURBED BORING
2-USP DATA

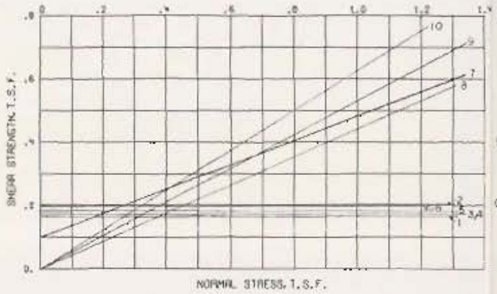
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JAN. 73 FILE NO. H-2-26015





PLASTICITY CHART



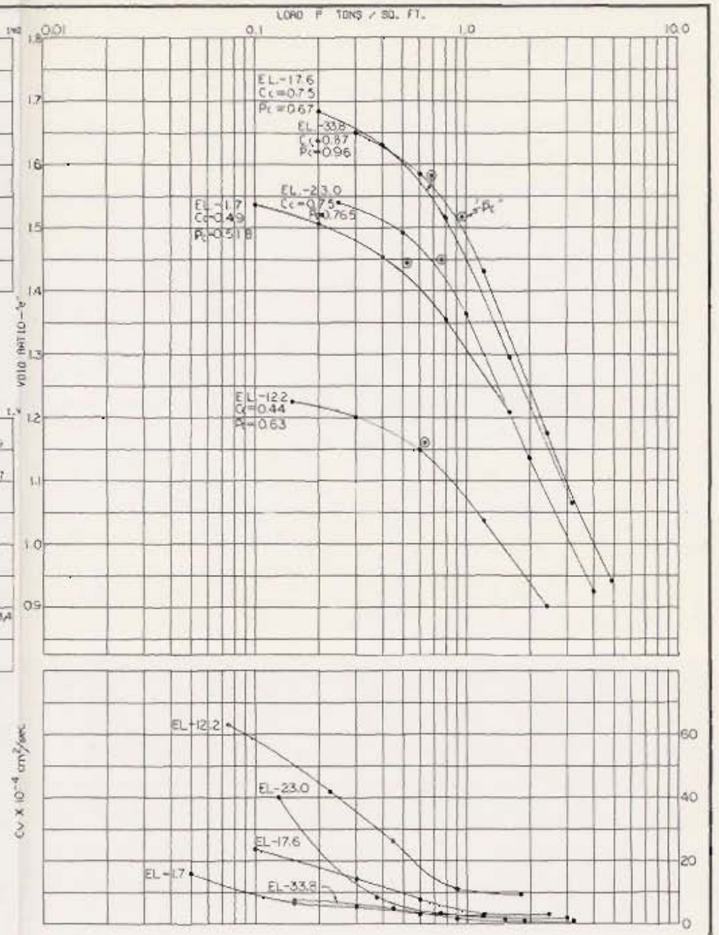
SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\phi°$	STRENGTH c, TSF	CLASS
I-USPT	1	1.4	Q	0	.165	CH
	2	-2.4		0	.200	CH
	3	-10.9		0	.170	CH
	4	-18.5		0	.170	CH
	5	-24.1		0	.185	CL
	6	-29.3		0	.195	CH
	7*	-13.3	R	21	.100	SM
	8	-10.2	S	24	0	CH
	9	-22.2		28	0	CL
	10	-43.2		32	0	(SP)F

* BASED ON $(\sigma_1 - \sigma_3)$ AT MAXIMUM PORE PRESSURE

NOTES:

1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 965+00 AND STA. 1102+98.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

- ○ - (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 5

FOR GENERAL NOTES SEE PLATE 12

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 34

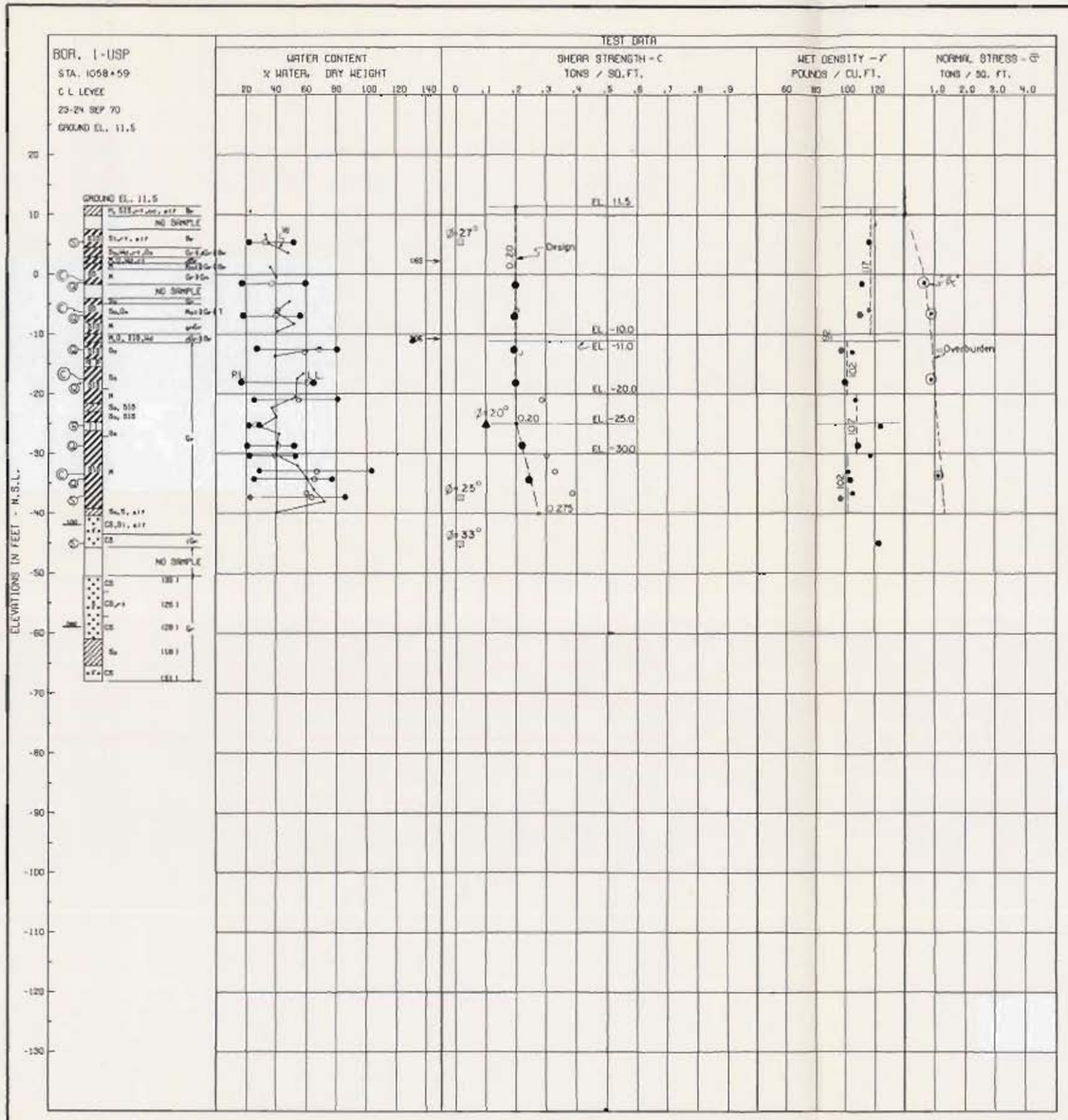
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

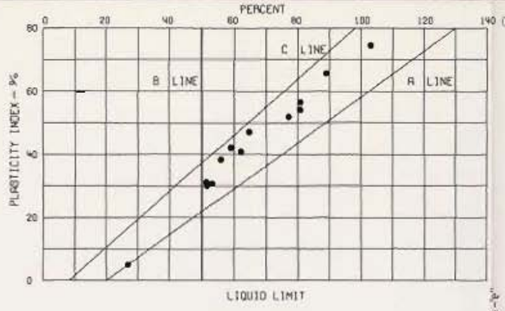
UNDISTURBED BORING

I-USPT DATA

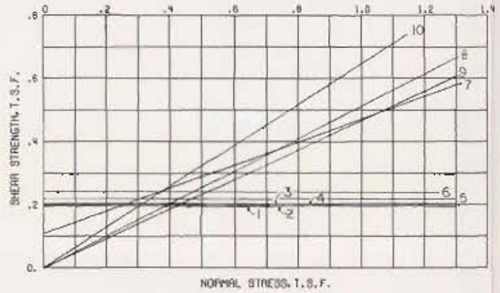
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JAN. 73 FILE NO. H-2-25016





PLASTICITY CHART

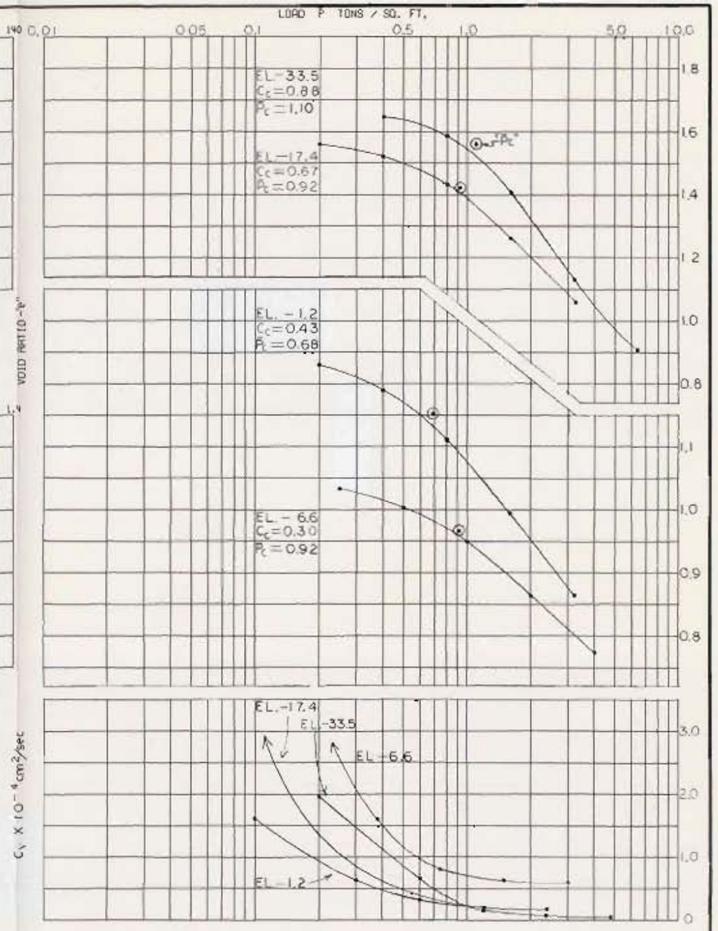


SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
I-USP	1	-1.5	Q	0	.198	CH
	2	-6.9		0	.195	CH
	3	-12.5		0	.202	CH
	4	-18.1		0	.200	CH
	5	-28.7		0	.220	CH
	6	-34.3		0	.240	CH
	7*	-25.2	R	20	.100	ML
	8	5.3	S	27	0	CH
	9	-37.2		25	0	CH
	10	-45.2		33	0	(SP)F

* BASED ON $(\sigma_1 - \sigma_3)$ AT MAXIMUM PORE PRESSURE

NOTES:
1. THE DESIGN SHEAR STRENGTH TRENDS SHOWN IN THE CLAYS APPLY BETWEEN STA. 965+00 AND STA. 1102+98.
2. SEE PLATE 41 FOR DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATION.



CONSOLIDATION DATA

NOTES

○ - (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 5
FOR GENERAL NOTES SEE PLATE 12
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 35

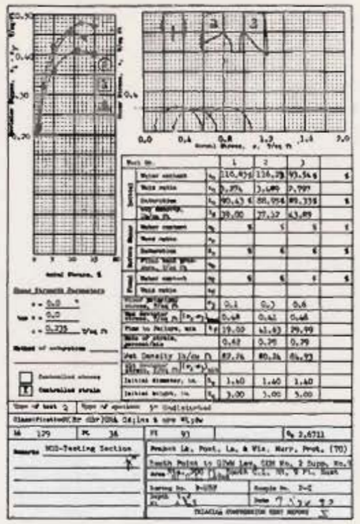
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

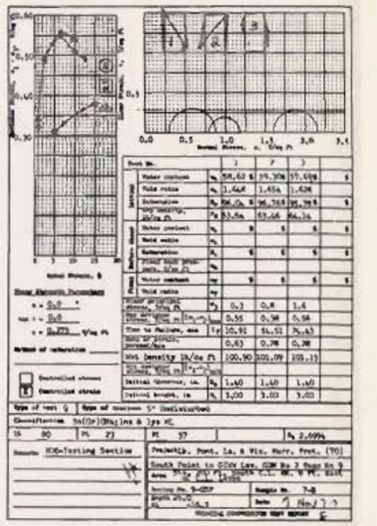
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

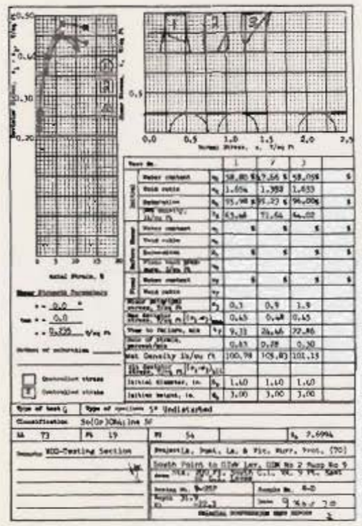
UNDISTURBED BORING
I - USP DATA

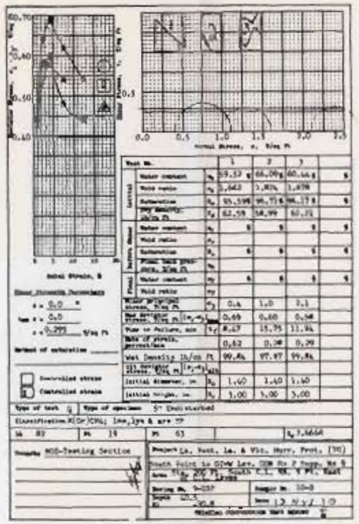
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

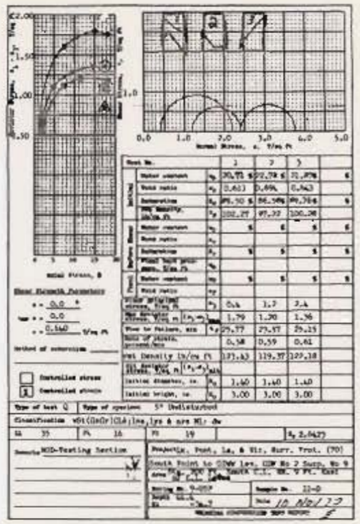
JAN. 73 FILE NO. H-2-26016

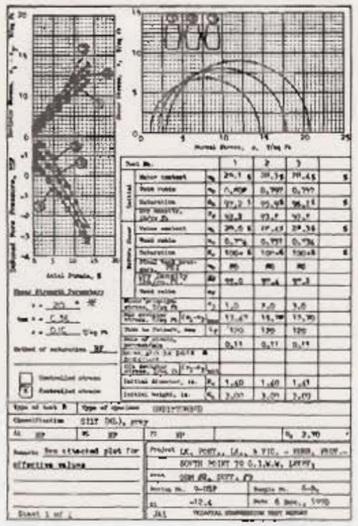


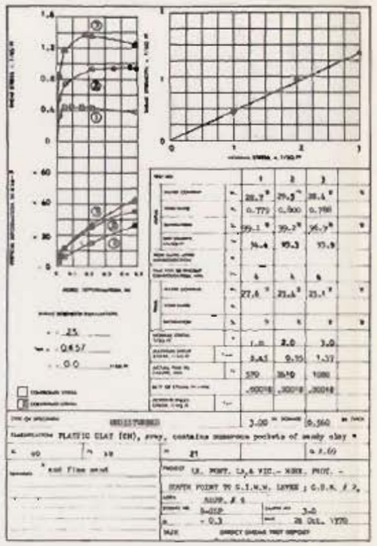


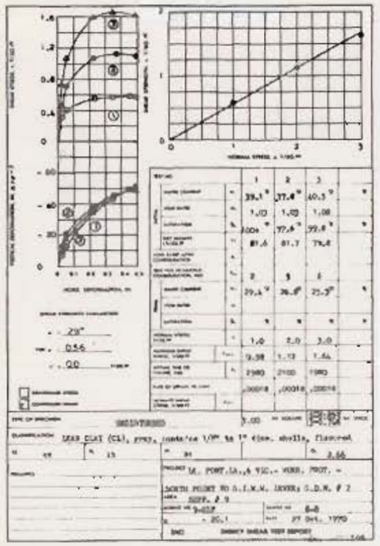


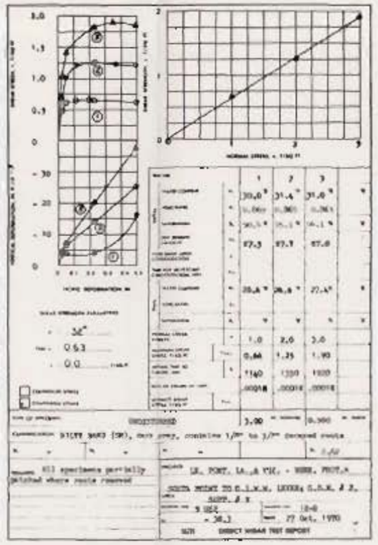












GENERAL NOTES:

(Q) — UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST.

(R) — CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST.

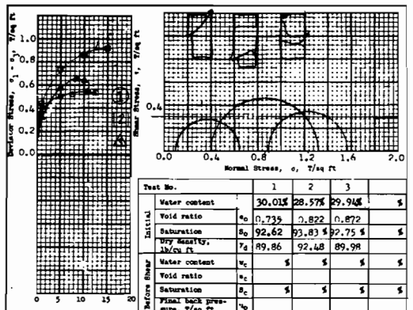
(S) — CONSOLIDATED-DRAINED DIRECT SHEAR TEST.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA
BORING 9-USP

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

JANUARY 1973 — FILE NO. H-2-26016



Test No.		1	2	3	
Initial: Water content	w_o	30.01%	28.57%	29.94%	%
Initial: Void ratio	e_o	0.739	0.822	0.822	
Initial: Saturation	S_o	92.62	93.83 %	92.75 %	%
Initial: Dry density, lb/cu ft	γ_d	89.86	92.48	89.98	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_b				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.10	0.40	0.90	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.54	0.92	0.65	
Time to failure, min	t_f	17.47	53.37	52.67	
Rate of strain, percent/min		0.62	0.28	0.28	
Wet Density, lb/cu ft		116.69	119.18	116.69	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters: ϕ = 0.0°; tan ϕ = 0.0; c = 0.300 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed

Classification M (Gn Gr) CL-6; lns and ars SP, org stks.

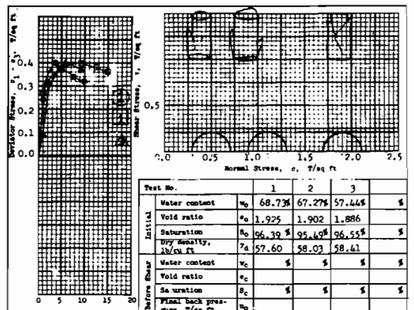
LL 44 | PL 18 | PI 26 | G_s 2.6985

Remarks NOD Testing Section

Project Lk.Pont.,La.&Vic.-Hurr.Prot. - 1970
South Point to GIWW Levee; GDM #2; Supp.#9
Area Sta. 1322 Ft.WCL I-10, C.L. Levee
Boring No. 9-USP | Sample No. 3-B
Depth 3.0 | Date 10 Dec 70
El -2.4

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 68 PREVIOUS EDITIONS ARE OBSOLETE



Test No.		1	2	3	
Initial: Water content	w_o	68.73%	67.27%	57.44%	%
Initial: Void ratio	e_o	1.925	1.902	1.886	
Initial: Saturation	S_o	96.39 %	95.40%	96.55%	%
Initial: Dry density, lb/cu ft	γ_d	57.60	58.03	58.41	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_b				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.30	0.90	1.70	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.40	0.40	0.40	
Time to failure, min	t_f	5.49	33.34	20.23	
Rate of strain, percent/min		0.63	0.28	0.29	
Wet Density, lb/cu ft		97.34	97.34	97.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters: ϕ = 0.0°; tan ϕ = 0.0; c = 0.200 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed

Classification So (Gr)CH-4; lns & lyrs ML; dw; slf

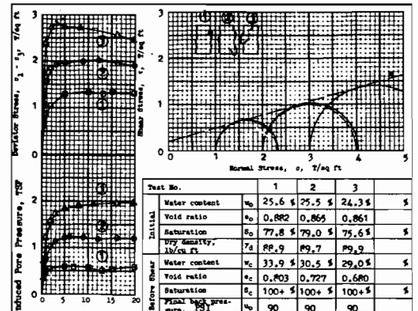
LL 74 | PL 34 | PI 40 | G_s 2.7000

Remarks NOD Testing Section

Project Lk.Pont.,La.&Vic.-Hurr.Prot. - 1970
South Point to GIWW Lev.; GDM No. 2; Supp. #9
Area Sta. 1322 Ft. N.C.L. I-10; C.L. Levee
Boring No. 8-USP | Sample No. 8-B
Depth 5.0 | Date 10 Dec 70
El -15.8

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM PREVIOUS EDITIONS ARE OBSOLETE



Test No.		1	2	3	
Initial: Water content	w_o	25.6 %	25.5 %	24.3 %	%
Initial: Void ratio	e_o	0.882	0.865	0.861	
Initial: Saturation	S_o	77.8 %	79.0 %	75.6 %	%
Initial: Dry density, lb/cu ft	γ_d	88.9	89.7	89.9	
Before Shear: Water content	w_c	33.9 %	30.5 %	29.0 %	%
Before Shear: Void ratio	e_c	0.803	0.727	0.680	
Before Shear: Saturation	S_c	100+ %	100+ %	100+ %	%
Before Shear: Final back pressure, T/sq ft	u_b	90	90	90	
Before Shear: Dry density lbs/cu.ft.	γ_d	92.8	96.9	99.6	
Before Shear: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	1.34	2.03	2.81	
Time to failure, min	t_f	101	123	31	
Rate of strain, percent/min		0.10	0.10	0.10	
$(\sigma_1-\sigma_3)$ at max pore pressure		1.30	1.98	2.80	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.34	1.39	1.43	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters: ϕ = 16° *; tan ϕ = 0.285; c = 0.200 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification SANDY CLAY (CL), gray, contains numerous pockets of plastic clay — silty sand and

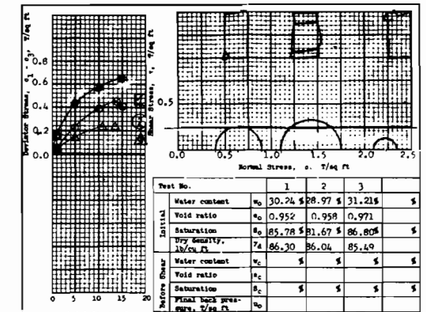
LL 44 | PL 18 | PI 26 | G_s 2.68

Remarks See attached plot for affective values Atterberg limits are probably not indicative of soil type as separation of SM and CH was not possible

Project LK. PONT., LA. & VIC. - HURR. PROT.
SOUTH POINT TO GIWW LEVEE; GDM NO.2
Area SUPP. NO. 9
Boring No. 8-USP | Sample No. 2-C
Depth 5.3 | Date 16 Nov.,1970
El

PJR TRIAXIAL COMPRESSION TEST REPORT

ENG FORM PREVIOUS EDITIONS ARE OBSOLETE



Test No.		1	2	3	
Initial: Water content	w_o	30.24 %	28.97 %	31.21%	%
Initial: Void ratio	e_o	0.952	0.958	0.971	
Initial: Saturation	S_o	85.78 %	81.67 %	86.80%	%
Initial: Dry density, lb/cu ft	γ_d	86.30	86.04	85.40	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_b				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.40	1.10	2.10	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.45	0.65	0.24	
Time to failure, min	t_f	21.71	24.40	16.84	
Rate of strain, percent/min		0.63	0.61	0.64	
Wet Density, lb/cu ft		112.32	111.07	112.32	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters: ϕ = 0.0°; tan ϕ = 0.0; c = 0.225 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed

Classification M (IGr) CL6; lns & ars ML; ox-ars; org ars

LL 32 | PL 18 | PI 14 | G_s 2.7000

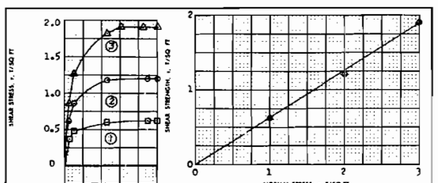
Remarks NOD Testing Section

Project Lk.Pont.,La.&Vic.-Hurr.Prot. - 1970
South Point to GIWW Lev., GDM #2; Supp. #9
Area 1322 Ft. WCL I-10, C.L. Levee
Boring No. 8-USP | Sample No. 11-C
Depth 27.4 | Date 10 Dec 70
El -26.1

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 68 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT



TEST NO		1	2	3	
INITIAL: WATER CONTENT	w_o	31.4%	31.4 %	30.1 %	%
INITIAL: VOID RATIO	e_o	0.876	0.891	0.864	
INITIAL: SATURATION	S_o	97.9%	94.8 %	93.7 %	%
INITIAL: DRY DENSITY, LB/CU FT	γ_d	89.5	88.6	90.2	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	1	2	1	
FINAL: WATER CONTENT	w_f	25.7%	23.2%	22.7 %	%
FINAL: VOID RATIO	e_f				
FINAL: SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.62	1.20	1.91	
ACTUAL TIME TO FAILURE, MIN	t_f	2520	2490	2740	
RATE OF STRAIN, IN /MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: ϕ = 33°; TAN ϕ = 0.637; c' = 0 T/SQ FT

☐ CONTROLLED STRESS ☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 3.00 IN THICK

CLASSIFICATION LEAN CLAY (CL), gray, contains sand lenses and a few 1/8" to 1/2" *

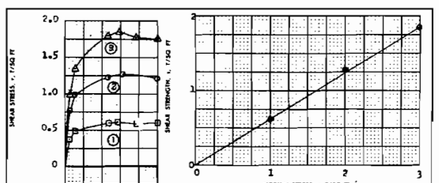
LL 41 | PL 15 | PI 26 | G. 2.69

REMARKS *diam. shells

PROJECT LK.PONT.LA.&VIC.- HURR.PROT.- SOUTH POINT TO G.I.W.W.LEVEE; G.D.M.#2,Supp. #9
AREA
BORING NO 8-USP | SAMPLE NO 9-B
EL -17.9 | DATE 3 Nov. 1970

DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 68 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)



TEST NO		1	2	3	
INITIAL: WATER CONTENT	w_o	26.8 %	26.6%	27.5 %	%
INITIAL: VOID RATIO	e_o	0.750	0.754	0.761	
INITIAL: SATURATION	S_o	95.8 %	94.5 %	96.8%	%
INITIAL: DRY DENSITY, LB/CU FT	γ_d	95.6	95.4	95.0	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	<1	<1	<1	
FINAL: WATER CONTENT	w_f	25.9 %	23.9%	22.7 %	%
FINAL: VOID RATIO	e_f				
FINAL: SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.61	1.27	1.85	
ACTUAL TIME TO FAILURE, MIN	t_f	1530	1680	1590	
RATE OF STRAIN, IN /MIN		.00019	.00019	.00019	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: ϕ = 32°; TAN ϕ = 0.617; c' = 0 T/SQ FT

☐ CONTROLLED STRESS ☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 0.560 IN THICK

CLASSIFICATION SANDY CLAY (CL), tan and gray

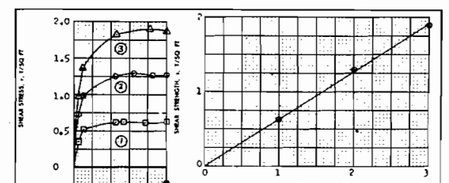
LL 35 | PL 19 | PI 16 | G. 2.68

REMARKS

PROJECT LK. PONT.,& VIC., - HURR. PROT. - SOUTH POINT TO G.I.W.W. LEVEE; G.D.M. # 2.
AREA SUPP. # 9
BORING NO 8-USP | SAMPLE NO 11-B
EL -25.4 | DATE 3 Nov. 1970

WJH DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 68 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)



TEST NO		1	2	3	
INITIAL: WATER CONTENT	w_o	32.1 %	31.7 %	32.2 %	%
INITIAL: VOID RATIO	e_o	0.867	0.834	0.850	
INITIAL: SATURATION	S_o	98.1 %	99.3%	100.4%	%
INITIAL: DRY DENSITY, LB/CU FT	γ_d	88.6	90.2	89.4	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL: WATER CONTENT	w_f	28.2 %	27.3 %	26.8%	%
FINAL: VOID RATIO	e_f				
FINAL: SATURATION	S_f	%	%	%	%
NORM. I STRESS, T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.63	1.29	1.90	
ACTUAL TIME TO FAILURE, MIN	t_f	1560	1830	2280	
RATE OF STRAIN, IN /MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: ϕ = 32°; TAN ϕ = 0.633; c' = 0 T/SQ FT

☐ CONTROLLED STRESS ☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 0.550 IN THICK

CLASSIFICATION SANDY SILT (ML), gray, contains a trace of clay

LL 30 | PL 24 | PI 6 | G. 2.65

REMARKS

PROJECT LK. PONT.,LA.,&VIC.-HURR.PROT.- SOUTH POINT TO G.I.W.W. LEVEE;G.D.M. # 2 ,SUPP.# 9
AREA
BORING NO 8-USP | SAMPLE NO 13-B
EL -34.8 | DATE 4 Nov. 1970

DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 68 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)

FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

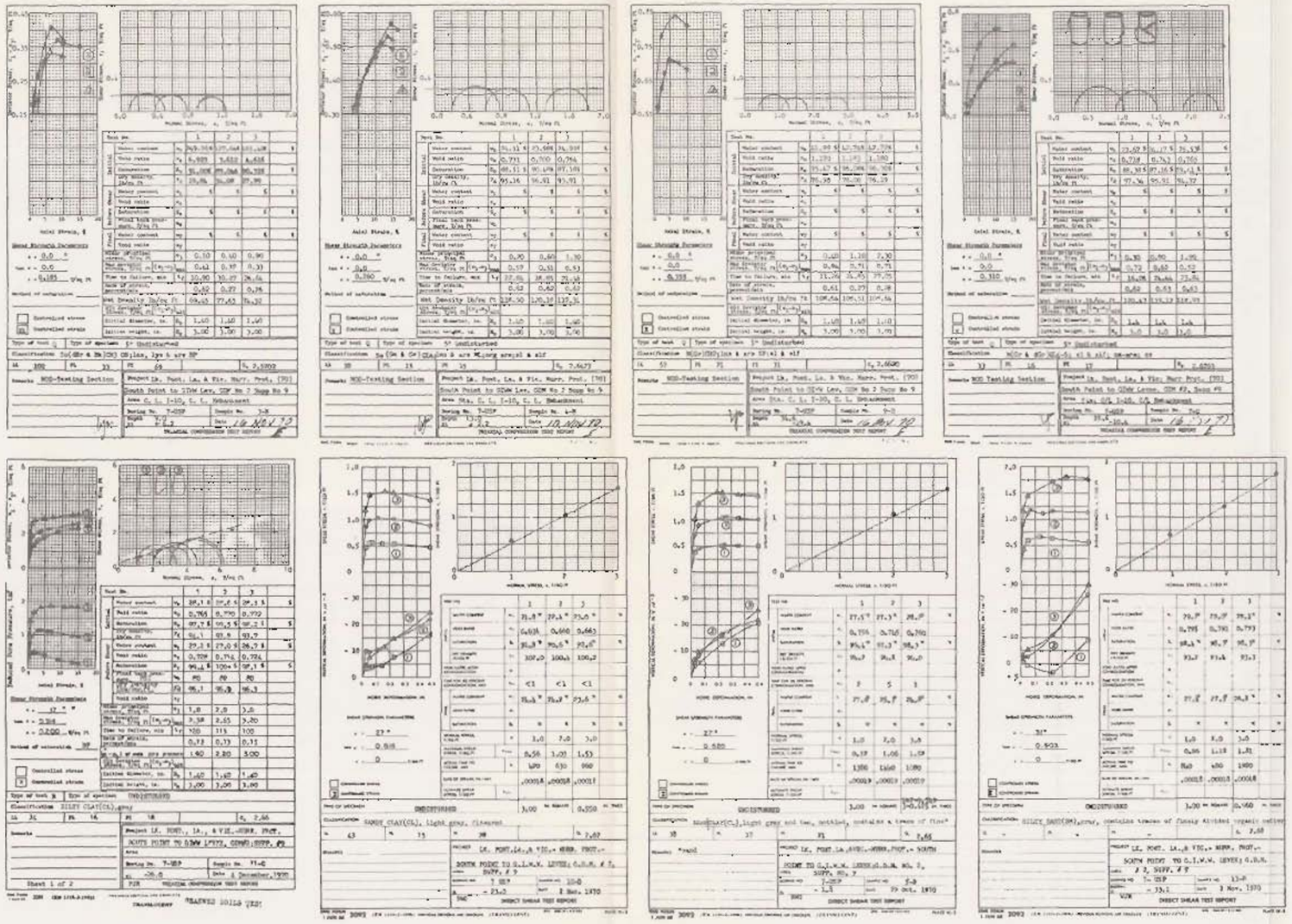
DETAIL SHEAR STRENGTH DATA

BORING 8-USP

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

JANUARY 1973 | FILE NO. H-2-26016

PLATE 25



FOR GENERAL NOTES SEE PLATE 24.

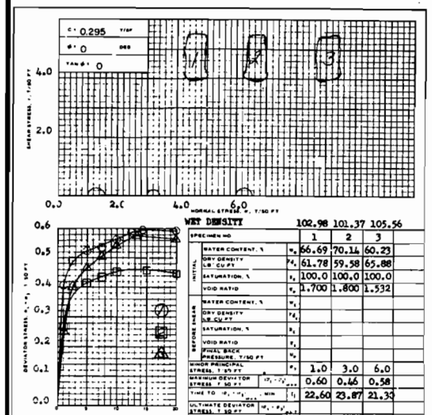
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA

BORING 7-USP

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

JANUARY 1973 FILE NO. H-2-26018



		1	2	3
WET DENSITY		102.98	101.37	105.56
INITIAL: WATER CONTENT, %	w_o	66.69	70.14	60.23
INITIAL: DRY DENSITY LB/CU FT	γ_d	61.78	59.58	65.88
INITIAL: SATURATION, %	S_o	100.0	100.0	100.0
INITIAL: VOID RATIO	e_o	1.700	1.800	1.532
BEFORE SHEAR: WATER CONTENT, %	w_c			
BEFORE SHEAR: DRY DENSITY LB/CU FT	γ_d			
BEFORE SHEAR: SATURATION, %	S_c			
BEFORE SHEAR: VOID RATIO	e_c			
BEFORE SHEAR: PORE BACK PRESSURE, T/SQ FT	u_o			
MINOR PRINCIPAL STRESS, T/SQ FT	σ_3	1.0	3.0	6.0
MAXIMUM DEVIATOR STRESS, T/SQ FT	$(\sigma_1-\sigma_3)_{max}$	0.60	0.66	0.58
TIME TO $(\sigma_1-\sigma_3)_{max}$, MIN	t_f	22.60	23.87	21.33
ULTIMATE DEVIATOR STRESS, T/SQ FT	$(\sigma_1-\sigma_3)_{ult}$			
INITIAL DIAMETER, IN	D_o	1.40	1.40	1.40
INITIAL HEIGHT, IN	H_o	3.00	3.00	3.00

CONTROLLED-STRAIN @ TEST

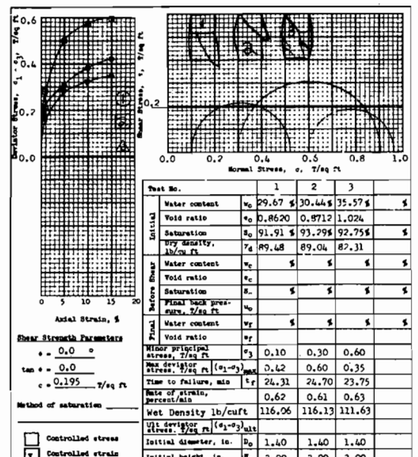
DESCRIPTION OF SPECIMENS M (Gr) CH4; lns & ars ML; ars SP

LL 76 PL 25 PI 51 G_s 2.6731 TYPE OF SPECIMEN Gr Undis. TYPE OF TEST NQR

REMARKS

PROJECT LK. PONT. LA. & VIC. WURR. PROT.(71)
SO. PT. TO GIWW LEV. GDM #2 SUPP 9
BORING NO 6-USP SAMPLE NO. 12-B
DEPTH ELEV. 40.3 / -33.1
LABORATORY NOD DATE 3 NOV. 72

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial: Water content	w_o	29.67 %	30.44 %	35.57 %	%
Initial: Void ratio	e_o	0.8620	0.8712	1.024	
Initial: Saturation	S_o	91.91 %	93.29 %	92.75 %	%
Initial: Dry density, lb/cu ft	γ_d	89.48	89.04	82.31	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.10	0.30	0.60	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.42	0.60	0.35	
Time to failure, min	t_f	24.31	24.70	23.75	
Rate of strain, percent/min		0.62	0.61	0.63	
Wet Density lb/cu ft		116.06	116.13	111.63	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.195 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q Type of specimen 5" Undisturbed

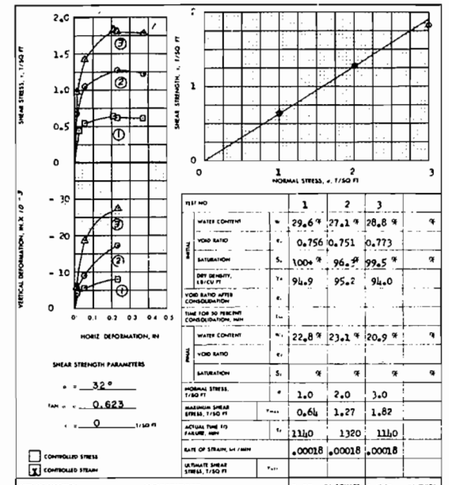
Classification M(gnGr)CL6; lns & ars ML; ars SP

LL 41 PL 16 PI 25 G_s 2.6706

Remarks NOD-Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Point to GIWW Lev. GDM No. 2 Supp No 9
Area Sta. 300 Ft. North Hwy. 11, 11 Ft.
South G.I.W.W. Levee
Boring No. 6-USP Sample No. 2-C
Depth 5.9 Date 24 NOV 72
El 1.3

TRIAXIAL COMPRESSION TEST REPORT



TEST NO		1	2	3	
INITIAL: WATER CONTENT	w_o	29.6 %	27.1 %	28.8 %	%
INITIAL: VOID RATIO	e_o	0.756	0.751	0.773	
INITIAL: SATURATION	S_o	100+ %	96.9 %	99.5 %	%
INITIAL: DRY DENSITY, LB/CU FT	γ_d	94.9	95.2	94.0	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL: WATER CONTENT	w_f	22.8 %	23.1 %	20.9 %	%
FINAL: VOID RATIO	e_f				
FINAL: SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.64	1.27	1.82	
ACTUAL TIME TO FAILURE, MIN	t_f	1110	1320	1110	
RATE OF STRAIN, IN/MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 32°
tan φ = 0.623
c = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED 3.00 IN. SQUARE 0.550 IN. THICK

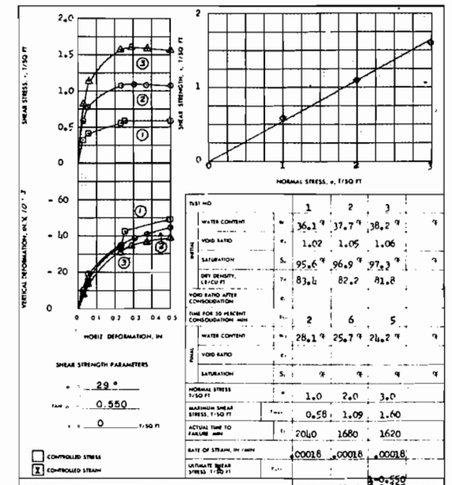
CLASSIFICATION SILTY SAND (SM), light gray, contains CLAY (CH) strata

LL - PL - PI - G_s 2.67

REMARKS

PROJECT LK.PONT.LA.& VIC.- HURR. PROT.-
SOUTH POINT TO G.I.W.W. LEVEE; G.D.M.# 2,
AREA SUPP. # 9
BORING NO 6-USP SAMPLE NO 6-C
EL - 23.7 DATE 1 Nov. 1970

DIRECT SHEAR TEST REPORT



TEST NO		1	2	3	
INITIAL: WATER CONTENT	w_o	36.1 %	37.7 %	38.2 %	%
INITIAL: VOID RATIO	e_o	1.02	1.05	1.06	
INITIAL: SATURATION	S_o	95.6 %	96.9 %	97.3 %	%
INITIAL: DRY DENSITY, LB/CU FT	γ_d	83.4	82.2	81.8	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	2	6	5	
FINAL: WATER CONTENT	w_f	28.1 %	25.7 %	24.2 %	%
FINAL: VOID RATIO	e_f				
FINAL: SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.58	1.09	1.60	
ACTUAL TIME TO FAILURE, MIN	t_f	2040	1680	1620	
RATE OF STRAIN, IN/MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 29°
tan φ = 0.550
c = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED 3.00 IN. SQUARE 0.550 IN. THICK

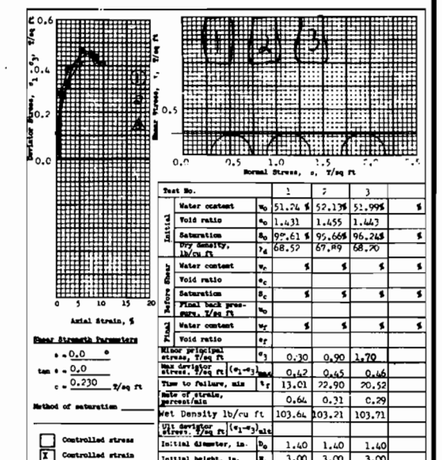
CLASSIFICATION LEAN CLAY (CL), gray, contains a trace of sand and 1" to 1½" *

LL 45 PL 15 PI 30 G_s 2.70

REMARKS diam. shells

PROJECT LK.PONT.LA.& VIC.-HURR.PROT.- SOUTH POINT TO G.I.W.W. LEVEE; G.D.M.# 2,SUPP.# 9
AREA
BORING NO 6-USP SAMPLE NO 8-C
EL - 21.9 DATE 17 Nov. 1970

DIRECT SHEAR TEST REPORT



Test No.		1	2	3	
Initial: Water content	w_o	51.74 %	52.178	51.995 %	%
Initial: Void ratio	e_o	1.431	1.455	1.443	
Initial: Saturation	S_o	99.61 %	95.668	96.268	%
Initial: Dry density, lb/cu ft	γ_d	68.57	67.89	68.70	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.30	0.90	1.70	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.42	0.45	0.46	
Time to failure, min	t_f	13.01	22.90	20.52	
Rate of strain, percent/min		0.64	0.31	0.29	
Wet Density lb/cu ft		103.64	103.71	103.71	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.230 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q Type of specimen 5" Undisturbed

Classification M(Gr)CH4; lns & lyrs ML: lns SP

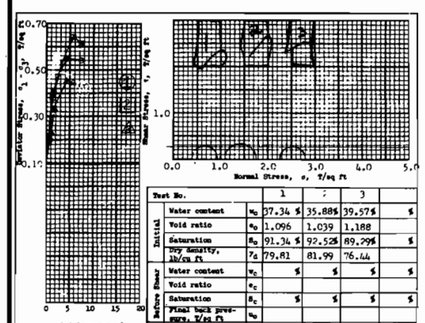
LL 66 PL 20 PI 46 G_s 2.6711

Remarks NOD-Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Point to GIWW Lev. GDM No. 2 Supp No 9
Area Sta. 300 Ft. North Hwy. 11, 11 Ft.
South G.I.W.W. Levee
Boring No. 6-USP Sample No. 9-C
Depth 37.6 Date 24 NOV 72
El -25.4

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-3-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial: Water content	w_o	37.34 %	35.88 %	39.57 %	%
Initial: Void ratio	e_o	1.096	1.039	1.188	
Initial: Saturation	S_o	91.34 %	92.52 %	89.29 %	%
Initial: Dry density, lb/cu ft	γ_d	79.81	81.99	76.44	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.40	1.10	2.29	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.55	0.64	0.45	
Time to failure, min	t_f	7.20	22.74	16.87	
Rate of strain, percent/min		0.63	0.27	0.27	
Wet Density lb/cu ft		109.57	111.44	106.70	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.275 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q Type of specimen 5" Undisturbed

Classification M(Gr)CH3; lns & lyrs ML: lns SP: org ars; dw

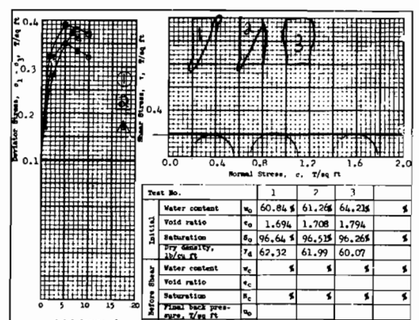
LL 54 PL 15 PI 26 G_s 2.6763

Remarks NOD-Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Point to GIWW Lev. GDM No. 2 Supp No 9
Area Sta. 300 Ft. North Hwy. 11, 11 Ft.
South G.I.W.W. Levee
Boring No. 6-USP Sample No. 14-C
Depth 49.2 Date 24 NOV 72
El -42.0

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-3-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial: Water content	w_o	60.84 %	61.26 %	64.21 %	%
Initial: Void ratio	e_o	1.694	1.708	1.794	
Initial: Saturation	S_o	96.64 %	96.53 %	96.26 %	%
Initial: Dry density, lb/cu ft	γ_d	62.32	61.99	60.07	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.20	0.70	1.40	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.35	0.39	0.37	
Time to failure, min	t_f	7.87	17.60	22.50	
Rate of strain, percent/min		0.63	0.28	0.30	
Wet Density lb/cu ft		100.21	99.96	98.65	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.190 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q Type of specimen 5" Undisturbed

Classification M(Gr)CH4;lns & lyrs ML; dw

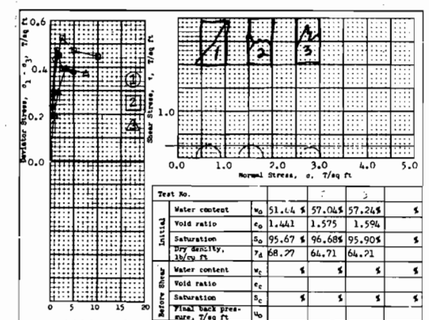
LL 81 PL 20 PI 61 G_s 2.6864

Remarks NOD-Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Point to GIWW Lev. GDM No. 2 Supp No 9
Area Sta. 300 Ft. North Hwy 11, 11 Ft.
South G.I.W.W. Levee
Boring No. 6-USP Sample No. 7-D
Depth 26.0 Date 24 NOV 72
El -18.6

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-3-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial: Water content	w_o	51.64 %	57.04 %	57.24 %	%
Initial: Void ratio	e_o	1.441	1.575	1.594	
Initial: Saturation	S_o	95.67 %	96.68 %	95.90 %	%
Initial: Dry density, lb/cu ft	γ_d	68.77	64.71	64.21	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.40	1.30	2.60	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.47	0.52	0.40	
Time to failure, min	t_f	2.54	4.62	10.41	
Rate of strain, percent/min		0.61	0.34	0.33	
Wet Density lb/cu ft		103.46	101.59	101.03	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.250 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q Type of specimen 5" Undisturbed

Classification M(Gr)CH?; lns,lyrs & ars SP; dw; rt

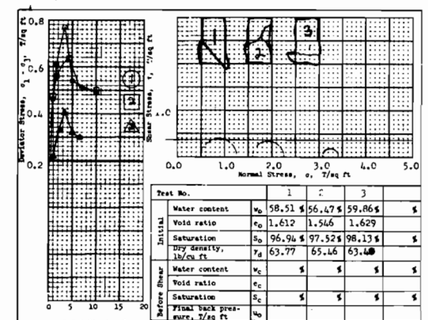
LL 69 PL 21 PI 48 G_s 2.6706

Remarks NOD-Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Point to GIWW Lev. GDM No. 2 Supp No 9
Area Sta. 300 Ft. North Hwy. 11, 11 Ft.
South G.I.W.W. Levee
Boring No. 6-USP Sample No. 16-D
Depth 58.3 Date 24 NOV 72
El -51.1

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-3-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial: Water content	w_o	58.51 %	56.47 %	59.86 %	%
Initial: Void ratio	e_o	1.612	1.546	1.629	
Initial: Saturation	S_o	96.94 %	97.52 %	98.13 %	%
Initial: Dry density, lb/cu ft	γ_d	63.77	65.16	63.48	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.50	1.60	3.10	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.77	0.64	0.31	
Time to failure, min	t_f	5.16	15.41	12.94	
Rate of strain, percent/min		0.67	0.28	0.27	
Wet Density lb/cu ft		101.15	102.40	101.34	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.355 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q Type of specimen 5" Undisturbed

Classification M(Gr)CH4; lns, lyrs & ars SP

LL 77 PL 23 PI 54 G_s 2.6663

Remarks NOD-Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Point to GIWW Lev. GDM No. 2 Supp No. 9
Area Sta. 300 Ft. North Hwy 11, 11 Ft.
South G.I.W.W. Levee
Boring No. 6-USP Sample No. 19-D
Depth 70.2 Date 24 NOV 72
El -63.0

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-3-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT

FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

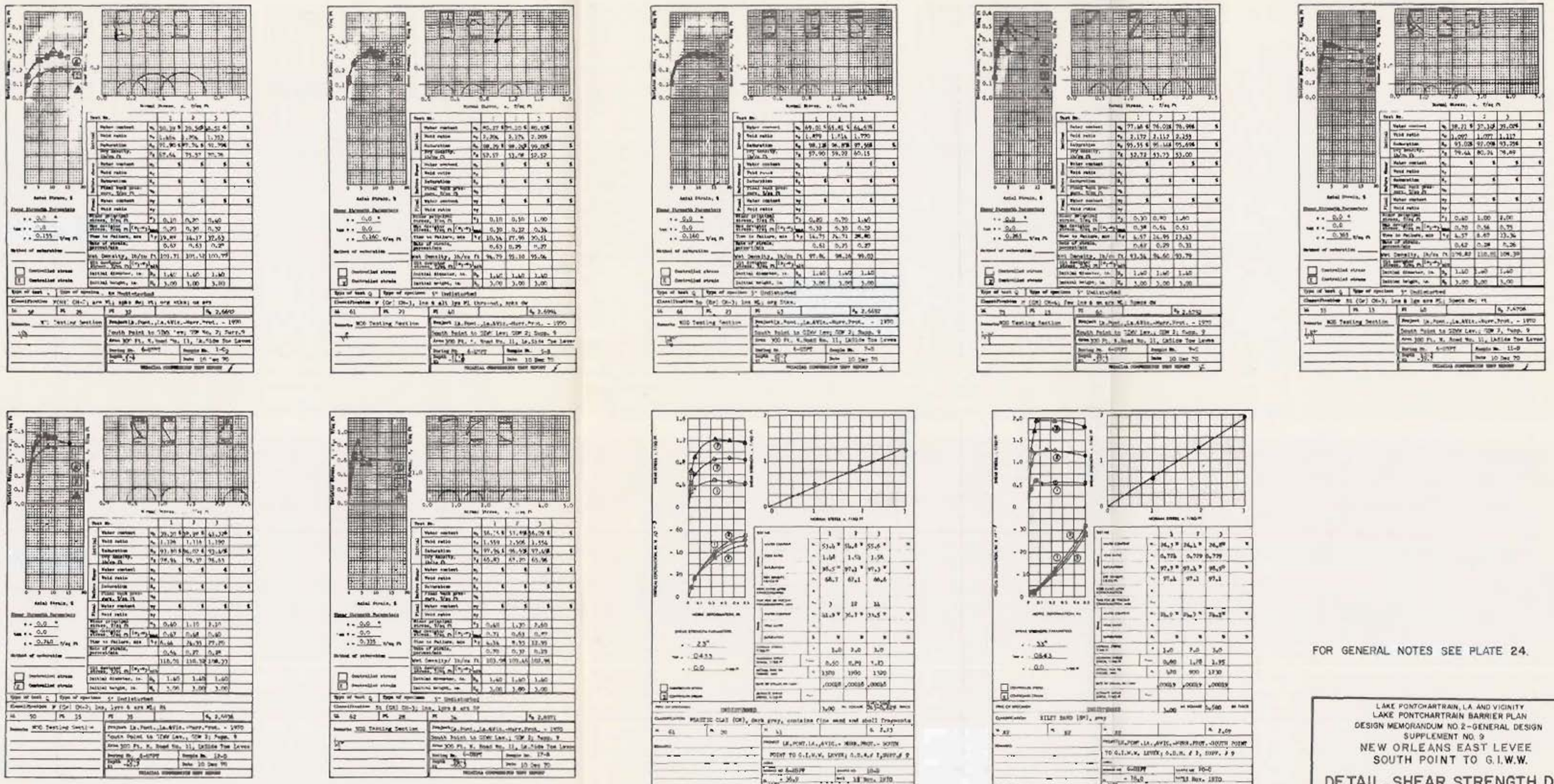
DETAIL SHEAR STRENGTH DATA

BORING 6-USP

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

JANUARY 1973 FILE NO. H-2-26016

PLATE 27



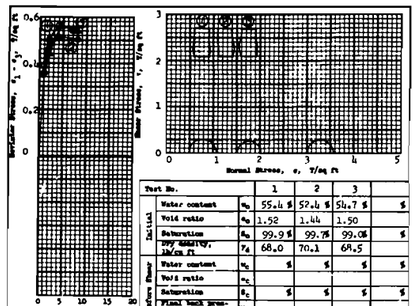
FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA
BORING 6 – USPT

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

JANUARY 1973 FILE NO. H-2-26016



Test No.			1	2	3	
Initial	Water content	w_o	55.4 %	52.4 %	54.7 %	%
	Void ratio	e_o	1.52	1.44	1.50	
	Saturation	S_o	99.9 %	99.7%	99.0%	%
	Dry density, lb/cu ft	γ_d	68.0	70.1	68.5	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.56	0.51	0.56	
	Time to failure, min	t_f	13	20	25	
	Rate of strain, percent/min		0.318	0.195	0.178	
	Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
	Initial diameter, in.	D_o	1.40	1.41	1.40	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0.0 °

$\tan\phi$ = 0.0

c = 0.272 T/sq ft

Method of saturation _____

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY(CH),gray, contains silt lenses

LL 68 | PL 23 | PI 45 | G_s 2.74

Remarks _____

Project LK.PONT.LA.,& VIC.-HURR.PROT.-SO. POINT TO GIWW LEV.-GDM # 2, SUPP. # 9

Area (1971)

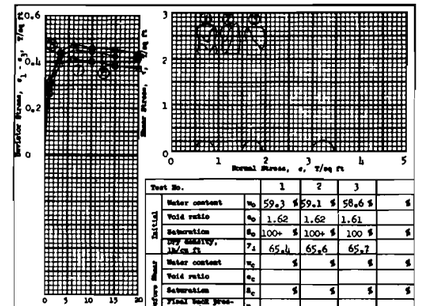
Boring No. 5-USP | Sample No. 9-A

Sample Elev. - 19.9 | Date 7 April 1971

CHR TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (ER 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION



Test No.			1	2	3	
Initial	Water content	w_o	59.3 %	59.1 %	58.6 %	%
	Void ratio	e_o	1.62	1.62	1.61	
	Saturation	S_o	100+ %	100+ %	100 %	%
	Dry density, lb/cu ft	γ_d	65.4	65.6	65.7	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.41	0.45	0.47	
	Time to failure, min	t_f	16	25	22	
	Rate of strain, percent/min		0.370	0.260	0.270	
	Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
	Initial diameter, in.	D_o	1.40	1.40	1.40	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0.0 °

$\tan\phi$ = 0.0

c = 0.221 T/sq ft

Method of saturation _____

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY(CH),gray

LL 75 | PL 22 | PI 53 | G_s 2.75

Remarks _____

Project LK.PONT.LA.,& VIC.-HURR. PROT.-SO. POINT TO GIWW LEV.,GDM # 2,SUPP. # 9

Area (1971)

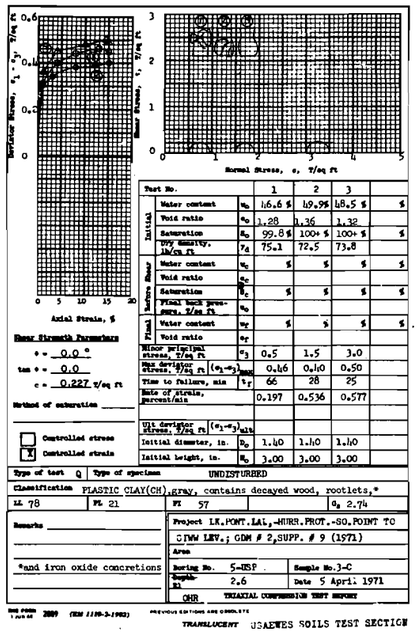
Boring No. 5-USP | Sample No. 7-D

Sample Elev. - 14.1 | Date 6 April 1971

CHR TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (ER 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION



Test No.			1	2	3	
Initial	Water content	w_o	16.6 %	19.9%	18.5 %	%
	Void ratio	e_o	1.28	1.36	1.32	
	Saturation	S_o	99.8 %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	75.1	72.5	73.8	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.46	0.40	0.50	
	Time to failure, min	t_f	66	28	25	
	Rate of strain, percent/min		0.197	0.536	0.577	
	Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
	Initial diameter, in.	D_o	1.40	1.40	1.40	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0.0 °

$\tan\phi$ = 0.0

c = 0.227 T/sq ft

Method of saturation _____

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY(CH),gray, contains decayed wood, rootlets,*

LL 78 | PL 21 | PI 57 | G_s 2.74

Remarks _____

*and iron oxide concretions

Project LK.PONT.LA.,-HURR.PROT.-SO.POINT TO GIWW LEV.; GDM # 2,SUPP. # 9 (1971)

Area

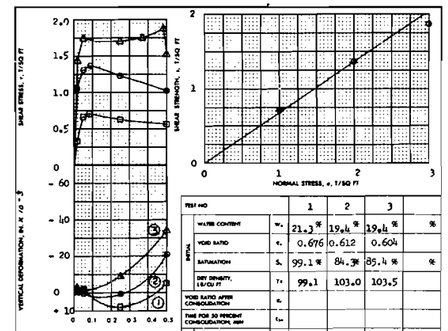
Boring No. 5-USP | Sample No. 3-C

Sample Elev. 2.6 | Date 5 April 1971

CHR TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (ER 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION



SHEAR STRENGTH PARAMETERS

ϕ' = 34 °

TAN ϕ' = 0.680

c' = 0 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	21.3 %	19.4 %	19.4 %	%
	VOID RATIO	e_o	0.676	0.612	0.604	
	SATURATION	S_o	99.1 %	84.3%	85.4 %	%
	DRY DENSITY, LB/CU FT	γ_d	99.1	103.0	103.5	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL	WATER CONTENT	w_f	15.1 %	18.1 %	16.8 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
	NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
	MAXIM. SHEAR STRESS, T/SQ FT	τ_{max}	0.70	1.36	1.87	
	ACTUAL TIME TO FAILURE, MIN	t_f	540	540	2520	
	RATE OF STRAIN, IN/MIN		.00020	.00020	.00020	
	ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.540 IN THICK

CLASSIFICATION SAND(SP),light gray

LL _ | PL _ | PI _ | G_s 2.66

REMARKS _____

PROJECT LK.PONT.LA.,& VIC.-HURR. PROT.-SOUTH POINT TO GIWW LEV.; GDM # 2,SUPP.# 9

AREA (1971)

BORING NO 5-USP | SAMPLE NO 14-8

SAMPLE EL - 40.7 | DATE 5 April 1971

GDA DIRECT SHEAR TEST REPORT

USAEWES SOILS TEST SECTION

ENG FORM 1 JUN 65 2092 (ER 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE GE-3

FOR GENERAL NOTES SEE PLATE 24.

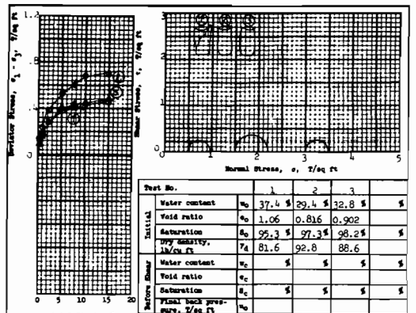
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA

BORING 5-USP

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

JANUARY 1973 | FILE NO. H-2-26016



Test No.			1	2	3	
Initial	Water content	w_o	37.4 %	29.4 %	32.8 %	%
	Void ratio	e_o	1.06	0.816	0.902	
	Saturation	S_o	95.3 %	97.3%	98.2%	%
	Dry density, lb/cu ft	γ_d	81.6	92.8	88.6	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.46	0.70	0.48	
	Time to failure, min	t_f	170	170	170	
	Rate of strain, percent/min		0.088	0.088	0.088	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.40	1.40	1.40	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0°
tan ϕ = 0.0
c = 0.235 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

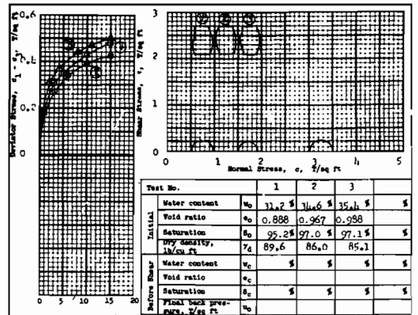
Type of test Q | Type of specimen UNDISTURBED

Classification LEAN CLAY(CL),gray, contains sand pockets, crumbly

LL 44 | PL 17 | PI 27 | G_s 2.70

Remarks _____

Project LAKE PONT.LA.,&VIC.HURR. PROT.- SO. POINT TO GIWW LEV: GDM#2,SUPP.#9 (1971)
Area
Boring No. 4-USP | Sample No. 5-B
Depth El -4.2 | Date 2 April 1971
TES TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	31.2 %	34.6 %	35.4 %	%
	Void ratio	e_o	0.888	0.967	0.958	
	Saturation	S_o	95.2%	97.0 %	97.1%	%
	Dry density, lb/cu ft	γ_d	89.6	86.0	85.1	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.48	0.42	0.50	
	Time to failure, min	t_f	95	15	55	
	Rate of strain, percent/min		0.161	0.235	0.273	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.41	1.40	1.40	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0°
tan ϕ = 0.0
c = 0.223 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

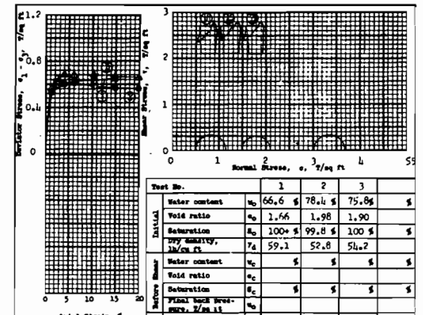
Type of test Q | Type of specimen UNDISTURBED

Classification LEAN CLAY(CL),greenish gray, contains scattered pockets and*

LL 46 | PL 16 | PI 30 | G_s 2.71

Remarks *lenses of silty sand

Project LK.PONT.LA.,& VIC.- HURR. PROT.-SO. POINT TO GIWW LEV.; GDM # 2, SUPP. # 9(1971)
Area
Boring No. 4-USP | Sample No. 3-C
Depth El 3.1 | Date 1 April 1971
JMS TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	66.6 %	78.4 %	75.8%	%
	Void ratio	e_o	1.66	1.98	1.90	
	Saturation	S_o	100+ %	99.8 %	100 %	%
	Dry density, lb/cu ft	γ_d	59.1	52.8	54.2	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.65	0.61	0.68	
	Time to failure, min	t_f	199	80	51	
	Rate of strain, percent/min		0.075	0.075	0.075	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.39	1.39	1.39	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0°
tan ϕ = 0.0
c = 0.323 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

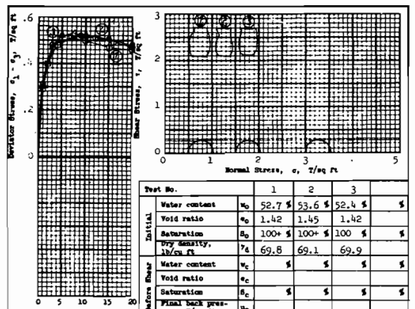
Classification PLASTIC CLAY(CH),gray, contains decayed roots and strata of*

LL 119 | PL 41 | PI 78 | G_s 2.52

Remarks *organic material

Project LK.PONT.LA.,& VIC-HURR.PROT.-SO.POINT TO GIWW LEV.; GDM # 2,SUPP # 9(1971)
Area
Boring No. 4-USP | Sample No. 6-C
Depth El - 8.9 | Date 2 April 1971
TES TRIAXIAL COMPRESSION TEST REPORT

TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	52.7 %	53.6 %	52.4 %	%
	Void ratio	e_o	1.42	1.45	1.42	
	Saturation	S_o	100+ %	100+ %	100 %	%
	Dry density, lb/cu ft	γ_d	69.8	69.1	69.9	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.51	0.52	0.53	
	Time to failure, min	t_f	26	35	33	
	Rate of strain, percent/min		0.269	0.260	0.231	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.40	1.39	1.39	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0°
tan ϕ = 0.0
c = 0.260 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

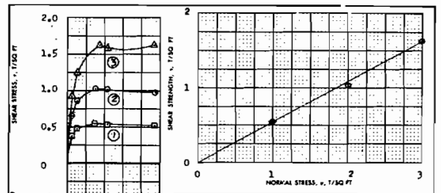
Classification PLASTIC CLAY(CH),gray, contains silt lenses

LL 65 | PL 23 | PI 42 | G_s 2.71

Remarks _____

Project LK. PONT.LA.,&VIC.-HURR. PROT.- SO.POINT TO GIWW LEV.; GDM#2, SUPP.#9 (1971)
Area
Boring No. 4-USP | Sample No. 8-D
Depth El -18.0 | Date 2 April 1971
JMS TRIAXIAL COMPRESSION TEST REPORT

TRANSLUCENT



SHEAR STRENGTH PARAMETERS
ϕ = 29°
tan ϕ = 0.543
c = 0.0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	33.5 %	33.0 %	32.7%	%
	VOID RATIO	e_o	0.929	0.905	0.877	
	SATURATION	S_o	97.4 %	98.4 %	97.6%	%
	DRY DENSITY, LB/CU FT	γ_d	87.4	88.5	89.8	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL	WATER CONTENT	w_f	31.3 %	29.6 %	27.8%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
	NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
	MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.54	1.03	1.63	
	ACTUAL TIME TO FAILURE, MIN	t_f	900	900	1080	
	RATE OF STRAIN, IN /MIN		.00017	.00017	.00017	
	ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.540 IN. THICK

CLASSIFICATION SANDY SILTY CLAY(CL),gray

LL 28 | PL 21 | PI 7 | G_s 2.70

REMARKS _____

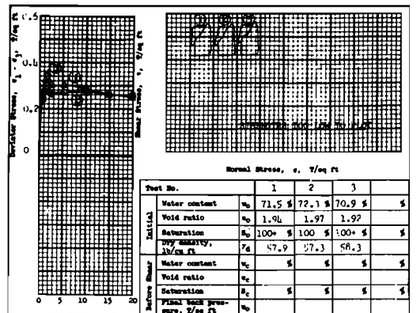
PROJECT LK.PONT.,LA.,& VIC.-HURR. PROT.-SO. POINT TO GIWW LEV.;GDM NO.2,SUPP.NO.9(1971)
AREA
BORING NO 4-USP | SAMPLE NO 12-D
DEPTH El - 34.0 | DATE 2 April 1971
GDA DIRECT SHEAR TEST REPORT

FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA
BORING 4-USP

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



Test No.			1	2	3	
Initial	Water content	w_o	71.5 %	72.1 %	70.9 %	%
	Void ratio	e_o	1.94	1.97	1.97	
	Saturation	S_o	100+ %	100 %	100+ %	%
	Dry density, lb/cu ft	γ_d	57.9	57.3	58.3	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.31	0.27	0.35	
	Time to failure, min	t_f	15	10	15	
	Rate of strain, percent/min		0.107	0.107	0.107	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.39	1.39	1.39	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.155 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

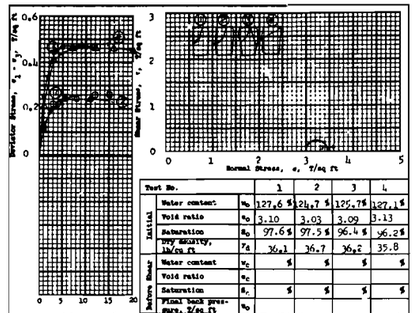
Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY(CH),gray, contains scattered decayed roots

LL 78 | PL 23 | PI 55 | G_s 2.71

Remarks _____

Project LK.P.CT.LA.,& VIC.-HURR.PROT.-
SO.POINT TO GIWW LEV.;GDM # 2,SUPP. # 9
Area (1971)
Boring No. 4-USPT | Sample No. 5-C
Depth El - 13.8 | Date 5 April 1971
TES TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	4
Initial	Water content	w_o	127.6 %	124.7 %	125.7 %	127.1 %
	Void ratio	e_o	3.10	3.03	3.09	3.13
	Saturation	S_o	97.6 %	97.5 %	96.4 %	96.2 %
	Dry density, lb/cu ft	γ_d	36.1	36.7	36.2	35.8
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	3.0
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.26	0.24	0.47	0.48
	Time to failure, min	t_f	59	24	36	40
	Rate of strain, percent/min		0.231	0.231	0.247	0.372
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.39	1.40	1.40	1.41
	Initial height, in.	H_o	3.00	3.00	3.00	3.00

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.180 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

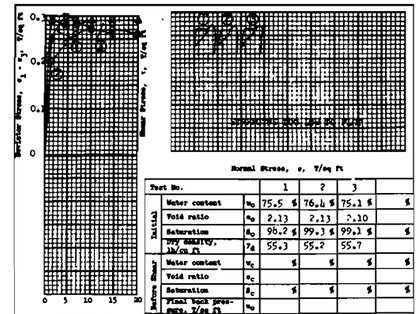
Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY(CH),dark gray, highly organic

LL 165 | PL 57 | PI 108 | G_s 2.37

Remarks Strengths of specimens 1 and 2 too low too low to plot

Project LK.PONT.LA.,& VIC.-HURR. PROT.-
SO. POINT TO GIWW LEV.; GDM # 2,SUPP. # 9
Area (1971)
Boring No. 4-USPT | Sample No. 3-D
Depth El - 6.8 | Date 5 April 1971
JMS TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	75.5 %	76.4 %	75.1 %	%
	Void ratio	e_o	2.13	2.13	2.10	
	Saturation	S_o	98.2 %	99.3 %	99.1 %	%
	Dry density, lb/cu ft	γ_d	55.3	55.2	55.7	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.30	0.27	0.29	
	Time to failure, min	t_f	38	82	12	
	Rate of strain, percent/min		0.122	0.122	0.122	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.40	1.39	1.39	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.143 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

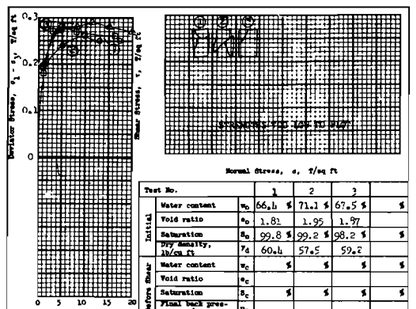
Classification PLASTIC CLAY(CH),gray, contains pockets of fine sand

LL 90 | PL 28 | PI 62 | G_s 2.77

Remarks _____

Project LK.PONT.LA.,& VIC.-HURR.PROT.-
SO.POINT TO GIWW LEV.; GDM # 2,SUPP. # 9
Area (1971)
Boring No. 4-USPT | Sample No. 6-D
Depth El - 18.8 | Date 5 April 1971
TES TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT U.S. ARMY ENG. SOILS LAB. SECTION



Test No.			1	2	3	
Initial	Water content	w_o	66.4 %	71.1 %	67.5 %	%
	Void ratio	e_o	1.81	1.95	1.87	
	Saturation	S_o	99.8 %	99.2 %	98.2 %	%
	Dry density, lb/cu ft	γ_d	60.4	57.5	59.2	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
	Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$		0.28	0.26	0.29	
	Time to failure, min	t_f	20	35	51	
	Rate of strain, percent/min		0.251	0.277	0.220	
	Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$					
	Initial diameter, in.	D_o	1.40	1.40	1.40	
	Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.138 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

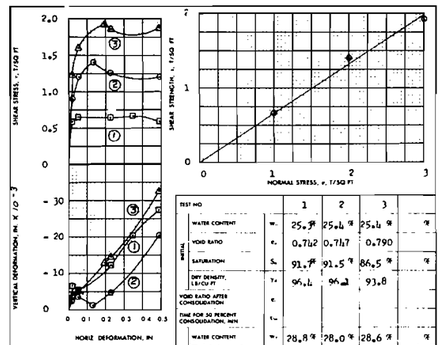
Classification PLASTIC CLAY(CH),gray, contains silt lenses

LL 73 | PL 25 | PI 48 | G_s 2.72

Remarks _____

Project LK.PONT. LA.,& VIC.-HURR. PROT.-
SO. POINT TO GIWW LEV.; GDM # 2, SUPP. # 9
Area (1971)
Boring No. 4-USPT | Sample No. 7-D
Depth El - 22.9 | Date 5 April 1971
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT U.S. ARMY ENG. SOILS LAB. SECTION



SHEAR STRENGTH PARAMETERS
ϕ = 33 °
TAN ϕ = 0.660
c = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	25.9 %	25.4 %	25.4 %	%
	VOID RATIO	e_o	0.742	0.747	0.790	
	SATURATION	S_o	91.7 %	91.5 %	86.5 %	%
	DRY DENSITY, LB/CU FT	γ_d	96.1	96.2	93.8	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL	WATER CONTENT	w_f	28.8 %	28.0 %	28.6 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
	NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
	MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.66	1.40	1.93	
	ACTUAL TIME TO FAILURE, MIN	t_f	1980	810	1170	
	RATE OF STRAIN, IN/MIN		.00018	.00018	.00018	
	ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.550 IN. THICK

CLASSIFICATION SILTY SAND(SM)gray

LL - | PL - | PI - | G_s 2.69

REMARKS _____

PROJECT LK.PONT.LA.,&VIC.-HURR.PROT.-
SO.POINT TO GIWW LEV.; GDM # 2,SUPP. # 9
AREA (1971)
BORING NO 4-USPT | SAMPLE NO 13-B
DEPTH EL - 45.0 | DATE 5 April 1971
BMG DIRECT SHEAR TEST REPORT
U.S. ARMY ENG. SOILS TEST SECTION

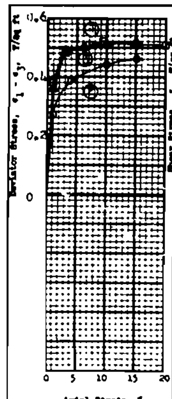
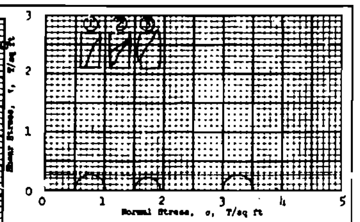
ENG FORM 1 JUN 68 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE IX-3

FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA
BORING 4-USPT

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-26016

Shear Strength Parameters

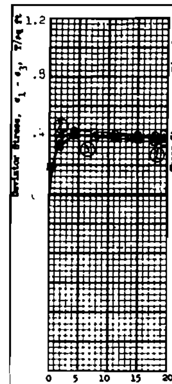
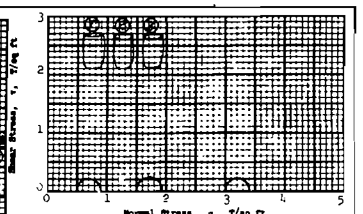
φ = 0.0°
tan φ = 0.0
c = 0.250 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	46.6 %	44.5 %	43.5 %	%
Initial: Void ratio	e_o	1.28	1.24	1.21	
Initial: Saturation	S_o	99.0 %	97.6 %	97.8 %	%
Initial: Dry density, lb/cu ft	γ_d	74.6	75.8	76.9	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.52	0.46	0.52	
Time to failure, min	t_f	43	60	50	
Rate of strain, percent/min		0.225	0.248	0.300	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray, contains scattered rootlets and sand*
LL 7- | PL 2- | PI 50 | G_s 2.72
Remarks *lenses
Project LK.PONT.LA.,& VIC.-HURR.PROT.-SOUTH POINT TO GIWW LEVEE;GDM # 2, SUPP. # 9
Area (1971)
Boring No. 3-USP | Sample No. 4-B
Depth El - 1.0 | Date 20 April 1971
JMS TRIAXIAL COMPRESSION TEST REPORT

Shear Strength Parameters

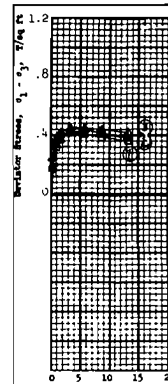
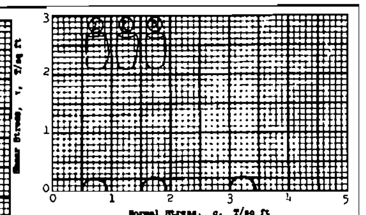
φ = 0.0°
tan φ = 0.0
c = 0.205 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	56.[illegible] %	56.[illegible] %	56.5 %	%
Initial: Void ratio	e_o	1.54	1.53	1.53	
Initial: Saturation	S_o	98.0 %	99.2 %	99.3 %	%
Initial: Dry density, lb/cu ft	γ_d	66.9	66.3	66.4	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.40	0.43	0.40	
Time to failure, min	t_f	36	36	36	
Rate of strain, percent/min		0.115	0.115	0.115	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray, contains silt lenses,thin layers of *
LL 73 | PL 26 | PI 47 | G_s 2.69
Remarks *silt and fine sand
Project LK. PONT., LA. & VIC. -HURR. PROT.- SOUTH POINT TO GIWW LEVEE;GDM#2,SUPP.#9
Area (1971)
Boring No. 3-USP | Sample No. 10-B
Depth El -24.8 | Date 20 April 1971
TES TRIAXIAL COMPRESSION TEST REPORT

Shear Strength Parameters

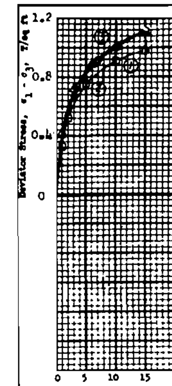
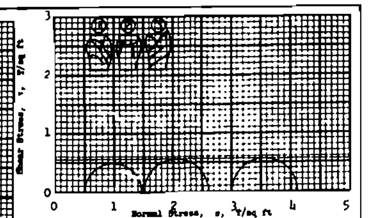
φ = 0.0°
tan φ = 0.0
c = 0.217 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	65.5 %	64.4 %	59.5 %	%
Initial: Void ratio	e_o	1.76	1.73	1.60	
Initial: Saturation	S_o	99.7 %	99.8 %	99.7 %	%
Initial: Dry density, lb/cu ft	γ_d	60.6	61.2	64.4	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.42	0.43	0.45	
Time to failure, min	t_f	36	63	36	
Rate of strain, percent/min		0.090	0.090	0.090	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.38	1.39	1.38	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray, contains large decayed roots, *
LL 81 | PL 25 | PI 56 | G_s 2.68
Remarks *slickensided
Project LK. PONT.,LA.&VIC.-HURR. PROT.- SOUTH POINT TO GIWW LEVEE;GDM # 2, SUPP.# 9
Area (1971)
Boring No. 3-USP | Sample No. 8-C
Depth El -17.9 | Date 20 April 1971
TES TRIAXIAL COMPRESSION TEST REPORT

Shear Strength Parameters

φ = 0.0°
tan φ = 0.0
c = 0.555 T/sq ft

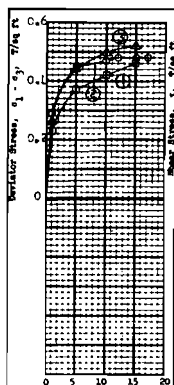
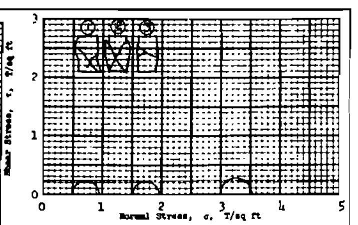
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	27.4 %	28.1 %	32.3 %	%
Initial: Void ratio	e_o	0.788	0.809	0.832	
Initial: Saturation	S_o	93.2 %	93.1 %	100+ %	%
Initial: Dry density, lb/cu ft	γ_d	93.6	92.5	91.3	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.99	1.11	1.11	
Time to failure, min	t_f	32	53	31	
Rate of strain, percent/min		0.464	0.263	0.476	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.39	1.40	1.39	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray and tan
LL 27 | PL 15 | PI 12 | G_s 2.68
Remarks
Project LK.PONT.LA.,&VIC.-HURR.PROT.-SOUTH POINT TO GIWW LEVEE; GDM # 2,SUPP. # 9
Area (1971)
Boring No. 3-USP | Sample No. 2-D
Depth El 5.2 | Date 20 April 1971
FAM TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT [illegible] SOILS TEST SECTION

Shear Strength Parameters

φ = 0.0°
tan φ = 0.0
c = 0.243 T/sq ft

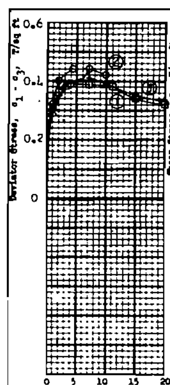
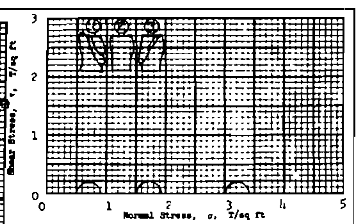
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	36.6 %	35.4 %	34.8 %	%
Initial: Void ratio	e_o	1.02	0.962	0.940	
Initial: Saturation	S_o	96.9 %	99.4 %	100 %	%
Initial: Dry density, lb/cu ft	γ_d	83.5	85.9	86.9	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.46	0.48	0.52	
Time to failure, min	t_f	59	49	63	
Rate of strain, percent/min		0.254	0.246	0.239	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray, contains sand pockets and 1/8" dia.*
LL 50 | PL 20 | PI 30 | G_s 2.7
Remarks *roots
Project LK.PONT.LA.,&VIC.-HURR.PROT.-SOUTH POINT TO GIWW LEVEE; GDM # 2,SUPP.# 9
Area (1971)
Boring No. 3-USP | Sample No. 5-D
Depth El - 6.8 | Date 20 April 1971
GDA TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT USAEWES SOILS [illegible]

Shear Strength Parameters

φ = 0.0°
tan φ = 0.0
c = 0.207 T/sq ft

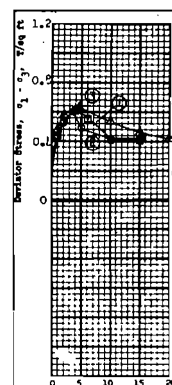
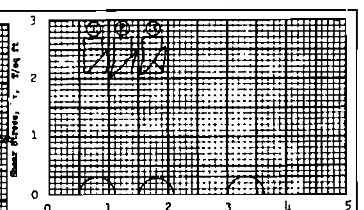
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	72.9 %	71.2 %	72.8 %	%
Initial: Void ratio	e_o	1.96	1.93	1.97	
Initial: Saturation	S_o	100+ %	100 %	100+ %	%
Initial: Dry density, lb/cu ft	γ_d	57.1	57.8	57.0	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.39	0.44	0.41	
Time to failure, min	t_f	8	29	42	
Rate of strain, percent/min		0.500	0.147	0.159	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray
LL 94 | PL 32 | PI 62 | G_s 2.71
Remarks
Project LK.PONT.LA.,&VIC-HURR.PROT.-SOUTH POINT TO GIWW LEVEE; GDM # 2,SUPP. # 9(1971)
Area
Boring No. 3-USP | Sample No. 12-D
Depth El - 34.8 | Date 21 April 1971
OHR TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT [illegible] SOILS TEST SECTION

Shear Strength Parameters

φ = 0.0°
tan φ = 0.0
c = 0.305 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	67.5 %	69.3 %	68.4 %	%
Initial: Void ratio	e_o	1.85	1.85	1.85	
Initial: Saturation	S_o	99.6 %	100+ %	100+ %	%
Initial: Dry density, lb/cu ft	γ_d	59.8	59.7	59.7	
Before Shear: Water content	w_c	%	%	%	%
Before Shear: Void ratio	e_c				
Before Shear: Saturation	S_c	%	%	%	%
Before Shear: Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Final: Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.61	0.59	0.63	
Time to failure, min	t_f	23	30	46	
Rate of strain, percent/min		0.176	0.124	0.105	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY(CH),gray
LL 95 | PL 29 | PI 66 | G_s 2.73
Remarks
Project LK.PONT.LA.,&VIC.-HURR. PROT.-SOUTH POINT TO GIWW LEVEE;GDM # 2,SUPP. # 9
Area (1971)
Boring No. 3-USP | Sample No. 15-D
Depth El - 46.8 | Date 21 April 1971
GDA TRIAXIAL COMPRESSION TEST REPORT

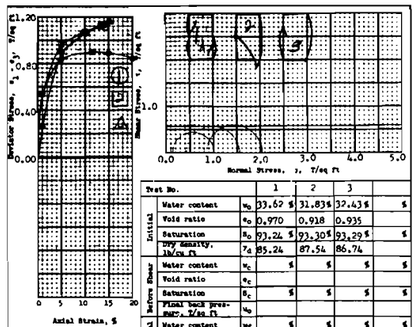
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT [illegible] SOILS TEST SECTION

FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA
BORING 3 – USP

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



Test No.			1	2	3	
Initial	Water content	w_o	33.62 %	31.83%	32.43%	%
	Void ratio	e_o	0.970	0.918	0.935	
	Saturation	S_o	93.24 %	93.30%	93.29%	%
	Dry density, lb/cu ft	γ_d	85.24	87.54	86.74	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.14	0.43	0.86	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.90	1.13	1.16	
Time to failure, min		t_f	18.19	22.31	25.05	
Rate of strain, percent/min			0.60	0.60	0.60	
Wet Density lb/cu ft			111.82	115.38	114.86	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0.0 °

tan ϕ = 0.0

c = 0.575 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed

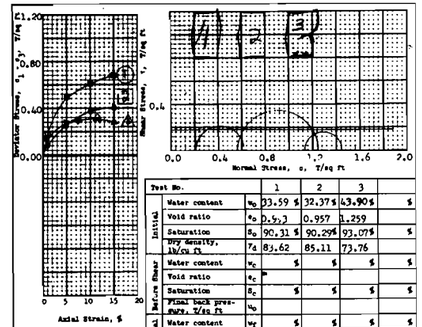
Classification St(GrMT)CH;lns & ars ML; org stks

LL 56 | PL 19 | PI 37 | G_s 2.6933

Remarks NOD Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Pt. to GIWW Lev. GDM #2, Supp. No. 9
Area Sta. 50 Ft. N. C.L. Hwy. 90 C.L. Levee
Boring No. 2-USP | Sample No. 3-C
Depth 9.4 / El 1.2 | Date 6 JAN 71

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	33.59 %	32.37%	43.90%	%
	Void ratio	e_o	0.943	0.957	1.259	
	Saturation	S_o	90.31 %	90.29%	93.07%	%
	Dry density, lb/cu ft	γ_d	83.62	85.11	73.76	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.21	0.57	1.14	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.41	0.68	0.91	
Time to failure, min		t_f	23.90	24.76	18.38	
Rate of strain, percent/min			0.63	0.61	0.63	
Wet Density lb/cu ft			111.70	112.69	106.08	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0.0 °

tan ϕ = 0.0

c = 0.180 T/sq ft

Method of saturation _____

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed

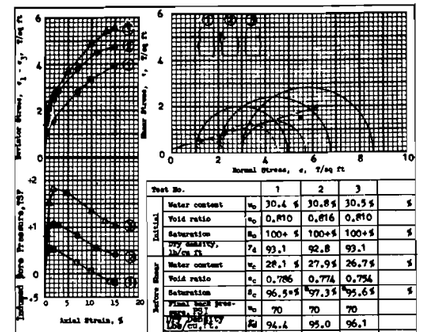
Classification M(GrMT) CH;lns&ars ML; org stks; ox ars

LL 50 | PL 25 | PI 25 | G_s 2.6717

Remarks NOD Testing Section

Project Lk. Pont. La. & Vic. Hurr. Prot. (70)
South Pt. to GIWW Lev. GDM #2, Supp. No. 9
Area Sta. 50 Ft. N. C.L. Hwy. 90 C.L. Levee
Boring No. 2-USP | Sample No. 4-C
Depth 13.0 / El -2.4 | Date 6 JAN 71

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	30.4 %	30.8%	30.5%	%
	Void ratio	e_o	0.810	0.816	0.810	
	Saturation	S_o	100+ %	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	93.1	92.8	93.1	
Before Shear	Water content	w_c	28.1 %	27.9%	26.7%	%
	Void ratio	e_c	0.786	0.774	0.754	
	Saturation	S_c	96.5+%	97.3%	95.6%	%
	Final back pressure, T/sq ft	u_b	70	70	70	
	Pore pressure, T/sq ft	$\bar{u}$	94.4	95.0	96.1	
Final	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	3.93	4.78	5.57	
Time to failure, min		t_f	150	150	150	
Rate of strain, percent/min			0.10	0.10	0.10	
$(\sigma_1-\sigma_3)$ at max pore pressure			1.2	2.5	2.7	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 17 °

tan ϕ = 0.307

c = 0.200 T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification SILT (ML), gray, contains rust colored concretions

LL 32 | PL 24 | PI 8 | G_s 2.70

Remarks Pore pressure response indicated 100% saturation

Portion of sample allowed to drain before trimming

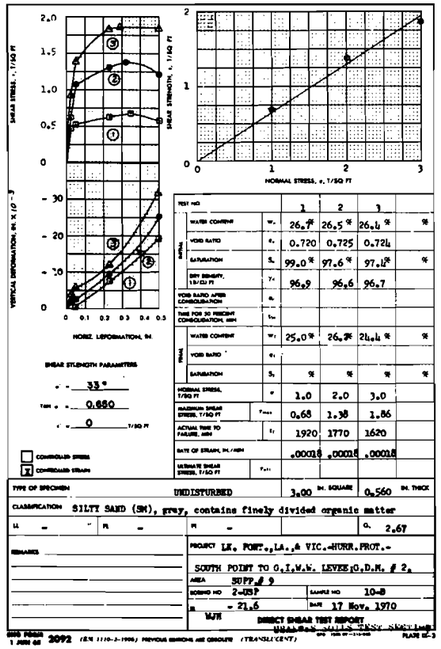
Project LK. PONT. LA., & VIC. - HURR. PROT.
SOUTH POINT TO GIWW LEVEE; GDM NO.2
Area SUPP. NO.9
Boring No. 2-USP | Sample No. 5-B
Depth-El -6.1 | Date 18 Nov.,1970

PJR TRIAXIAL COMPRESSION TEST REPORT

DWG FORM 1 JUN 66 2089 (ER 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT

t 1 of 2

USAEWES SOILS SECTION



TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	26.7%	26.5 %	26.4 %	%
	VOID RATIO	e_o	0.720	0.725	0.724	
	SATURATION	S_o	99.0%	97.6 %	97.1%	%
	DRY DENSITY, LB/CU FT	γ_d	96.9	96.6	96.7	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 90 PERCENT CONSOLIDATION, MIN	t_{90}				
FINAL	WATER CONTENT	w_f	25.0%	26.2%	24.4 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.68	1.38	1.86	
ACTUAL TIME TO FAILURE, MIN		t_f	1920	1770	1620	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

ϕ' = 33°

tan ϕ' = 0.650

c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.560 IN. THICK

CLASSIFICATION SILTY SAND (SM), gray, contains finely divided organic matter

LL - | PL - | PI - | G_s 2.67

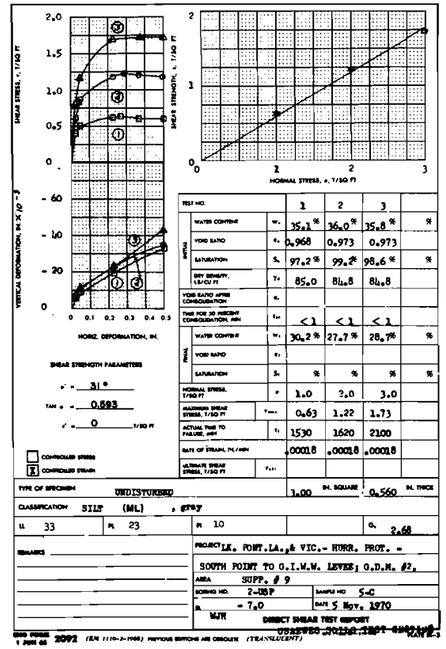
REMARKS

PROJECT LK. PONT., LA., & VIC.-HURR.PROT.-
SOUTH POINT TO G.I.W.W. LEVEE;G.D.N. # 2,
AREA SUPP.# 9
BORING NO 2-USP | SAMPLE NO 10-B
DEPTH - 21.5 | DATE 17 Nov. 1970

WJH DIRECT SHEAR TEST REPORT

USAEWES SOILS SECTION

DWG FORM 1 JUN 66 2092 (ER 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE E-3



TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	35.1 %	36.0%	35.8 %	%
	VOID RATIO	e_o	0.968	0.973	0.973	
	SATURATION	S_o	97.2 %	99.2%	98.6 %	%
	DRY DENSITY, LB/CU FT	γ_d	85.0	81.8	81.8	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 90 PERCENT CONSOLIDATION, MIN	t_{90}	< 1	< 1	< 1	
FINAL	WATER CONTENT	w_f	30.2 %	27.7 %	28.7%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.63	1.22	1.73	
ACTUAL TIME TO FAILURE, MIN		t_f	1530	1620	2100	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

ϕ' = 31°

tan ϕ' = 0.693

c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.560 IN. THICK

CLASSIFICATION SILT (ML) , gray

LL 33 | PL 23 | PI 10 | G_s 2.68

REMARKS

PROJECT LK. PONT.LA.,& VIC.- HURR. PROT. -
SOUTH POINT TO G.I.W.W. LEVEE; G.D.N. #2,
AREA SUPP. # 9
BORING NO. 2-USP | SAMPLE NO 5-C
DEPTH - 7.0 | DATE 5 Nov. 1970

WJH DIRECT SHEAR TEST REPORT

USAEWES SOILS SECTION

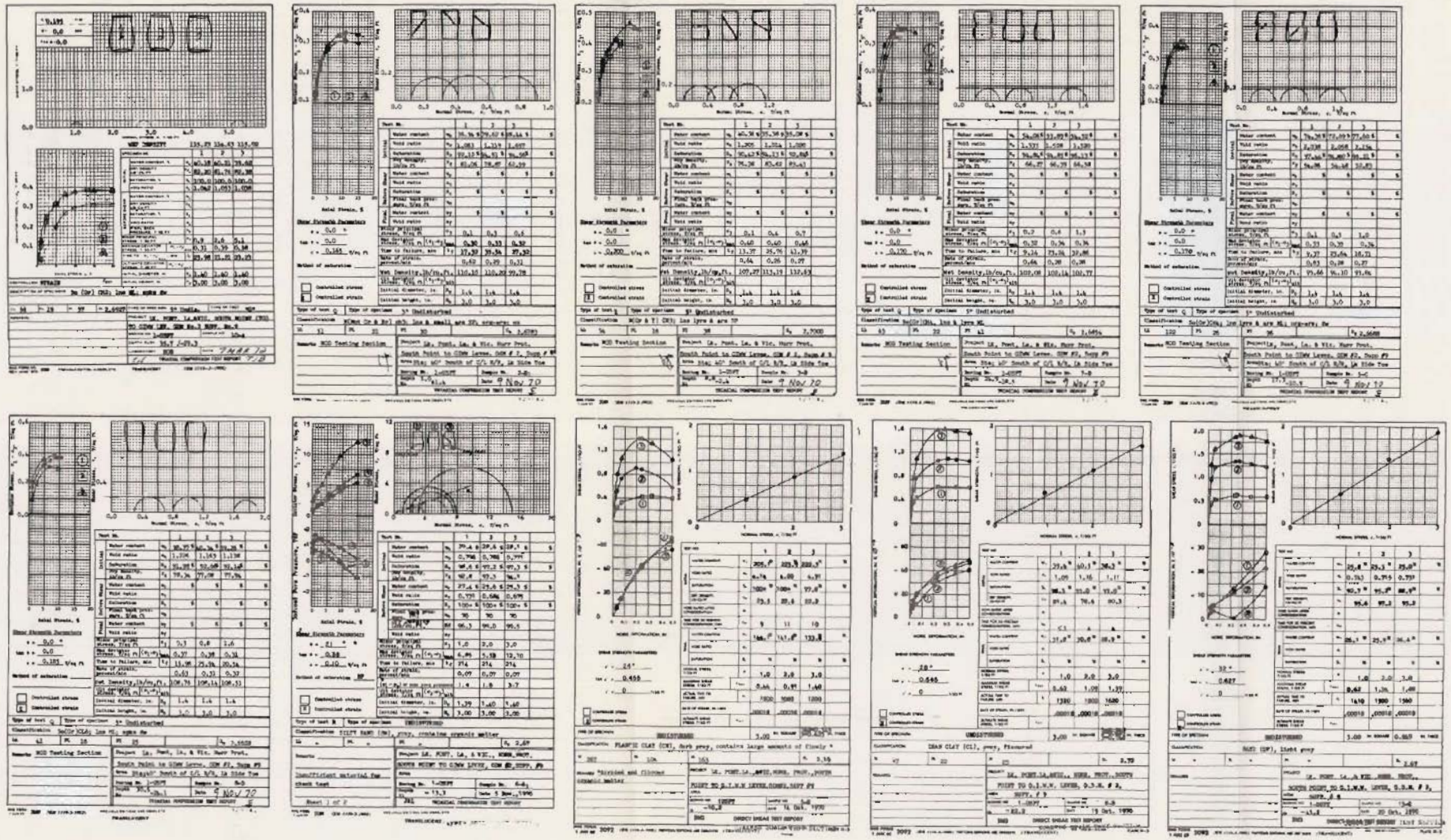
DWG FORM 1 JUN 66 2092 (ER 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE E-3

FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DETAIL SHEAR STRENGTH DATA
BORING 2-USP

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-26016



FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

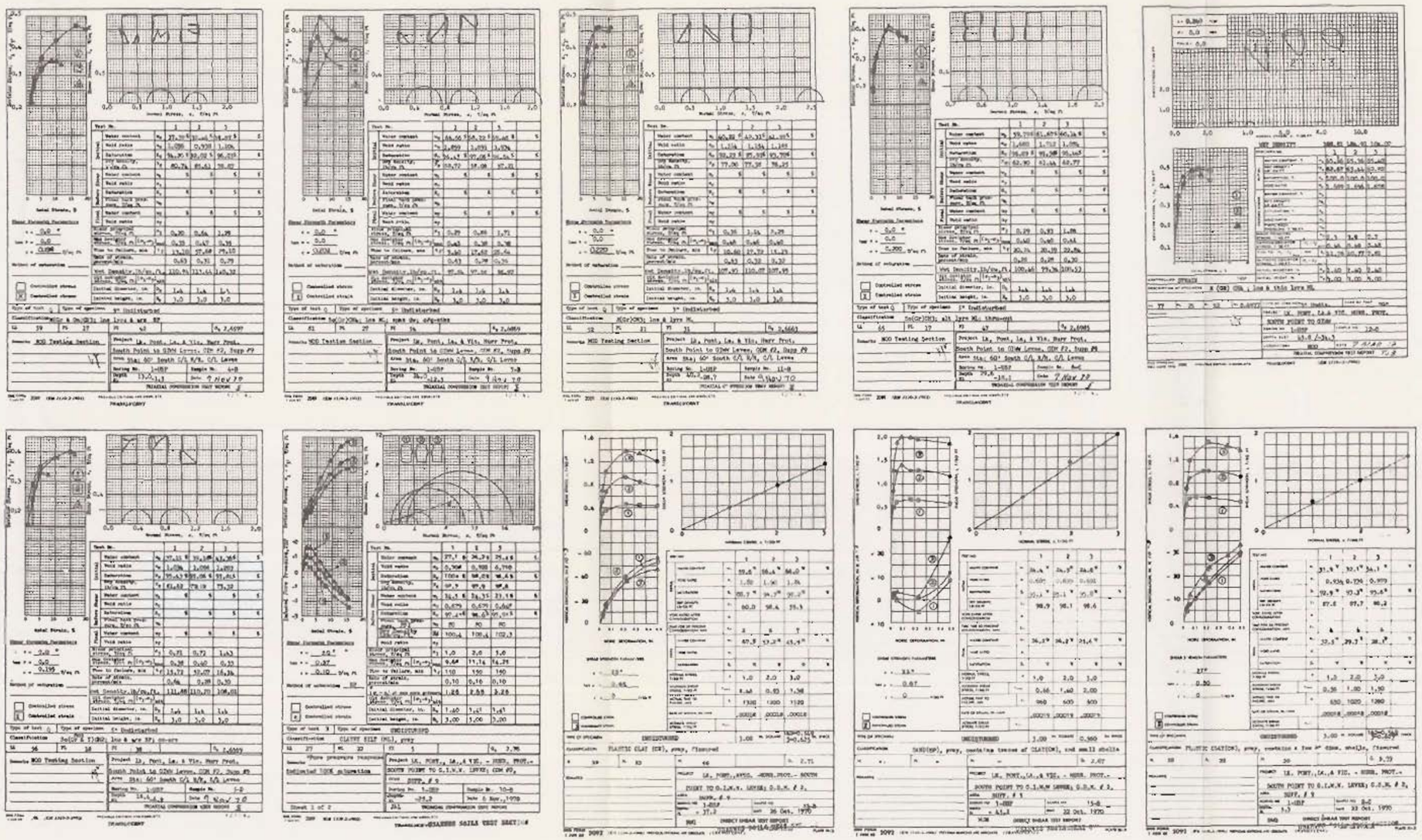
DETAIL SHEAR STRENGTH DATA

BORING I-USPT

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

JANUARY 1973

FILE NO. H-2-2606



FOR GENERAL NOTES SEE PLATE 24.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

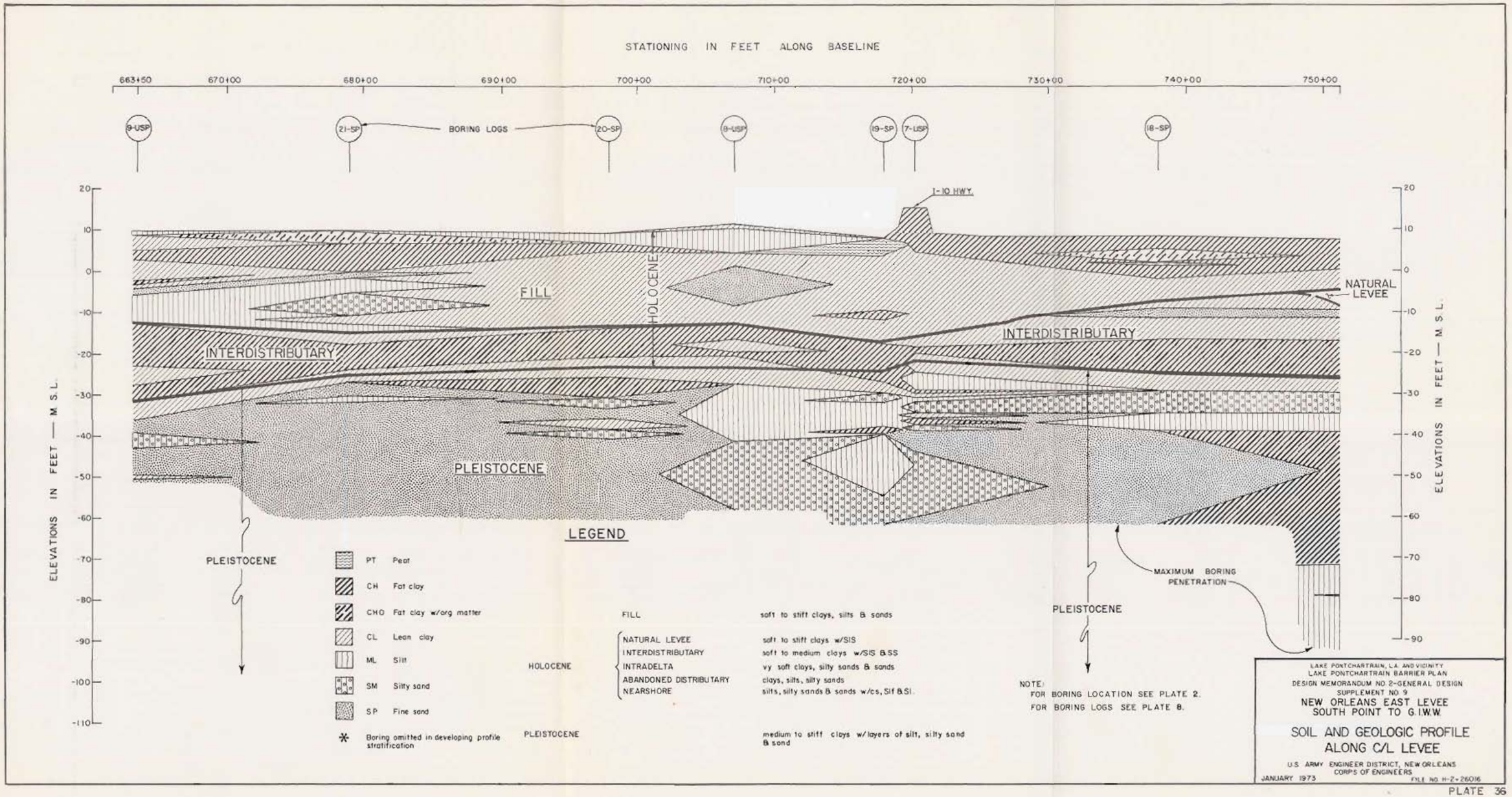
DETAIL SHEAR STRENGTH DATA

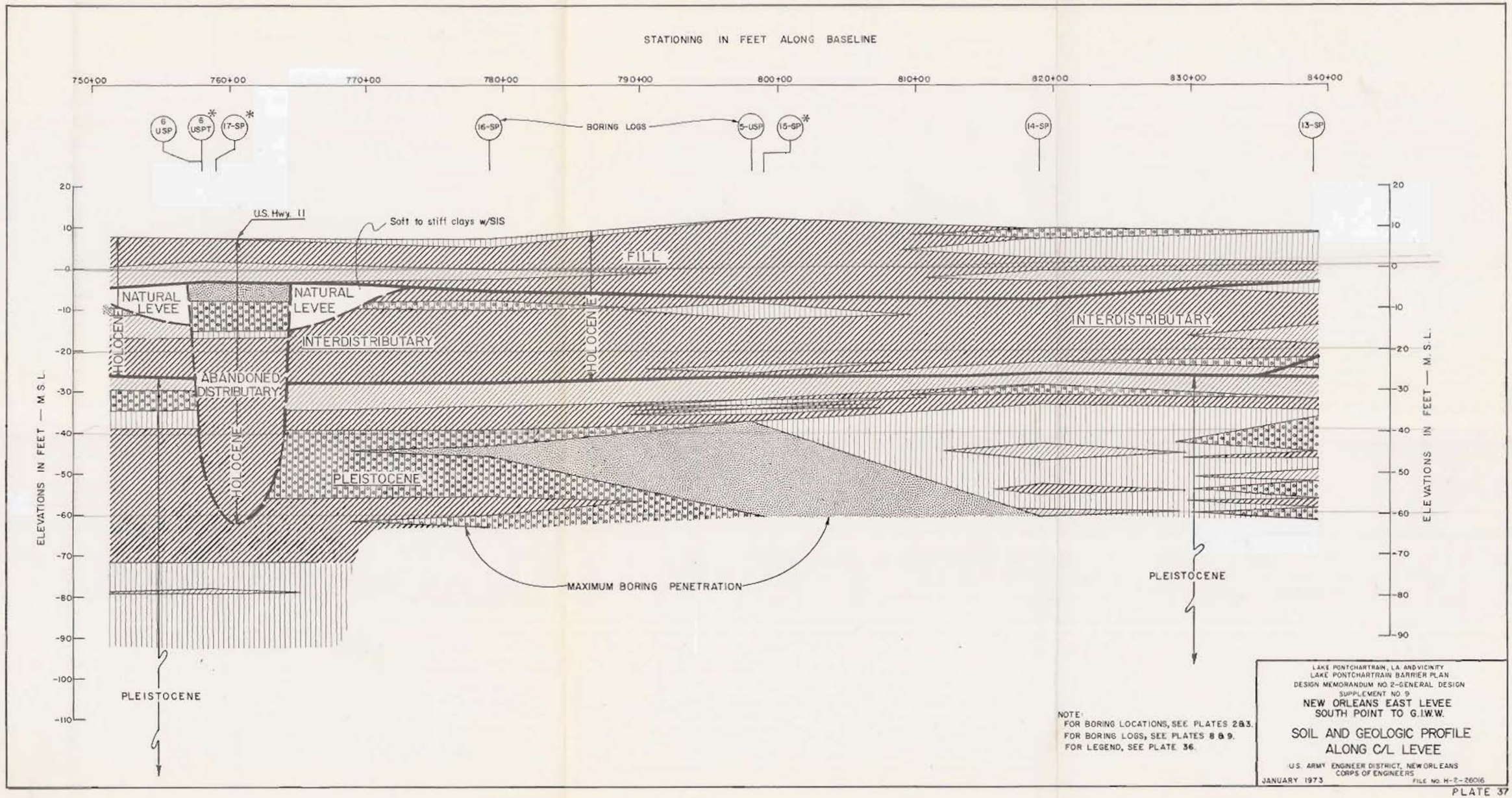
BORING I-USP

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

JANUARY 1973

FILE NO. H-2-26016


STATIONING IN FEET ALONG BASELINE
663+50
670+00
680+00
690+00
700+00
710+00
720+00
730+00
740+00
750+00
9-USP
21-SP
BORING LOGS
20-SP
8-USP
19-SP
7-USP
18-SP
I-10 HWY.
FILL
HOLOCENE
NATURAL LEVEE
INTERDISTRIBUTARY
INTERDISTRIBUTARY
PLEISTOCENE
PLEISTOCENE
PLEISTOCENE
MAXIMUM BORING PENETRATION
ELEVATIONS IN FEET — M.S.L.
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
LEGEND
PT Peat
CH Fat clay
CHO Fat clay w/org matter
CL Lean clay
ML Silt
SM Silty sand
SP Fine sand
* Boring omitted in developing profile stratification
FILL soft to stiff clays, silts & sands
HOLOCENE
NATURAL LEVEE soft to stiff clays w/SIS
INTERDISTRIBUTARY soft to medium clays w/SIS & SS
INTRADELTA vy soft clays, silty sands & sands
ABANDONED DISTRIBUTARY clays, silts, silty sands
NEARSHORE silts, silty sands & sands w/cs, Slf & Sl.
PLEISTOCENE medium to stiff clays w/layers of silt, silty sand & sand
NOTE:
FOR BORING LOCATION SEE PLATE 2.
FOR BORING LOGS SEE PLATE 8.
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
SOIL AND GEOLOGIC PROFILE
ALONG C/L LEVEE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016

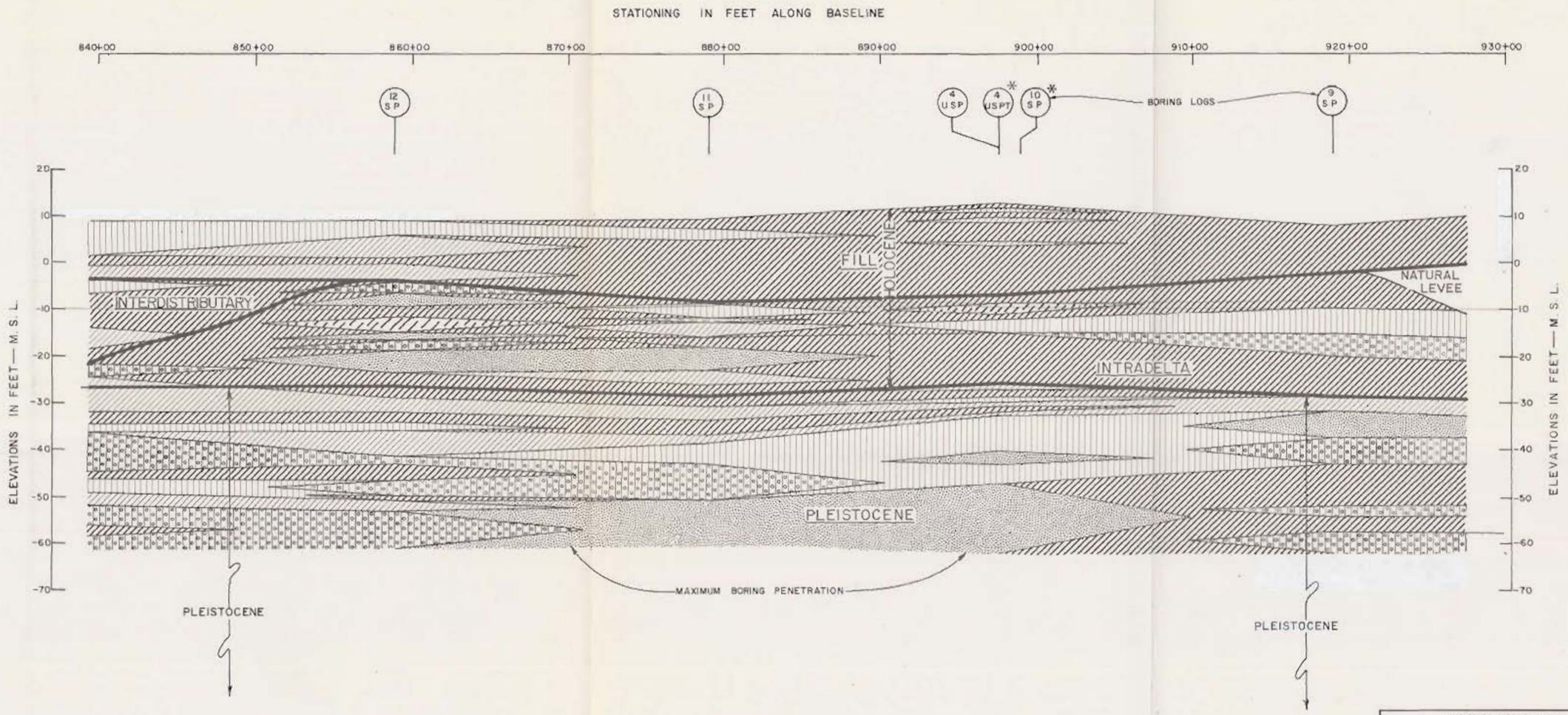


NOTE:
FOR BORING LOCATIONS, SEE PLATES 2&3.
FOR BORING LOGS, SEE PLATES 8 & 9.
FOR LEGEND, SEE PLATE 36.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SOIL AND GEOLOGIC PROFILE
ALONG C/L LEVEE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



NOTE:
FOR BORING LOCATIONS, SEE PLATE 3.
FOR BORING LOGS, SEE PLATES 9 & 10.
FOR LEGEND SEE PLATE 36.

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2-GENERAL DESIGN
SUPPLEMENT NO 9

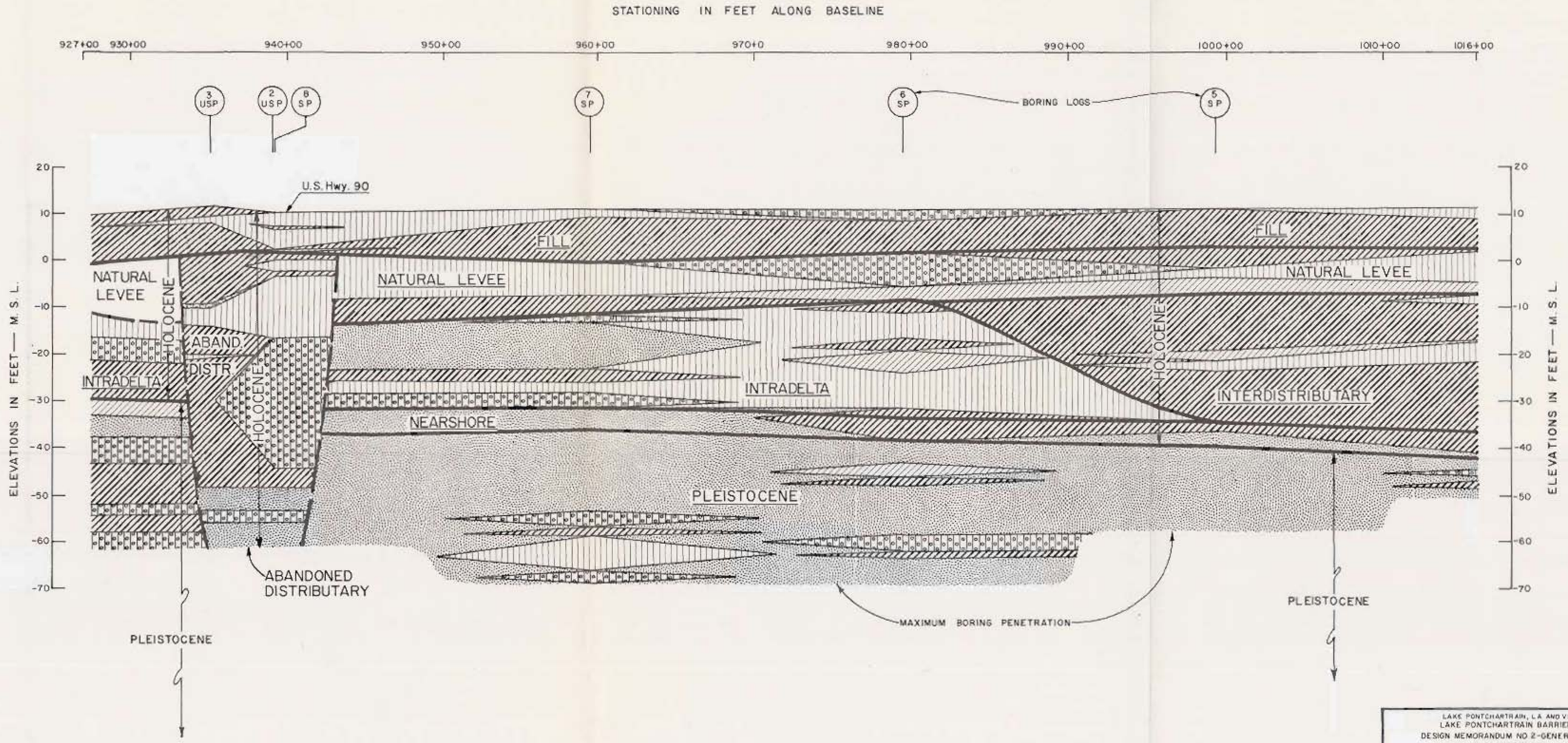
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SOIL AND GEOLOGIC PROFILE
ALONG C/L LEVEE

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

JANUARY 1973

FILE NO H-2-26016

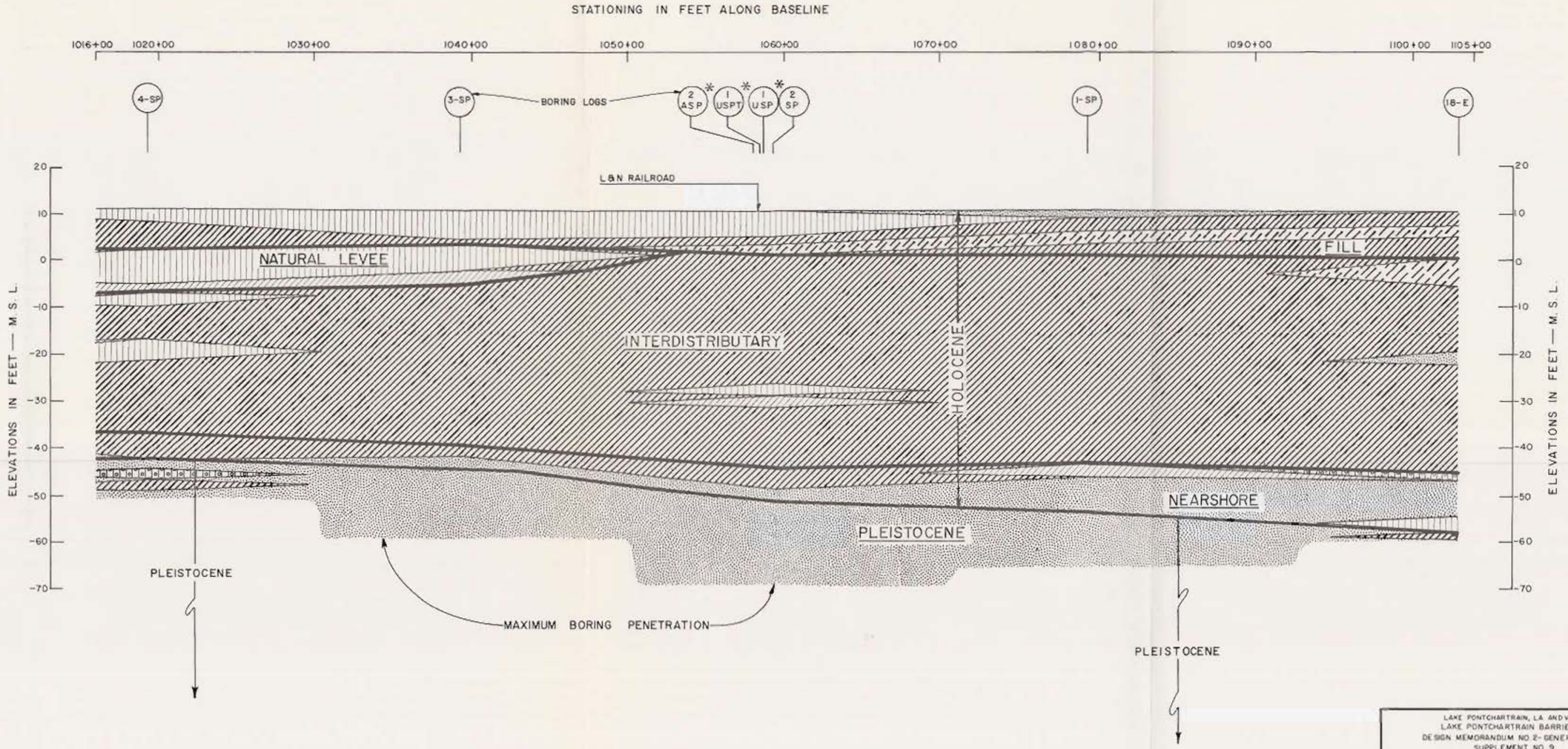


NOTE:
FOR BORING LOCATIONS, SEE PLATE 4.
FOR BORING LOGS, SEE PLATES 10 & 11.
FOR LEGEND SEE PLATE 36.

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2-GENERAL DESIGN
SUPPLEMENT NO 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SOIL AND GEOLOGIC PROFILE
ALONG C/L LEVEE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO H-2-26016



NOTE:

FOR BORING LOCATIONS, SEE PLATES 4 & 5.
FOR BORING LOGS, SEE PLATE 11.
FOR LEGEND SEE PLATE 36.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2- GENERAL DESIGN
SUPPLEMENT NO. 9

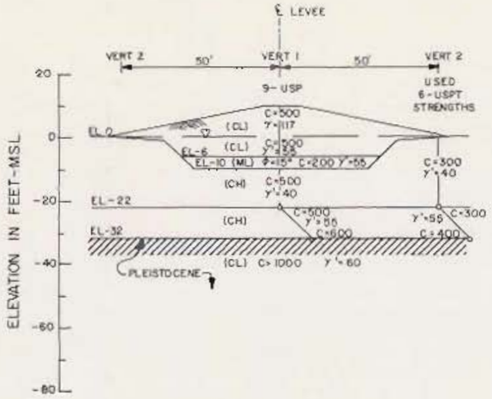
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SOIL AND GEOLOGIC PROFILE
ALONG C/L LEVEE

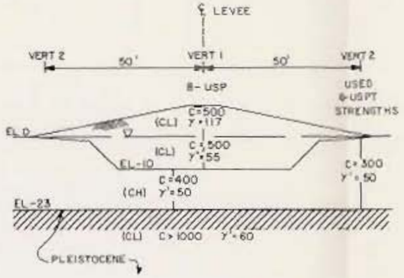
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973

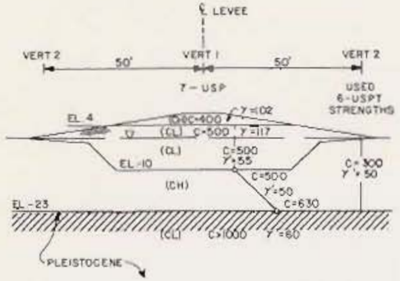
FILE NO. H-2-26016



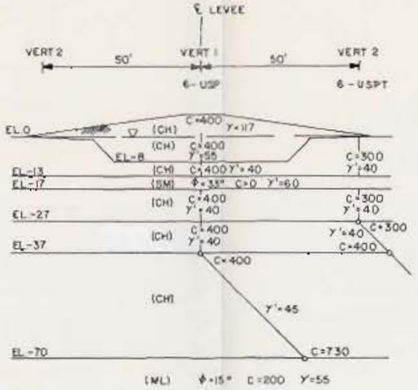
STA. 666+00 TO STA. 687+50
(AT SOUTH POINT)



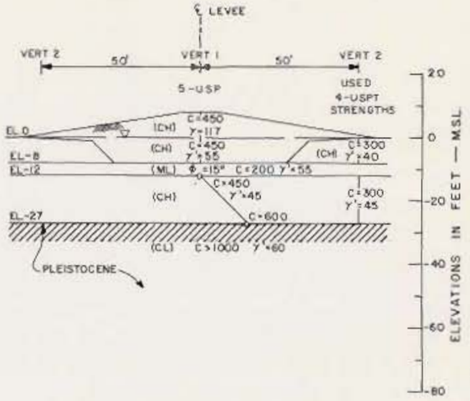
STA. 687+50 TO STA. 715+00



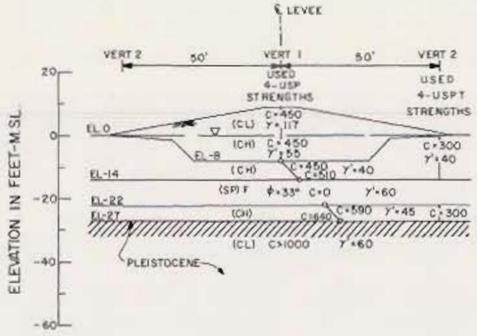
STA. 715+00 TO STA. 747+50



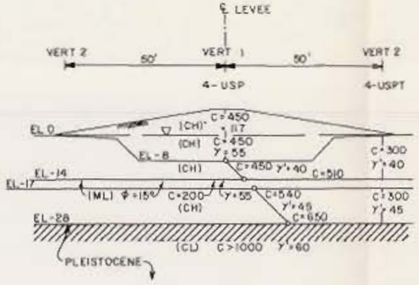
STA. 747+50 TO STA. 770+00



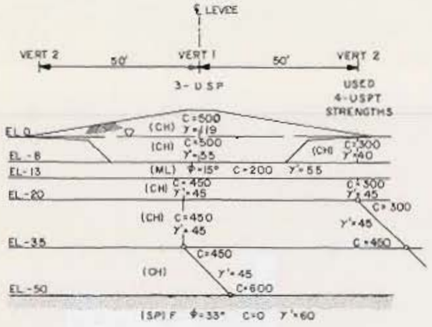
STA. 770+00 TO STA. 830+00



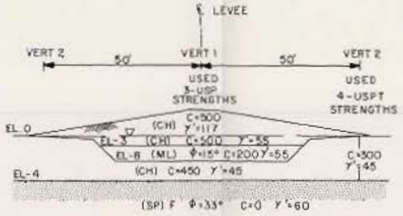
STA. 830+00 TO STA. 882+00



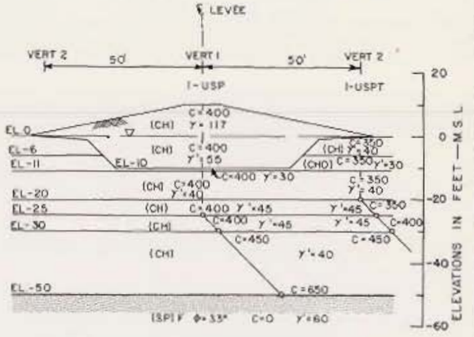
STA. 882+50 TO STA. 910+00



STA. 910+00 TO STA. 945+00



STA. 945+00 TO STA. 965+00



STA. 965+00 TO STA. 1102+98
(AT NEW ORLEANS EAST BACK LEVEE)

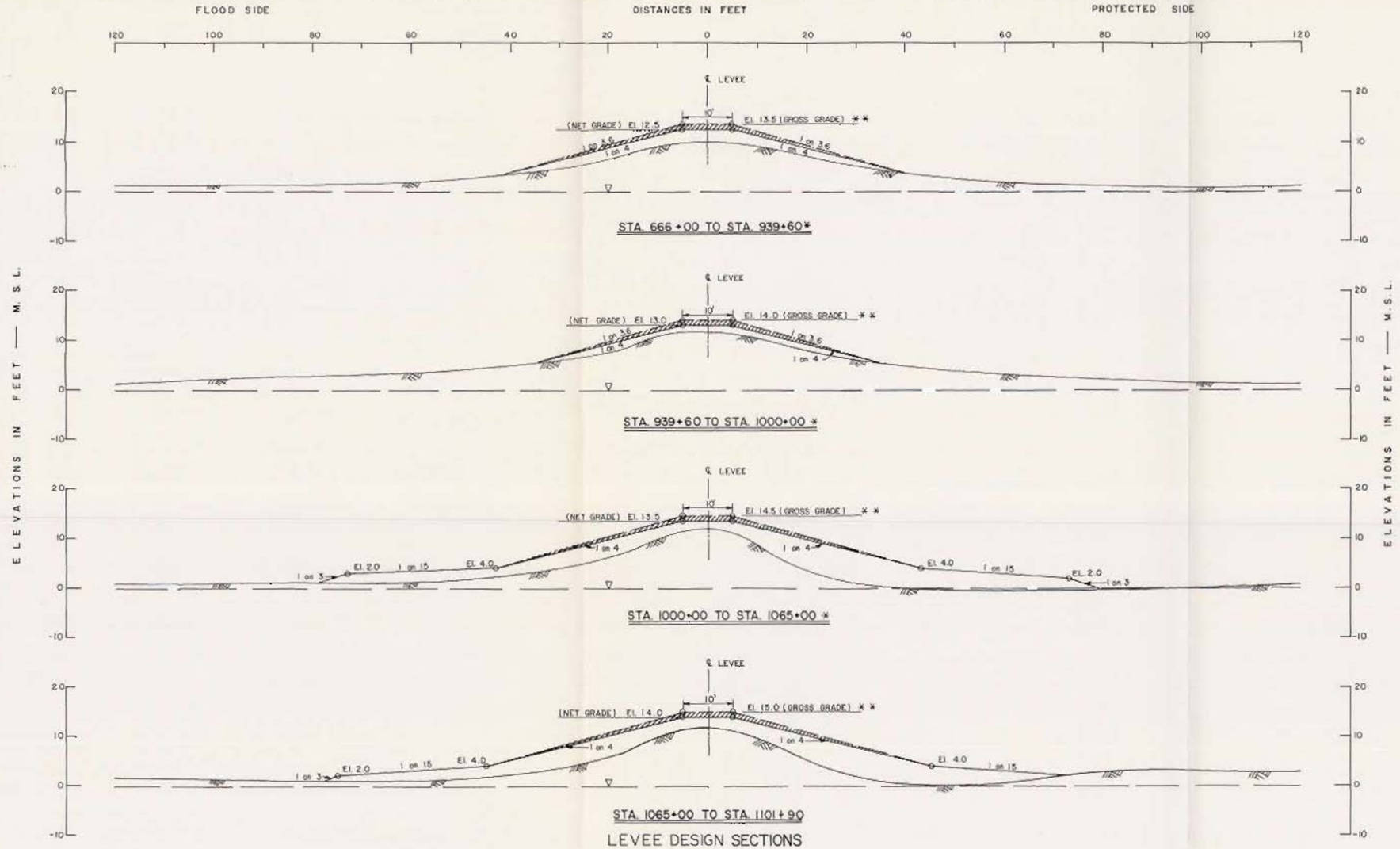
NOTES:

1. THE ABOVE SHEAR STRENGTH TRENDS AND STRATIFICATIONS ARE BASED ON AVAILABLE BORINGS AND TEST DATA WITHIN THE RESPECTIVE REACHES.
2. 1-USP AND 1-USPT ARE UNDISTURBED SOIL BORING DESIGNATIONS.
3. INITIAL DEMUCKED SECTION FURNISHED BY ORLEANS PARISH LEVEE BOARD WAS ADJUSTED TO THAT SHOWN USING THE CURRENT BORING DATA.
4. COHESION OF 400 P.S.F. AND A UNIT WEIGHT OF 117 PCF WAS USED FOR LEVEE FILL MATERIAL ABOVE THE SECTION SHOWN.
5. AN ANGLE OF INTERNAL FRICTION OF $\phi = 0°$ WAS USED, UNLESS SHOWN OTHERWISE.
6. THE LEVEE NET GRADE IS AS FOLLOWS IN M.S.L.:
   A. ELEVATION 12.5 FT. FROM STA. 666+00 TO STA. 939+60.
   B. ELEVATION 13.0 FT. FROM STA. 939+60 TO STA. 1000+00.
   C. ELEVATION 13.5 FT. FROM STA. 1000+00 TO STA. 1065+00.
   D. ELEVATION 14.0 FT. FROM STA. 1065+00 TO STA. 1101+90.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DESIGN (Q) SHEAR STRENGTHS AND SOIL STRATIFICATIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



LEVEE DESIGN SECTIONS

NOTES:

THESE DESIGN SECTIONS ARE APPLICABLE IN THEIR RESPECTIVE REACHES EXCEPTING THE FOLLOWING WHICH WILL BE COVERED SEPARATELY:

* THE CROSSING OF INTERSTATE 10 AND U.S. HWY. 11, STA. 796+50 TO STA. 800+00, STA. 924+50 TO STA. 928+00, THE CROSSING OF U.S. HWY. 90, AND STA. 1052+50 TO STA. 1059+50.

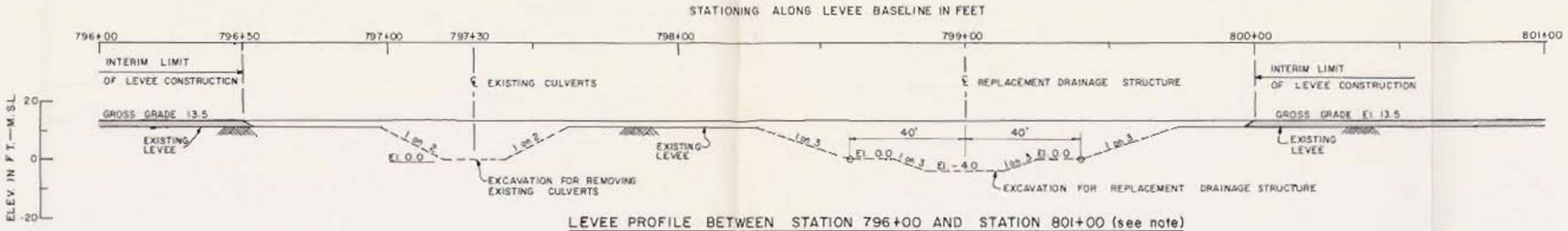
A ROAD IS TO BE CONSTRUCTED ON THE CROWN OF THE LEVEE FROM VICINITY STA. 939+29 TO VICINITY STA. 1101+90 TO PROVIDE ACCESS TO THE CHEF MENTEUR PASS CONTROL AND NAVIGATION STRUCTURES.

**, ** RESULTS OF SETTLEMENT CALCULATIONS INDICATE THAT APPROXIMATELY ONE FOOT OF LONG TERM SETTLEMENT WILL OCCUR SUBSEQUENT TO CONSTRUCTION OF THE LEVEE ENLARGEMENT.

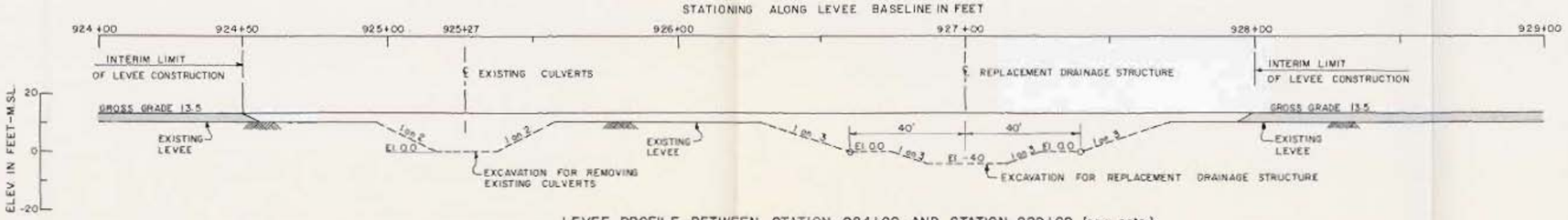
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

LEVEE DESIGN SECTIONS
STA. 666+00 TO STA. 1101+90

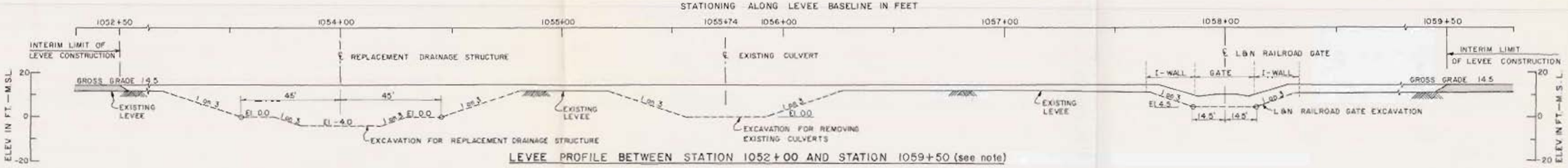
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-25015



LEVEE PROFILE BETWEEN STATION 796+00 AND STATION 801+00 (see note)



LEVEE PROFILE BETWEEN STATION 924+00 AND STATION 929+00 (see note)



LEVEE PROFILE BETWEEN STATION 1052+00 AND STATION 1059+50 (see note)

NOTES: CONSTRUCTION OF THE LEVEE BETWEEN THE FOLLOWING STATIONS WILL BE ACCOMPLISHED AFTER THE REPLACEMENT DRAINAGE STRUCTURES ARE OPERATIVE AND THE EXISTING CULVERTS HAVE BEEN REMOVED:

STA 796+50 TO STA 800+00
STA 924+50 TO STA 928+00
STA 1052+50 TO STA 1059+50

SEE PLATES 48 AND 49 FOR BACKFILL DESIGN GRADES AND SECTIONS AT THE EXISTING CULVERT REMOVAL LOCATIONS.

SCALE IN FEET

20 0 20 40 60 80

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

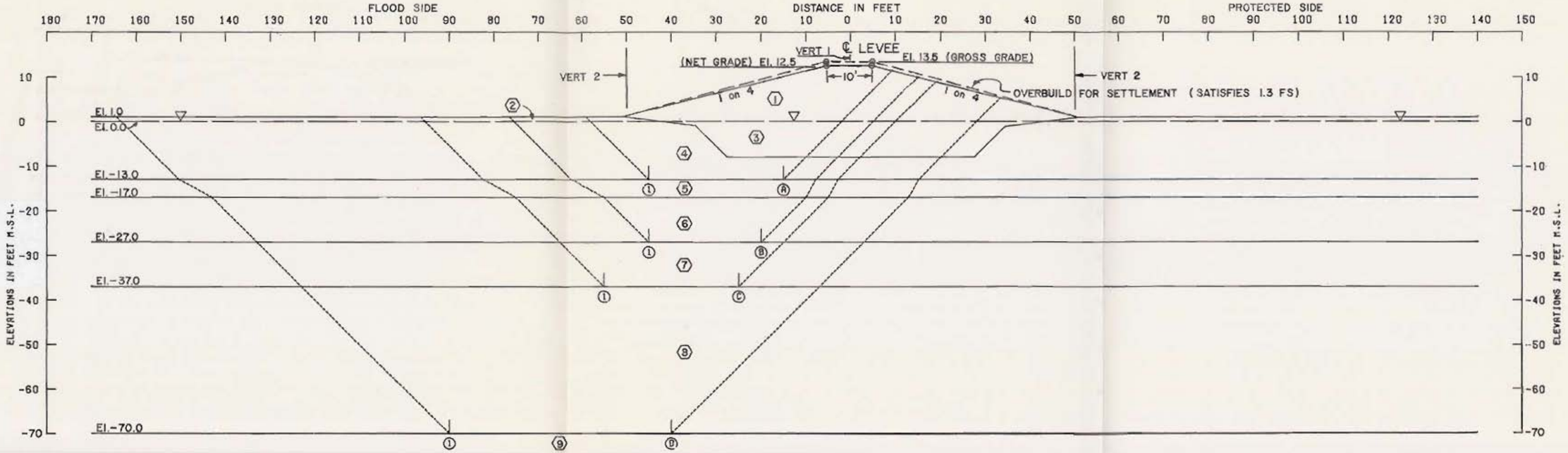
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

LEVEE C/L PROFILES IN THE VICINITY OF THE REPLACEMENT DRAINAGE STRUCTURES AND THE L&N R/R GATE

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

JANUARY 1973

FILE NO. H-2-26016



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 6-USP & 6-USPT DATA PLATES 15 & 16 RESPECTIVELY.

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	117.0	117.0	400.0	400.0	400.0	400.0	0.0
2	CH	102.0	102.0	300.0	300.0	300.0	300.0	0.0
3	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
4	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
5	SM	60.0	60.0	0.0	0.0	0.0	0.0	33.0
6	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
7	CH	40.0	40.0	400.0	350.0	400.0	400.0	0.0
8	CH	45.0	45.0	565.0	565.0	730.0	730.0	0.0
9	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0

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	
A 1	-13.00	19270	10200	8400	30799	5282	37870	25516	1.484
B 1	-27.00	31612	8375	21499	61545	18868	61486	42677	1.441
C 1	-37.00	38037	12000	28499	86836	32959	79535	53878	1.476
D 1	-70.00	72791	36500	85789	190234	112302	175079	77932	2.247

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

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

APPLICABLE BETWEEN STATION 666+00 AND STATION 939+60 (ONLY THE ANALYSIS FOR THE REACH WITH THE LOWEST SHEAR STRENGTH TREND, STATION 747+50 TO STATION 770+00, IS PRESENTED).

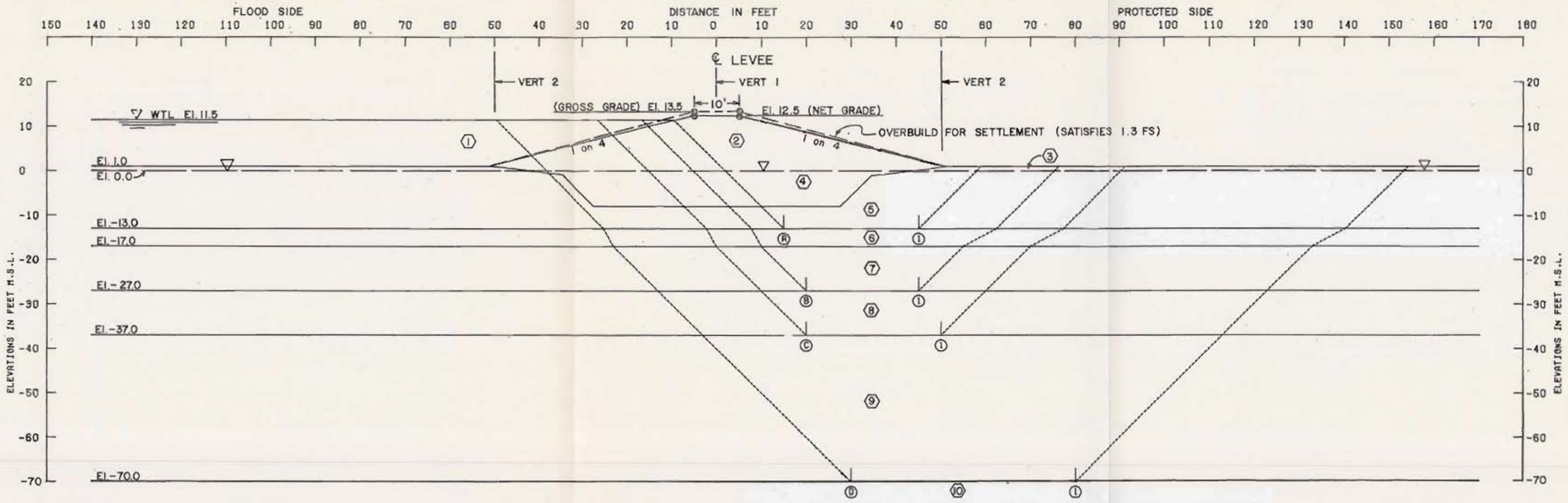
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

LEVEE (Q) SHEAR STABILITY ANALYSIS
FLOOD SIDE
STA. 666+00 TO STA. 939+60

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

JANUARY 1973 FILE NO. H-2-26016



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS, SEE BORING 6-USP & 6-USPT DATA PLATES 15 & 16 RESPECTIVELY.

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	WATER	62.5	62.5	0.0	0.0	0.0	0.0	0.0
2	CH	117.0	117.0	400.0	400.0	400.0	400.0	0.0
3	CH	102.0	102.0	300.0	300.0	300.0	300.0	0.0
4	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
5	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
6	SM	60.0	60.0	0.0	0.0	0.0	0.0	33.0
7	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
8	CH	40.0	40.0	400.0	350.0	400.0	400.0	0.0
9	CH	45.0	45.0	565.0	565.0	730.0	730.0	0.0
10	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0

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	
R 1	-13.00	19270	10200	8400	30800	5282	37870	25518	1.484
B 1	-27.00	31612	8375	21499	61913	18868	61486	43045	1.428
C 1	-37.00	38450	12000	28499	88999	32971	78948	56028	1.409
D 1	-70.00	69313	36500	65789	200405	112302	171601	88103	1.948

APPLICABLE BETWEEN STATION 666+00 AND STATION 939+60 (ONLY THE ANALYSIS FOR THE REACH WITH THE LOWEST SHEAR STRENGTH TREND, STATION 747+50 TO STATION 770+00, IS PRESENTED).

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

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

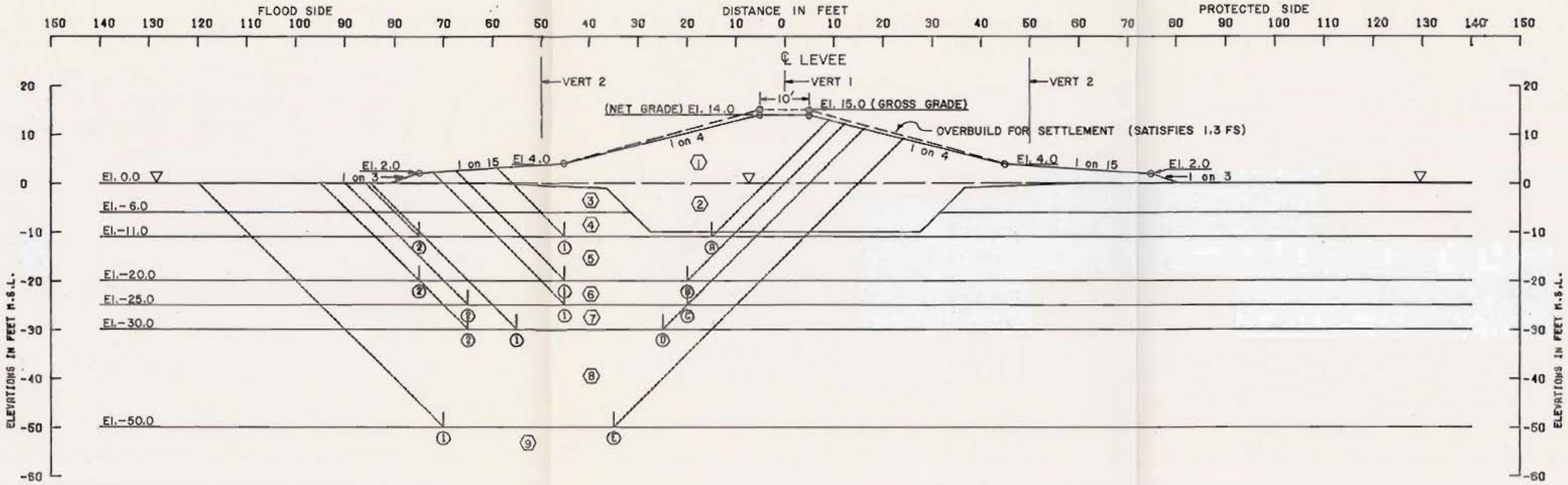
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

LEVEE (Q) SHEAR STABILITY ANALYSIS
PROTECTED SIDE
STA. 666+00 TO STA. 939+60

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

JANUARY 1973 FILE NO. H-2-26016



LEVEE TO BE CONSTRUCTED TO EL. 13.0, EL. 13.5, AND EL. 14.0 (NET GRADES) BETWEEN STA. 939+60 TO STA. 1101+90

HOWEVER, ONLY THE STABILITY OF THE LEVEE TO EL. 14.0 (THE MOST CRITICAL) IS PRESENTED

USING THE LOWEST SHEAR STRENGTH TREND FROM THE REACH STA. 965+00 TO STA. 1101+90.

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 1-USP & 1-USPT DATA PLATES 23 & 22 RESPECTIVELY.

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. CENTER OF STRATUM		C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM		FRICTION ANGLE
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	DEGREES
1	CH	117.0	117.0	400.0	400.0	400.0	400.0	0.0
2	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
3	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
4	CH	30.0	30.0	400.0	350.0	400.0	350.0	0.0
5	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
6	CH	45.0	45.0	400.0	375.0	400.0	400.0	0.0
7	CH	45.0	45.0	425.0	425.0	450.0	450.0	0.0
8	CH	40.0	40.0	550.0	550.0	650.0	650.0	0.0
9	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE 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	-11.00	19171	11100	10212	31053	7662	40483	23391	1.731
A	2	-11.00	19171	21613	7700	31053	2994	48484	28059	1.728
B	1	-20.00	25460	9188	16017	50153	15742	50664	34410	1.472
B	2	-20.00	25460	19700	14000	50153	8123	59160	42030	1.408
C	1	-25.00	28673	10000	19615	62261	21429	58188	40832	1.425
C	2	-25.00	28673	16000	17750	62261	15172	64423	47089	1.368
D	1	-30.00	32923	13500	22000	74279	24152	68423	50127	1.365
D	2	-30.00	32923	18000	22000	74279	20808	72923	53671	1.359
E	1	-50.00	53565	22750	44000	130440	51137	120305	79303	1.517

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

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

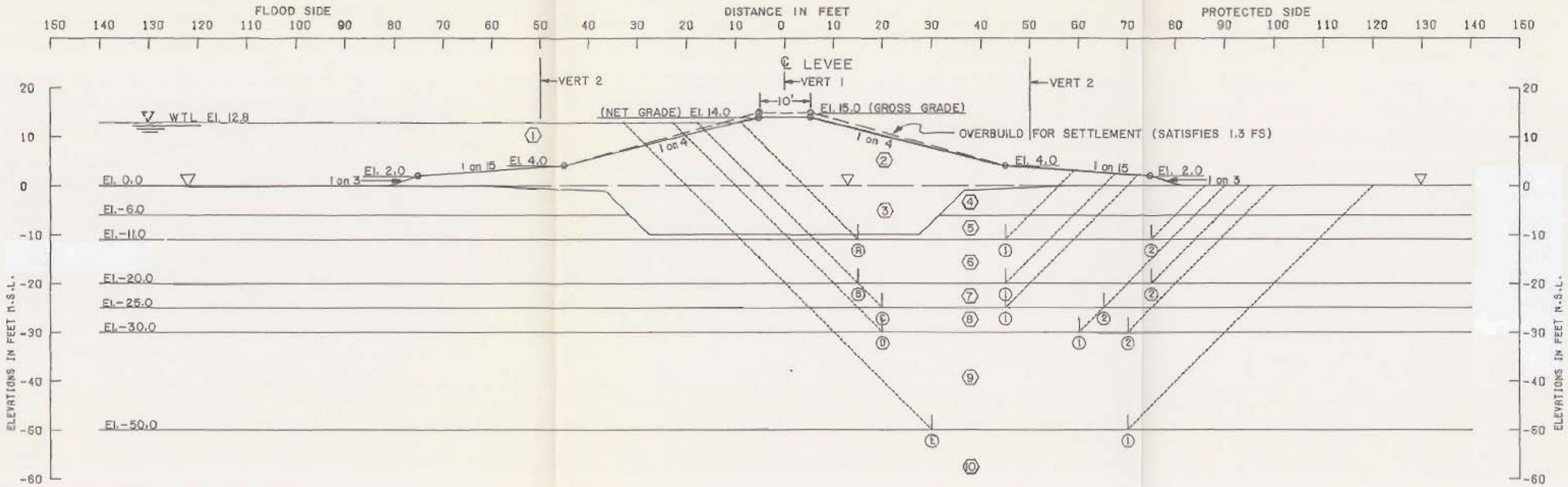
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

LEVEE (Q) SHEAR STABILITY ANALYSIS
FLOOD SIDE

STA. 939+60 TO STA. 1101+90

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

JANUARY 1973 FILE NO. H-2-26016



LEVEE TO BE CONSTRUCTED TO EL. 13.0, EL. 13.5, AND EL. 14.0 (NET GRADES) BETWEEN STA. 939+60 TO STA. 1101+90.
HOWEVER, ONLY THE STABILITY OF THE LEVEE TO EL. 14.0 (THE MOST CRITICAL) IS PRESENTED.
USING THE LOWEST SHEAR STRENGTH TREND FROM THE REACH STA. 965+00 TO STA. 1101+90.

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 1-USP & 1-USPT DATA PLATES 23 & 22 RESPECTIVELY.

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	WATER	62.5	62.5	0.0	0.0	0.0	0.0	0.0
2	CH	117.0	117.0	400.0	400.0	400.0	400.0	0.0
3	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
4	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
5	CH	30.0	30.0	400.0	350.0	400.0	350.0	0.0
6	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
7	CH	45.0	45.0	400.0	375.0	400.0	400.0	0.0
8	CH	45.0	45.0	425.0	425.0	450.0	450.0	0.0
9	CH	40.0	40.0	550.0	550.0	650.0	650.0	0.0
10	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

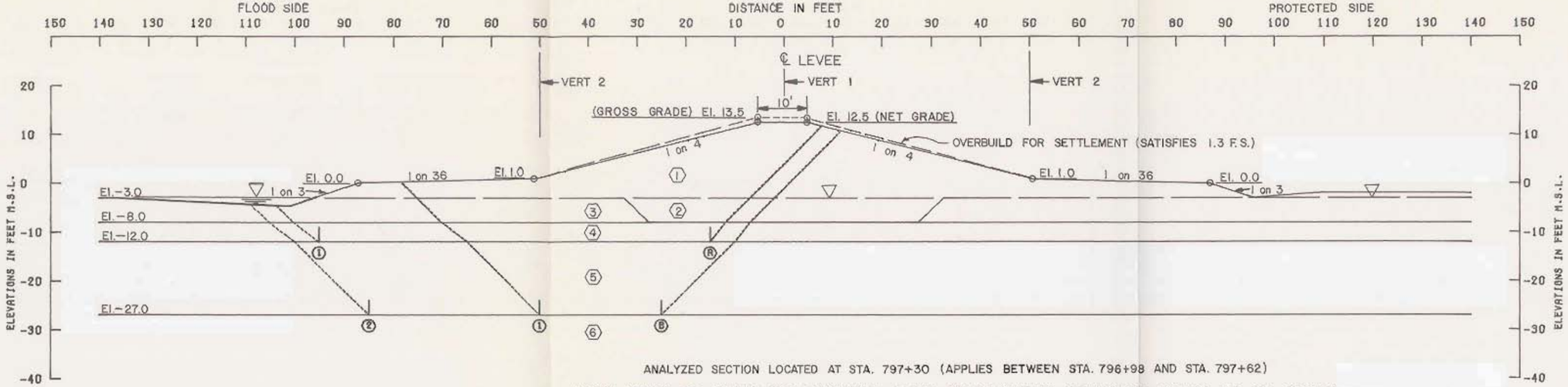
ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_F	D_A	$-D_F$	RESISTING	DRIVING	
A 1	-11.00	19171	11100	10212	31053	7662	40483	23391	1.731
A 2	-11.00	19171	21613	7700	31053	2994	48484	28059	1.728
B 1	-20.00	24760	11100	16017	51087	15742	51877	35345	1.468
B 2	-20.00	24760	21613	14000	51087	8123	60373	42965	1.405
C 1	-25.00	26673	10000	19515	62712	21429	58188	41284	1.409
C 2	-25.00	26673	18000	17750	62712	15172	64423	47540	1.355
D 1	-30.00	32248	18000	22000	76048	22276	72248	53772	1.344
D 2	-30.00	32248	22500	22000	76048	19140	76748	56908	1.349
E 1	-50.00	52698	26000	44000	136378	51137	122698	84241	1.457

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
F -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_F}{D_A - D_F}$$

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
LEVEE (Q) SHEAR STABILITY ANALYSIS
PROTECTED SIDE
STA. 939+60 TO STA. 1101 +90
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



ANALYZED SECTION LOCATED AT STA. 797+30 (APPLIES BETWEEN STA. 796+98 AND STA. 797+62)

DESIGN GRADES AND SLOPES ALSO APPLICABLE AT STA. 925+27 (APPLIES BETWEEN STA. 924+96 AND STA. 925+58)

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 5-USP & 4-USPT DATA PLATES 17 & 19 RESPECTIVELY.

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	117.0	117.0	450.0	450.0	450.0	450.0	0.0
2	CH	55.0	55.0	450.0	450.0	450.0	450.0	0.0
3	CH	40.0	40.0	450.0	300.0	450.0	300.0	0.0
4	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
5	CH	45.0	45.0	525.0	300.0	600.0	300.0	0.0
6	CL	60.0	60.0	1000.0	1000.0	1000.0	1000.0	0.0

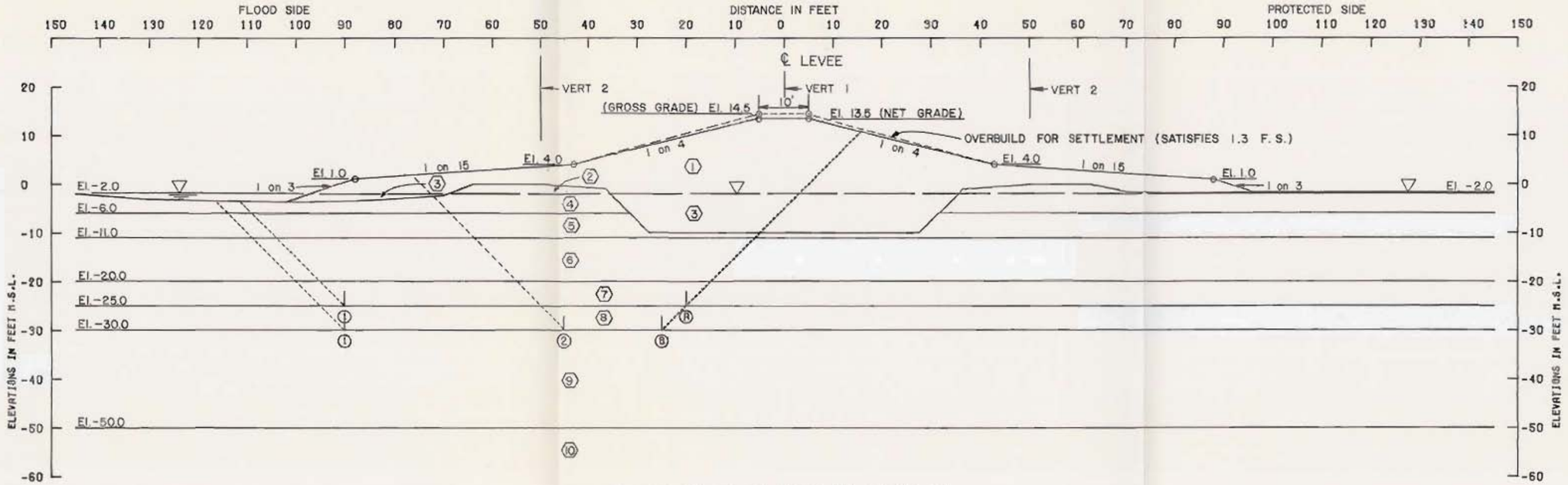
ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A 1	-12.00	22245	27675	4951	30771	1389	54870	29382	1.867
B 1	-27.00	34973	9375	18983	65501	24060	63331	41441	1.528
B 2	-27.00	34973	19675	13977	65501	14792	68624	50710	1.357

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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
LEVEE (Q) SHEAR STABILITY ANALYSIS
FLOOD SIDE-VIC. OF EXISTING CULVERTS
AT STA. 797+30 AND STA. 925+27
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



(APPLIES BETWEEN STA. 1055+21 AND STA. 1056+27)

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS I-USP & I-USPT DATA PLATES 23 & 22 RESPECTIVELY.

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	117.0	117.0	400.0	400.0	400.0	400.0	0.0
2	CH	102.0	102.0	400.0	350.0	400.0	350.0	0.0
3	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
4	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
5	CH	30.0	30.0	400.0	350.0	400.0	350.0	0.0
6	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
7	CH	45.0	45.0	400.0	375.0	400.0	400.0	0.0
8	CH	45.0	45.0	425.0	425.0	450.0	450.0	0.0
9	CH	40.0	40.0	550.0	550.0	650.0	650.0	0.0
10	SP	60.0	60.0	0.0	0.0	0.0	0.0	30.0

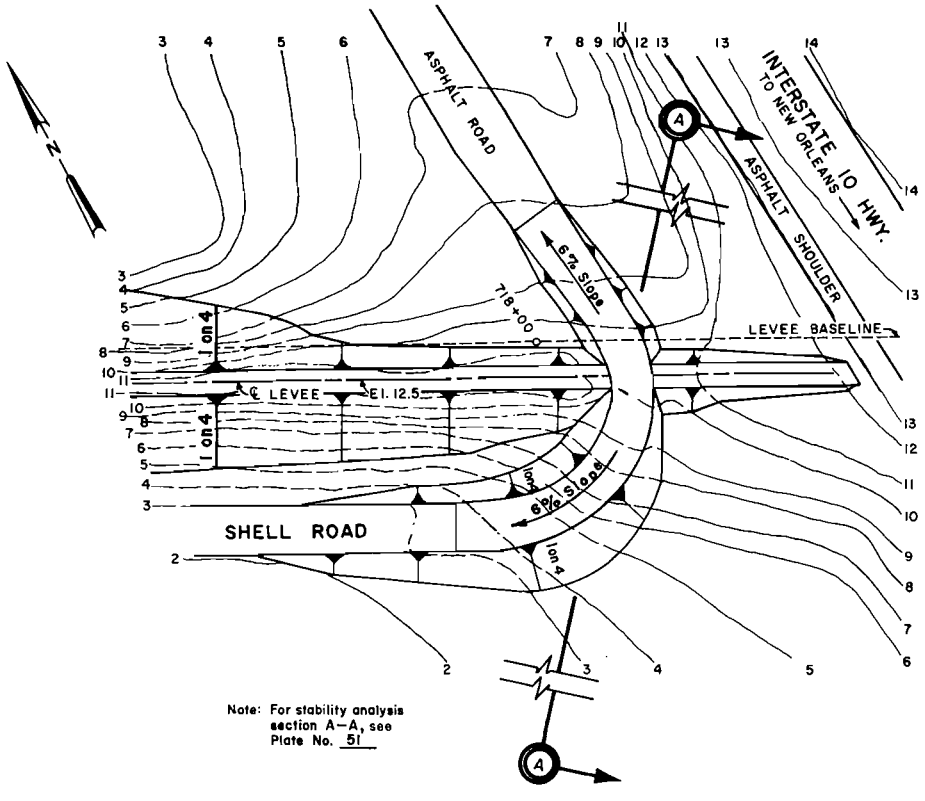
ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A 1	-26.00	28553	28000	15278	63131	10165	71830	52966	1.362
B 1	-30.00	32603	29250	19591	75477	14905	81444	60572	1.345
B 2	-30.00	32603	9000	23650	75477	31380	65253	44097	1.480

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\bar{\gamma}$ -- 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
LEVEE (Q) SHEAR STABILITY ANALYSIS
FLOOD SIDE — VIC. OF EXISTING
CULVERT AT STA. 1055+74
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. M-2-26016



Note: For stability analysis section A—A, see Plate No. 51

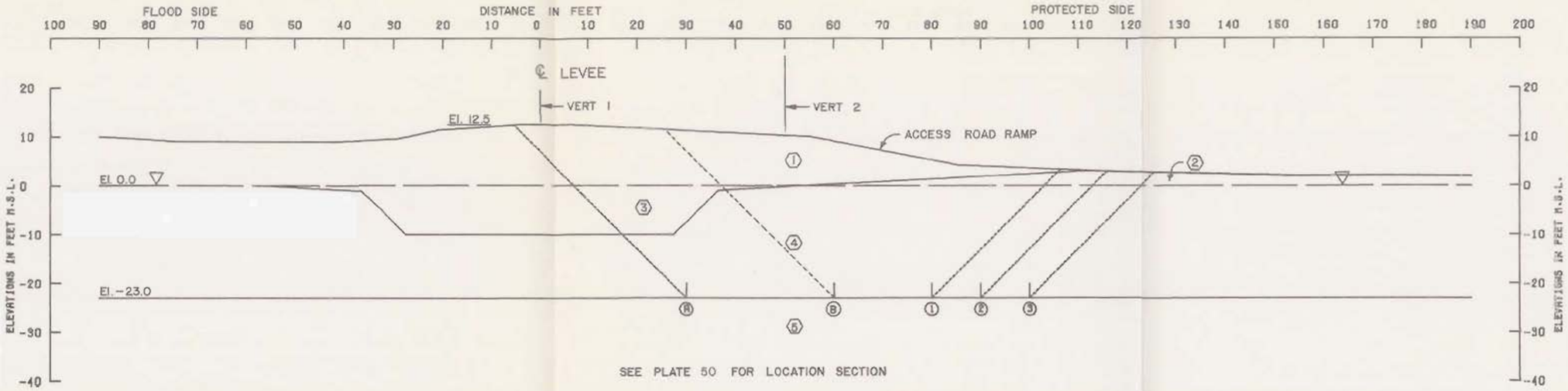
SHELL ROAD DETAIL

NOT TO SCALE

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SHELL ROAD DETAIL

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 7-USP & 6-USPT DATA PLATES 14 & 16 RESPECTIVELY.

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	CL	117.0	117.0	500.0	500.0	500.0	500.0	0.0
2	CH	112.0	112.0	300.0	300.0	300.0	300.0	0.0
3	CL	55.0	55.0	500.0	500.0	500.0	500.0	0.0
4	CH	50.0	50.0	400.0	300.0	400.0	300.0	0.0
5	CL	60.0	60.0	1000.0	1000.0	1000.0	1000.0	0.0

ASSUMED FAILURE SURFACE		REGISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	REGISTING	DRIVING	
Ⓐ ①	-23.00	31649	16400	16040	55029	24416	63969	30613	2.061
Ⓐ ②	-23.00	31649	18400	15556	55029	22833	65605	32197	2.038
Ⓐ ③	-23.00	31649	21400	15410	55029	21665	68458	33364	2.052
Ⓑ ①	-23.00	25735	6000	16040	48155	24416	47775	23739	2.01
Ⓑ ②	-23.00	25735	9000	15556	48155	22833	50291	25322	1.99
Ⓑ ③	-23.00	25735	12000	15410	48155	21665	53145	26490	2.01

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL REGISTING 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

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

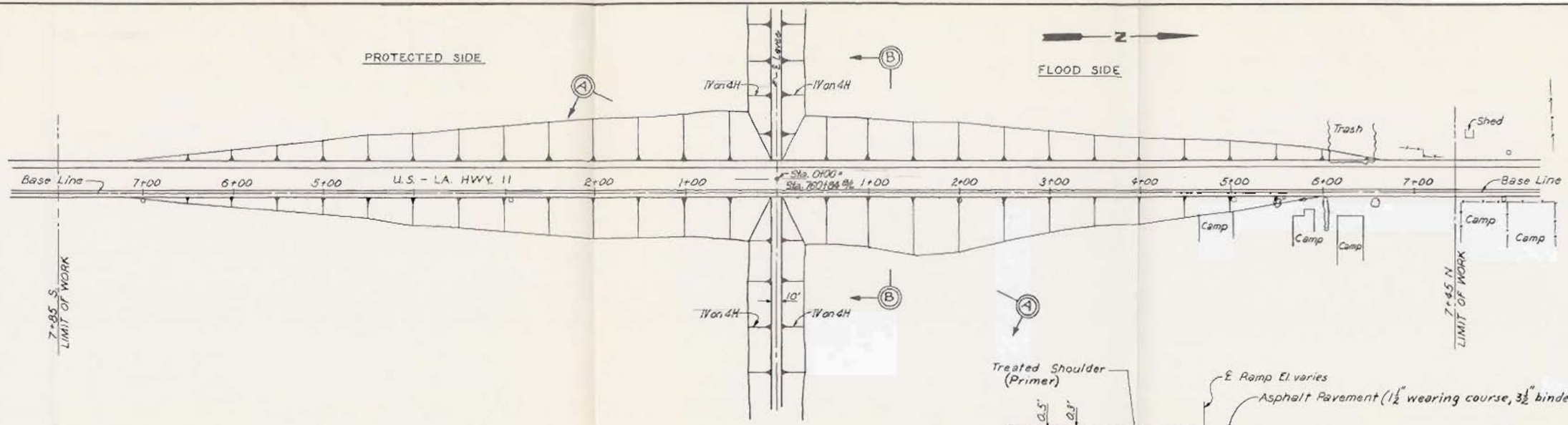
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO.9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SECTION A-A ACROSS ACCESS ROAD RAMP AT INTERSTATE 10
(Q) SHEAR STABILITY

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

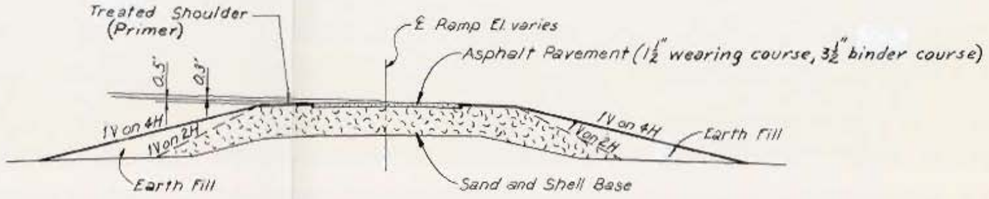
JAN 75 FILE NO. H-2-26018



PLAN

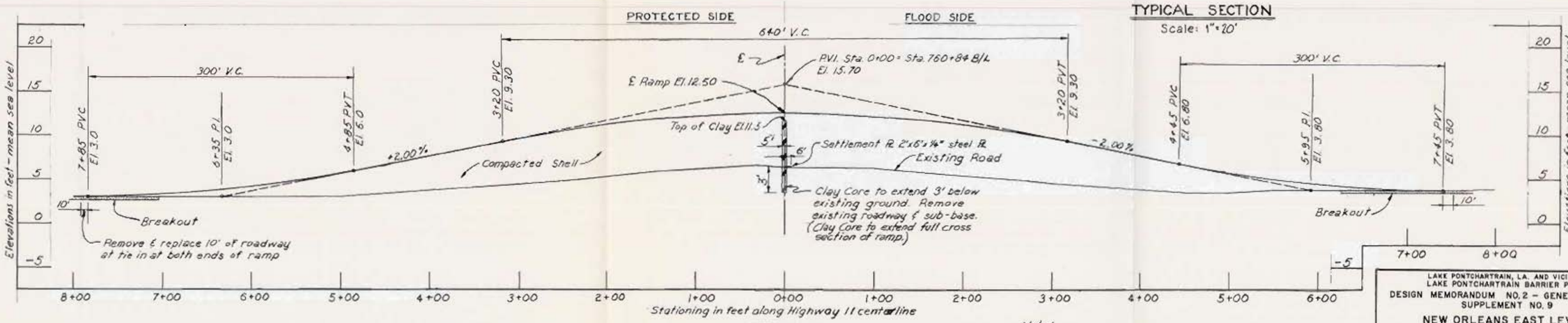
Scale: 1" = 100'

Note:
Design speed 60 M.P.H. ramp constructed by Orleans Levee District.



TYPICAL SECTION

Scale: 1" = 20'



PROFILE

Note:
For stability analysis of sections A-A and B-B see plates 53 and 54 respectively.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9

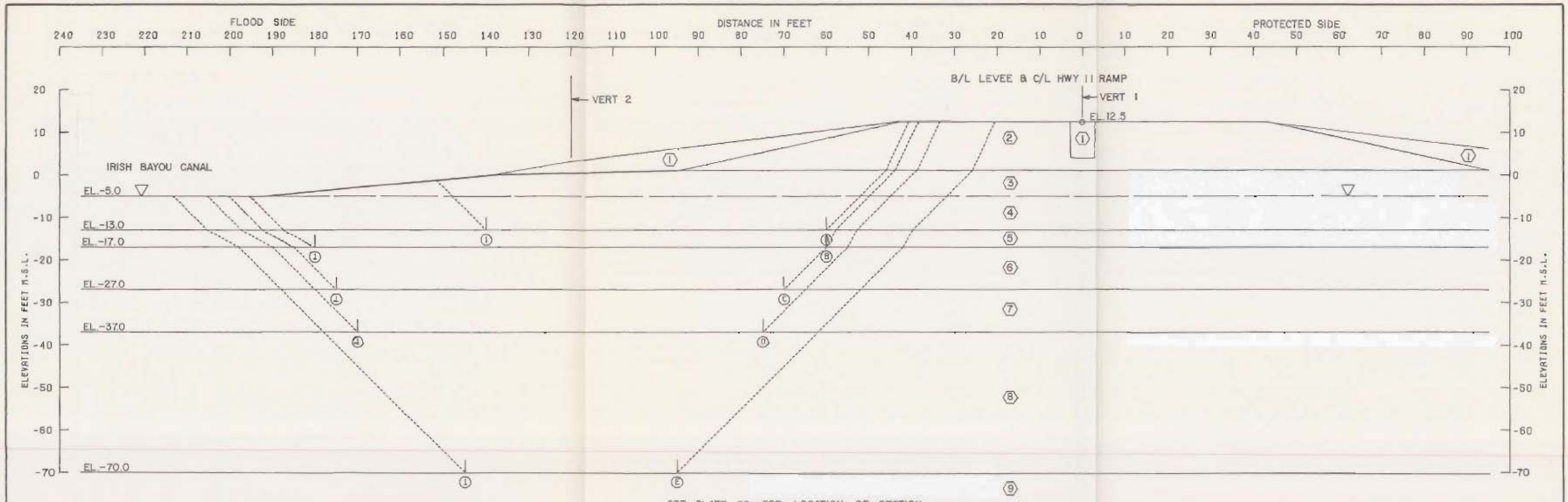
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN AND PROFILE OF
U. S. HIGHWAY 11 RAMP

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

JANUARY 1973

FILE NO. H-2-26016



GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 6-USP & 6-USPT DATA PLATES 15 & 16 RESPECTIVELY.

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	117.0	117.0	400.0	400.0	400.0	400.0	0.0
2	SI	90.0	90.0	0.0	0.0	0.0	0.0	40.0
3	CH	102.0	102.0	400.0	300.0	400.0	300.0	0.0
4	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
5	SM	60.0	60.0	0.0	0.0	0.0	0.0	33.0
6	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
7	CH	40.0	40.0	400.0	350.0	400.0	400.0	0.0
8	CH	45.0	45.0	565.0	565.0	730.0	730.0	0.0
9	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0

ASSUMED FAILURE NO.	ASSUMED 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	-13.00	14466	25500	7037	26988	5678	47023	21310	2.207
B 1	-17.00	20065	37500	9760	35102	3453	67345	31648	2.128
C 1	-27.00	27002	92542	15309	57243	11895	74852	45348	1.651
D 1	-37.00	34751	98000	22033	84086	24511	94784	59575	1.591
E 1	-70.00	72955	96500	59299	200735	102041	168754	98694	1.710

NOTES

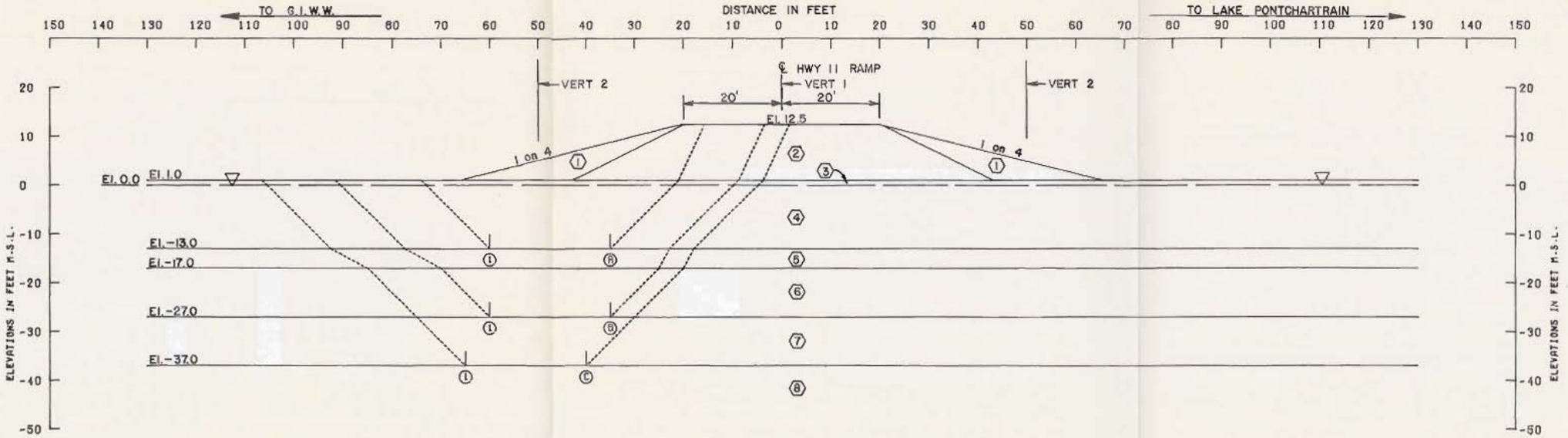
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SECTION A-A AT HWY 11 RAMP
(Q) SHEAR STABILITY

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



SEE PLATE 52 FOR LOCATION OF SECTION

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 6-USP & 6-USPT DATA PLATES 15 & 16 RESPECTIVELY.

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	117.0	117.0	400.0	400.0	400.0	400.0	0.0
2	SI	90.0	90.0	0.0	0.0	0.0	0.0	40.0
3	CH	102.0	102.0	400.0	300.0	400.0	300.0	0.0
4	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
5	SM	60.0	60.0	0.0	0.0	0.0	0.0	33.0
6	CH	40.0	40.0	400.0	300.0	400.0	300.0	0.0
7	CH	40.0	40.0	400.0	350.0	400.0	400.0	0.0
8	CH	45.0	45.0	565.0	565.0	730.0	730.0	0.0

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	
A 1	-13.00	14284	7725	8400	23429	5280	30409	18149	1.675
B 1	-27.00	26519	7725	21499	51408	18866	55942	32542	1.716
C 1	-37.00	34573	10000	28499	75114	32973	73071	42141	1.734

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

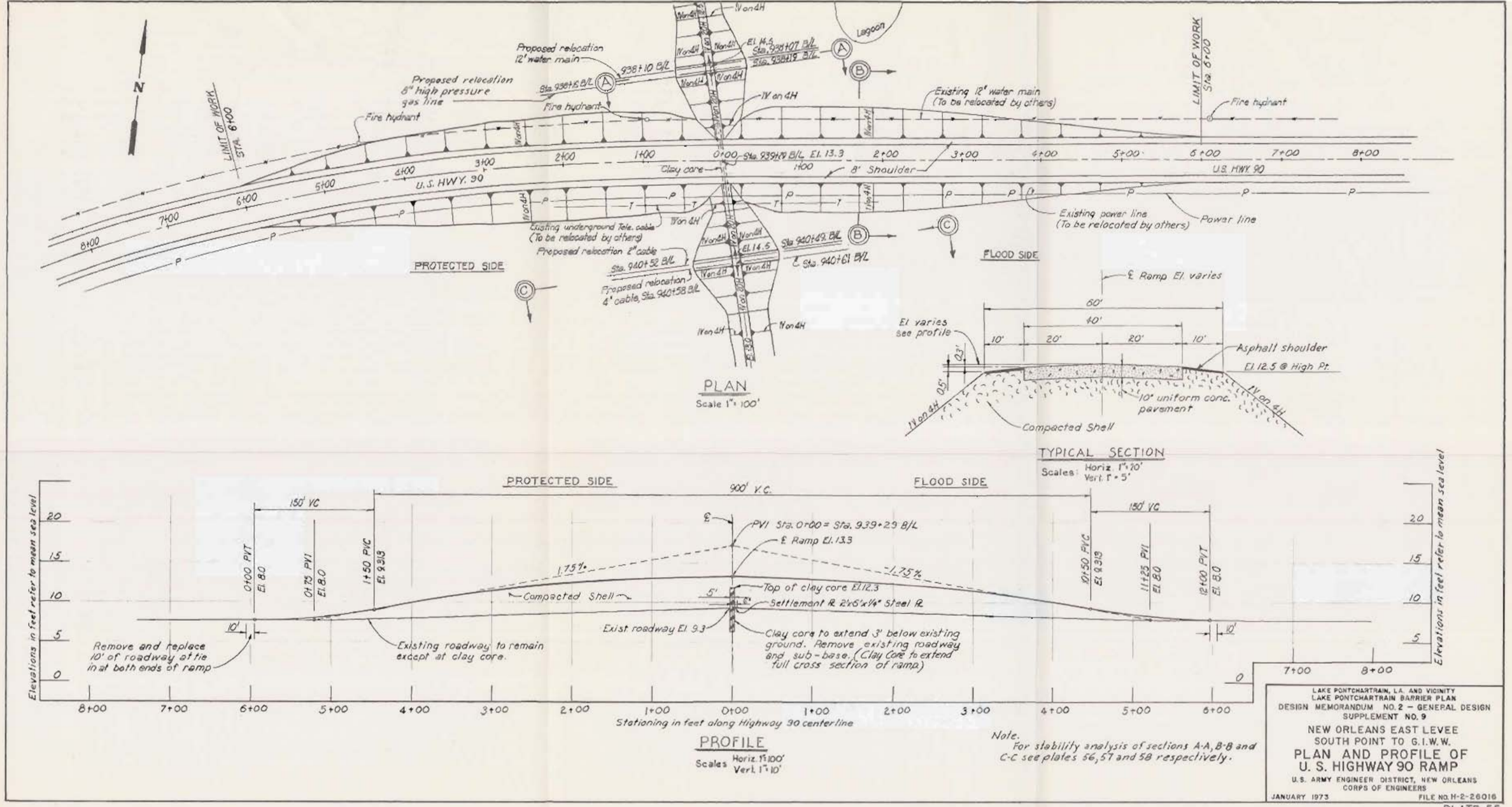
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

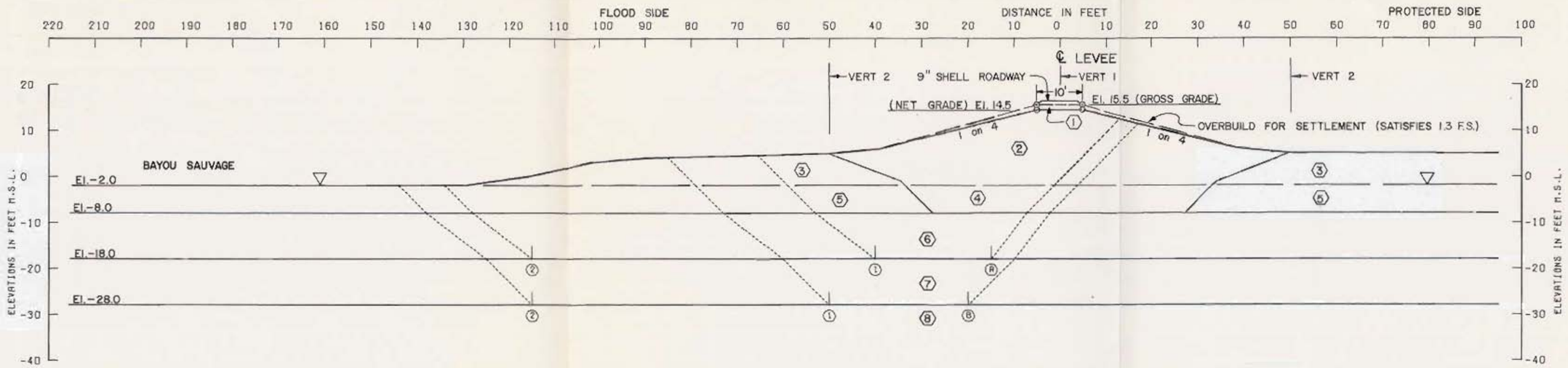
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SECTION B-B AT HWY 11 RAMP

(Q) SHEAR STABILITY

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016


N
LIMIT OF WORK STA. 6+00
Proposed relocation 12" water main
Proposed relocation 8" high pressure gas line
Sta. 938+16 B/L
938+10 B/L
Fire hydrant
1V on 4H
Lagoon
El. 14.5 Sta. 938+07 B/L
Sta. 938+19 B/L
Existing 12" water main (To be relocated by others)
LIMIT OF WORK Sta. 6+00
Sta. 939+29 B/L El. 13.3
Clay core
8' Shoulder
U.S. HWY. 90
U.S. HWY. 90
Existing power line (To be relocated by others)
Power line
Existing underground Tele. cable (To be relocated by others)
Proposed relocation 2" cable Sta. 940+52 B/L
Proposed relocation 4" cable, Sta. 940+58 B/L
Sta. 940+49 B/L
℄ Sta. 940+61 B/L
El. 14.5
PROTECTED SIDE
FLOOD SIDE
PLAN
Scale 1" = 100'
℄ Ramp El. varies
60'
40'
10'
20'
20'
10'
El. varies see profile
0.3'
0.5'
Asphalt shoulder
El. 12.5 @ High Pt.
10" uniform conc. pavement
1V on 4H
Compacted Shell
TYPICAL SECTION
Scales: Horiz. 1" = 20' Vert. 1" = 5'
PROTECTED SIDE
FLOOD SIDE
900' V.C.
150' VC
150' VC
PVI Sta. 0+00 = Sta. 939+29 B/L
℄ Ramp El. 13.3
1.75%
-1.75%
Top of clay core El. 12.3
Compacted Shell
Settlement R. 2"x6"x1/4" Steel R.
Exist. roadway El. 9.3
Clay core to extend 3' below existing ground. Remove existing roadway and sub-base. (Clay Core to extend full cross section of ramp)
Existing roadway to remain except at clay core.
Remove and replace 10' of roadway at tie in at both ends of ramp
0+00 PVT El. 8.0
0+75 PVI El. 8.0
1+50 PVC El. 9.313
10+50 PVC El. 9.313
11+25 PVI El. 8.0
12+00 PVT El. 8.0
Elevations in feet refer to mean sea level
Stationing in feet along Highway 90 centerline
PROFILE
Scales Horiz. 1" = 100' Vert. 1" = 10'
Note.
For stability analysis of sections A-A, B-B and C-C see plates 56, 57 and 58 respectively.
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
PLAN AND PROFILE OF
U. S. HIGHWAY 90 RAMP
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



SEE PLATE 55 FOR LOCATION OF SECTION

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. *

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. CENTER OF STRATUM		C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM		FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	SI	90.0	90.0	0.0	0.0	0.0	0.0	40.0
2	CH	117.0	117.0	500.0	500.0	500.0	500.0	0.0
3	CH	102.0	102.0	450.0	300.0	450.0	300.0	0.0
4	CH	55.0	55.0	500.0	500.0	500.0	500.0	0.0
5	CH	40.0	40.0	450.0	300.0	450.0	300.0	0.0
6	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
7	CH	45.0	45.0	450.0	450.0	450.0	450.0	0.0
8	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

* USED STRENGTHS IN ACCORDANCE WITH THE REACH BETWEEN STATION 910+00 AND STATION 945+00 AS SHOWN ON PLATE 41. HOWEVER, THE STRATIFICATION WAS ADJUSTED IN ACCORDANCE WITH BORING NO. 8-SP.

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	R_B	R_F	DRIVING FORCES D_A	$-D_F$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A	1	-18.00	33220	11250	21794	51422	20100	66265	31322	2.116
A	2	-18.00	33220	45000	13273	51422	7134	91494	44288	2.066
B	1	-28.00	41850	13500	29774	78824	35588	85123	43236	1.969
B	2	-28.00	41850	42750	21506	78824	17615	106106	61209	1.734

NOTES

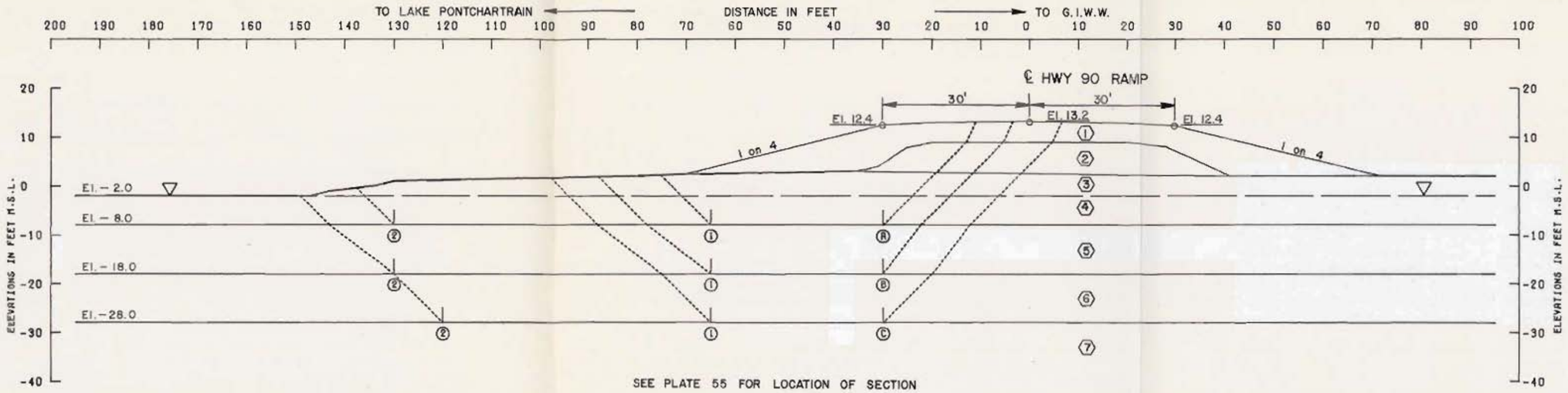
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
F -- AS A SUBSCRIPT, REFERS TO PASSIVE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

$$\text{FACTOR OF SAFETY} = \frac{R_B + R_A + R_F}{D_B - D_F}$$

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W

SECTION A-A at UTILITY RELOCATION RAMP, (Q) SHEAR STABILITY

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-26018



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. *

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	SI	90.0	90.0	0.0	0.0	0.0	0.0	40.0
2	CH	117.0	117.0	500.0	500.0	500.0	500.0	0.0
3	CH	102.0	102.0	450.0	300.0	450.0	300.0	0.0
4	CH	40.0	40.0	450.0	300.0	450.0	300.0	0.0
5	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
6	CH	45.0	45.0	450.0	450.0	450.0	450.0	0.0
7	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

* USED STRENGTHS IN ACCORDANCE WITH THE REACH BETWEEN STATION 910+00 AND STATION 945+00 AS SHOWN ON PLATE 41. HOWEVER, THE STRATIFICATION WAS ADJUSTED IN ACCORDANCE WITH BORING NO. 8-SP.

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	
A	1	-8.00	14901	11881	6115	20991	4823	32698	16368	1.998
A	2	-8.00	14901	31200	4560	20991	2268	50661	18723	2.706
B	1	-18.00	26736	15750	17930	41775	13677	60415	28096	2.150
B	2	-18.00	26736	45000	13694	41775	7909	85430	33866	2.523
C	1	-28.00	36750	15750	26438	68049	27807	78938	40242	1.962
C	2	-28.00	36750	40500	22694	68049	21219	99944	46831	2.134

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

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

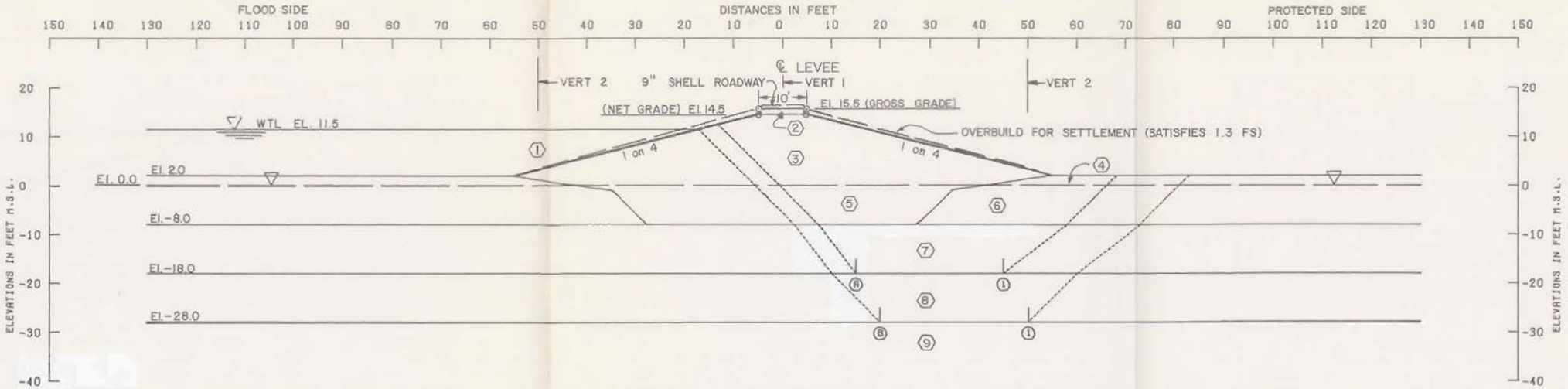
SECTION B-B AT U.S. HWY. 90 RAMP

(Q) SHEAR STABILITY

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

JANUARY 1973

FILE NO. H-2-26016



SEE PLATE 55 FOR LOCATION OF SECTION

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. *

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	WATER	62.5	62.5	0.0	0.0	0.0	0.0	0.0
2	SI	90.0	90.0	0.0	0.0	0.0	0.0	40.0
3	CH	117.0	117.0	500.0	500.0	500.0	500.0	0.0
4	CH	102.0	102.0	450.0	300.0	450.0	300.0	0.0
5	CH	55.0	55.0	500.0	500.0	500.0	500.0	0.0
6	CH	40.0	40.0	450.0	300.0	450.0	300.0	0.0
7	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
8	CH	45.0	45.0	450.0	450.0	450.0	450.0	0.0
9	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

* USED STRENGTHS IN ACCORDANCE WITH THE REACH BETWEEN STATION 910+00 AND STATION 945+00 AS SHOWN ON PLATE 41. HOWEVER, THE STRATIFICATION WAS ADJUSTED IN ACCORDANCE WITH BORING NO. 8-SR.

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	
A	1	-18.00	32714	13500	17659	49322	12344	63873	36978	1.727
B	1	-28.00	41341	13500	25792	75490	24498	80633	50992	1.581

NOTES

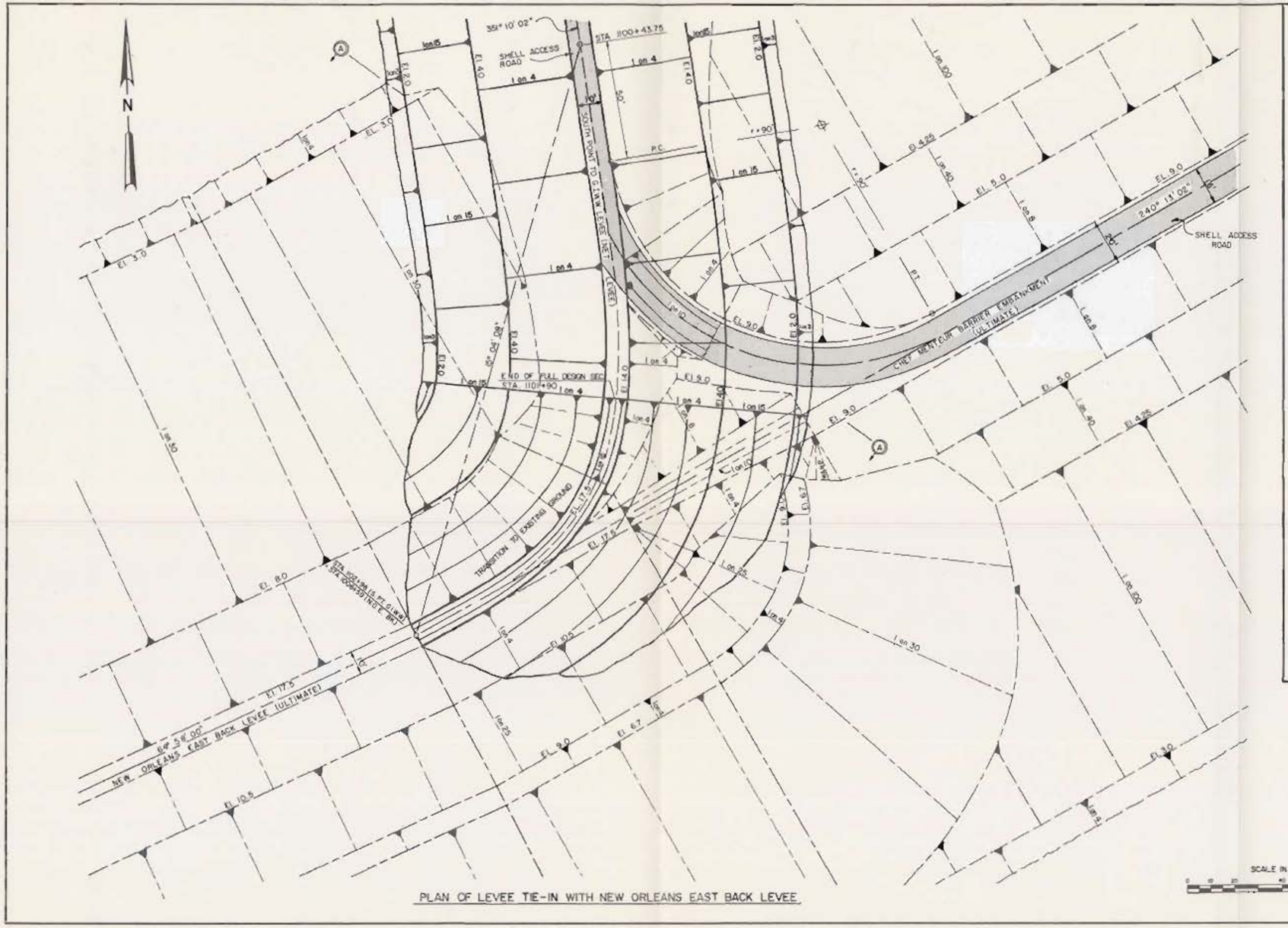
Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

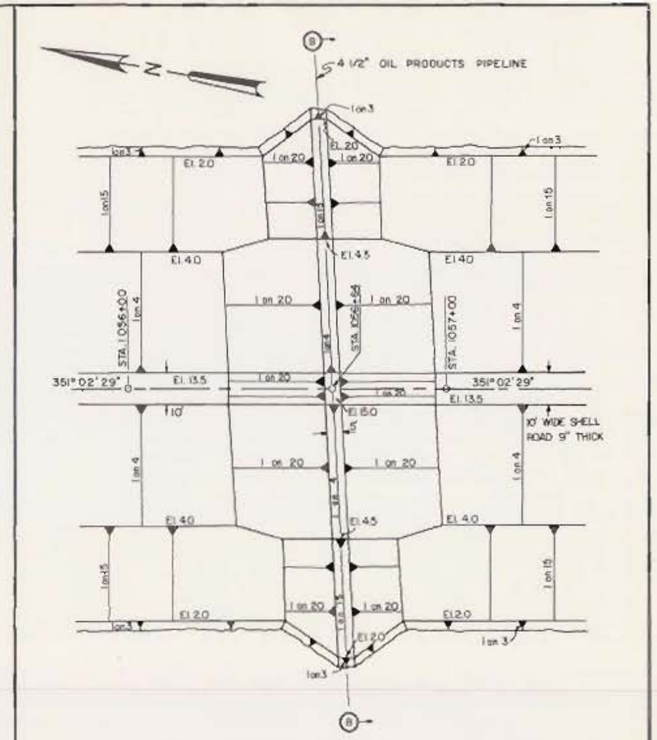
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SECTION C-C at UTILITY RELOCATION RAMP, (Q) SHEAR STABILITY

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



PLAN OF LEVEE TIE-IN WITH NEW ORLEANS EAST BACK LEVEE



PIPELINE RELOCATION VICINITY STA. 1056+64

SCALE IN FEET

NOTES:

SEE PLATE 60 FOR STABILITY ANALYSIS OF SECTION A-A.
SEE PLATE 61 FOR STABILITY ANALYSIS OF SECTION B-B.
ELEVATIONS SHOWN ARE EXPRESSED IN FEET AND REFER TO MEAN SEA LEVEL.

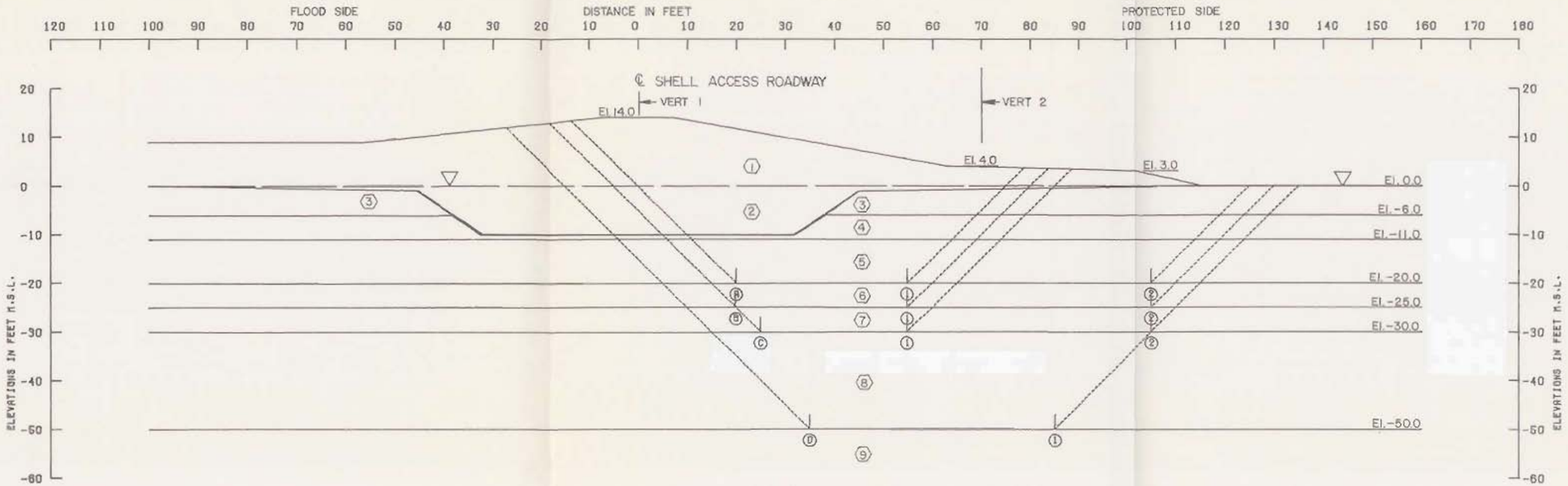
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

LEVEE TIE-IN WITH NEW ORLEANS EAST BACK LEVEE AND CHEF MENTEUR BARRIER EMBANKMENT, PIPELINE RELOCATION VICINITY STA. 1056+64

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

JAN 73 FILE NO. 14-2-26016



SEE PLATE 59 FOR LOCATION OF SECTION

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS I-USP & I-USPT DATA PLATES 23 & 22 RESPECTIVELY.

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	117.0	117.0	400.0	400.0	400.0	400.0	0.0
2	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
3	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
4	CH	30.0	30.0	400.0	350.0	400.0	350.0	0.0
5	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
6	CH	45.0	45.0	400.0	375.0	400.0	400.0	0.0
7	CH	45.0	45.0	425.0	425.0	450.0	450.0	0.0
8	CH	40.0	40.0	550.0	550.0	650.0	650.0	0.0
9	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

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	-20.00	26533	13063	17137	52428	18311	56732	34117	1.663
A	2	-20.00	26533	30843	14000	52428	8771	71176	43657	1.630
B	1	-25.00	30165	14000	20725	65412	24757	64889	40656	1.596
B	2	-25.00	30165	34000	17750	65412	13082	81915	52330	1.565
C	1	-30.00	34415	13500	24775	78371	32242	72689	46129	1.576
C	2	-30.00	34415	36000	22000	78371	18619	92415	58852	1.544
D	1	-50.00	55826	32500	44000	140287	57943	132326	82344	1.607

NOTES

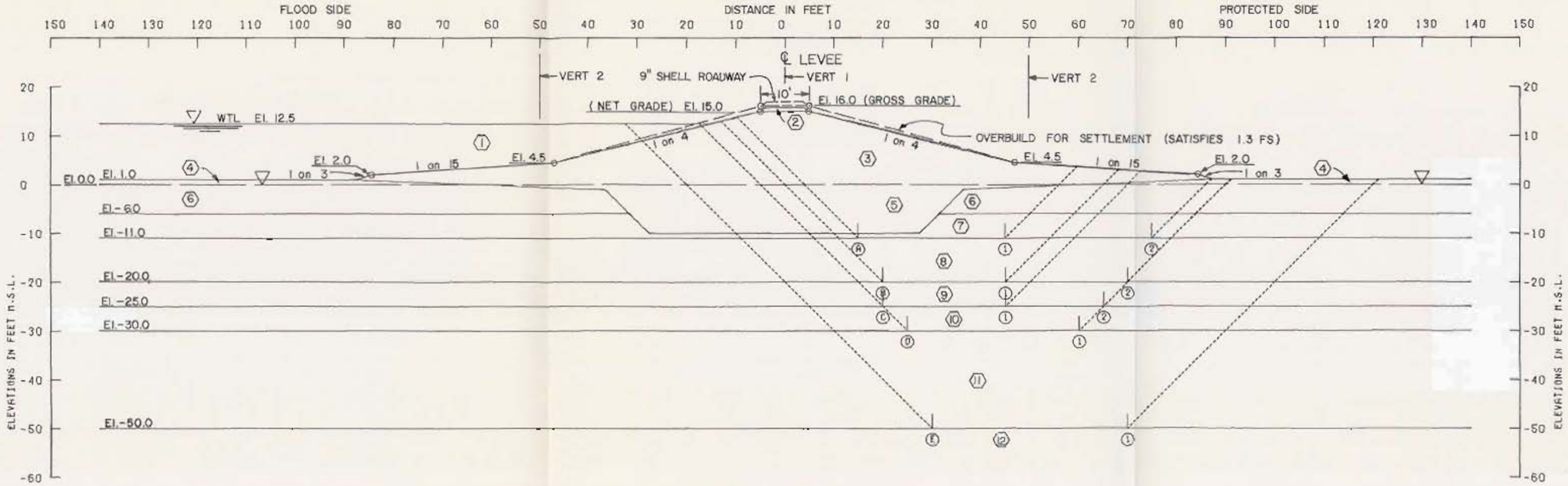
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SECTION A-A AT LEVEE
TIE-IN, (Q) SHEAR STABILITY

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-25014



SEE PLATE 59 FOR LOCATION OF SECTION

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS I-USP & I-USPT DATA PLATES 23 & 22 RESPECTIVELY.

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	WATER	62.5	62.5	0.0	0.0	0.0	0.0	0.0
2	SI	90.0	90.0	0.0	0.0	0.0	0.0	40.0
3	CH	117.0	117.0	400.0	400.0	400.0	400.0	0.0
4	CH	102.0	102.0	400.0	400.0	400.0	400.0	0.0
5	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
6	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
7	CH	30.0	30.0	400.0	350.0	400.0	350.0	0.0
8	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
9	CH	45.0	45.0	400.0	375.0	400.0	375.0	0.0
10	CH	45.0	45.0	425.0	425.0	450.0	450.0	0.0
11	CH	40.0	40.0	550.0	550.0	650.0	650.0	0.0
12	SP	60.0	60.0	0.0	0.0	0.0	0.0	33.0

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	
A 1	-11.00	19811	11100	10671	34556	8729	41582	25827	1.610
A 2	-11.00	19811	21613	8600	34556	5144	50024	29412	1.701
B 1	-20.00	26100	9188	16484	54615	17415	51772	37200	1.392
B 2	-20.00	26100	17950	14800	54615	12290	58850	42325	1.390
C 1	-25.00	29313	9594	19888	67230	23426	53894	43805	1.344
C 2	-25.00	29313	17100	18550	67230	18416	64963	48815	1.331
D 1	-30.00	33563	15750	22800	79834	25876	72113	53958	1.336
E 1	-50.00	53338	26000	44800	141346	57095	124138	84250	1.473

NOTES

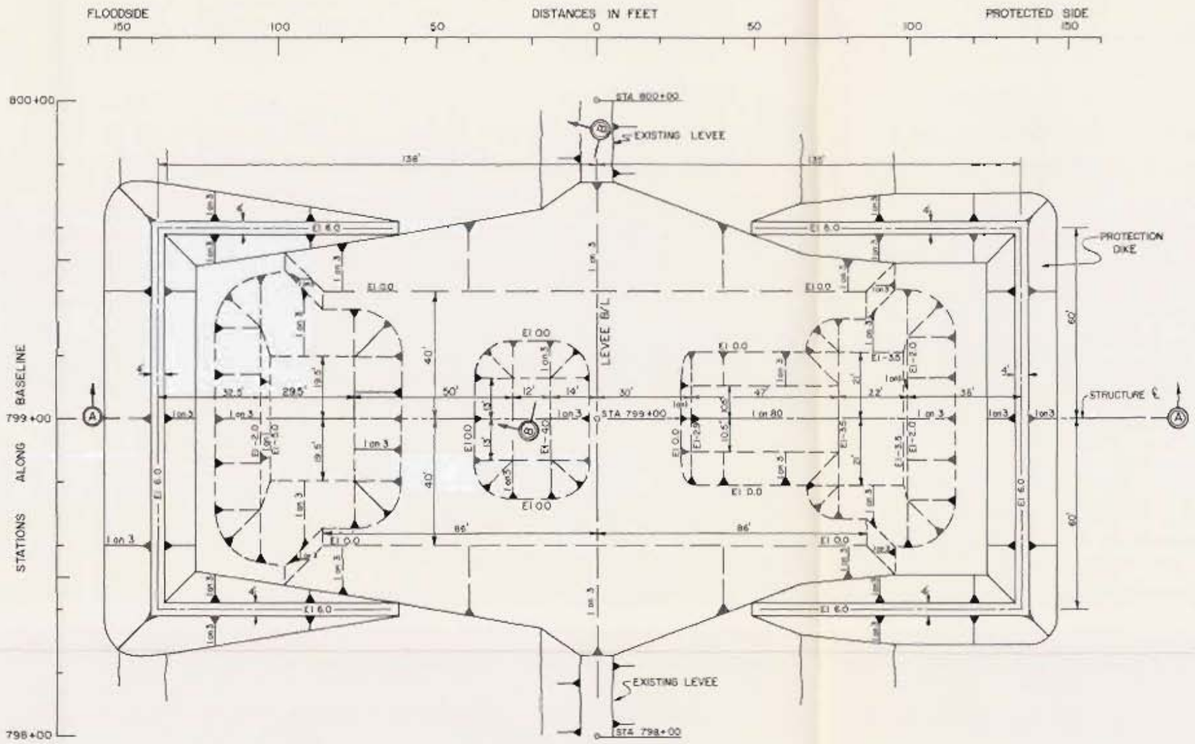
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

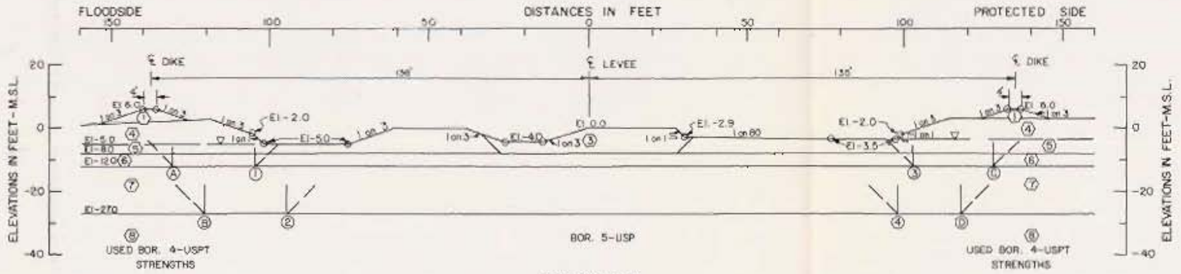
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

SECTION B-B ALONG C/L PIPELINE AT STATION 1056+64 (Q) SHEAR STABILITY

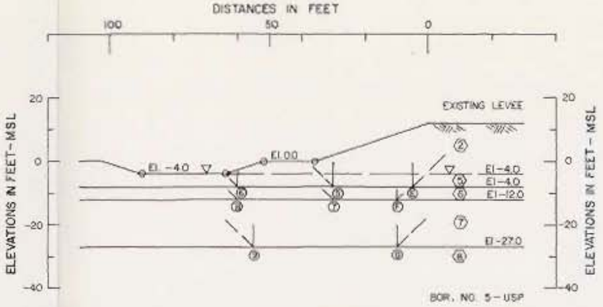
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-25016



PLAN OF EXCAVATION



SECTION A-A



SECTION B-B

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	
SECTION A-A	Ⓐ—①	-12.0	10440	7800	5191	14269	1694	23431	12575	1.86
	Ⓑ—②	-27.0	18945	7800	13883	36538	11705	40628	24833	1.64
	Ⓒ—③	-12.0	10340	7500	5740	13585	1772	23580	11813	2.00
	Ⓓ—④	-27.0	18973	6000	14595	35254	12625	39568	22629	1.75
SECTION B-B	Ⓔ—⑤	-8.0	17550	11248	7200	21287	3918	35998	17369	2.07
	Ⓕ—⑥	-8.0	17550	22625	3600	21287	751	43775	20536	2.13
	Ⓕ—⑦	-12.0	21783	11534	11868	28165	6956	45185	21209	2.13
	Ⓕ—⑧	-12.0	21783	24679	6774	28165	1998	53236	26167	2.03
	Ⓖ—⑨	-27.0	38054	27000	22357	67327	14998	87411	52329	1.67

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. -P.C.F.		C- UNIT COHESION - P.S.F. CENTER OF STRATUM		BOTTOM OF STRATUM		FRICTION
		VERT 1	VERT 2	VERT 1	VERT 2	VERT 1	VERT 2	
①	CH	117	117	300	300	300	300	0
②	CH	117	117	450	450	450	450	0
③	CH	55	55	450	450	450	450	0
④	CH	102	102	450	300	450	300	0
⑤	CH	40	40	450	300	450	300	0
⑥	ML	55	55	200	200	200	200	15
⑦	CH	45	45	525	300	600	300	0
⑧	CL	60	60	1000	1000	1000	1000	0

VERT 1 = BORING 5-USP
VERT 2 = BORING 4-USPT

GENERAL NOTES

EXCAVATED MATERIAL IS TO BE USED TO CONSTRUCT PROTECTION DIKES. STOCKPILE EXCESS MATERIAL BEHIND DIKES, ADJACENT TO LEVEE, TO BE USED FOR STRUCTURE BACKFILL.

SEE PLATE 64 FOR ULTIMATE PLAN AND SECTION.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 9

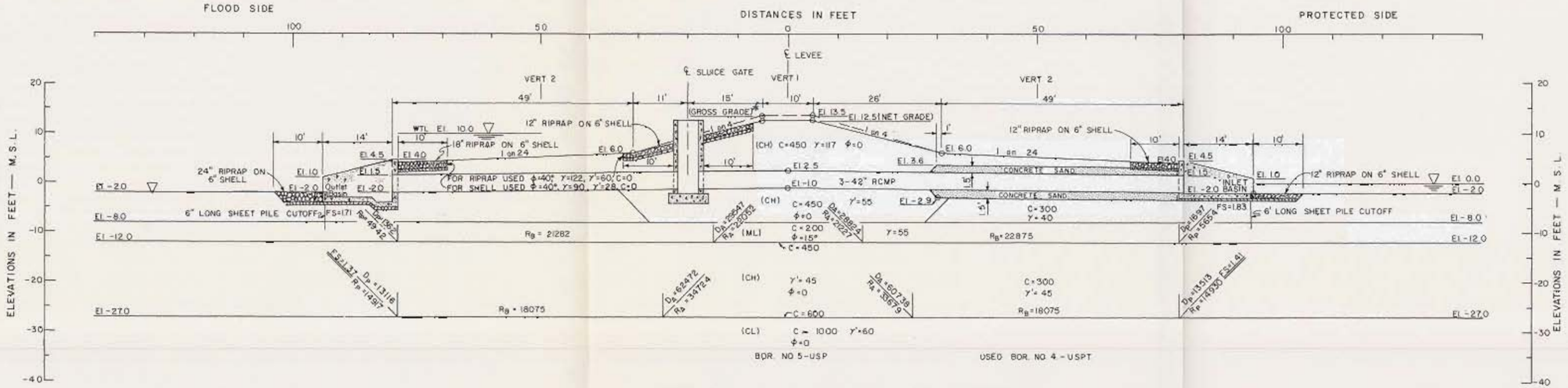
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN OF EXCAVATION
DRAINAGE STRUCTURE VICINITY STA.799+00
AND (Q) SHEAR STABILITY

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

JANUARY 1973

FILE NO. H-2-25016



SECTION THROUGH DRAINAGE STRUCTURE ℄ VIC. STA. 799+00

ANALYSES SHOWN ARE FOR THE LEVEE TO NET GRADE AND DO NOT INCLUDE THE SURCHARGE OF INLET AND OUTLET BASINS.

NOTES:

*MEETS A MINIMUM FACTOR OF SAFETY OF 1.3 INCLUDING THE INLET AND OUTLET BASINS AS A SURCHARGE

FOR DRAINAGE STRUCTURE DETAILS, SEE PLATE 64

FOR EXCAVATION PLAN AND SECTIONS, SEE PLATE 62

FOR DESIGN SHEAR STRENGTHS, SEE PLATE 41

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2-GENERAL DESIGN
SUPPLEMENT NO. 9

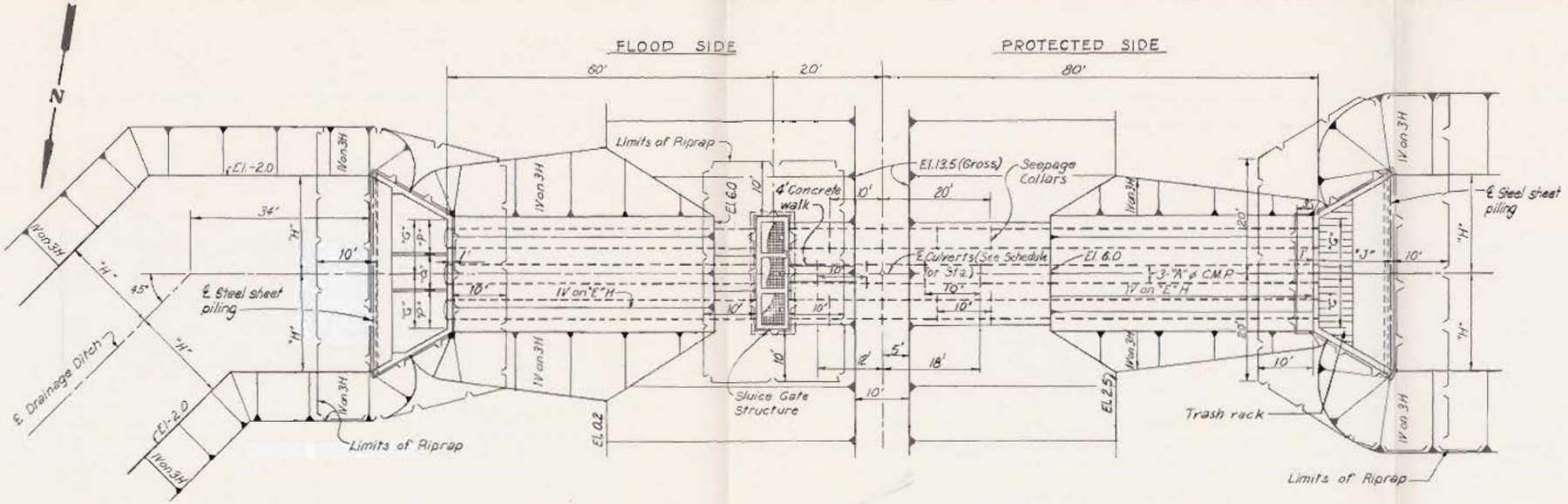
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DRAINAGE STRUCTURE VIC. STA. 799+00

(Q) SHEAR STABILITY

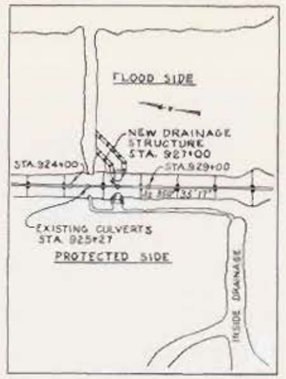
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973 FILE NO. H-2-26016



PLAN

Scale: 1" = 20'

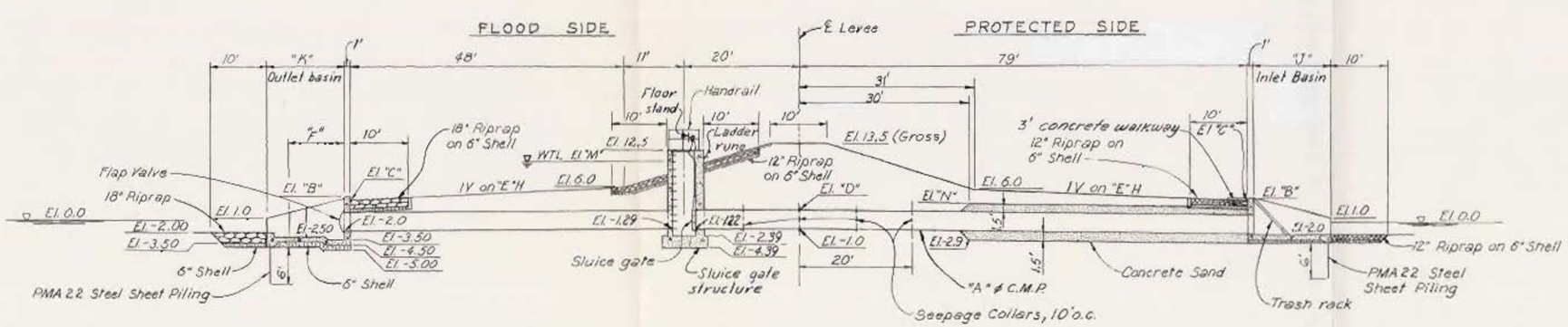


LOCATION MAP

STA. 927+00

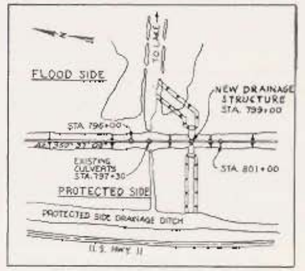
No scale

SCHEDULE														
℄ STATION	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"J"	"K"	"M"	"N"	"P"	"Q"
799+00	42"	4.5	4.0	2.5	24	8'-0"	10'-0"	18'-0"	14'-0"	13'-0"	10.0	3.6	6'-9"	6'-6"
927+00	48"	5.0	4.5	3.0	32	9'-6"	10'-6"	19'-6"	15'-6"	14'-6"	11.5	4.1	7'-0"	7'-0"



SECTION

Scale: 1" = 20'



LOCATION MAP

STA. 799+00

No scale

Note:
Plan and section shown facing increasing stations.
Elevations shown are expressed in feet and refer to mean sea level.

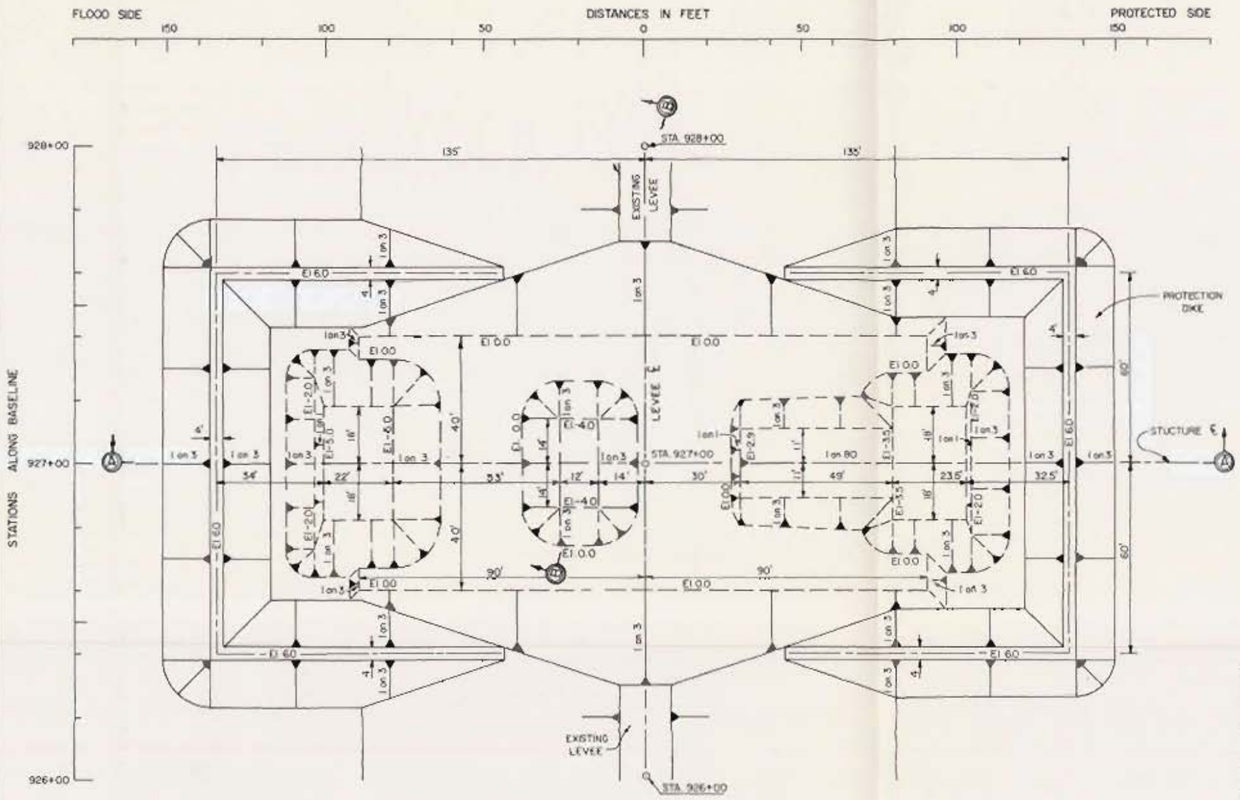
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9

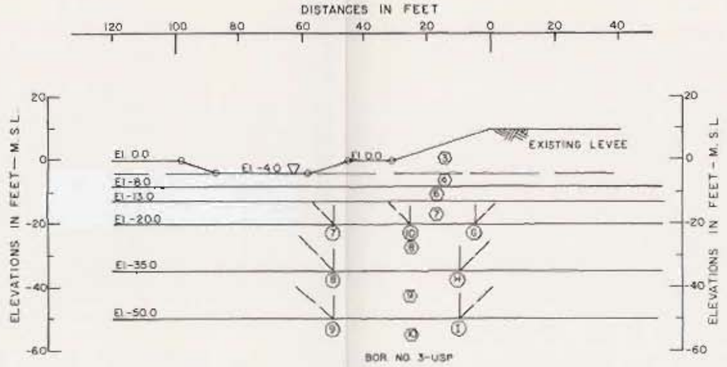
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN AND SECTION OF DRAINAGE STRUCTURES at Sta. 799+00 and Sta. 927+00

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

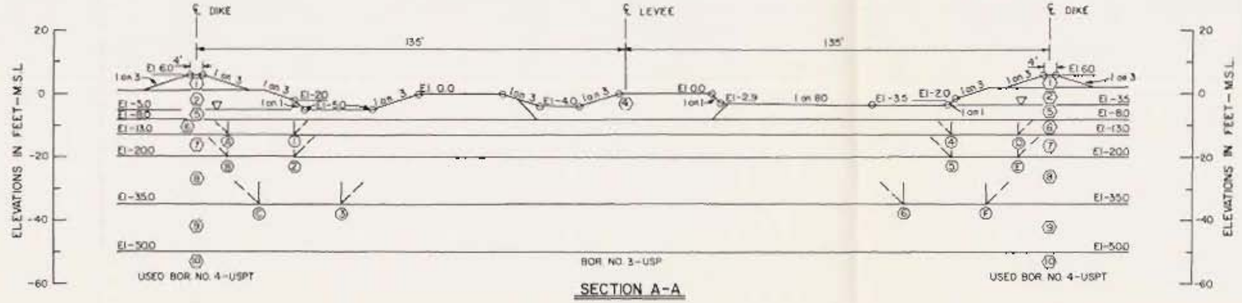
JANUARY 1973 FILE NO. H-2-26016





SECTION B-B

	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
SEC. A-A	(A)	(1)	-13.0	12270	6300	5306	15834	1467	23876	14367	1.66
	(B)	(2)	-20.0	15548	6300	9505	26440	5334	31353	21106	1.49
	(C)	(3)	-35.0	25655	11700	20755	52890	21044	58110	31846	1.82
	(D)	(4)	-13.0	11848	6300	6415	14802	1992	24563	12810	1.92
	(E)	(5)	-20.0	15126	6300	10615	24652	6278	32041	18374	1.74
	(F)	(6)	-35.0	25600	11700	21865	50042	22889	59165	27153	2.18
SEC. B-B	(G)	(7)	-20.0	29938	20250	14164	44004	7940	64352	36064	1.78
	(H)	(8)	-35.0	43438	18000	27654	84373	25155	89092	59218	1.50
	(I)	(9)	-50.0	59188	24000	43404	136283	52491	126592	83792	1.51
	(J)	(10)	-20.0	29938	9000	19432	44004	15863	58370	28141	2.07



SECTION A-A

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	CH	117	117	400	400	400	400	0
2	CH	102	102	300	300	300	300	0
3	CH	117	117	300	500	500	500	0
4	CH	55	55	500	500	500	500	0
5	CH	40	40	300	300	300	300	0
6	ML	55	55	200	200	200	200	15
7	CH	45	45	450	300	450	300	0
8	CH	45	45	450	375	450	450	0
9	CH	45	45	525	525	600	600	0
10	SP	60	60	0	0	0	0	33

VERT 1 = BORING 3-USP
VERT 2 = BORING 4-USPT

NOTES:

EXCAVATED MATERIAL IS TO BE USED TO CONSTRUCT PROTECTION DIKES. STOCKPILE EXCESS MATERIAL BEHIND DIKES, ADJACENT TO LEVEE, TO BE USED FOR STRUCTURE BACKFILL.

SEE PLATE 64 FOR ULTIMATE PLAN AND SECTION. FOR DESIGN SHEAR STRENGTH, SEE PLATE 41

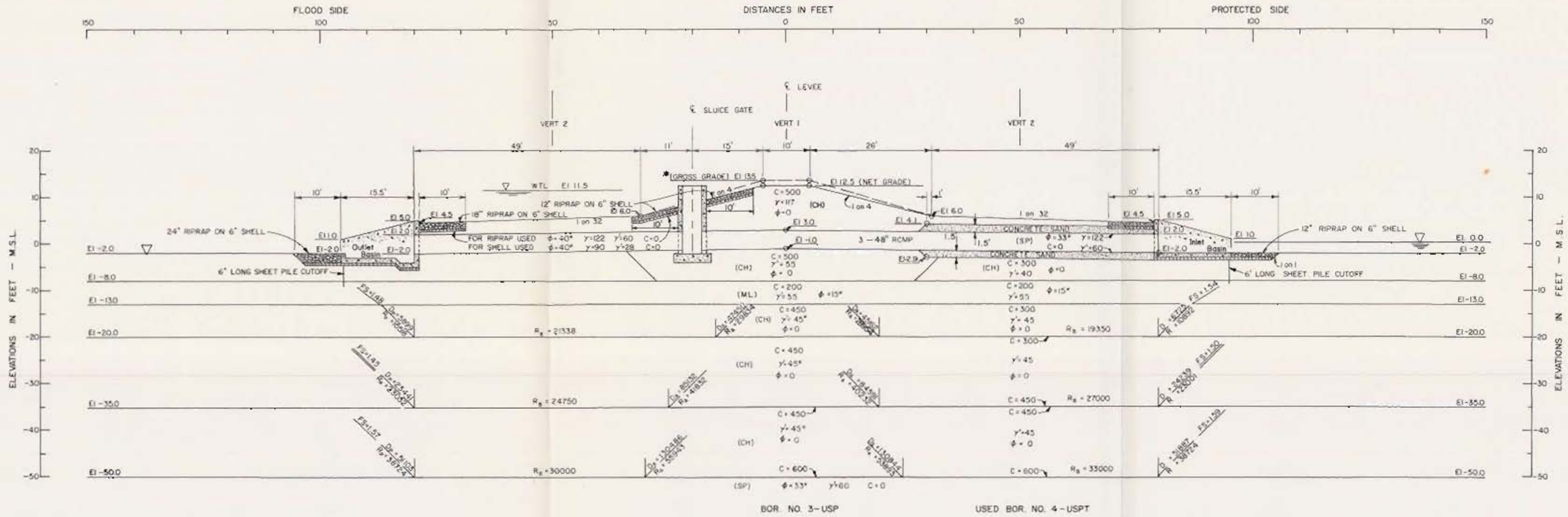
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DRAINAGE STRUCTURE VIC. STA. 927+00
PLAN OF EXCAVATION AND (Q) SHEAR STABILITY

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

JANUARY 1973 FILE NO. H-2-26016



SECTION THROUGH DRAINAGE STRUCTURE ℄ VIC. STA. 927+00

THE ANALYSES SHOWN ARE FOR THE LEVEE TO NET GRADE AND DO NOT INCLUDE THE SURCHARGE OF THE INLET AND OUTLET BASINS.

NOTES:

*MEETS A MINIMUM FACTOR OF SAFETY OF 1.3 INCLUDING INLET AND OUTLET BASINS AS A SURCHARGE.

FOR DRAINAGE STRUCTURE DETAILS, SEE PLATE 64.

FOR EXCAVATION PLAN AND SECTIONS, SEE PLATE 65.

FOR DESIGN SHEAR STRENGTH, SEE PLATE 41

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

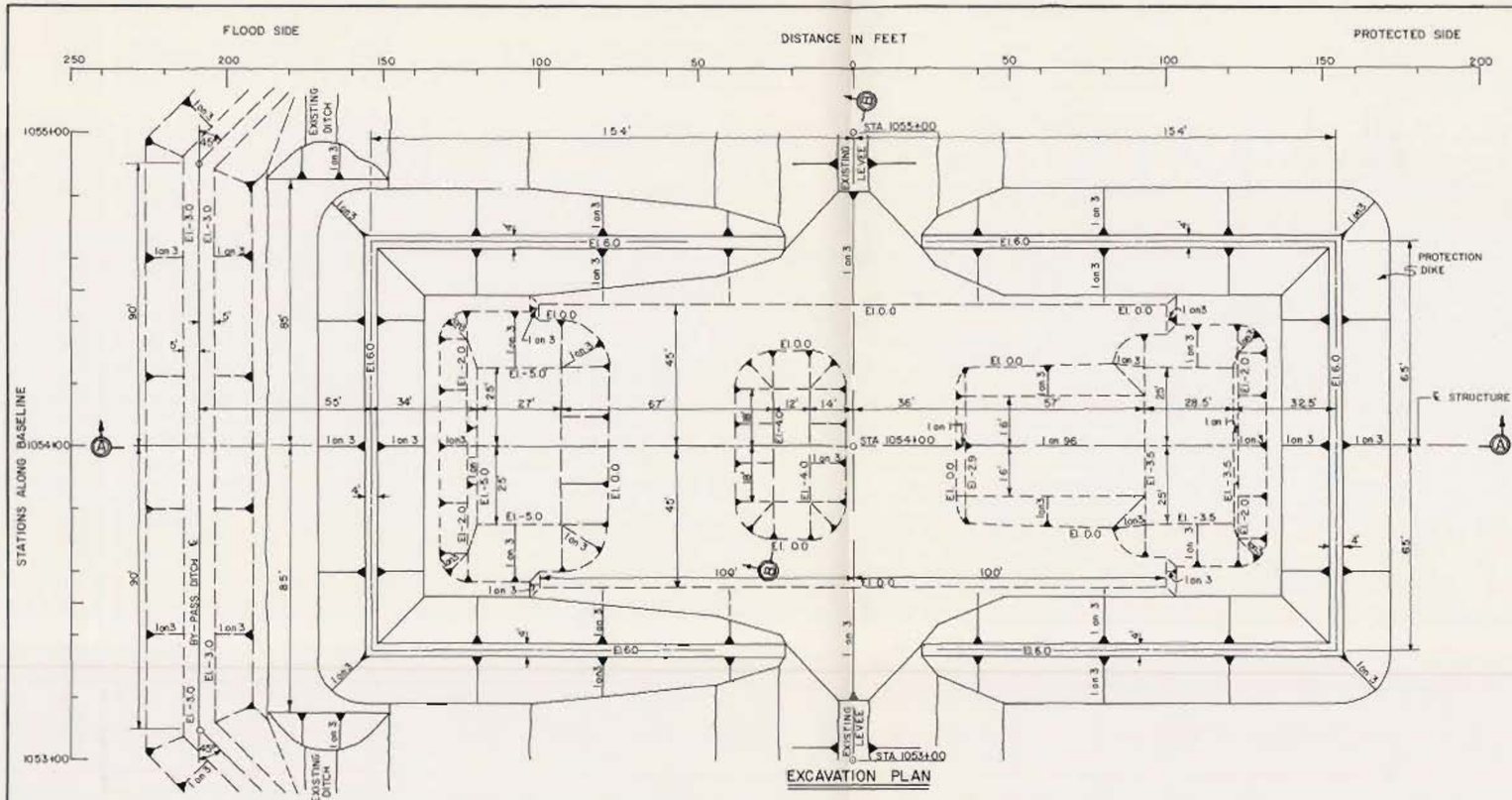
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

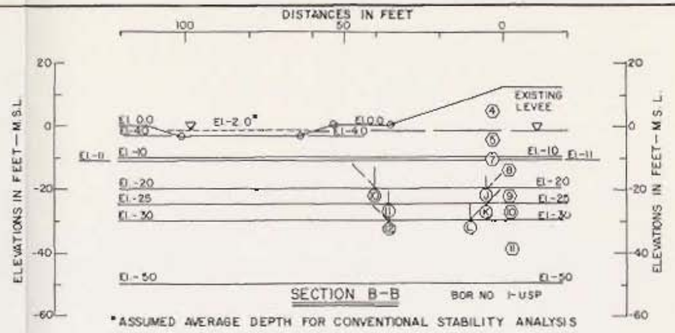
DRAINAGE STRUCTURE VIC. STA. 927+00
(Q) SHEAR STABILITY

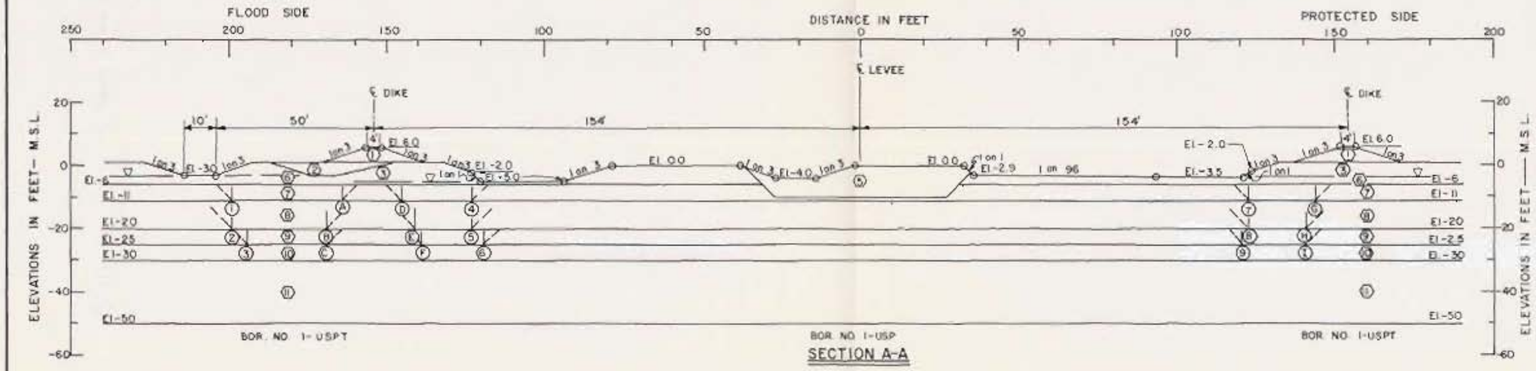
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973

FILE NO. H-2-26016







STRATUM NO.	SOIL TYPE	EFFECTIVE VERT 1	EFFECTIVE VERT 2	C – UNIT COHESION – P.S.F. CENTER OF STRATUM VERT 1	CENTER OF STRATUM VERT 2	BOTTOM OF STRATUM VERT 1	BOTTOM OF STRATUM VERT 2	FRICTION ANGLE DEGREES
1	CH	117	117	300	300	300	300	0
2	CH	102	102	280	280	280	280	0
3	CH	102	102	400	350	400	350	0
4	CH	117	117	400	400	400	400	0
5	CH	55	55	400	400	400	400	0
6	CH	40	40	400	350	400	350	0
7	CHO	30	40	400	350	400	350	0
8	CH	40	40	400	350	400	350	0
9	CH	45	45	400	375	400	400	0
10	CH	45	45	425	425	450	450	0
11	CH	40	40	550	550	650	650	0

VERT 1 - BORING 1-USP
VERT 2 - BORING 1-USPT

	ASSUMED FAILURE SURF. NO.	ELEV	RESISTIVE FORCES R_A	R_B	R_P	DRIVING FORCES D_A	D_P	FACTOR OF SAFETY
SEC. A-A	(A)-(1)	-11	10463	12250	5600	12107	1579	2.69
	(B)-(2)	-20	16350	10500	12600	22228	5675	2.38
	(C)-(3)	-25	19350	10000	16350	29224	10661	2.46
	(D)-(4)	-11	10248	7700	4200	13107	594	1.77
	(E)-(5)	-20	15658	6300	10500	24563	3921	1.57
	(F)-(6)	-25	18874	8000	14250	31829	7233	1.67
SEC. B-B	(G)-(7)	-11	10650	7350	5250	12347	943	2.04
	(H)-(8)	-20	16050	6300	11550	23098	4767	1.85
	(I)-(9)	-25	19050	8000	15300	29957	8424	1.97
	(J)-(10)	-20	25600	14000	14600	48548	11791	1.48
	(K)-(11)	-25	29600	12000	18600	61451	17749	1.38
	(L)-(12)	-30	33850	11250	22650	74056	23600	1.34

GENERAL NOTES

EXCAVATED MATERIAL IS TO BE USED TO CONSTRUCT PROTECTION DIKES, STOCKPILE EXCESS MATERIAL BEHIND DIKES, ADJACENT TO LEVEE, TO BE USED FOR STRUCTURE BACKFILL. SEE PLATE 68 FOR ULTIMATE PLAN AND SECTION. SEE PLATE 41 FOR SHEAR STRENGTH DATA.

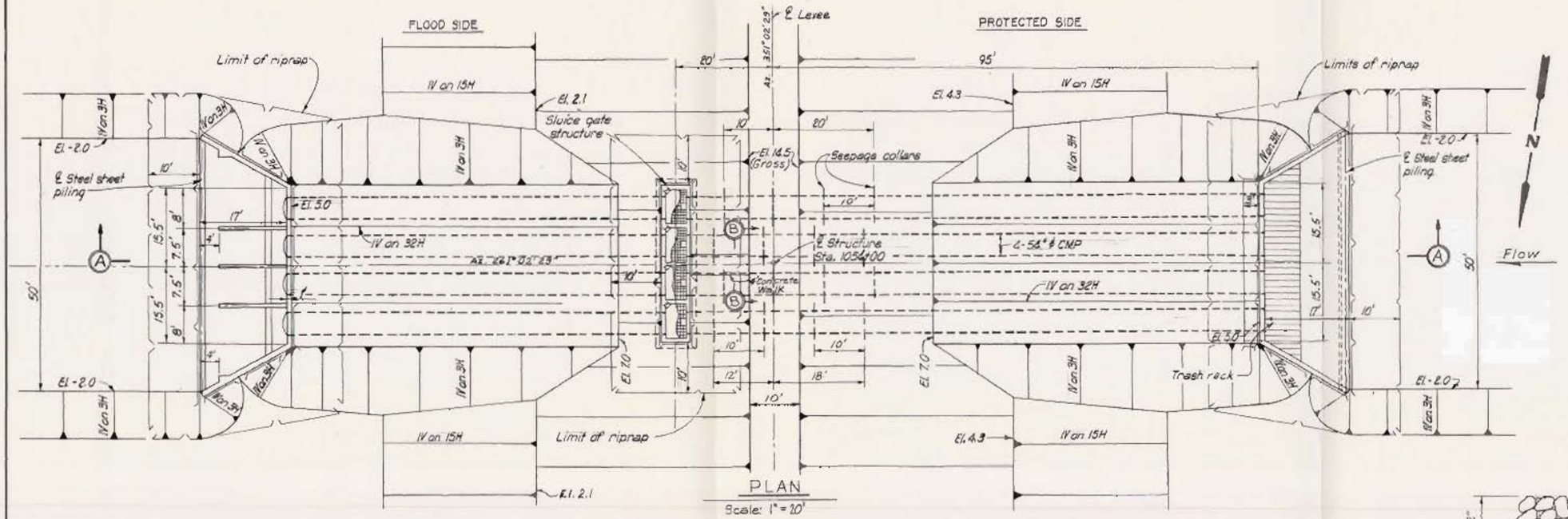
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DRAINAGE STRUCTURE VIC. STA. 1054+00
PLAN OF EXCAVATION
AND (Q) SHEAR STABILITY

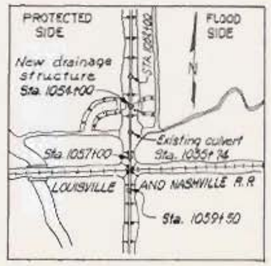
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973 FILE NO. H-2-26016



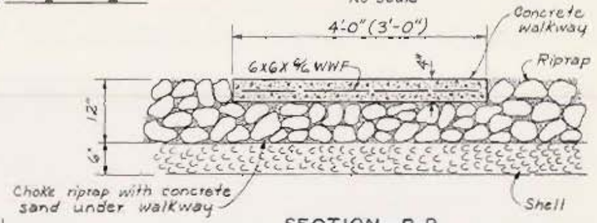
PLAN

Scale: 1" = 20'



LOCATION MAP

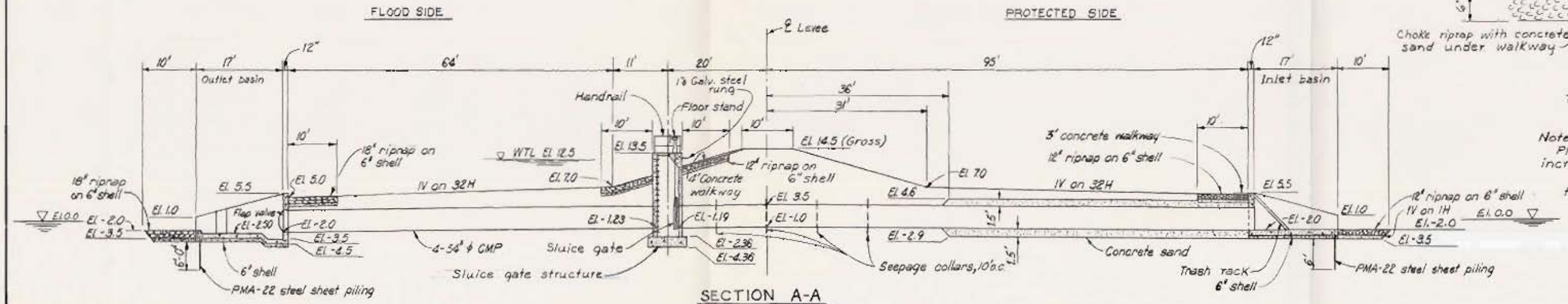
No scale



SECTION B-B

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

Typical for all drainage structures.



SECTION A-A

Scale: 1" = 20'

Note:
Plan and sections shown facing increasing stations.
Elevations shown are expressed in feet and refer to Mean Sea Level.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9

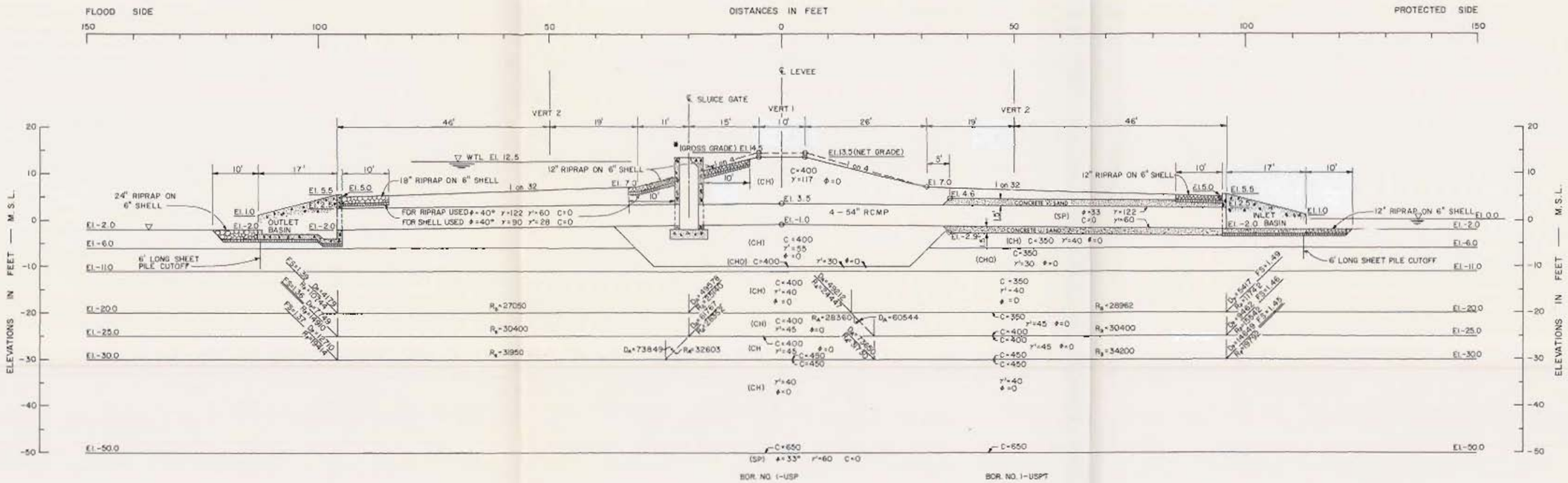
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

PLAN AND SECTION OF DRAINAGE STRUCTURE at Sta. 1054+00

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

JANUARY 1973 FILE NO. H-2-26016

PLATE 68



SECTION THROUGH DRAINAGE STRUCTURE ℄ VIC. STA. 1054+00

THE ANALYSES SHOWN ARE FOR THE LEVEE TO NET GRADE AND DO NOT INCLUDE THE SURCHARGE OF THE INLET AND OUTLET BASINS.

NOTES:

*MEETS A MINIMUM FACTOR OF SAFETY OF 1.3 INCLUDING INLET AND OUTLET BASINS AS A SURCHARGE

FOR DRAINAGE STRUCTURE DETAILS, SEE PLATE 68

FOR EXCAVATION PLAN AND SECTIONS, SEE PLATE 67

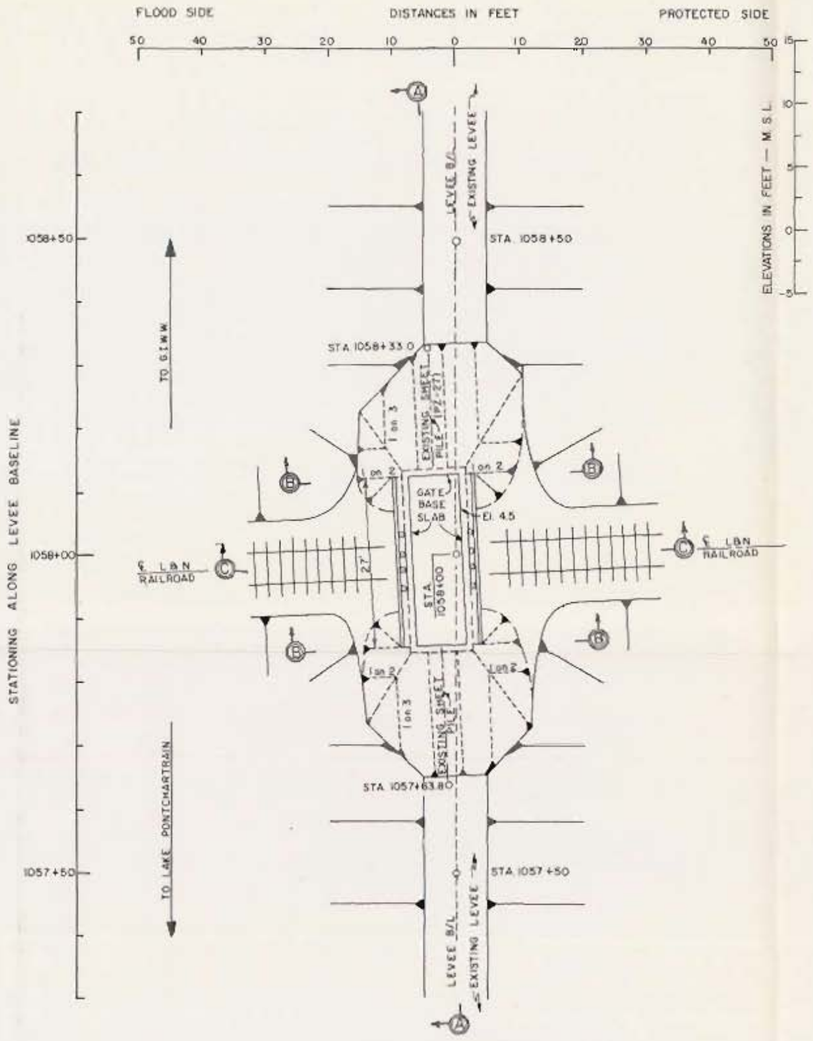
FOR DESIGN SHEAR STRENGTH, SEE PLATE 41

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

DRAINAGE STRUCTURE VIC. STA. 1054+00
(Q) SHEAR STABILITY

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

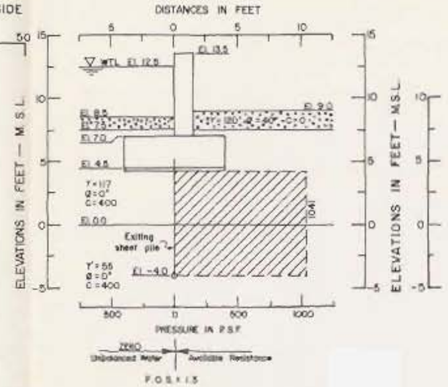
JANUARY 1973 FILE NO. H-2-26016



PLAN OF EXCAVATION

UNDER GATE AT L&N R/R GATE

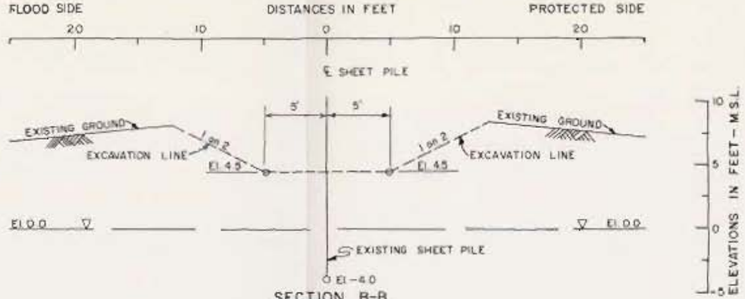
SCALE IN FEET 0 10 20



SHEET PILE CUTOFF ANALYSIS

L&N R/R GATE

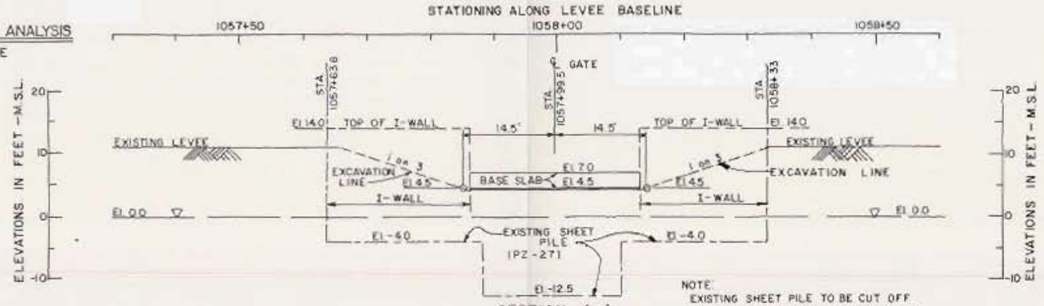
SCALE IN FEET 0 5 10



SECTION B-B

ACROSS END OF BASE SLAB

SCALE IN FEET 0 5 10

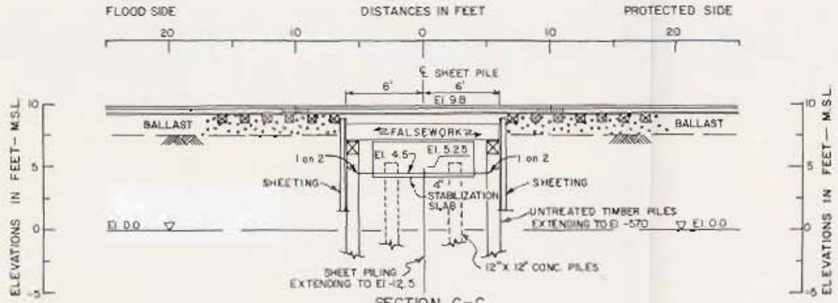


NOTE:
EXISTING SHEET PILE TO BE CUT OFF AT EL. 5.25 BENEATH GATE MONOLITH

SECTION A-A

ALONG ℄ GATE MONOLITH

SCALE IN FEET 0 10 20



SECTION C-C

ALONG ℄ R/R TRACK

SCALE IN FEET 0 5 10

GENERAL NOTES

SEE PLATE 72 FOR STABILITY ANALYSIS OF SECTION A-A AND FOR PILE DESIGN CURVES.

SEE PLATE 77 FOR CONSTRUCTION PLAN.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

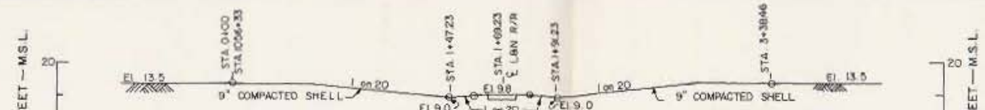
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

L&N R/R GATE VIC. STA. 1057+99.5
EXCAVATION PLAN

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

JANUARY 1973

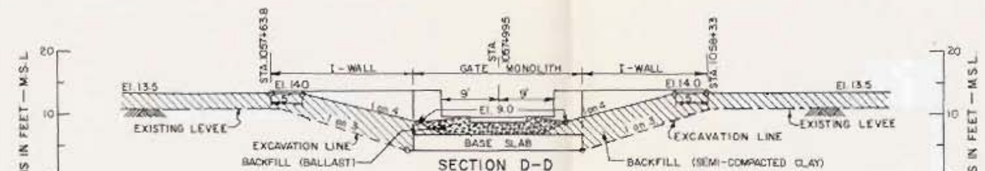
FILE NO. H-2-26016



SECTION D'-D'

℄ PROFILE OF SHELL ROAD AT RAILROAD GATE

NOT TO SCALE

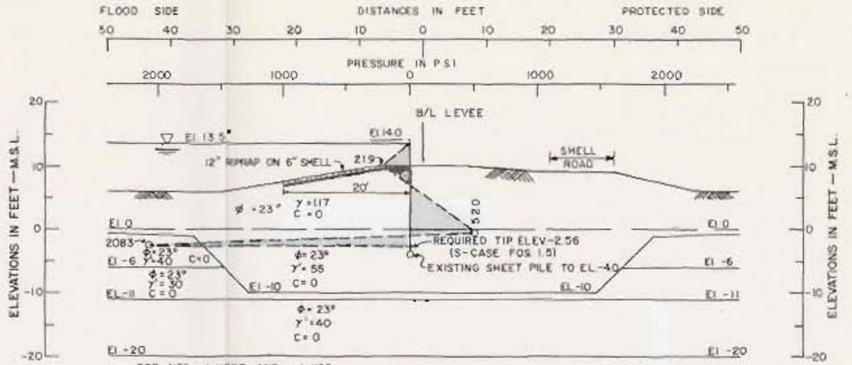


SECTION D-D

℄ PROFILE OF LEVEE AT RAILROAD GATE

SCALE IN FEET

0 10 20



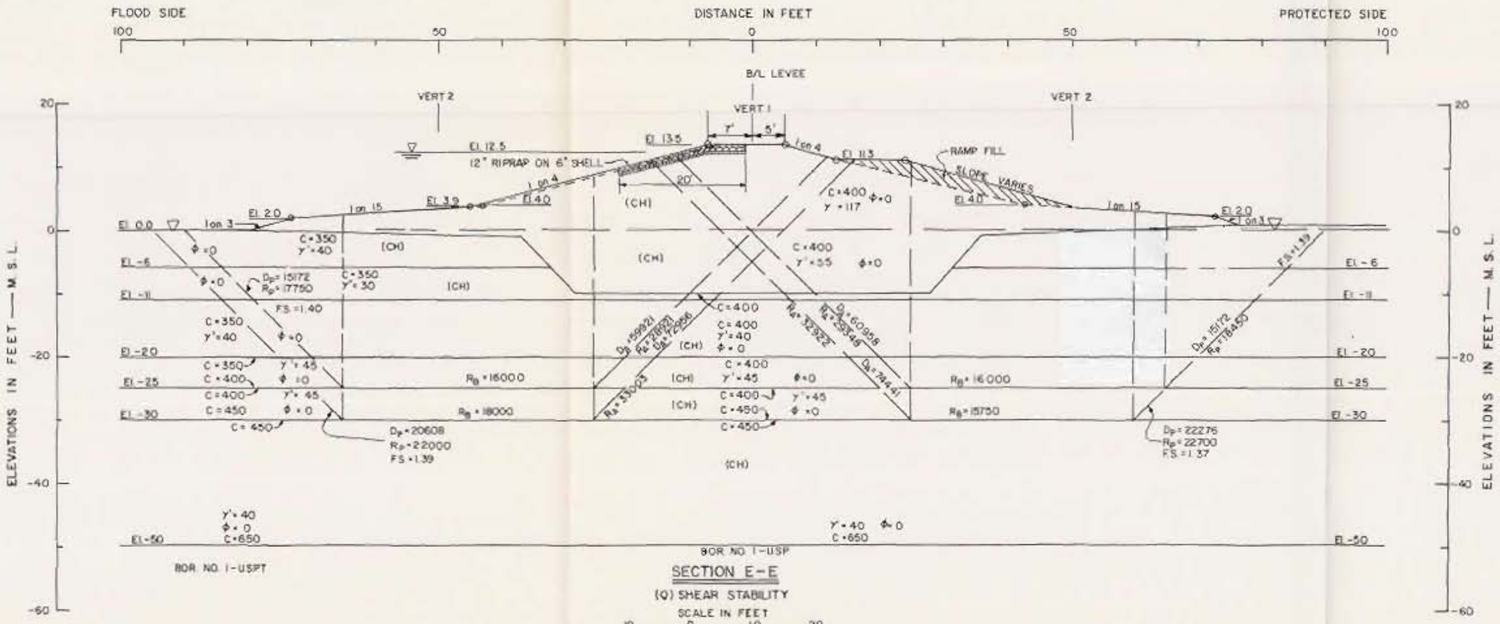
SECTION F-F

I-WALL ANALYSIS - (S) CASE GOVERNS

*WTL EL. 12.5, WALL WAS ANALYZED WITH WATER 0.5 FT. FROM TOP OF WALL

SCALE IN FEET

20 0 20 40



SECTION E-E

(Q) SHEAR STABILITY

SCALE IN FEET

10 0 10 20

NOTES:

THE LEVEE IS TO BE CONSTRUCTED TO A GROSS GRADE OF ELEVATION 14.5 AND THE I-WALL IS TO BE CONSTRUCTED TO A GROSS GRADE OF ELEVATION 15.0.

SEE PLATE 70 FOR EXCAVATION PLAN.

SEE PLATE 41 FOR DESIGN SHEAR STRENGTHS.

SEE PLATE 77 FOR LOCATION OF SECTIONS.

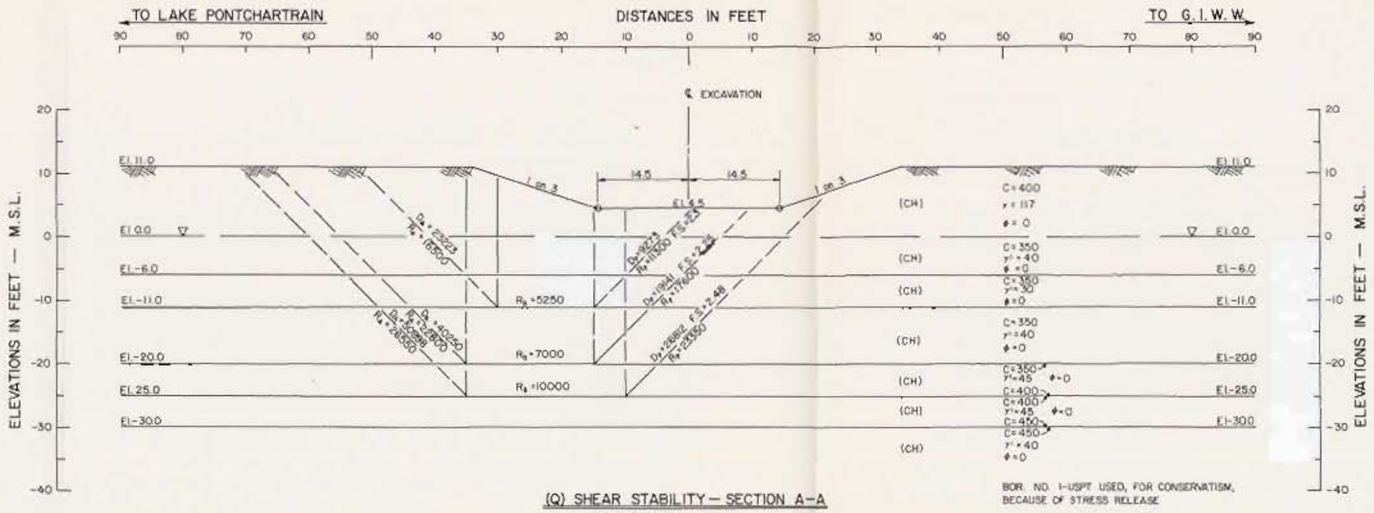
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
L&N R/R GATE VIC. STA. 1057+99.5

CONSTRUCTION PLAN
(Q) SHEAR STABILITY & I-WALL ANALYSIS

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

JAN. 73 FILE NO. H-2-26016

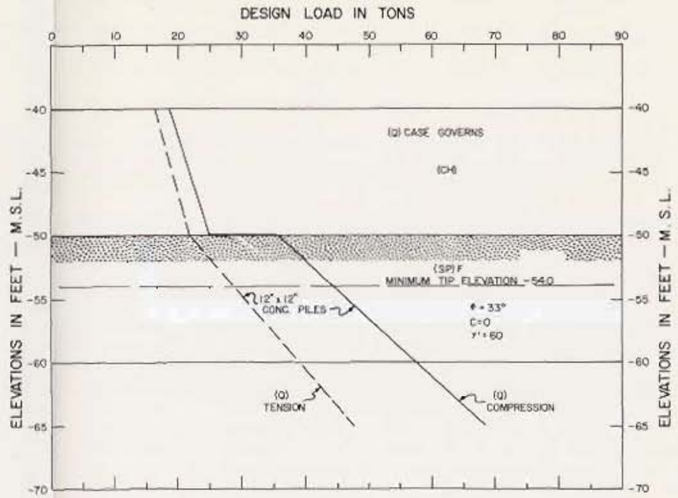


BOR. NO. 1-USPT USED, FOR CONSERVATISM, BECAUSE OF STRESS RELEASE

(Q) SHEAR STABILITY — SECTION A-A

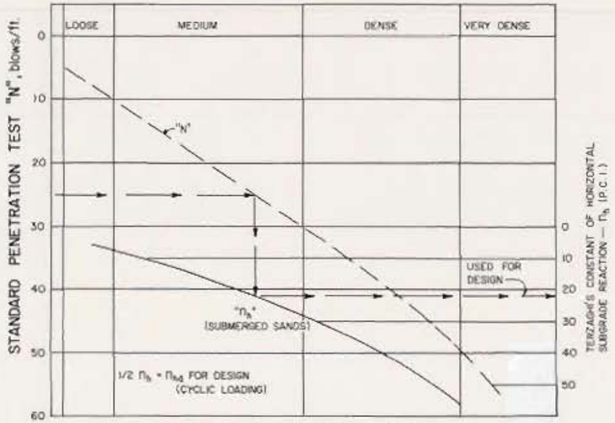
ALONG ℄ GATE MONOLITH IN VIC. BASELINE, STA. 1057+99.5

0 10 20
SCALE IN FEET

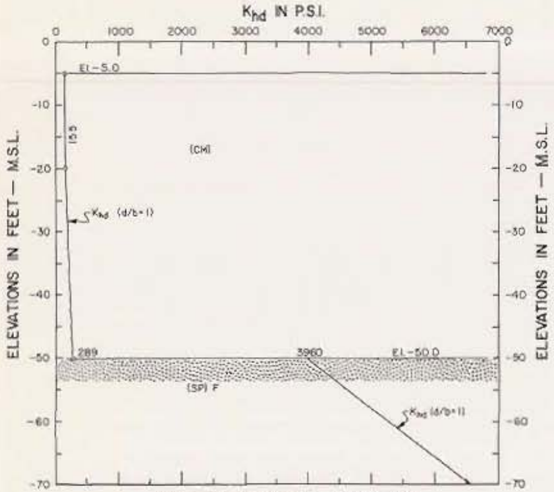


DESIGN LOAD VS TIP ELEVATION

PILE CAPACITY ANALYSIS IN VICINITY OF STA. 1057+99.5



CORRELATION OF "N" AND "n_h"



SUBGRADE MODULI VS. ELEVATION

VIC. STATION 1057+99.5

COHESIONLESS SANDS

$K_{hd} = (n_{hd})(X)(d/b)$, FOR DESIGN

K_h = SUBGRADE MODULUS (P.S.I.)

n_h = CONSTANT OF HORIZONTAL SUBGRADE REACTION FOR SUBMERGED SANDS (P.C.I.)

X = DEPTH BELOW TOP OF SAND (IN.)

d = PROJECTED DIAMETER OF PILE (IN.)

b = 12" = UNIT CONVERSION FACTOR (IN.)

SUB "d" DENOTES DESIGN

COHESIVE CLAYS

$K_o = (80)(Q_u)$ psf $= (0.5555)(Q_u)$ psi

$K_{hd} = (0.4)(K_o)(d/b) = (0.2222)(Q_u)(d/b)$ psi, DESIGN

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN P.S.F.

GENERAL NOTES

(Q) CASE GOVERNS FOR DESIGN CAPACITIES.

SEE PLATE 41 FOR SOIL BORING DATA.

K_o AND n_h VALUES ARE THOSE PROPOSED BY K. TERZAGHI IN "EVALUATION OF COEFFICIENTS OF SUBGRADE REACTIONS", GEOTECHNIQUE, LONDON, ENGLAND, VOL. X, 1955, pp. 297-326.

K_{hd} VALUES INCLUDE REDUCTION FACTORS FOR CYCLIC LOADING.

THE COHESIVE OVERBURDEN, ABOVE THE BURIED SAND, WAS CONVERTED TO A "WEIGHTED" THICKNESS OF MATERIAL WITH A UNIT WEIGHT EQUAL THAT OF THE SUBMERGED SAND. THIS THICKNESS WAS USED IN DETERMING "X" IN THE COHESIONLESS SAND EXPRESSION FOR APPROXIMATING K_{hd}. DESIGN K_{hd} VALUES ARE ASSIGNED FOR PURPOSES OF CONSERVATISM IN THE SANDS.

DESIGN LOAD IS THE STRUCTURE LOAD CARRIED BY THE PILE. THE PILE CAPACITY CURVES INCLUDE THE SAFETY FACTORS OF 1.75 FOR COMPRESSION AND 2.0 FOR TENSION WITH APPLIED CONJUGATE STRESS RATIOS OF K=1.0 IN COMPRESSION AND K=0.7 IN TENSION.

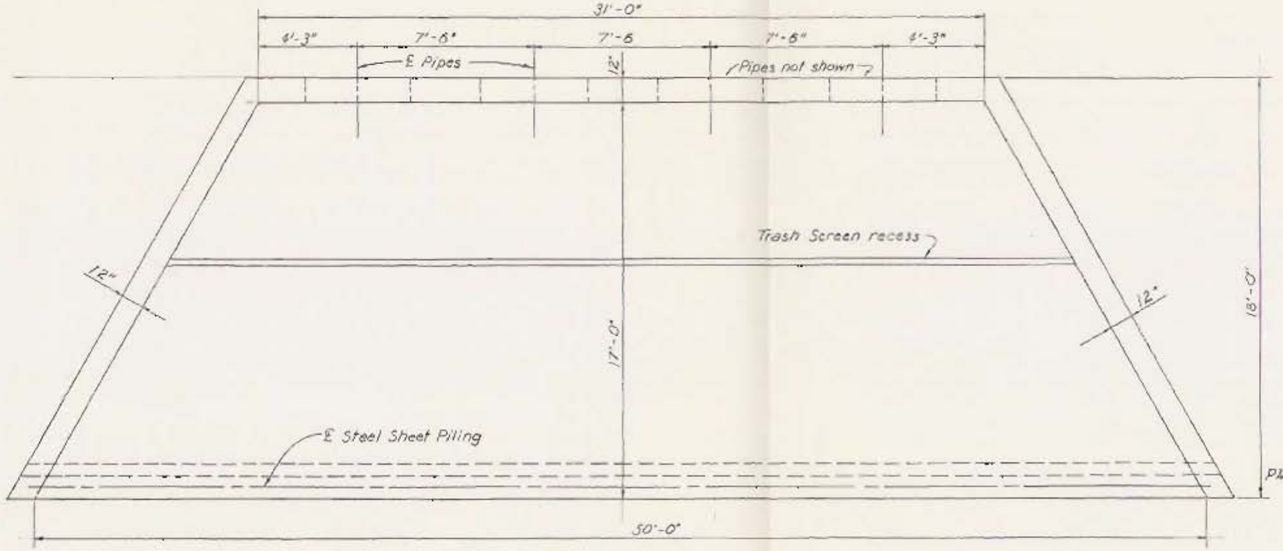
SEE PLATE 70 FOR LOCATION OF SECTION A-A.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
(Q) SHEAR STABILITY
PILE DESIGN LOAD VS. TIP ELEVATION AND BEARING PILE SUBGRADE MODULI

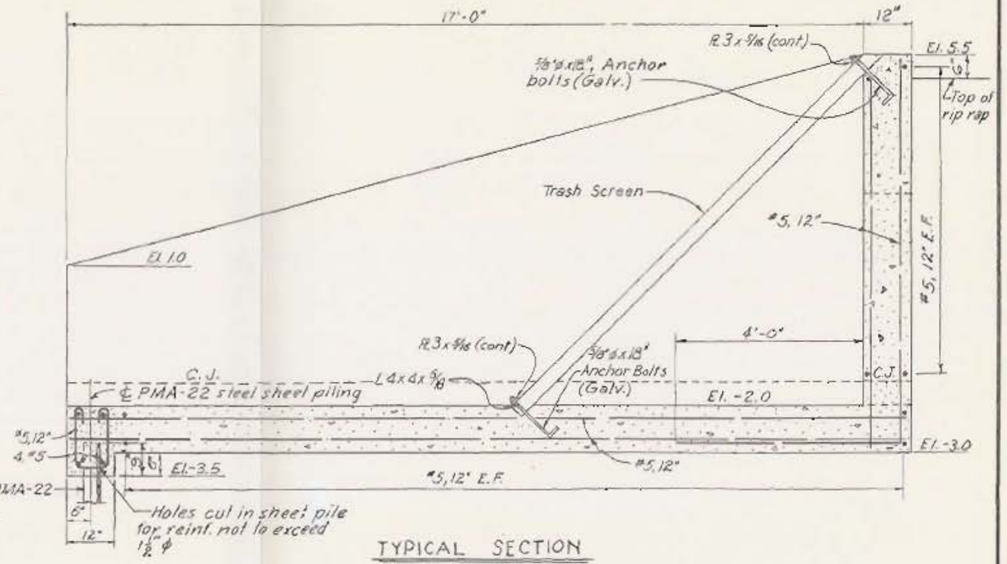
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973 FILE NO. H-2-26016



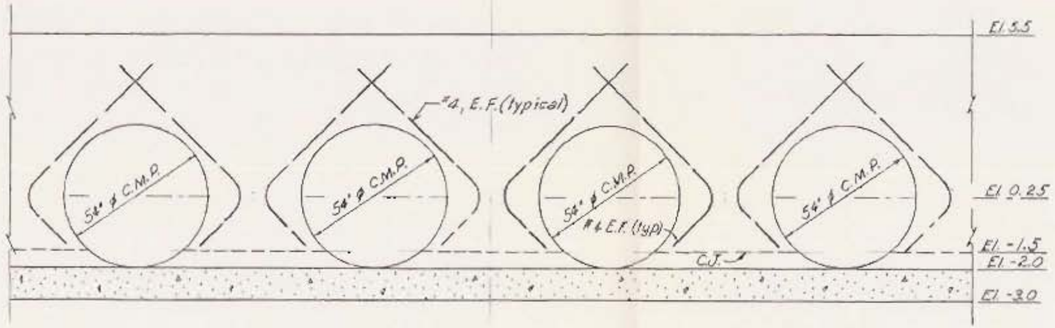
PLAN

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



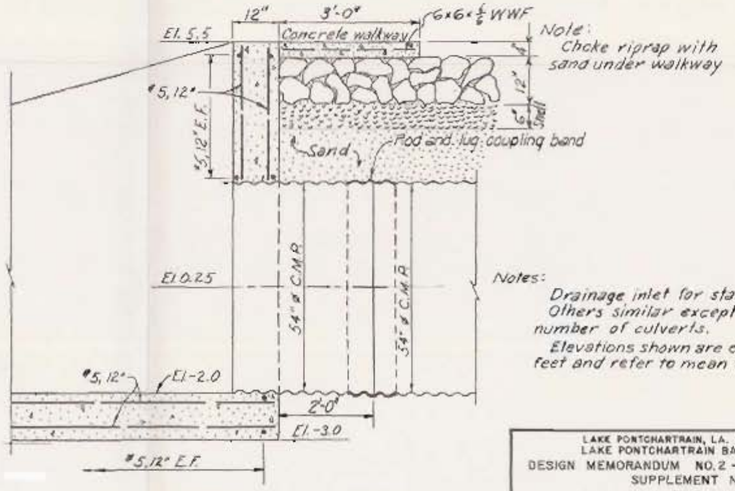
TYPICAL SECTION

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



HEADWALL ELEVATION

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



Notes:

Drainage inlet for sta. 1054+00 shown. Others similar except for size and number of culverts.

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

SECTION AT ℄ OF PIPES

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9

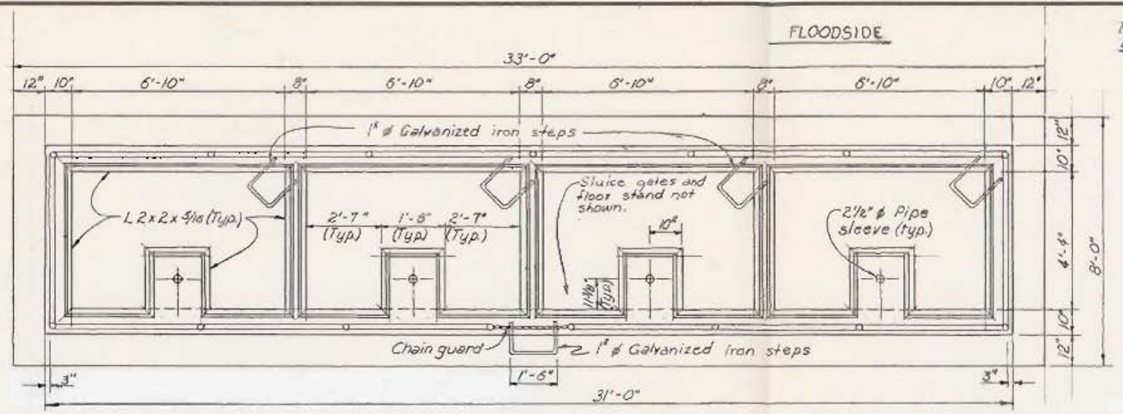
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

TYPICAL INLET BASIN DETAILS

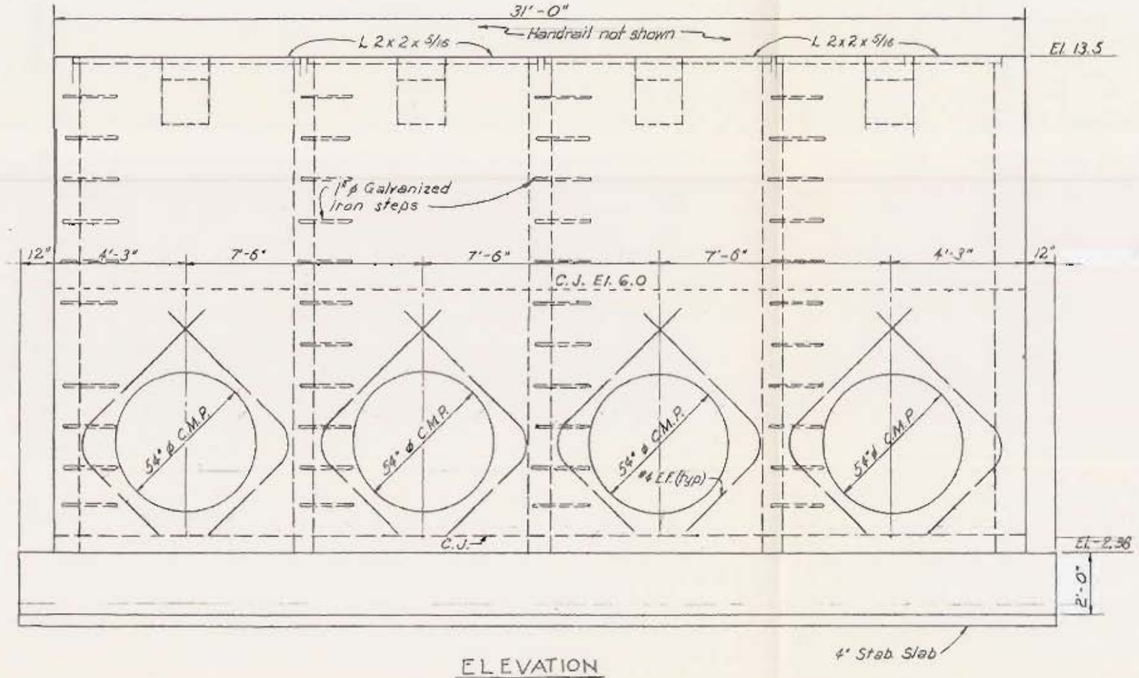
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JANUARY 1973

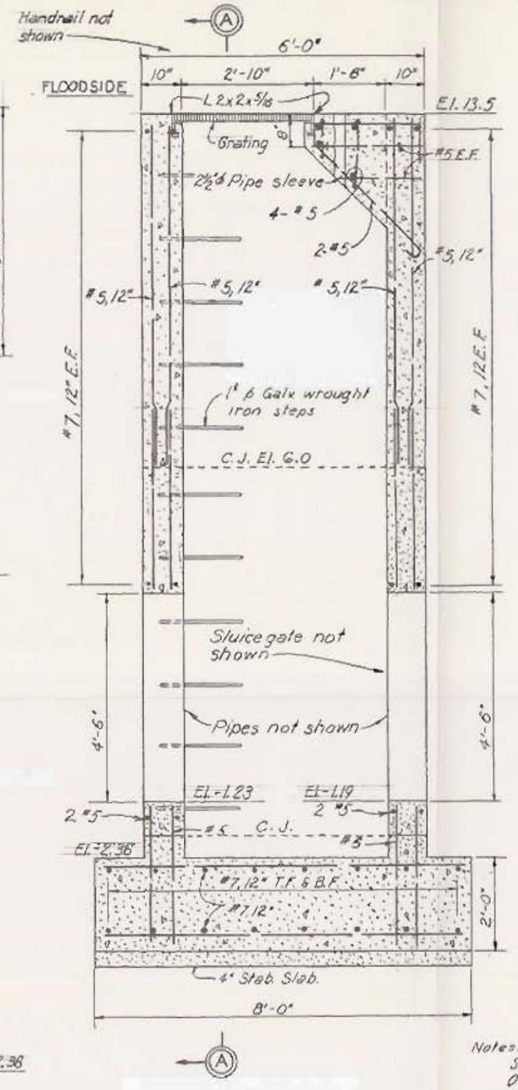
FILE NO. H-2-26016



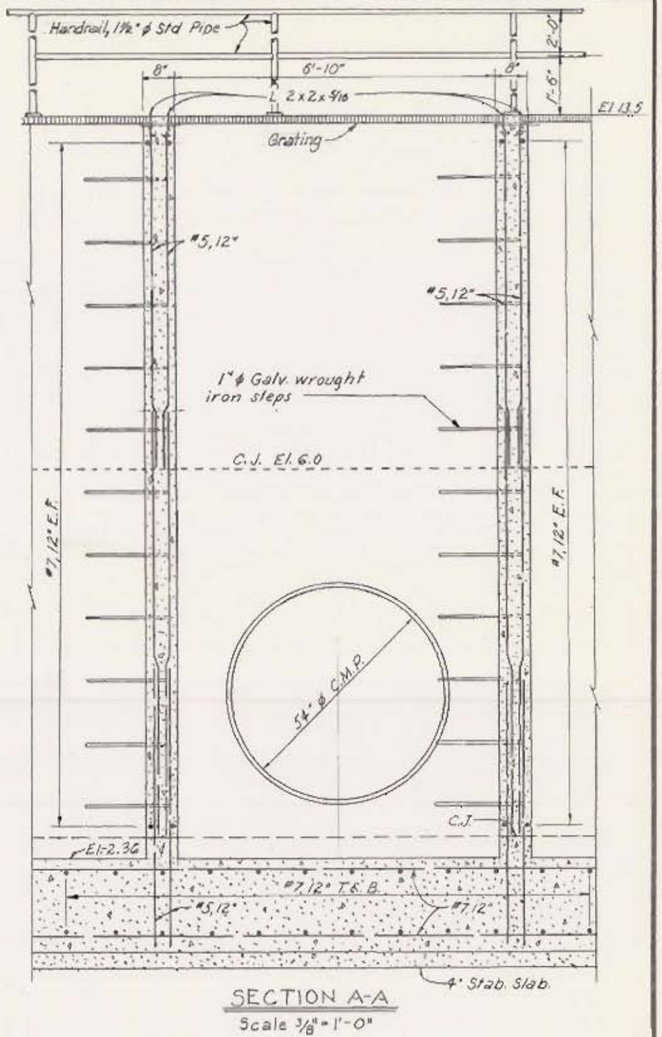
PLAN
SLUICE GATE STRUCTURE
Scale: 1/4" = 1'-0"



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



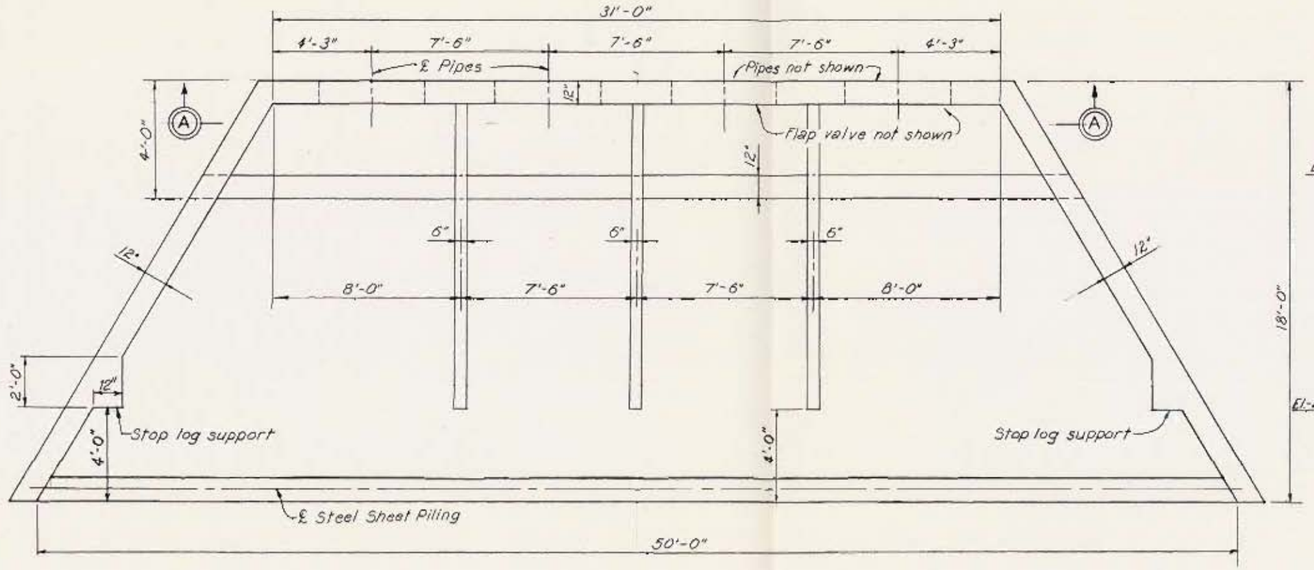
TYPICAL SECTION AT ℄ PIPE
Scale: 3/8" = 1'-0"



SECTION A-A
Scale 3/8" = 1'-0"

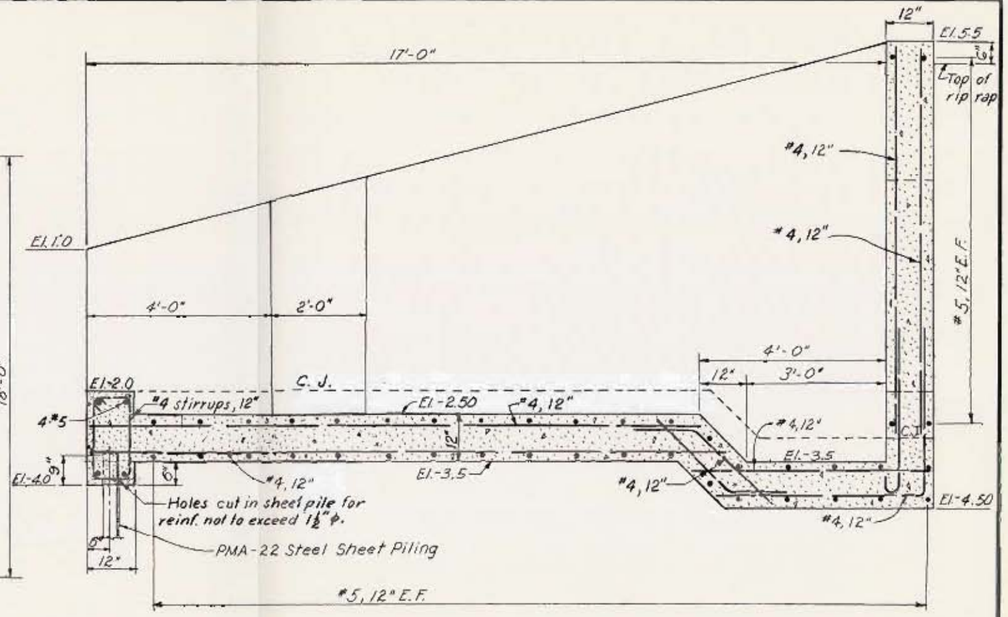
Notes:
Structure for sta. 105+00 shown. Others similar except for size and number of culverts.
Elelations shown are expressed in feet and refer to mean sea level.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
TYPICAL SLUICE GATE STRUCTURE DETAILS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973 FILE NO. H-2-26016



PLAN

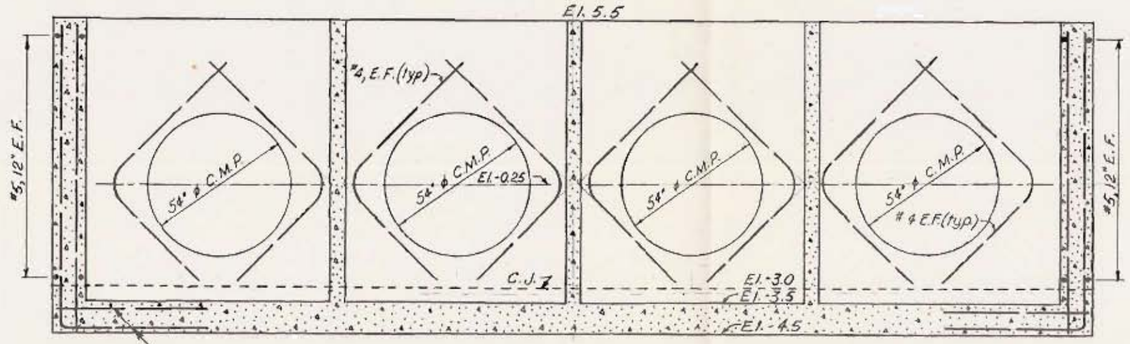
Scale: 3/16" = 1'-0"



TYPICAL SECTION

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

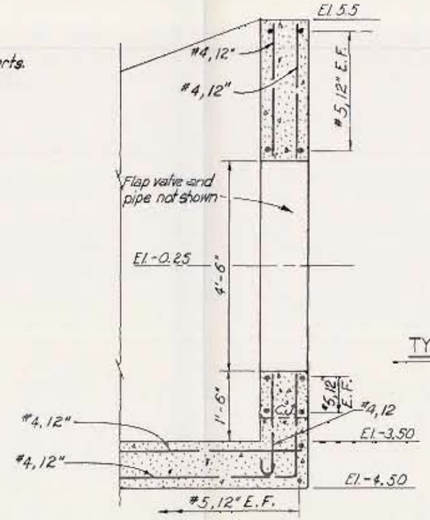
Notes:
Drainage outlet for Sta. 1054+00 shown.
Others similar except for size and number of culverts.
Elevations shown are expressed in feet and refer to mean sea level.



#5, 6" to 4'-0 from headwall,
#5, 12" beyond 4'-0" from headwall.

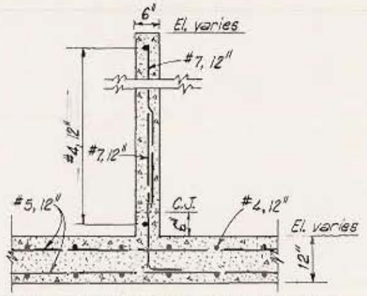
SECTION A-A

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



SECTION AT ℄ OF PIPES

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



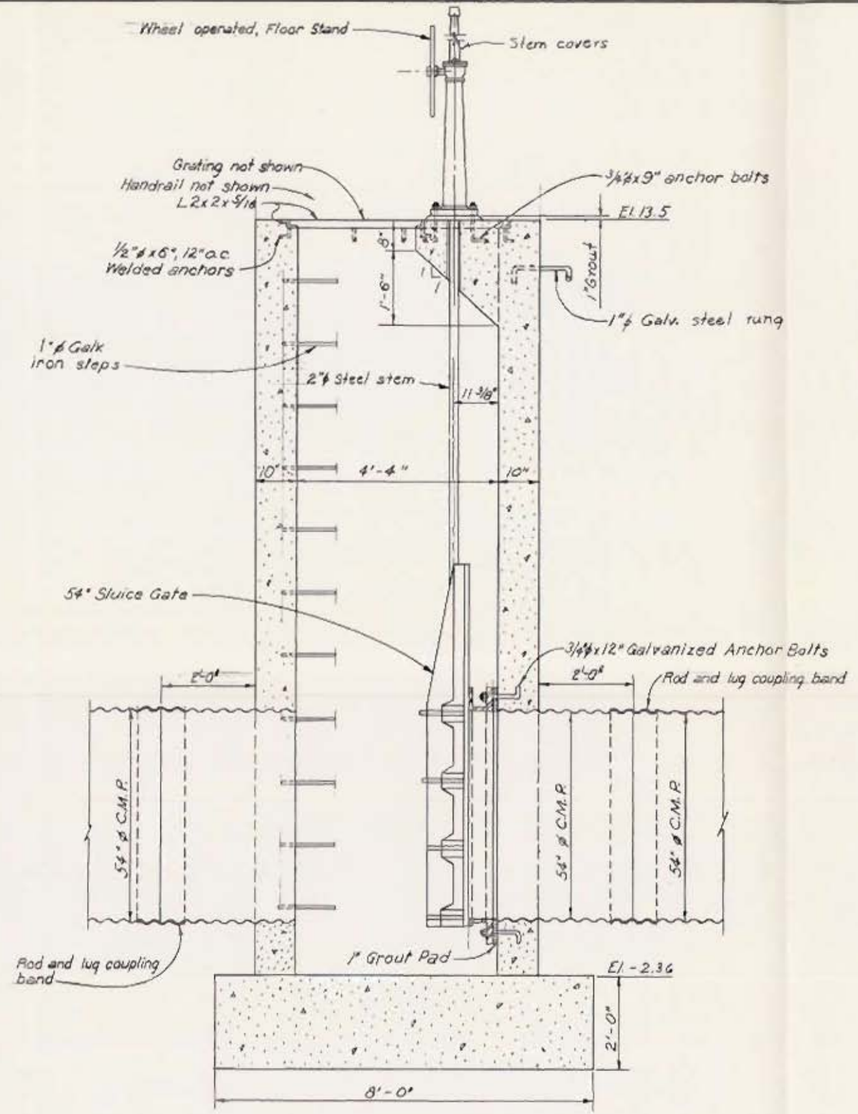
TYPICAL SECTION THRU SPLITTER WALLS

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

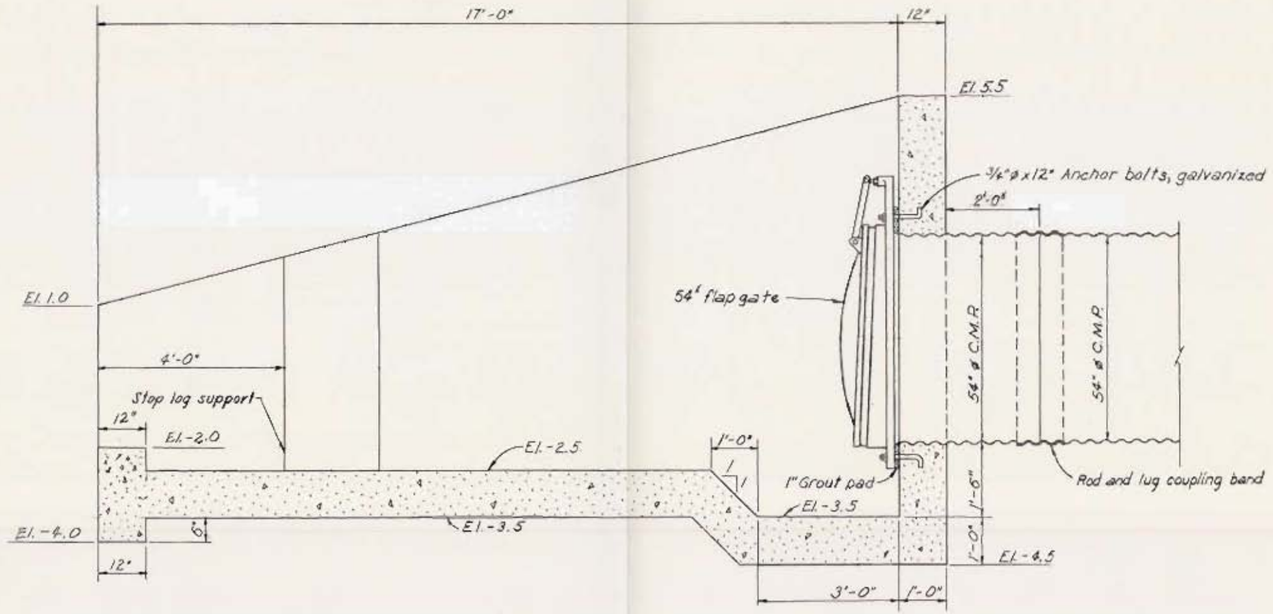
TYPICAL OUTLET BASIN DETAILS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016



SLUICE GATE DETAIL

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



FLAP GATE DETAIL

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

Note:
Flap gate and sluice gate shown for structure at sta. 1054+00. Others similar except for size and number of culverts.
Elevations in Feet mean sea level.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

TYPICAL SLUICE GATE AND FLAP GATE DETAILS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016

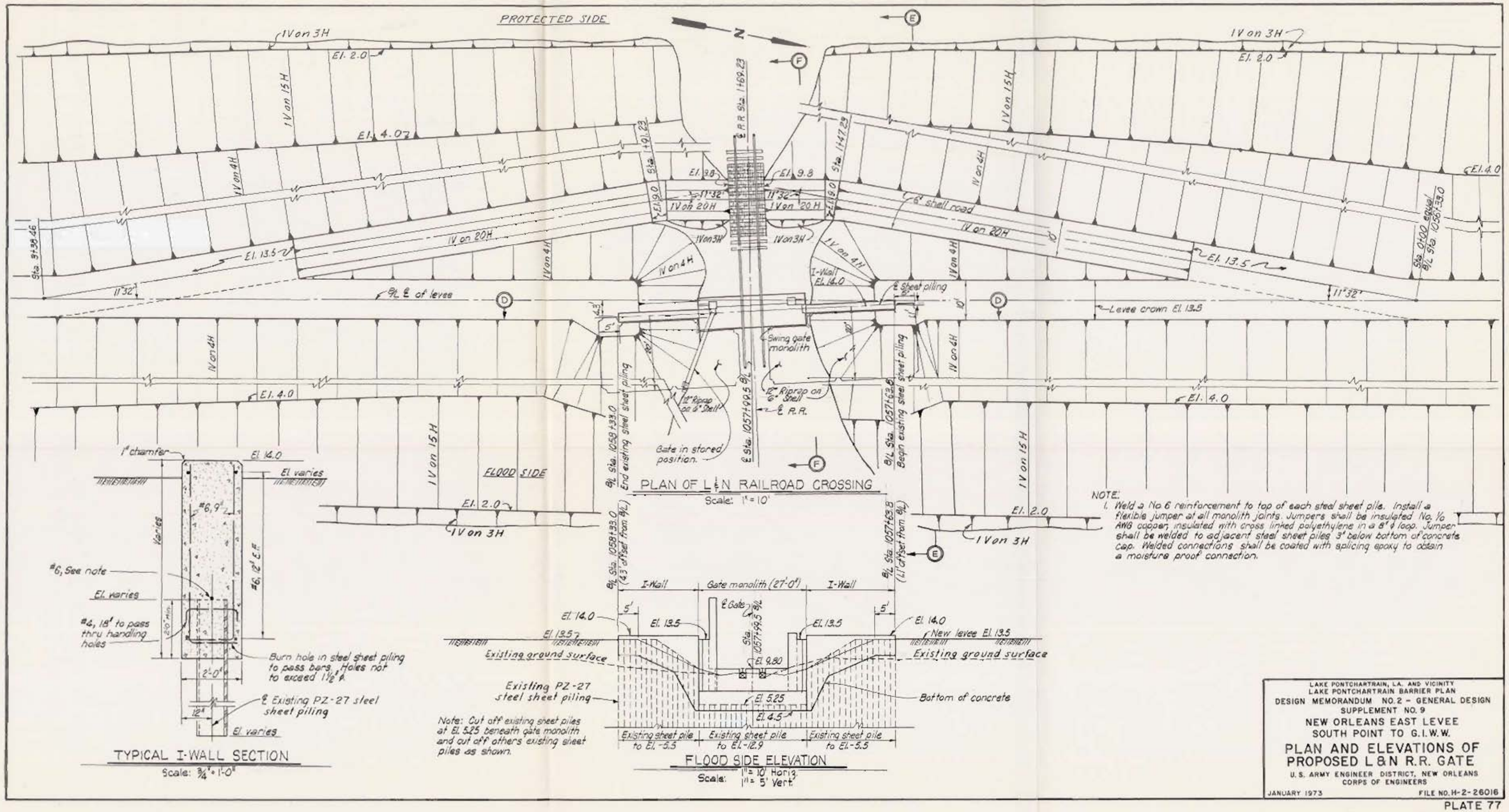
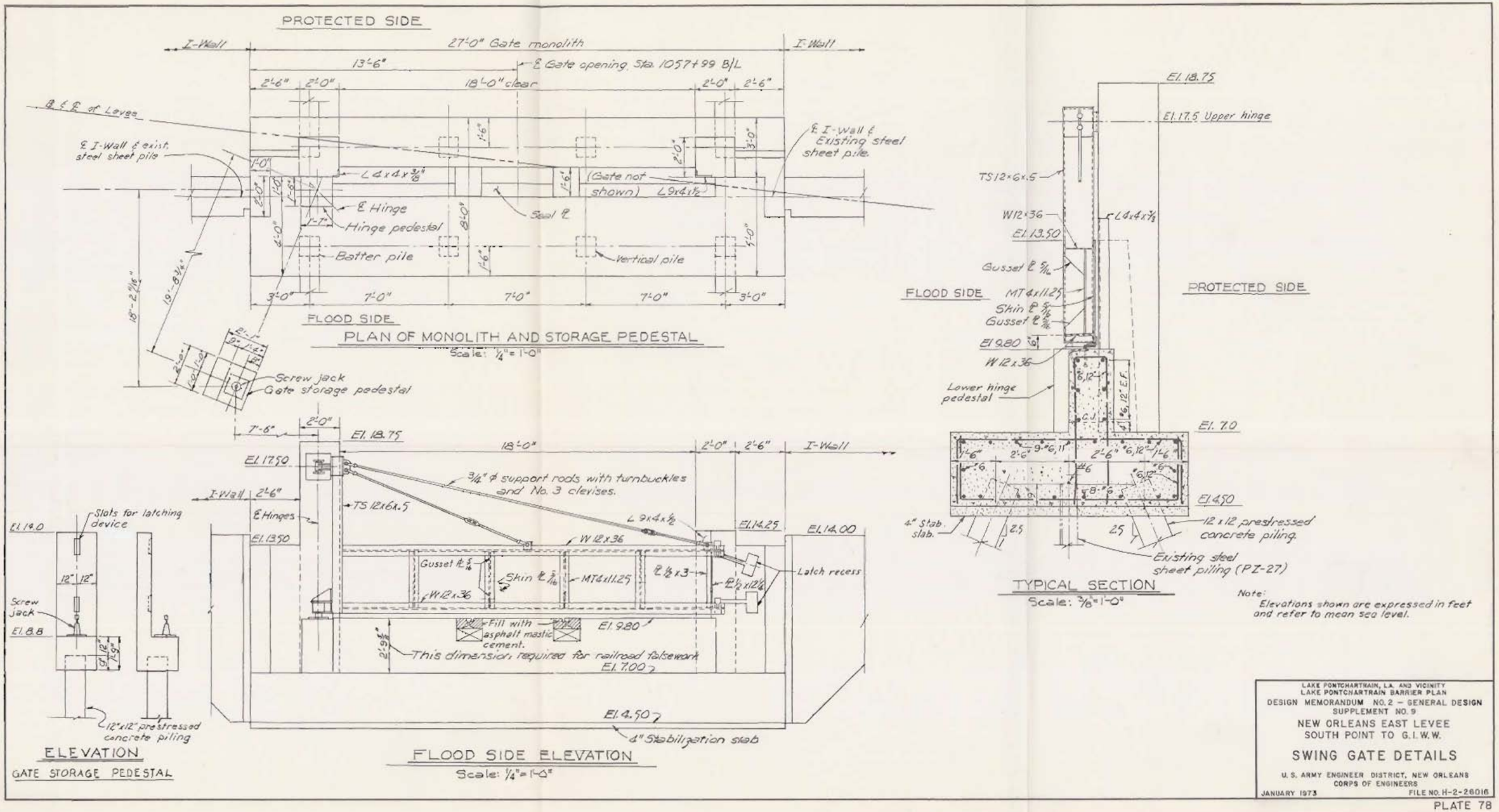
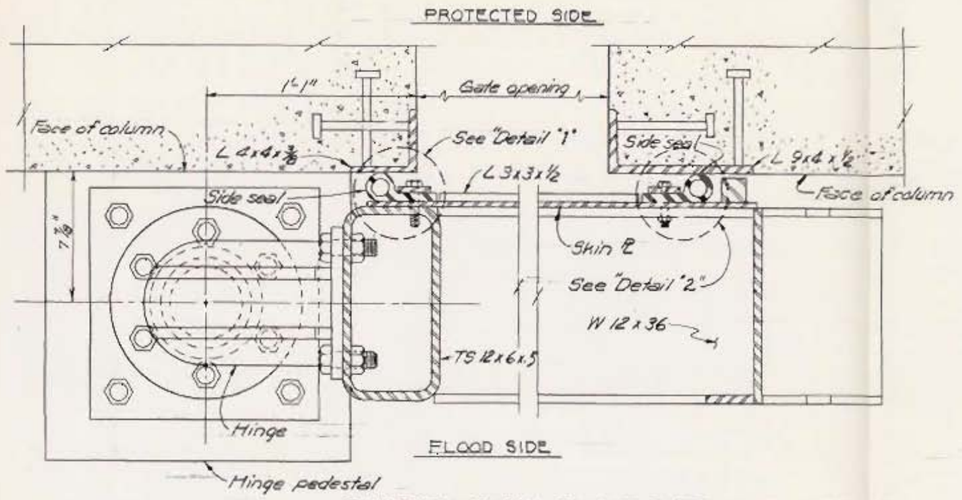
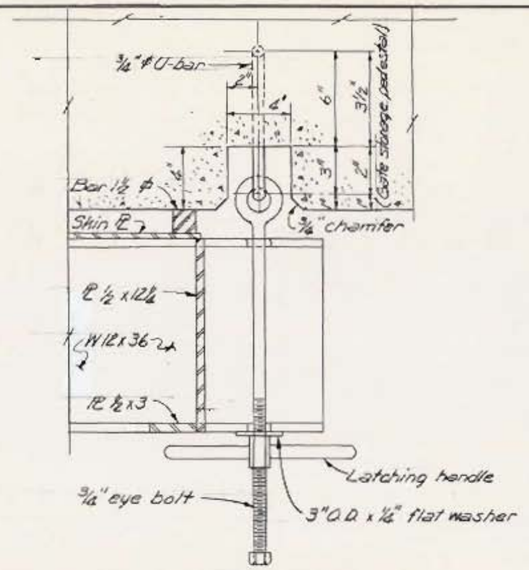

PROTECTED SIDE
FLOOD SIDE
1V on 3H
1V on 15H
1V on 4H
1V on 20H
El. 2.0
El. 4.0
El. 13.5
El. 9.8
El. 9.0
11°32'
6" shell road
Levee crown El. 13.5
Swing gate monolith
12" Riprap on 6" Shell
Gate in stored position.
℄ R.R.
℄ Sheet piling
I-Wall El. 14.0
B/L ℄ of levee
Sta. 3+38.46
Sta. 1+91.23
Sta. 1+47.23
Sta. 0+00 equal B/L Sta. 1056+33.0
B/L Sta. 1058+33.0 End existing steel sheet piling
B/L Sta. 1057+63.8 Begin existing steel sheet piling
B/L Sta. 1058+33.0 (4.3' offset from B/L)
B/L Sta. 1057+63.8 (1.1' offset from B/L)
PLAN OF L & N RAILROAD CROSSING
Scale: 1" = 10'
1" chamfer
El. 14.0
El. varies
#6, 9"
Varies
#6, 12" E.F.
#6, See note
#4, 18" to pass thru handling holes
Burn hole in steel sheet piling to pass bars. Holes not to exceed 1½" ϕ.
2'-0"
12"
℄ Existing PZ-27 steel sheet piling
TYPICAL I-WALL SECTION
Scale: ¾" = 1'-0"
I-Wall
Gate monolith (27'-0")
℄ Gate
El. 13.5
El. 9.80
El. 5.25
El. 4.5
New levee El. 13.5
Existing ground surface
Existing PZ-27 steel sheet piling
Bottom of concrete
Existing sheet pile to El. -5.5
Existing sheet pile to El. -12.9
Note: Cut off existing sheet piles at El. 5.25 beneath gate monolith and cut off others existing sheet piles as shown.
FLOOD SIDE ELEVATION
Scale: 1" = 10' Horiz. 1" = 5' Vert.
NOTE:
1. Weld a No 6 reinforcement to top of each steel sheet pile. Install a flexible jumper at all monolith joints. Jumpers shall be insulated No. 1/0 AWG copper, insulated with cross linked polyethylene in a 8" ϕ loop. Jumper shall be welded to adjacent steel sheet piles 3" below bottom of concrete cap. Welded connections shall be coated with splicing epoxy to obtain a moisture proof connection.
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
PLAN AND ELEVATIONS OF PROPOSED L & N R.R. GATE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016

PLATE 77


PROTECTED SIDE
I-Wall
27'-0" Gate monolith
I-Wall
13'-6"
℄ Gate opening, Sta. 1057+99 B/L
2'-6"
2'-0"
18'-0" clear
2'-0"
2'-6"
℄ & ℄ of Levee
℄ I-Wall & exist. steel sheet pile
℄ I-Wall & Existing steel sheet pile
L 4x4x3/8"
(Gate not shown)
L 9x4x1/2
℄ Hinge
Hinge pedestal
Seal ℄
Batter pile
Vertical pile
FLOOD SIDE
PLAN OF MONOLITH AND STORAGE PEDESTAL
Scale: 1/4" = 1'-0"
Screw jack
Gate storage pedestal
El. 18.75
El. 17.5 Upper hinge
TS 12x6x.5
W 12x36
L 4x4x7/8
El. 13.50
Gusset ℄ 5/16
FLOOD SIDE
MT 4x11.25
PROTECTED SIDE
Skin ℄ 5/16
Gusset ℄ 5/16
El. 9.80
W 12x36
Lower hinge pedestal
El. 7.0
El. 4.50
4" Slab.
12 x 12 prestressed concrete piling.
Existing steel sheet piling (PZ-27)
TYPICAL SECTION
Scale: 3/8" = 1'-0"
Note:
Elevations shown are expressed in feet and refer to mean sea level.
El. 18.75
El. 17.50
3/4" ϕ support rods with turnbuckles and No. 3 clevises.
I-Wall
TS 12x6x.5
℄ Hinges
El. 13.50
L 9x4x1/2
El. 14.25
El. 14.00
W 12x36
Gusset ℄ 5/16
Skin ℄ 5/16
MT 4x11.25
℄ 1/2 x 3
℄ 1/2 x 12 1/4
Latch recess
Fill with asphalt mastic cement.
El. 9.80
This dimension required for railroad falsework
El. 7.00
El. 4.50
4" Stabilization slab
FLOOD SIDE ELEVATION
Scale: 1/4" = 1'-0"
El. 14.0
Slots for latching device
Screw jack
El. 8.8
12" x 12" prestressed concrete piling
ELEVATION
GATE STORAGE PEDESTAL
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
SWING GATE DETAILS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-26016
PLATE 78



SECTION THRU SWING GATE
Scale: 1½" = 1'-0"



LATCHING ASSEMBLY
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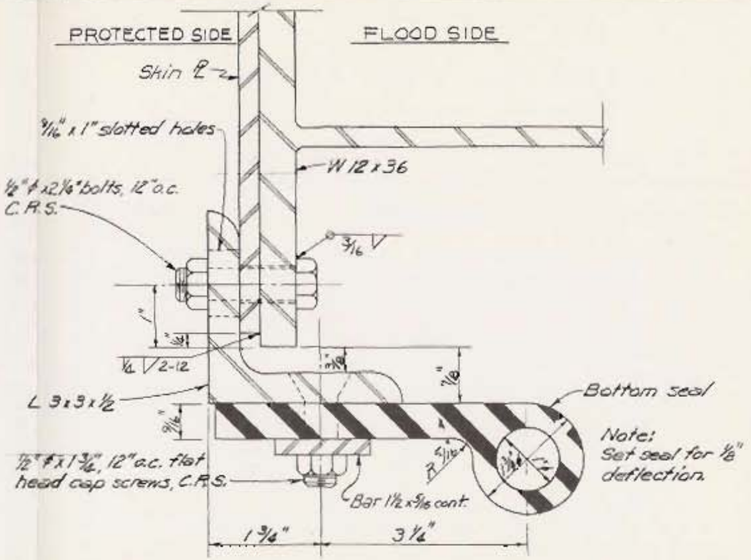
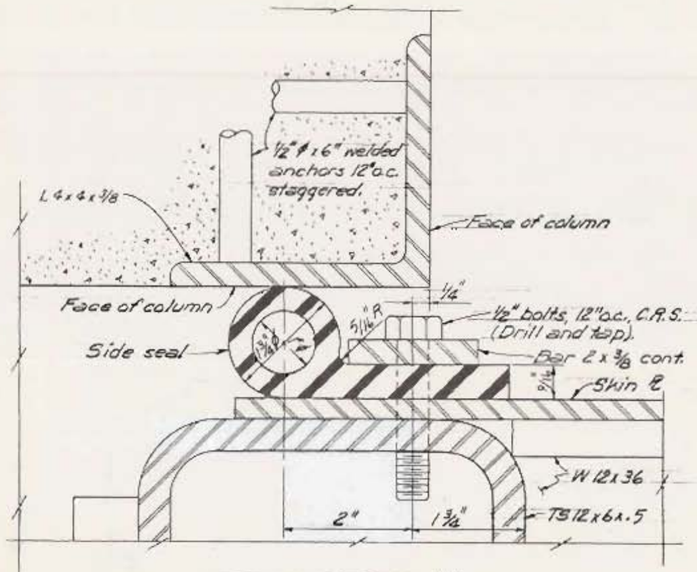
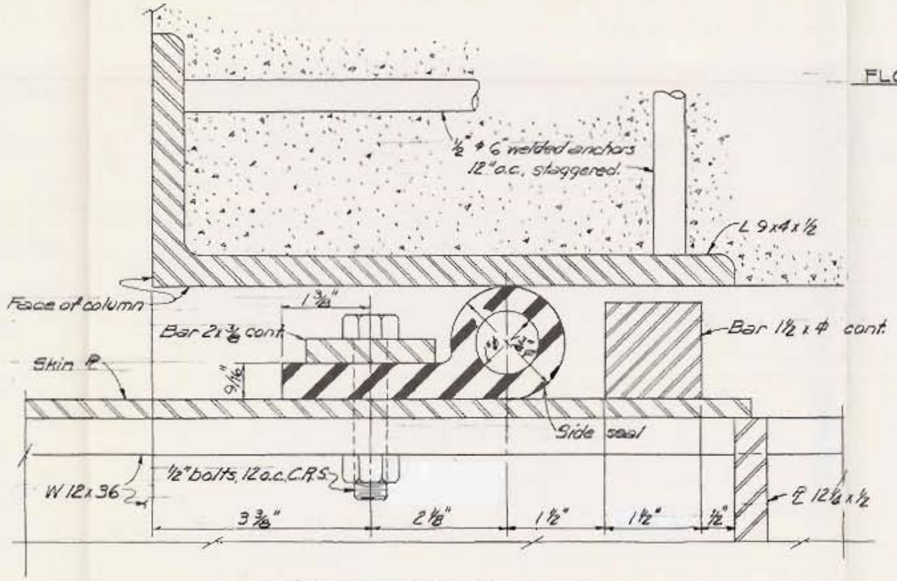


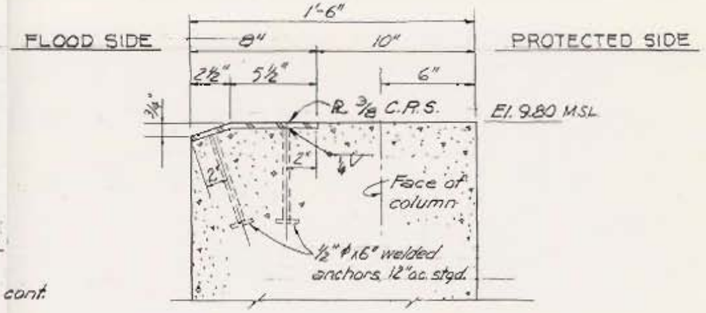
SECTION THRU BOTTOM SEAL
Scale: Half size



DETAIL "1"
Scale: Half size



DETAIL "2"
Scale: Half size



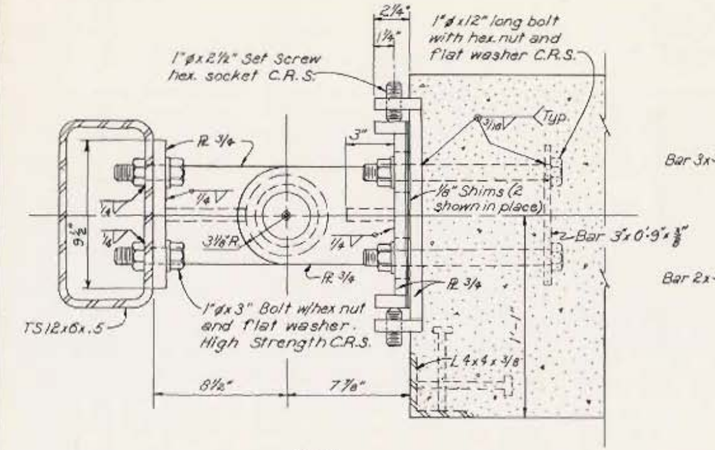
SEAL PLATE DETAIL
Scale: 1½" = 1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

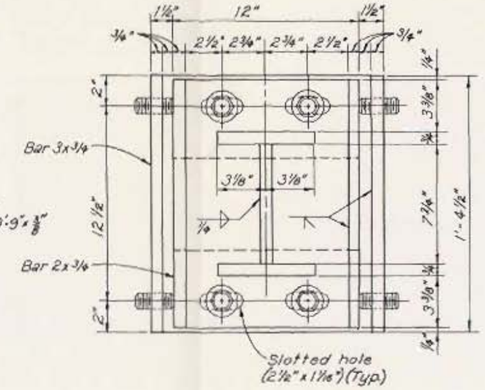
SWING GATE SEAL DETAILS

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

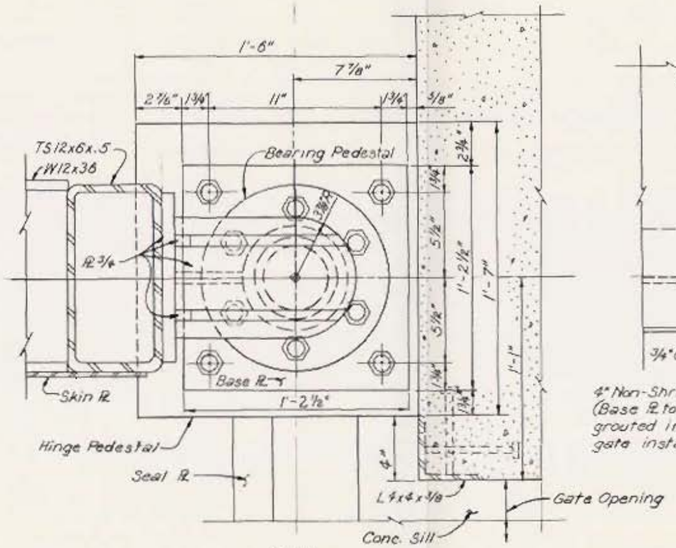
JANUARY 1973 FILE NO. H-2-26016



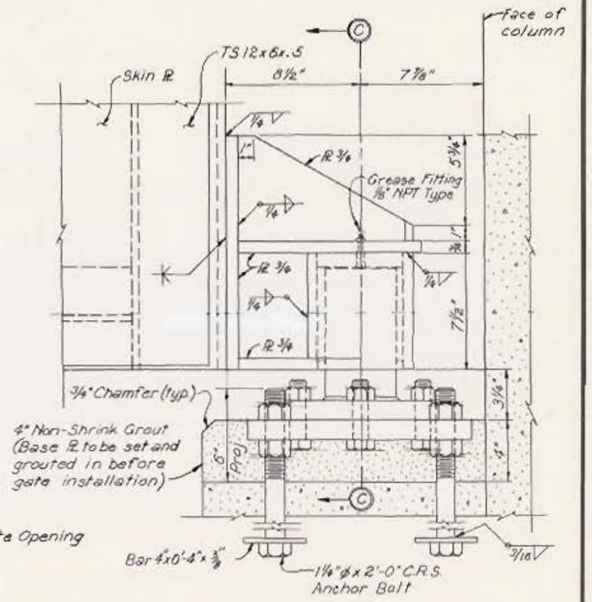
PLAN



SECTION A-A



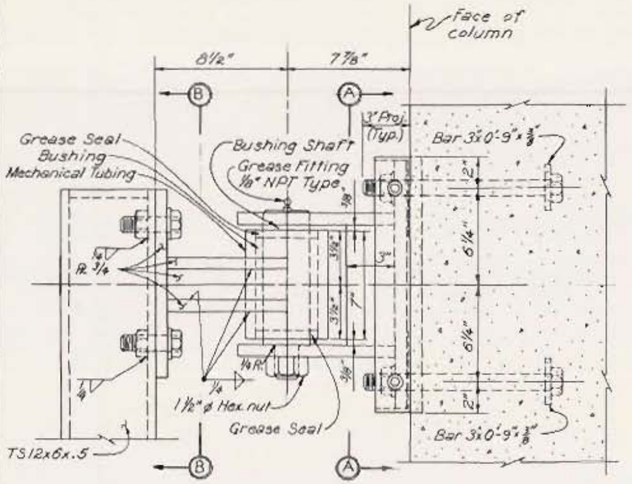
PLAN



ELEVATION

LOWER HINGE

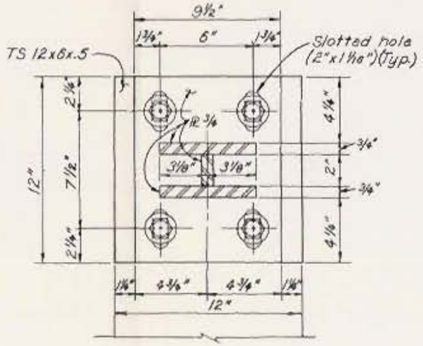
Scale: 1½" = 1'-0"



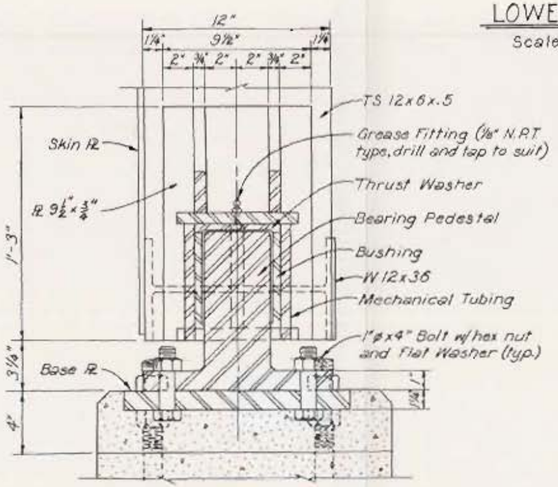
ELEVATION

UPPER HINGE

Scale: 1½" = 1'-0"



SECTION B-B



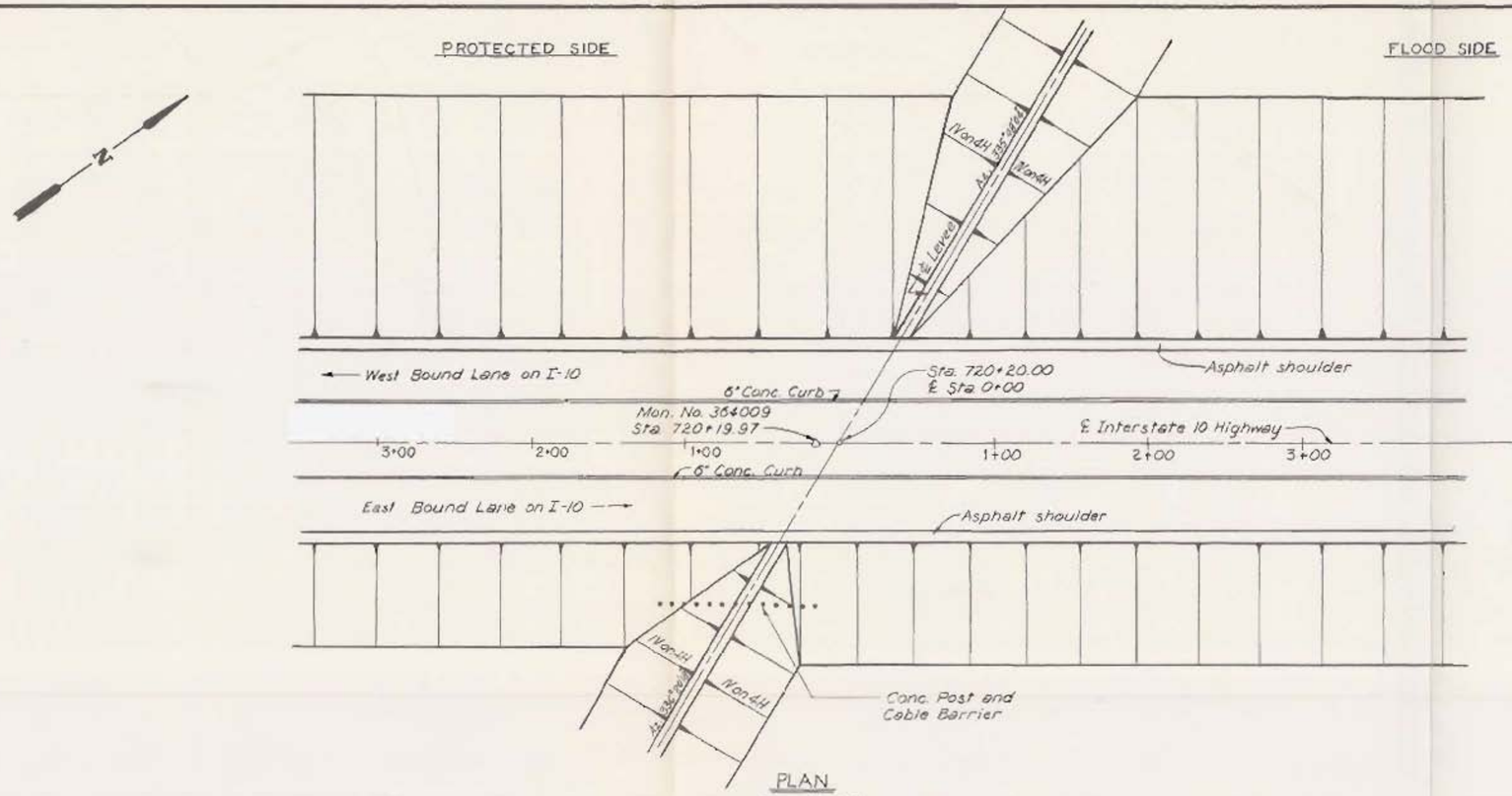
SECTION C-C

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

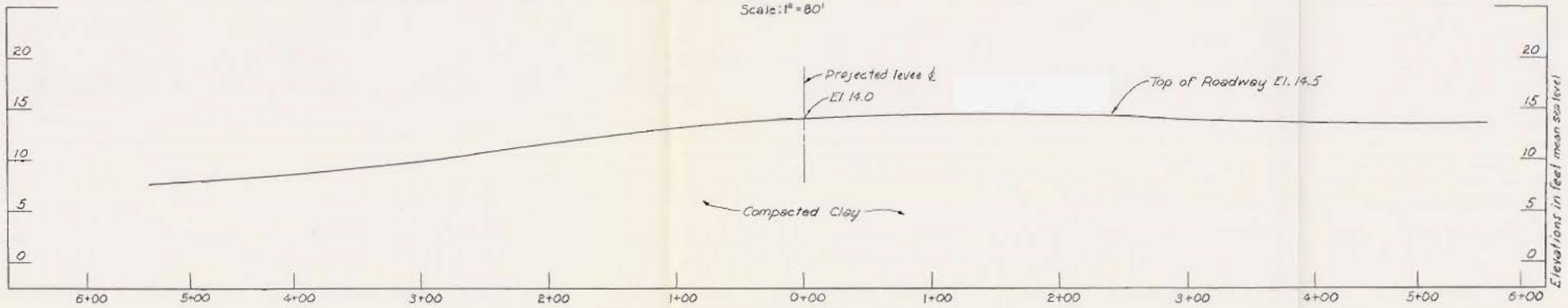
SWING GATE HINGE DETAILS

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

JANUARY 1973 FILE NO. H-2-26016



PLAN
Scale: 1" = 80'



PROFILE
Scale ~ Horiz. 1" = 80' Vert. 1" = 10'

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G. I. W. W.

JUNCTION OF LEVEE AND
INTERSTATE HIGHWAY 10

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

JANUARY 1973 FILE NO. H-2-26016

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		TYPE	LETTER SYMBOL	SYMBOL	TYPICAL NAMES
COARSE – GRAINED SOILS More than half of material is larger than No. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than No.4 sieve size.	CLEAN GRAVEL (Little or No Fines)	GW		GRAVEL, Well Graded, gravel-sand mixtures, little or no fines
			GP		GRAVEL, Poorly Graded, gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable Amount of Fines)	GM		SILTY GRAVEL, gravel-sand-silt mixtures
			GC		CLAYEY GRAVEL, gravel-sand-clay mixtures
	SANDS More than half of coarse fraction is smaller than No.4 sieve size.	CLEAN SAND (Little or No Fines)	SW		SAND, Well-Graded, gravelly sands
			SP		SAND, Poorly-Graded, gravelly sands
		SANDS WITH FINES (Appreciable Amount of Fines	SM		SILTY SAND, sand-silt mixtures
			SC		CLAYEY SAND, sand-clay mixtures
FINE – GRAINED SOILS More than half the material is smaller than No. 200 sieve size.		SILTS AND CLAYS (Liquid Limit <50)	ML		SILT & very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
			CL		LEAN CLAY; Sandy Clay; Silty Clay; of low to medium plasticity
			OL		ORGANIC SILTS and organic silty clays of low plasticity
		SILTS AND CLAYS (Liquid Limit >50)	MH		SILT, fine sandy or silty soil with high plasticity
			CH		FAT CLAY, inorganic clay of high plasticity
			OH		ORGANIC CLAYS of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt		PEAT, and other highly organic soil
WOOD			Wd		WOOD
SHELLS			Sl		SHELLS
NO SAMPLE					

NOTE: Soils possessing characteristics of two groups are designated by combinations of group symbols

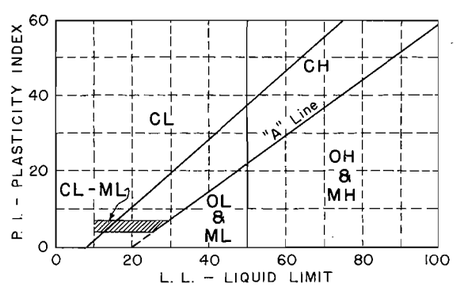
DESCRIPTIVE SYMBOLS

COLOR

COLOR	SYMBOL
TAN	T
YELLOW	Y
RED	R
BLACK	BK
GRAY	Gr
LIGHT GRAY	lGr
DARK GRAY	dGr
BROWN	Br
LIGHT BROWN	lBr
DARK BROWN	dBr
BROWNISH-GRAY	br Gr
GRAYISH-BROWN	gy Br
GREENISH-GRAY	gn Gr
GRAYISH-GREEN	gy Gn
GREEN	Gn
BLUE	Bl
BLUE-GREEN	Bl Gn
WHITE	Wh
MOTTLED	Mot

CONSISTENCY FOR COHESIVE SOILS

CONSISTENCY	COHESION IN LBS./SQ. FT. FROM UNCONFINED COMPRESSION TEST	SYMBOL
VERY SOFT	< 250	vSo
SOFT	250 - 500	So
MEDIUM	500 - 1000	M
STIFF	1000 - 2000	St
VERY STIFF	2000 - 4000	vSt
HARD	> 4000	H



PLASTICITY CHART

For classification of fine - grained soils

MODIFICATIONS

MODIFICATION	SYMBOL
Traces	Tr-
Fine	F
Medium	M
Coarse	C
Concretions	cc
Rootlets	rt
Lignite fragments	lg
Shale fragments	sh
Sandstone fragments	sds
Shell fragments	slf
Organic matter	O
Clay strata or lenses	CS
Silt strata or lenses	SIS
Sand strata or lenses	SS
Sandy	S
Gravelly	G
Boulders	B
Slickensides	SL
Wood	Wd
Oxidized	Ox

NOTES:

FIGURES TO LEFT OF BORING UNDER COLUMN "W OR D_{10}"

Are natural water contents in percent dry weight

When underlined denotes D_{10} size in mm *

FIGURES TO LEFT OF BORING UNDER COLUMNS "LL" AND "PL"

Are liquid and plastic limits, respectively

SYMBOLS TO LEFT OF BORING

- ▽ Ground-water surface and date observed
- (C) Denotes location of consolidation test **
- (S) Denotes location of consolidated-drained direct shear test **
- (R) Denotes location of consolidated-undrained triaxial compression test **
- (Q) Denotes location of unconsolidated-undrained triaxial compression test **
- (T) Denotes location of sample subjected to consolidation test and each of the above three types of shear tests **
- FW Denotes free water encountered in boring or sample

FIGURES TO RIGHT OF BORING

Are values of cohesion in lbs./sq. ft. from unconfined compression tests

In parenthesis are driving resistances in blows per foot determined with a standard split spoon sampler ($1\frac{3}{8}$" I.D., 2" O.D.) and a 140 lb. driving hammer with a 30" drop

Where underlined with a solid line denotes laboratory permeability in centimeters per second of undisturbed sample

Where underlined with a dashed line denotes laboratory permeability in centimeters per second of sample remoulded to the estimated natural void ratio

* The D_{10} size of a soil is the grain diameter in millimeters of which 10% of the soil is finer, and 90% coarser than size D_{10}.

**Results of these tests are available for inspection in the U.S. Army Engineer District Office, if these symbols appear beside the boring logs on the drawings.

GENERAL NOTES:

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract.

Ground-water elevations shown on the boring logs represent ground-water surfaces encountered on the dates shown. Absence of water surface data on certain borings implies that no ground-water data is available, but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of these borings.

Consistency of cohesive soils shown on the boring logs is based on driller's log and visual examination and is approximate, except within those vertical reaches of the borings where shear strengths from unconfined compression tests are shown.

REVISION	DATE	DESCRIPTION	BY
3	5-3-71	ADDED UPPER LIMIT LINE (P.I.=0.9(LL-8)) ON PLASTICITY CHART	LMVED-G LETTER D'T'D 29 APRIL 1971
2	6-8-64	SYMBOL FW, NOTE REVISED	ORAL FROM L.M.V.G.G. 5 JUNE 1964
1	9-17-63	1ST. PAR. OF GENERAL NOTES REVISED	L.M.V.D. MULTIPLE LETTER, DATED 5 SEPT., 1963

SOIL BORING LEGEND

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FILE NO. H-2-21800

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

APPENDIX A
CORRESPONDENCE RELATIVE TO COORDINATION WITH OTHER AGENCIES

C O P Y

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

LMNED-PP 2 April 1968

Mr. C. Edward Carlson, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Carlson:

Please refer to our letter dated 21 April 1967 requesting your views and comments on the general design memorandum for the Lake Pontchartrain Barrier Plan feature of the "Lake Pontchartrain, La. and Vicinity" project.

Our letter dated 21 April 1967 indicated that your views and comments would be requested for each supplement to the general design memorandum. However, we now feel that your views on the entire Lake Pontchartrain Barrier Plan would be preferable. The layout of the Lake Pontchartrain Barrier Plan, as described in House Document No. 231, 89th Congress, 1st Session, is shown in inclosure 1. The plan, layout of which is shown on inclosure 2, now under consideration is essentially the same as that presented in the House Document, with the following exceptions:

a. Barrier. The Chief of Engineers has approved a change in the alignment of the barrier in the Chef Menteur Pass area to that shown on inclosure 3. The barrier elevation will be 9 feet mean sea level or the elevation of existing U. S. Highway 90, whichever is higher. The remaining structures sites will remain as specified in the House Document, except that consideration is being given to widening the Rigolets Lock from 84 feet to 110 feet. The modification of the width of the Rigolets Lock is not for public release.

b. Seabrook Lock. The Chief of Engineers has approved a change in the controlling elevation of the Seabrook Lock from 13.2 feet to 7.2 feet mean sea level. This change will be effected by lowering the crown of the rock dike which will tie the lock to the levee system. In addition, auxiliary control structures, located on each side of the lock, will be added to provide for passage of flows or salinity control and riparian use when the lock is passing traffic.

c. Levees. Based on revised parameters for the standard project hurricane, as developed by the U. S. Weather Bureau, the levee grades recommended in House Document No. 231 were increased by as much as 1 to 2 feet.

d. St. Charles Parish Levees. The St. Charles Parish Lakefront levee will extend across the Parish Line Canal and tie into the Jefferson Parish Lakefront levee, rather than having a levee extending south approximately 3.5 miles along the west side of the Parish Line Canal to the Illinois Central Railroad. Drainage structures will be provided in the Lakefront levee to allow gravity drainage of the area.

We have received your comments on Seabrook Lock and the Citrus Back Levee, i.e., the levee along the north bank of the Gulf Intracoastal Waterway from the Inner Harbor Navigation Canal to the Michoud Canal, by letters dated 7 June 1967 and 22 June 1967, respectively. Your views, recommendations, and comments on the remainder of the Lake Pontchartrain Barrier Plan are requested.

Because of the urgency of providing protection to the areas vulnerable to hurricane flooding, we are operating on a much compressed planning schedule. Accordingly, it would be very much appreciated if your comments are provided not later than 1 June 1968.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

3 Incl
1. Gen map (file H-2-23693) dtd Nov 65
2. Gen map (file H-2-23693) rev May 67
3. Map - barrier alignment (file H-2-24066, plate 2)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

May 15, 1968

District Engineer
U. S. Army, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter of April 2, 1968, (LMNED-PP), requesting our views on the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana, and Vicinity project.

The overall barrier plan and its influence on fish and wildlife resources have been discussed in prior Bureau reports, most recently our letter report of June 21, 1967.

As indicated in past reports, we are of the opinion that hurricane control structures in the Rigolets and Chef Menteur tidal passes will have little appreciable effect on salinities in Lakes Maurepas, Pontchartrain, and Borgne. Therefore, no adverse effects on fish and wildlife resources in these areas are expected.

Previous model tests have indicated that acceptable salinity levels for the preservation of fish and wildlife resources in Lake Pontchartrain can be obtained by utilization of the Seabrook Lock facility, which includes an auxiliary control structure on each side of the lock. Use of these auxiliary structures should insure that adequate diversion flows for salinity control and riparian use can be provided. The capability for adjusting salinities as may be required for fish and wildlife would tend to prevent the occurrence of detrimental effects.

New levee construction and levee enlargement works as planned, including the modified St. Charles Parish levee, are not expected to directly affect fish and wildlife resources to any great degree. Indirectly, the levee system will hasten urban and industrial development of additional marshland that now provides moderate quality habitat for wildlife. Your staff has indicated that the Parish Line Canal is no longer classed as a navigable waterway. Blockage of the channel, however, will inconvenience boat owners who now use the canal.

We are pleased with your previous recognition of the need for a salinity surveillance system at the Seabrook Lock upon its completion. This Bureau and the Louisiana Wild Life and Fisheries Commission will be glad to participate in the development and monitoring of such a system.

We appreciate the opportunity to provide these comments at this time. If current plans are modified, we request the opportunity for further review and comment.

A copy of this letter has been sent to the Louisiana Wild Life and Fisheries Commission. Any comments that agency wishes to make will be forwarded to you.

Sincerely yours,

W. L. Towns
Acting Regional Director

C O P Y

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

LMNED-PP

8 April 1968

Mr. William C. Galegar, Regional Director
Federal Water Pollution Control Administration
Third Floor--1402 Elm Street
Dallas, Texas 75202

Dear Mr. Galegar:

Please refer to our letter dated 21 April 1967 requesting your views and comments on the general design memorandum for the Lake Pontchartrain Barrier Plan feature of the "Lake Pontchartrain, La. and Vicinity" project.

Our letter dated 21 April 1967 indicated that your views and comments would be requested for each supplement to the general design memorandum. However, we now feel that your views on the entire Lake Pontchartrain Barrier Plan would be preferable. The layout of the Lake Pontchartrain Barrier Plan, as described in House Document No. 231, 89th Congress, 1st Session, is shown in inclosure 1. The plan, layout of which is shown on inclosure 2, now under consideration is essentially the same as that presented in the House Document, with the following exceptions:

a. Barrier. The Chief of Engineers has approved a change in the alignment of the barrier in the Chef Menteur Pass area to that shown on inclosure 3. The barrier elevation will be 9 feet mean sea level or the elevation of existing U. S. Highway 90, whichever is higher. The remaining structures sites will remain as specified in the House Document, except that consideration is being given to widening the Rigolets Lock from 84 feet to 110 feet. The modification of the width of the Rigolets Lock is not for public release.

b. Seabrook Lock. The Chief of Engineers has approved a change in the controlling elevation of the Seabrook Lock from 13.2 feet to 7.2 feet mean sea level. This change will be effected by lowering the crown of the rock dike which will tie the lock to the levee system. In addition, auxiliary control structures, located on each side of the lock, will be added to provide for passage of flows or salinity control and riparian use when the lock is passing traffic.

c. Levees. Based on revised parameters for the standard project hurricane, as developed by the U. S. Weather Bureau, the levee grades recommended in House Document No. 231 were increased by as much as 1 to 2 feet.

d. St. Charles Parish Levees.. The St. Charles Parish Lakefront levee will extend across the Parish Line Canal and tie into the Jefferson Parish Lakefront levee, rather than having a levee extending south approximately 3.5 miles along the west side of the Parish Line Canal to the Illinois Central Railroad. Drainage structures will be provided in the Lakefront levee to allow gravity drainage of the area.

We have received your comments on Seabrook Lock and the Citrus Back Levee, i.e., the levee along the north bank of the Gulf Intracoastal Waterway from the Inner Harbor Navigation Canal to the Michoud Canal, by letter dated 23 June 1967. Your views, recommendations, and comments on the remainder of the Lake Pontchartrain Barrier Plan are requested.

Because of the urgency of providing protection to the areas vulnerable to hurricane flooding, we are operating on a much compressed planning schedule. Accordingly, it would be very much appreciated if your comments are provided not later than 1 June 1968.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

3 Incl
1. Gen Map (file H-2-23693) dtd Nov 65
2. Gen map (file H-2-23693) rev May 67
3. Map - barrier alignment (file H-2-24-66, plate 2)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
1402 ELM STREET, 3RD FLOOR
DALLAS, TEXAS 75202

May 15, 1968

Your Ref: LMNED-PP

Colonel Thomas J. Bowen, District Engineer
Department of the Army
New Orleans District, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter of April 8, 1968 requesting review and comment on the remainder of the Lake Pontchartrain Barrier Plan.

We have reviewed the information submitted in accordance with Executive Order 11288, Sections 1(3) and 1(7) in regard to water pollution control measures and find as follows:

a. All contractors should perform construction operations in a manner that will reduce turbidity and siltation to the lowest practicable level.

b. All contractors should take precautions to prevent water pollution by accidental spillage of hazardous materials which would result in substantial harm to fish or shellfish. Also, all contractors should provide and maintain sanitation facilities that will adequately treat domestic wastes to conform with Federal and local health regulations.

c. It is desirable that the water quality control structures be constructed and operated so as to prevent changes in the present water quality and to ensure that ecological conditions remain unchanged.

The comments of the Louisiana Stream Control Commission have been incorporated in our review.

Colonel Thomas J. Bowen
C/E, New Orleans, Louisiana

5/15/68

Your cooperation in carrying out the requirements of the Order is appreciated.

Sincerely yours,

for WILLIAM C. GALEGAR
Regional Director

cc: Louisiana Stream Control Commission

C O P Y

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

LMNED-PP 15 July 1969

Mr. William C. Galegar, Regional Director
Federal Water Pollution Control Administration
Third Floor - 1402 Elm Street
Dallas, Texas 75202

Dear Mr. Galegar:

Please refer to our letter dated 8 April 1968 requesting your views on the entire Lake Pontchartrain Barrier Plan and your reply dated 15 May 1968. We are now considering a modification to that portion of the current plan located in the vicinity of the Rigolets Pass.

The layout of the Lake Pontchartrain Barrier Plan, provided with our letter of 8 April 1968, and the plan now under consideration are essentially the same; however, two additional schemes for the Rigolets Control Structure and Closure are presently being evaluated. The new schemes are as follows:

a. A control structure with sixteen 50-foot bays and a sill elevation of -30 feet m.s.l. (mean sea level). The structure would be located in the main channel of the Rigolets and constructed inside a cellular sheet pile cofferdam. A closure dam would extend from the east end of the structure thence across the Rigolets. This scheme required no approach channels. (Refer to inclosed layout.)

b. A control structure with twenty-three 50-foot bays and a sill elevation of -20 feet m.s.l. The layout is the same as for the above scheme.

It is requested that you furnish your views and comments on the above schemes at your earliest conveniience.

Sincerely yours,

Incl
Layout

HERBERT R. HAAR, JR.
Colonel, CE
District Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
1402 ELM STREET, 3RD FLOOR
DALLAS, TEXAS 75202

August 5, 1969

Your Ref: LMNED-PP

Colonel Herbert R. Haar, Jr.
District Engineer
U. S. Army Engineer District, New Orleans
P. O. Box 60267
New Orleans, Louisiana 70160

Attention: LMNED-PP

Dear Sir:

Reference is made to your letter of July 15, 1969 requesting our comments on the modifications to your Lake Pontchartrain Barrier Plan in the vicinity of the Rigolets Pass.

We have reviewed this modification in regard to water pollution control measures and recommend that the final plans and specifications for the project require the contractors to:

1. Provide and maintain sanitation facilities that will adequately treat domestic wastes to conform with Federal and State health regulations.

2. Perform construction operations in a manner that will reduce turbidity and siltation to the lowest practicable level.

3. Take precautions to prevent water pollution by accidental spillage of hazardous materials which would result in substantial harm to fish or shellfish.

The comments of the Louisiana Stream Control Commission and Louisiana State Department of Health have been incorporated in our review.

Your cooperation in carrying out the requirements of the Order is appreciated.

Sincerely yours,

JERRY T. THORNHILL, Assistant Chief
Federal Activities Coordination

cc: Louisiana Stream Control Commission

Louisiana State Department of Health

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

LMNED-PP

3 July 1969

Mr. C. Edward Carlson, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Carlson:

Please refer to our letter dated 2 April 1968 requesting your views on the entire Lake Pontchartrain Barrier Plan and your reply dated 15 May 1968. We are now considering a modification to that portion of the current plan located in the vicinity of the Rigolets Pass.

The layout of the Lake Pontchartrain Barrier Plan, provided with our letter of 2 April 1968, and the plan now under consideration are essentially the same; however, two additional schemes for the Rigolets Control Structure and Closure are presently being evaluated. The new schemes are as follows:

a. A control structure with sixteen 50-foot bays and a sill elevation of -30 feet m.s.l. (mean sea level). The structure would be located in the main channel of the Rigolets and constructed inside a cellular sheet pile cofferdam. A closure dam would extend from the east end of the structure thence across the Rigolets. This scheme required no approach channels. (Refer to inclosed layout.)

b. A control structure with twenty-three 50-foot bays and a sill elevation of -20 feet m.s.l. The layout is the same as for the above scheme.

It is requested that you furnish your views and comments on the above schemes at your earliest conveniience.

Sincerely yours,

HERBERT R. HAAR, JR.
Colonel, CE
District Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

August 21, 1969

District Engineer
U.S. Army, Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

This is in reply to your letter of July 3, 1969, (LMNED-PP), requesting our comments on the two additional schemes you are considering in modifying plans for the Rigolets Control Structure and Closure, a part of the Lake Pontchartrain Barrier Plan. The new schemes described in your letter are as follows:

a. A control structure with sixteen 50-foot bays and a sill elevation of -30 feet mean sea level. The structure would be located in the main channel of the Rigolets and constructed inside a cellular sheet pile cofferdam. A closure dam would extend from the east end of the structure across the Rigolets. This scheme requires no approach channels.

b. A control structure with twenty-three 50-foot bays and a sill elevation of -20 feet m.s.l. The layout is the same as for the above scheme.

The control structure described under "b" above is identical in dimensions to the structure originally planned. The influence of the original structure on fish and wildlife was discussed in prior Bureau reports and most recently in our letter of May 15, 1968. Apparently, the structure described under "a" above is designed to pass approximately the same volume of water as structure "b". Therefore, we are of the opinion that the proposed modifications to the planned structure will have little effect on salinities in adjacent waters and no significant adverse effects on fish and wildlife resources. The proposed location of the structures in the main channel of the Rigolets does not alter our views.

We appreciate the opportunity to provide these comments at this time. If current plans are further modified, we request the opportunity for further review and comment.

A copy of this letter has been sent to the Louisiana Wild Life and Fisheries Commission. Any comments that agency wishes to make will be forwarded to you.

Sincerely yours,

W. L. Towns
Acting Regional Director

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

APPENDIX B
STRUCTURAL DESIGN CALCULATIONS

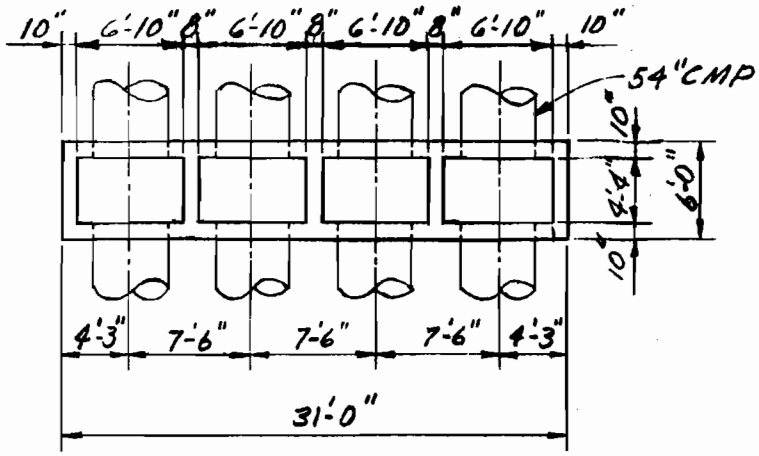
LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

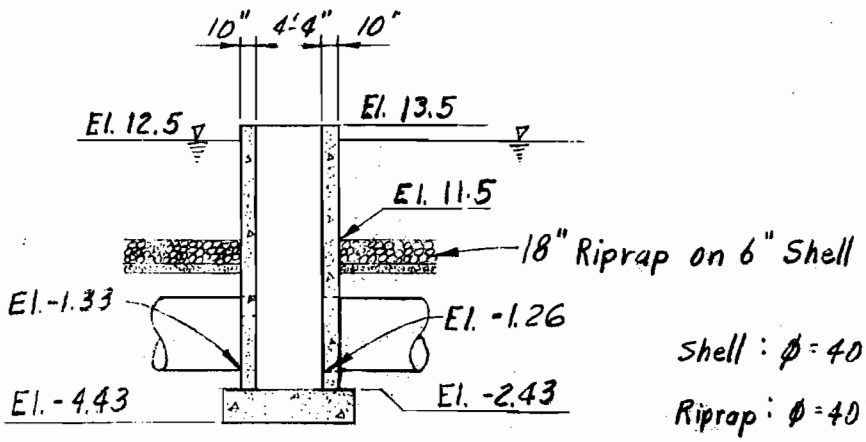
SOUTH POINT TO G.I.W.W.

Culvert @ Sta. 1054+00 - Sluice Gate Structure

Sheet No. 1
Computed By : K.D.U.
Checked By : LLW



PLAN



SECTION

Shell : $\phi = 40^\circ$, $\gamma = 100$, $\gamma' = 38$, $c = 0$

Riprap : $\phi = 40^\circ$, $\gamma = 122$, $\gamma' = 60$, $c = 0$

Soil : $\phi = 0^\circ$, $\gamma = 120$, $\gamma' = 58$, $c = 400$

Fig B-1

LAKE PONT. & VIC. (HURR. PROT.)

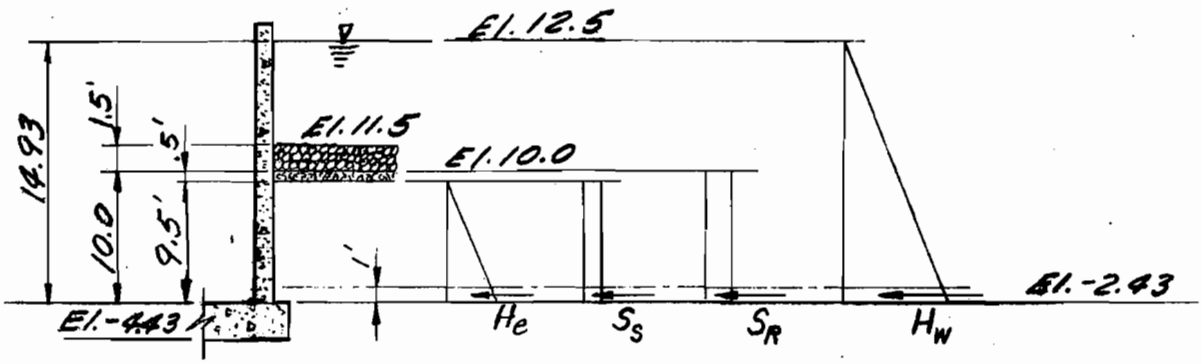
G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 2
Computed By : K.D.U.
Checked By : LLW

Culvert @ Sta. 1054+00 - Sluice Gate Structure

Reinforcement Design (Assume 1 ft. Section @ Base slab, ends fixed)



Forces on 1ft. horizontal section @ Base Slab

Soil : $K_a = \tan^2(45° - \frac{\phi}{2}) = \tan 45° = 1.00$

$H_e = \frac{1}{2}(9.5^2 - 8.5^2)(58)(1.00)$ = 522 lbs.

Shell : $S_S = (0.5)(38)(1.0)(1.0)$ = 19 lbs.

Riprap : $S_R = (1.5)(60)(1.0)(1.0)$ = 90 lbs.

Water : $H_W = \frac{1}{2}(14.93^2 - 13.93^2)(62.5)$ = 902 lbs.

1,533 lbs./lin. ft.

Use uniform loading, $w = 1.53$ K/ft.

Note : Soil pressure revised to $0.8\ \gamma_{sub}$

Soil pressure $= (115 - 62.5)\,0.8 \times 13.43 = 564$
water $= 62.5 \times 14.43 = 902$
$1{,}466 \approx 1533$

Calcs not changed

Fig. B-2

LAKE PONT. & VIC. (HURR. PROT.)

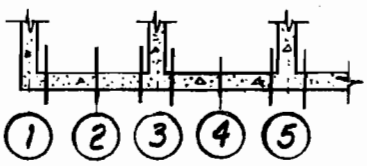
G. D. M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 3
Computed By: K.D.U.
Checked By: LLW

Culvert @ Sta. 1054+00 - Sluice Gate Structure

Moments



$M_1 = \frac{1}{24} w l'^2 = \frac{1}{24}(1.53)(6.83)^2 = 3.0$ ft-k

$M_2 = \frac{1}{14} w l'^2 = \frac{1}{14}(1.53)(6.83)^2 = 5.1$ ft-k

$M_3 = \frac{1}{10} w l'^2 = \frac{1}{10}(1.53)(6.83)^2 = 7.1$ ft-k

$M_4 = \frac{1}{16} w l'^2 = \frac{1}{16}(1.53)(6.83)^2 = 4.5$ ft-k

$M_5 = \frac{1}{11} w l'^2 = \frac{1}{11}(1.53)(6.83)^2 = 6.5$ ft-k

Design Steel ($f_s = 20{,}000$ psi, $f_c' = 3{,}000$ psi, $a = 1.44$)

$$A_s = \frac{M}{ad} = \frac{7.1 \text{ ft-k}}{(1.44)(9.5)} = 0.52 \text{ in.}^2$$

Minimum Area of Steel (A_{s_H}) - Horizontal

$A_{s_H} = 0.0025bd = (0.0025)(12)(9.5) = 0.29$ in.^{2}

Use #7 @ 12" o.c., each face horizontally

Temperature Steel (A_{s_V}) - Vertical

$A_{s_V} = 0.0025bt = (0.0020)(12)(12) = 36$ in.^{2} Half in each face

Use #4 @ 12" o.c., each face vertically

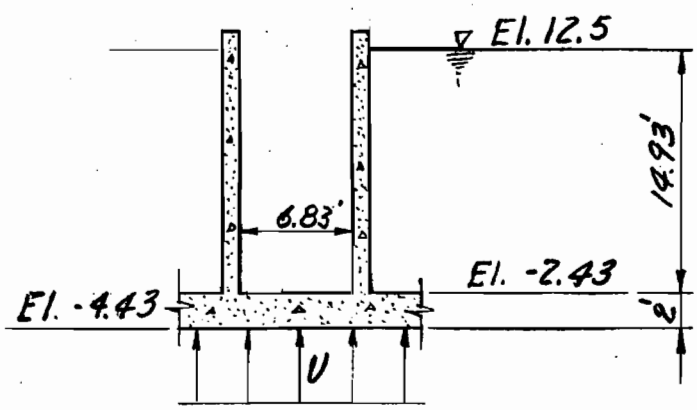
Fig. B-3

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 4
Computed By: K.D.U.
Checked By: LLW

Culvert @ Sta. 1054+00 - Sluice Gate Structure

Force on 1 ft. section - Base Slab



$u = (16.93)(62.5) = 1058$ lbs./ft.

Use uniform uplift loading, $u = 1.1$ K/ft.

Moment

$$M = \frac{1}{10} u \ell'^2 = \frac{1}{10}(1.1)(6.83)^2 = 5.13 \text{ ft-K}$$

Design Steel ($f_s = 20{,}000$ psi, $f'_c = 3{,}000$ psi, $a = 1.44$)

$$A_s = \frac{M}{ad} = \frac{5.13}{(1.44)(21.5)} = 0.17 \text{ in.}^2$$

Minimum Steel, $A_{s_{Min}}$

$$A_{s_{Min}} = 0.0025bd = (0.0025)(12)(21.5) = 0.65 \text{ in.}^2$$

Use #7 @ 11 o.c. both ways, each face

Fig. B-4

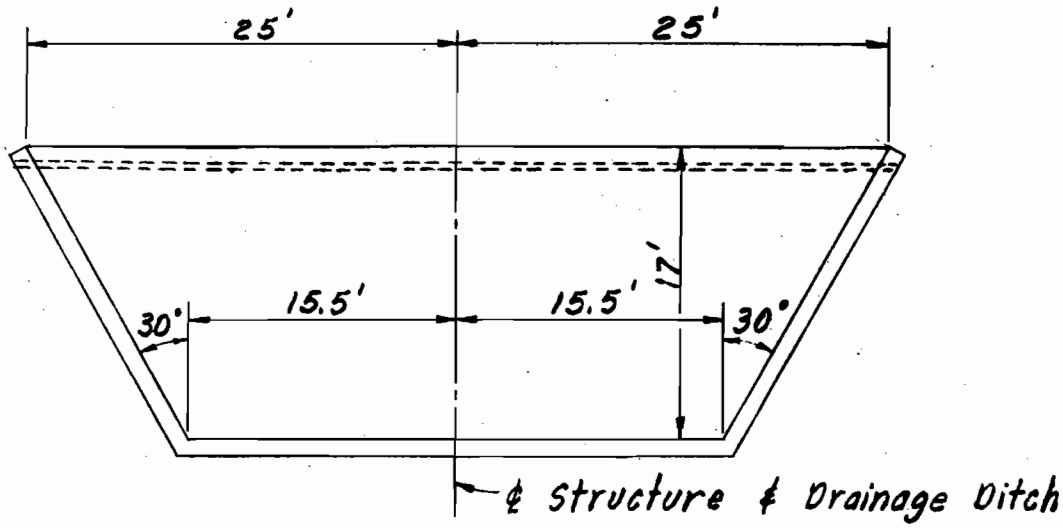
LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

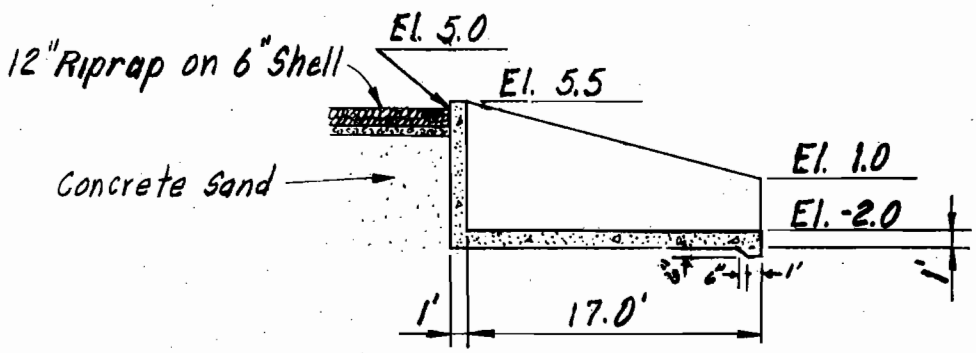
SOUTH POINT TO G.I.W.W.

Sheet No. 5
Computed By: K.D.U.
Checked By: LLW

Culvert @ Sta. 1054+00 – Drainage Inlet



Plan of Protected Side Headwall



Section

Fig. B-5

LAKE PONT. & VIC. (HURR. PROT.)
GDM #2
SOUTH POINT TO G.I.W.W.

Sheet No 6
Computed by: LLW
Chk'd by: TST

Culvert @ Sta. 1054+00 - Drainage Inlet.

Forces on 1' section of headwall as cantilever section

soil pressure: $W = (0.065 \times 6.5) \times 6.5 \times 0.5 \times 1 = 1.37^{K}$

$M = 1.37 \times 6.5/3 = 2.97'^{K}$

$A_s = \dfrac{2.97}{1.44 \times 9.5} = 0.22^{\square''}$

$Min. A_s = 0.0025 \times 12 \times 9.5 = 0.29^{\square''}$

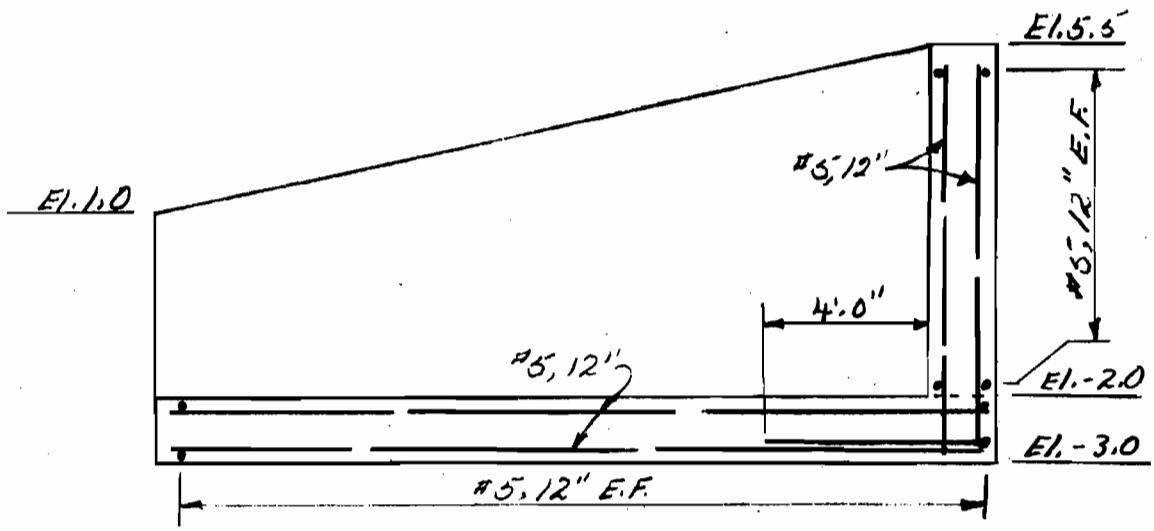
Headwall and Side Walls

USE: #5, 12" E.F. Vertical and Horizontal.

Slab Reinforcement

Max Moment = $3.71'^{K}$ (Same as Wall)

USE SAME Reinforcing as walls



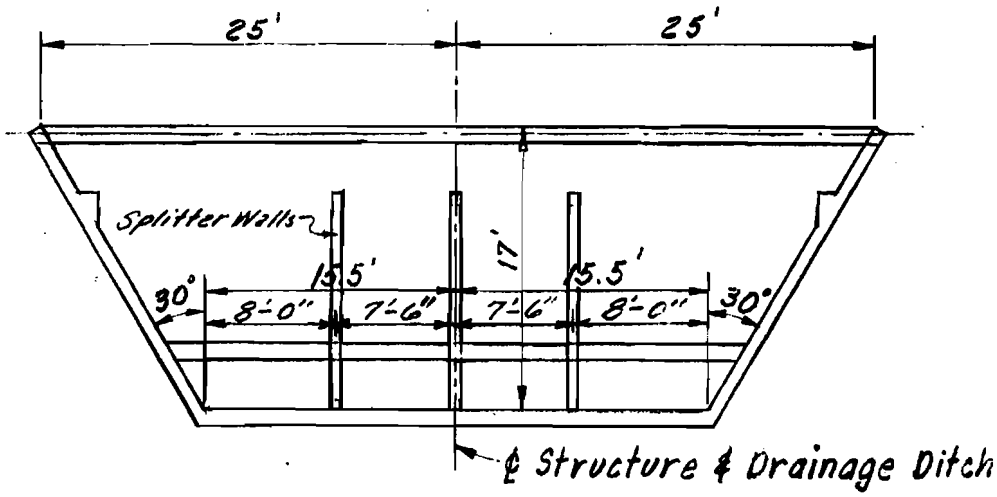
TYPICAL SECTION

Fig. B-6

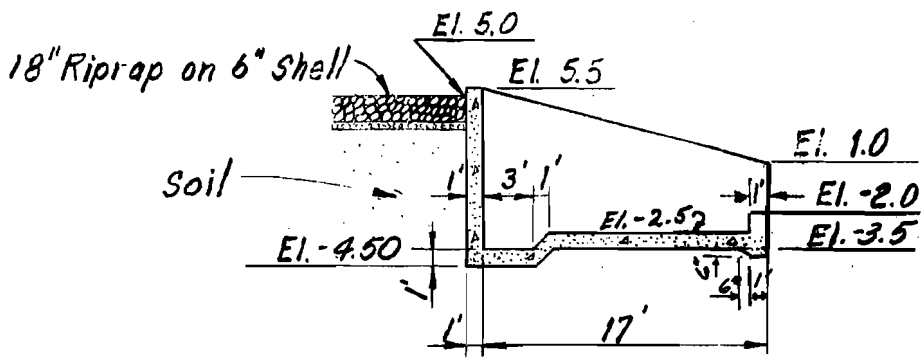
LAKE PONT & VIC. (HURR PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 7
Computed By: K.D.U.
Checked By: LLW

Culvert @ Sta. 1054+00 - Drainage Outlet



Plan of Flood Side Headwall



Section

Fig B-7

LAKE PONT. & VIC. (HURR. PROT.)
GDM # 2
SOUTH POINT TO G.I.W.W.

Sheet Nº 8
Computed by: LLW
Chkd by: TST

Culvert @ Sta. 1054+00 – Drainage Outlet.

Side Wall Reinforcing

Design as cantilever section
Construction Case (All water removed)

$w = (0.090 \times 8.0) \times 8.0 \times 1 \times 0.5 = 2.88^{k}$

$M = 2.88 \times \frac{8}{3} = 7.68^{'k}$

$A_s = \frac{7.68}{1.44 \times 9.5} = 0.56^{\square''}$ (max section)

$w = (0.090 \times 6.44) \times 6.44 \times 1 \times 0.5) = 1.87^{k}$ (At 4' From Headwall)

$M = 1.87 \times \frac{6.44}{3} = 4.01^{'k}$ (same moment is applied to slab)

$b = 12''$

$F = \frac{4.01}{152} = 0.026$

$d \cong 5'' : t = 5'' + 2\frac{1}{2}'' = 7\frac{1}{2}'' < 12''$ ok Use: $d = 9.5''$

$A_s = \frac{4.01}{1.44 \times 9.5} = 0.29^{\square''}$

$\text{Min } A_s = 0.0025 \times 12 \times 9.5 = 0.29^{\square''}$

Try #5, 12"; $A_s = 0.31^{\square''}$, $\Sigma_o = 2.0$

$v = \frac{V}{bd} = \frac{1.87}{12 \times 9.5} = 0.016 < 0.060$ ok

$u = \frac{V}{\Sigma_o jd} = \frac{1.87}{(2)(0.875)9.5} = 0.112 < 0.421$ ok

Use #5, 12" E.F. (Beginning 4' from Headwall)
Use #5, 6" E.F. (From Headwall for 4'-0")

Temp. Reinforcing (wall restrained one edge)

$A_s = 0.004 \times 12 \times 12 = 0.58^{\square''}$; $0.29^{\square''}$ Ea. Face.

USE #5, 12" E.F.

Fig. B-8

LAKE PONT. & VIC. (HURR. PROT.)
GDM # 2
SOUTH POINT TO G.I.W.W.

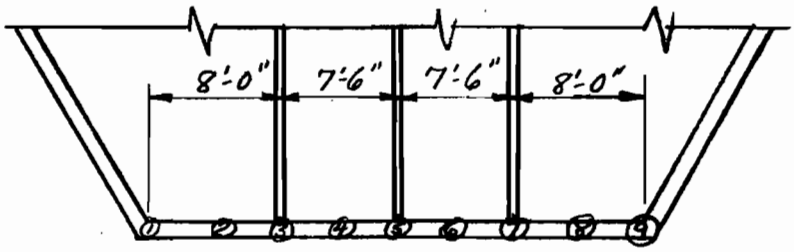
Sheet No 9
Computed by: LLW
ChKd. by: TST

Culvert @ Sta. 1054+00 Drainage Outlet

Headwall

Design as continuous beam.

$w_{max} = 0.065 \times 8.5 = 0.553$ KSF



$M_1 = M_9 = \frac{wl^2}{16} = \frac{0.553 \times 8^2}{16} = 2.21$ 'K

$M_2 = M_8 = \frac{wl^2}{14} = \frac{0.553 \times 8^2}{14} = 2.53$ 'K

$M_3 = M_7 = \frac{wl^2}{10} = \frac{0.553 \times 8^2}{10} = 3.54$ 'K

$M_4 = M_6 = \frac{wl^2}{16} = \frac{0.553 \times 7.5^2}{16} = 1.94$ 'K

$M_5 = \frac{wl^2}{11} = \frac{0.553 \times 7.5^2}{11} = 2.83$ 'K

$A_s = \frac{3.54}{1.44 \times 9.5} = 0.26$ #" (Max for Outside Face)

$A_s = \frac{2.53}{1.44 \times 9.5} = 0.18$ #" (Max for Inside Face)

Use #5, 12" Each Face

Shear at Face of Slab $= \frac{0.553}{12 \times 9.5} = 0.005 < 0.060$ OK

Temp. Reinforcement (Vertical)

$A_s = 0.0025 \times 12 \times 12 = 36$ #"; 0.18 #" Each Face

Use #4, 12" Each Face

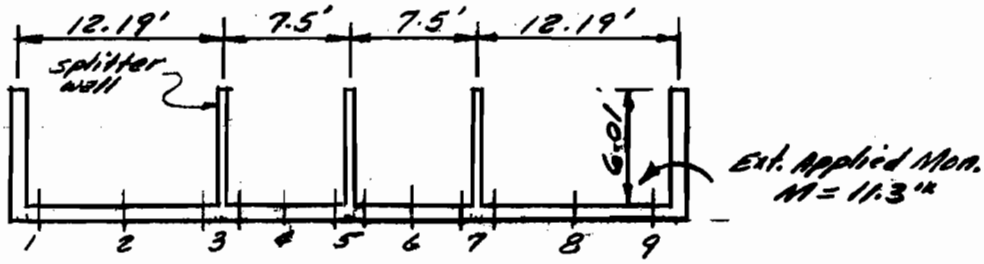
Fig. B-9

LAKE PONT. & VIC. (HURR. PROT.) Sheet No 10
G.D.M. #2 Computed by TST.
SOUTH POINT TO GIWW checked by LLW

Culvert @ Sta. 1054+00 – Drainage Outlet

Slab Design

Design as a continuous Beam



Section 7'-6" from Headwall

Earth pressure = 2(6.01×1)+3(6.01×0.5)+39.38×1 = 60.42 cu.ft.

= 60.42 × 0.15 = 9.06 ᵏ

$$w = \frac{9.06}{39.38 \times 1} = 0.23^{k}/1'$$

$M_1 = M_9$ = Applied Moments = 14.6'ᵏ (Reinforcing is same as sidewall)

$$M_2 = M_8 = \frac{w\ell^2}{14} = \frac{0.23(12.19)^2}{14} = 2.44'^{k}$$

$$M_3 = M_7 = \frac{w\ell^2}{10} = \frac{0.23(12.19)^2}{10} = 3.42'^{k}$$

$$M_4 = M_6 = \frac{w\ell^2}{16} = \frac{0.23(7.5)^2}{16} = 0.81'^{k}$$

$$M_5 = \frac{w\ell^2}{11} = \frac{0.23(7.5)^2}{11} = 1.18'^{k}$$

$+M_{max.} = 3.42'^{k}$ $-M_{max.} = 2.44'^{k}$

$$A_s = \frac{3.42}{1.44 \times 8} = 0.30^{\square''}$$

$$A_s = \frac{2.44}{1.44 \times 8} = 0.21^{\square''}$$

$$\text{Min } A_s = 0.0025 \times 12 \times 8 = 0.24^{\square''}$$

Use #5 @ 12" Top & Bottom To end of splitter walls (13'-0" from Headwall)

Fig B-10

LAKE PONT. & VIC. (HURR PROT.) Sheet No 11
G. D. M. #2 Computed by TST
SOUTH POINT TO GIWW Checked by LLW

Culvert @ Sta. 1054+00 — Drainage Outlet

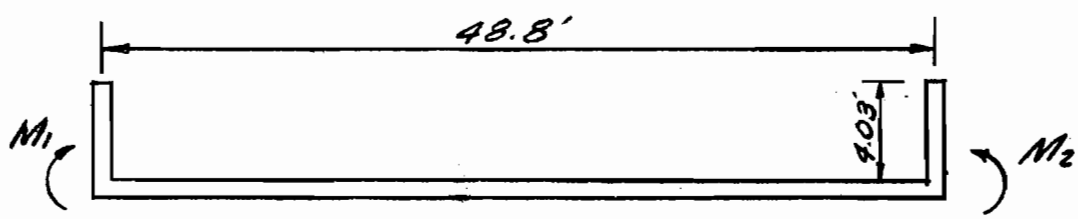
Slab Design (Con't.)

Temperature Reinforcement

$A_s = 0.0025 \times 12 \times 12 = 0.36^{\square''}$; $0.18^{\square''}$ E.F.

use #4 @ 12" $A_s = 0.20^{\square''}$

Slab Reinforcement Beyond end of splitter walls



Section @ 15'-0" from Headwall

Earth pressure $= 2(4.03) + (48.8 \times 1) = 56.86$ cu. ft.

$w = 56.86 \times 0.15 = 8.53^{k}$

$= \frac{8.53}{48.8} = 0.175$ ksf

External End Moment provided for by sidewall Reinforcing

(Ext. Moments) $M_1 = M_2 = [(0.117 \times 4.03) \times 4.03 \times 0.5 \times 1] \times \frac{4.03}{3}$

$= 1.28^{'k}$

Net Earth pressure = Total E.P. − Conc. slab wt.

$= 0.175 - 0.15 = 0.025$ ksf

Moment @ Center $= \frac{wl^2}{24} = \frac{0.025(48.8)^2}{24} = 2.5^{'k}$

$A_s = \frac{2.5}{1.44 \times 8} = 0.22^{\square''}$

Min $A_s = 0.0025 \times 12 \times 8 = 0.024^{\square''}$

use #5 @ 12" E.F.

Temperature Reinforcement

use #4 @ 12" E.F.

Fig 8-11

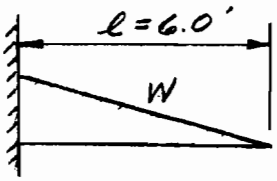
LAKE PONT. & VIC. (HURR. PROT.) sheet No 12
GDM #2 computed by TST
SOUTH POINT TO GIWW checked by LLW

Culvert @ Sta. 1054+00

<u>Drainage Outlet</u>

<u>Splitter Wall</u>

Consider one cell with no water and adjacent cell, water to TOP of pipe (El. 2.5)



$$W = (6.0 \times 0.0625) \times 6.0 \times 0.5 \times 1 = 1.125^{k}$$

$$M = \frac{w\ell}{3} = \frac{1.125 \times 6.0}{3} = 2.25^{'k}$$

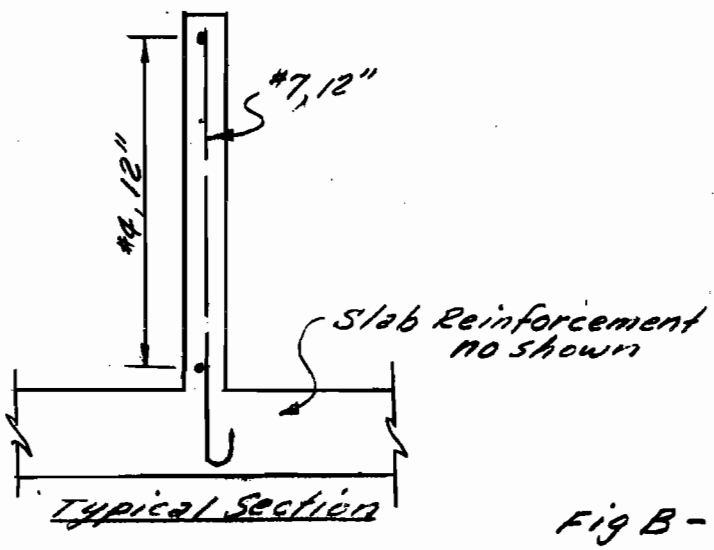
$$A_s = \frac{2.25}{1.44 \times 3} = 0.52^{\square''}$$

<u>use #7 bar @ 12" vertical Reinf.</u>

<u>Temperature Reinforcement</u>

$$A_s = 0.0025 \times 12 \times 6 = 0.18^{\square''}$$

<u>use #4 bar @ 12" Horizontal Reinf.</u>



Typical Section

Fig B-12

LAKE PONT. & VIC. (HURR. PROT.) Sheet No. 13
GDM #2 Computed by TST
SOUTH POINT TO GIWW Checked by LLW

Culvert @ Sta. 1054+00

<u>Drainage outlet</u> (Cont'd)

<u>Check shear & Bond stresses</u>

$V = 1.125^{k}$

$v = \frac{1125}{12(3)} = 31.3\ psi < 60\ psi_{o.k.}$

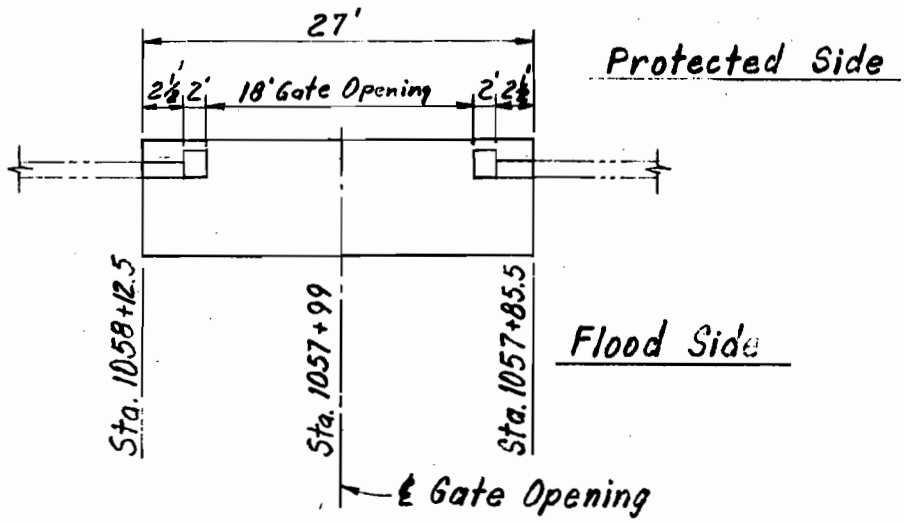
$U = \frac{1125}{2 \times 7/8 \times 3} = 214.3\ psi < 298\ psi_{o.k.}$

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 14
Computed By : K.D.U.
Checked By : LLW



Swing Gate ℄ at Sta. 1057+99

Top of Gate at El. 13.5

Top of Sill = El. 9.80

Still Water Level El. 13.0

Wind Load = 50 psf

Train Load on Monolith = 80K/axle @ 5' spacing - 15% braking force

No Wave Forces

Fig B-14

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

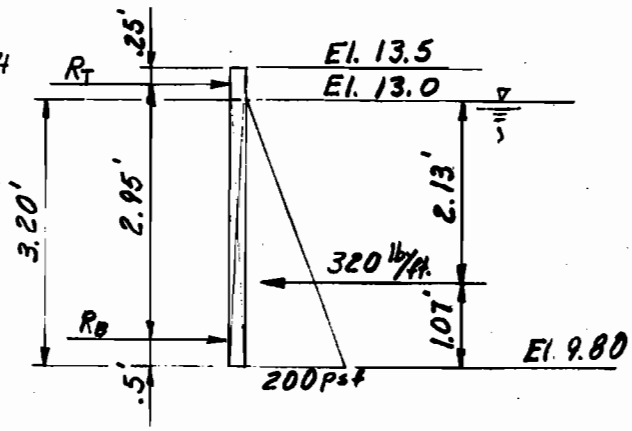
Sheet No. 15
Computed By : K.O.U.
Checked By : LLW

Swing Gate Design

CASE I - Water to El. 13.0, No Wind Load, F_b = 18,000 psi

$$R_T = \frac{1.07-0.5}{2.95}(320) = 61.8 \text{ lbs./ft}$$

$$R_B = \frac{2.13+0.25}{2.95}(320) = 258.2 \text{ lbs./ft}$$



Girder Design

Top Girder

Span (ℓ) = 18'-0" + 7 3/4" + 1'-1" = 19'-8 3/4"

Load (w) = 61.8 lb/ft.

$$M_{MAX} = \frac{w\ell^2}{8} = \frac{(61.8 \text{ lb/ft.})(19.73 \text{ ft.})^2}{8} = 3{,}007 \text{ ft-lb.} = 36{,}084 \text{ in-lb.}$$

$$S_{Req.} = \frac{M_{MAX}}{F_b} = \frac{36{,}084 \text{ in-lb.}}{18{,}000 \text{ lb/in}^2} = 2.00 \text{ in.}^3$$

Bottom Girder

Load (w) = 258.2 lbs/ft.

$$M_{MAX} = \frac{w\ell^2}{8} = \frac{(258.2 \text{ lbs/ft})(19.73 \text{ ft.})^2}{8} = 12{,}564 \text{ ft-lbs} = 150{,}768 \text{ in-lb.}$$

$$S_{Req.} = \frac{M_{MAX}}{F_b} = \frac{150{,}768 \text{ in-lb.}}{18{,}000 \text{ lb/in}^2} = 8.38 \text{ in.}^3$$

Fig B-15

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

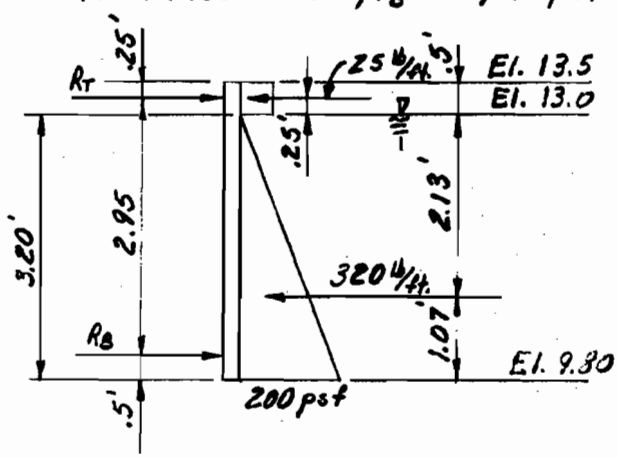
Sheet No. 16
Computed By : K.O.U.
Checked By : LLW

CASE II - Water to El. 13.0, Wind from Flood Side, $F_b = 24{,}000$ psi

$R_T = 61.83$ lbs. + (50 lbs/ft)(.5 ft.)

$R_T = 86.8$ lbs/ft.

$R_B = 258.2$ lbs./ft. (Same as CASE I)



Girder Design

Top Girder

Span (ℓ) = 19.73 ft.

Load (w) = 86.8 lbs

$$M_{MAX} = \frac{w\ell^2}{8} = \frac{(86.8 \text{ lbs/ft})(19.73 \text{ ft.})^2}{8} = 4{,}224 \text{ ft-lbs.} = 50{,}688 \text{ in.-lbs.}$$

$$S_{Req.} = \frac{M_{MAX}}{F_b} = \frac{50{,}688 \text{ in-lbs.}}{24{,}000 \text{ lb/in}^2} = 2.11 \text{ in.}^3$$

Bottom Girder

Span (ℓ) = 19.73 ft.

Load (w) = 258.2 lbs/ft.

$$M_{MAX} = \frac{w\ell^2}{8} = \frac{(258.2 \text{ lbs/ft.})(19.73 \text{ ft.})^2}{8} = 12{,}564 \text{ ft.-lbs.} = 150{,}768 \text{ in-lbs}$$

$$S_{Req.} = \frac{M_{MAX}}{F_b} = \frac{150{,}768 \text{ in.-lbs.}}{24{,}000 \text{ lbs/in.}^2} = 6.28 \text{ in.}^3$$

Fig. B-16

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

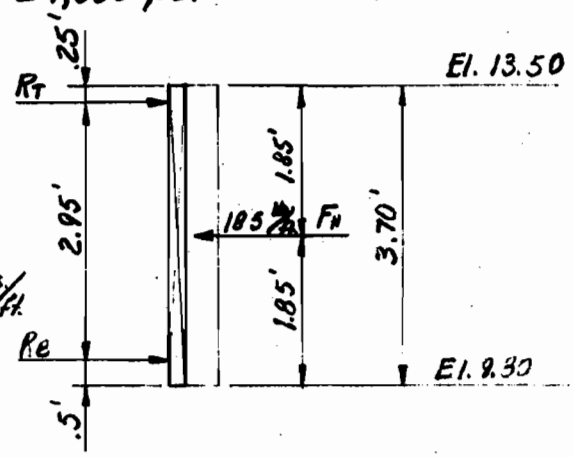
Sheet No. 17
Computed By : K.D.U.
Checked By : LLW

CASE III - Wind from Flood side, $F_b = 24{,}000$ psi

$F_H = (3.70\ ft.)(50\ lbs/ft^2) = 185\ lbs/ft.$

$R_T = \frac{1.85' - 0.5'}{2.95'}(185\ lbs/ft.) = 84.7\ lbs/ft.$

$R_B = \frac{1.85' - 0.25'}{2.95'}(185\ lbs/ft) = 100.3\ lbs/ft.$



Girder Design

Top Girder

Span (ℓ) = 19.73 ft.

Load (w) = 84.7 lbs/ft.

$M_{MAX} = \frac{w\ell^2}{8} = \frac{(84.7\ lbs/ft)(19.73\ ft.)^2}{8} = 4{,}121\ ft\text{-}lbs = 49{,}452\ in\text{-}lbs$

$S_{Req} = \frac{M_{MAX}}{F_b} = \frac{49{,}452\ in\text{-}lbs.}{24{,}000\ lbs/in^2} = 2.06\ in.^3$

Bottom Girder

Span (ℓ) = 19.73 ft.

Load (w) = 100.3 lbs/ft.

$M_{MAX} = \frac{w\ell^2}{8} = \frac{(100.3\ lbs/ft)(19.73\ ft.)^2}{8} = 4{,}881\ ft.lbs = 58{,}572\ in\text{-}lbs.$

$S_{Req} = \frac{M_{MAX}}{F_b} = \frac{58{,}572\ in\text{-}lbs}{24{,}000\ lbs/in^2} = 2.44\ in.^3$

Fig B-17

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 18
Computed By : K.D.U.
Checked By : LLW

Girder Selection

Requirements : $t_w \geqq 5/16''$

$d = 12''$ (Welded to TS 12x6x.5)

$S \geqq 8.38\ in.^3$

Try W 12 x 36 $\quad A = 10.59 in^2$, $d = 12.24$ in., $t_w = 5/16''$, $l_c = 6.9$ ft.

$l_u = 13.4$ ft., $\frac{d}{A_F} = 3.45$, $I_{x-x} = 280.8 in^4$, $S_{x-x} = 45.9\ in^3$

Assume lateral bracing @ 5.5 ft. $< l_c = 6.9$ ft. $\therefore F_b = 18{,}000$ psi OK

$M = F_b S = (18{,}000\ lbs/in^2)(45.9\ in^3) = 826{,}200$ in-lbs $> 150{,}758$ in-lbs

Deflection Check (USE CASE I Bottom Girder Load, $W = 258.2$ lbs/ft.)

$$\Delta = \frac{5Wl^3}{384EI} = \frac{5(258.2\ lb/ft.)(19.73\ ft)(19.73\ ft. \times 12\ in/ft)^3}{384(29{,}000{,}000\ lbs/in^2)(281\ in^4)}$$

$\Delta = 0.108$ in. $\qquad$ O.K.

Use W 12 x 36 for both top and bottom girders

Fig. B-18

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 19
Computed By : K.D.U
Checked By : L L W

Skin Plate

Use $\frac{5}{16}''$ skin plate (Minimum thickness), $t = 0.3125$ in.

$$I = \frac{bh^3}{12} = \frac{(12\text{ in.})(0.3125\text{ in.})^3}{12} = 0.0305\text{ in.}^4$$

$$S = \frac{I}{C} = \frac{0.0305\text{ in.}^4}{(\frac{1}{2})(0.3125\text{ in.})} = 0.1952\text{ in.}^3$$

Maximum Load $= 62.5\text{ lbs/ft.}^2 \times 3.20\text{ ft.} = 200.0\text{ lbs./ft.}$

Maximum Moment $= S \times f = (0.1952\text{ in.}^3)(18{,}000\text{ lbs/in.}^2) = 3{,}514\text{ in.-lbs.}$

$$M_{MAX}\text{ (Interior Span)} = \frac{w\,l^2}{12} = \frac{200.0\text{ lbs/ft.} \times \frac{1\text{ ft.}}{12\text{ in.}} \times l^2}{12} = 1.389\ \frac{\text{lbs.}}{\text{in.}}\,l^2$$

$$\text{Maximum Interior Span } (l_{MAX}) = \left(\frac{3{,}514\text{ in-lbs}}{1.389\text{ lbs/in.}}\right)^{\frac{1}{2}} = 50.30\text{ in} = 4.19\text{ ft.}$$

$$M_{MAX}\text{ (End Span)} = \frac{w\,l_E^2}{10} = \frac{200.0\text{ lbs/ft.} \times \frac{1\text{ ft.}}{12\text{ in.}} \times l_E^2}{10} = 1.667\ \frac{\text{lbs.}}{\text{in.}}\,l_E^2$$

$$\text{Maximum End Span } (l_{E_{MAX}}) = \left(\frac{3{,}514\text{ in.-lbs.}}{1.667\text{ lbs/in.}}\right)^{\frac{1}{2}} = 45.91\text{ in.} = 3.83\text{ ft.}$$

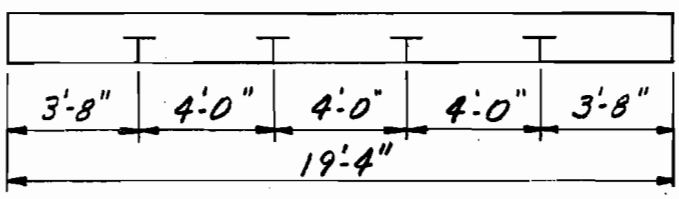


Fig B-19

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 20
Computed By : K.D.V.
Checked By : LLW

Stress Check - Interior Spans

$$M_I = \frac{wl^2}{12} = \frac{200.0\ \text{lbs/ft.} \times \frac{1\ \text{ft.}}{12\ \text{in.}} \times (4\ \text{ft.} \times 12\ \text{in./ft})^2}{12} = 3{,}200\ \text{in.-lbs.}$$

$$f_s = \frac{M}{S} = \frac{3{,}200\ \text{in.-lbs.}}{0.1952\ \text{in.}^3} = 16{,}393\ \text{psi} \quad < 18{,}000\ \text{psi} \quad \text{O.K.}$$

Stress Check - End Spans

$$M_E = \frac{wl^2}{10} = \frac{200.0\ \text{lbs/ft.} \times \frac{1\ \text{ft.}}{12\ \text{in.}} \times (44\ \text{in.})^2}{10} = 3{,}227\ \text{in.-lbs.}$$

$$f_s = \frac{M}{S} = \frac{3{,}227\ \text{in-lbs}}{0.1952\ \text{in.}^3} = 16{,}532\ \text{psi} \quad < 18{,}000\ \text{psi} \quad \text{O.K.}$$

LAKE PONT. & VIC. (HURR. PROT.)

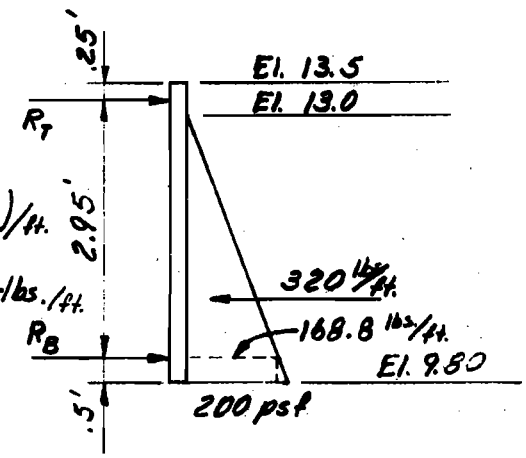
G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 21
Computed By : K.D.U.
Checked By : LLW

Vertical Members

Maximum Moment (M_{MAX}) occurs @ R_B



$$M_{MAX} = (168.8\ \text{lbs}/\text{ft.})(.5\ \text{ft.})(.25\ \text{ft.})/\text{ft.}$$
$$+ (62.5\ \text{lbs}/\text{ft.}^2)(.5\ \text{ft.})(.5\ \text{ft.})(.5)(.5\ \text{ft.})(\tfrac{2}{3})/\text{ft.}$$

$$M_{MAX} = 21.10\ \text{ft.-lbs.}/\text{ft.} + 2.60\ \text{ft.-lbs.}/\text{ft.} = 23.70\ \text{ft.-lbs.}/\text{ft.}$$

$$M_{MAX} = 284.4\ \text{in.-lbs.}/\text{ft}$$

Interior Stiffeners - Spacing @ 4'-0"

$$M_I = 284.4\ \text{in.-lbs.}/\text{ft.} \times 4.0\ \text{ft.} = 1{,}138\ \text{in.-lbs.}$$

$$S_{Req.} = \frac{M}{f} = \frac{1{,}138\ \text{in.-lbs.}}{18{,}000\ \text{lbs}/\text{in.}^2} = 0.063\ \text{in.}^3$$

End Stiffeners - Spacing @ 3'-8"

$$M_E = 284.4\ \text{in-lbs}/\text{ft.} \times 3.67\ \text{ft.} = 1{,}044\ \text{in.-lbs.}$$

$$S_{Req} = \frac{M}{f} = \frac{1{,}044\ \text{in.-lbs.}}{18{,}000\ \text{lbs}/\text{in.}^2} = 0.060\ \text{in.}^3$$

Fig B-21

LAKE PONT. & VIC. (HURR. PROT.)

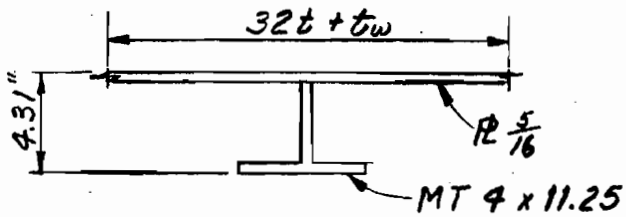
G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 22
Computed By : K.D.U.
Checked By : LLW

Try MT 4 x 11.25 , $S = 1.57\ in.^3$, $t_w = 3/8'' > 5/16''$ (Minimum Thickness)

Properties of $5/16''$ Skin Plate with MT 4 x 11.25



$32(5/16'') + 3/8'' = 10.38\ in.$

Member	Area (in.²)	Y (in.)	AY (in.³)	AY² (in.⁴)	I_o (in.⁴)
PL 5/16 x 10.375	3.24	0.156	0.505	0.079	—
MT 4 x 11.25	3.30	3.30	10.89	35.937	4.70
	6.54		11.40	36.02	4.70

$$\bar{Y} = \frac{\Sigma AY}{\Sigma A} = \frac{11.40\ in.^3}{6.54\ in.^2} = 1.74\ in.$$

$$I = I_o + \Sigma AY^2 - (\Sigma AY \times \bar{Y}) = 4.70\ in.^4 + 36.02\ in.^4 - (11.40\ in.^3 \times 1.74\ in.)$$

$$I = 20.88\ in.^4$$

$$S_{@PL} = \frac{I}{C_{PL}} = \frac{20.88\ in.^4}{1.74\ in.} = 12.00\ in.^3$$

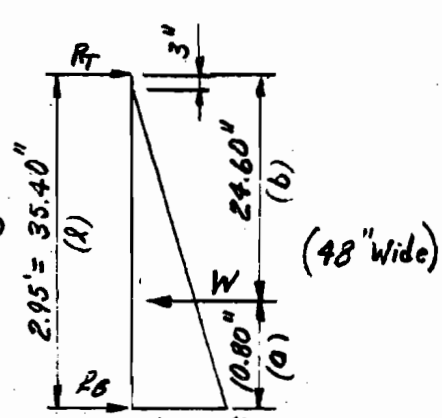
$$S_{@MT} = \frac{I}{C_{MT}} = \frac{20.88\ in.^4}{2.57\ in.} = 8.12\ in.^3$$

Check Deflection (Design of Weld Structure)

$$\Delta_{MAX} = 0.00652\ \frac{Ph^4m}{EI}$$

$$= 0.00652\ \frac{168.8\ (35.4)^4 48}{29000000(20.88)}$$

$$= 0.137\ in.\ \text{o.k.}$$



$W = (2.70)^2(0.0625)(0.5)(4) = 0.9113^k$

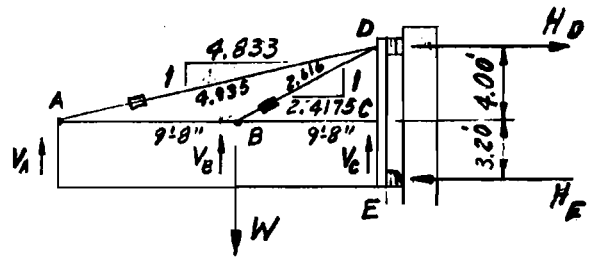
USE MT 4 x 11.25

Fig B-22

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 23
Computed By : K.D.U.
Checked By : LLW

Vertical End Member Design



Check Stress in End Column (DE), bars not stressed

TS 12x6x.5 , $S = 30.7\ in^3$ $W \cong 3{,}140$ lbs.

$\Sigma M @ E = 0$ ↻

$-(H_D)(7.20) + (3{,}140)(9.67) = 0$

$H_D = 4{,}217.2$ lbs.

$\Sigma H = 0$

$H_D - H_E = 0$

$-H_E = -4{,}217$ lbs.

Maximum Moment occurs @ C

$M = 4.00\ ft. \times 12\ in/ft. \times 4{,}217\ lbs = 202{,}416\ in\text{-}lbs.$

$f_b = \frac{M}{S} = \frac{202{,}416\ in\text{-}lbs.}{30.7\ in^3} = 6{,}593.4\ psi$ o.k.

Fig B-23

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 24
Computed By : K.D.V.
Checked By : JJW

MEMBER	SIZE	NO.	WT./FT.	LENGTH	WEIGHT
Top Girder	W 12x36	1	36	19.29	694.4
Bott. Girder	W 12x36	1	36	19.29	694.4
Skin Plate	PL 5/16 x 3'-3"	1	41.44	19.58	811.4
Vertical Ts	MT 4x11.25	4	11.25	2.65	119.3
Seal Angle	L 3x3x1/2	1	9.4	18.75	176.3
Bearing Bar	Bar 1 1/2 x 1 1/2	1	7.65	3.42	26.2
Stiffener PL	PL 5/16 x 8	4	8.50	0.60	20.4
End PL	PL 1/2 x 12 1/4	1	20.83	2.92	60.8
End PL	PL 1/2 x 3	1	5.10	2.40	12.2
End Column	TS 12x6x.5	1	54.15	7.98	432.1
				Steel Gate Weight	3047.5 lbs

Total Gate Wt. (Included Misc. Wt.) = 3140 lbs

Fig B-24

LAKE PONT & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 25
Computed By : K.D.U.
Checked By : LLN

<u>Check stress in support bars</u> - Bar 3/4 ϕ, $A = 0.4418$ in.^{2}

Assume points A, B, & C have zero deflection, A & B supported by tension in bars

$V_A = V_C = (0.1875)(3140 \text{ lbs.}) = 589 \text{ lbs.}$

$V_B = (0.625)(3140 \text{ lbs.}) = 1{,}963 \text{ lbs.}$

(Forces proportioned similar to example on p. 301, Structural Analysis, by Jack C. McCormac.)

$$t_{A\text{-}D} = \frac{589 \text{ lbs.} \times 4.9354}{0.4418 \text{ in.}^2} = 6{,}580 \text{ psi} \quad \text{O.K.}$$

$$t_{B\text{-}D} = \frac{1{,}963 \text{ lbs.} \times 2.6162}{0.4418 \text{ in.}^2} = 11{,}624 \text{ psi} \quad \text{O.K.}$$

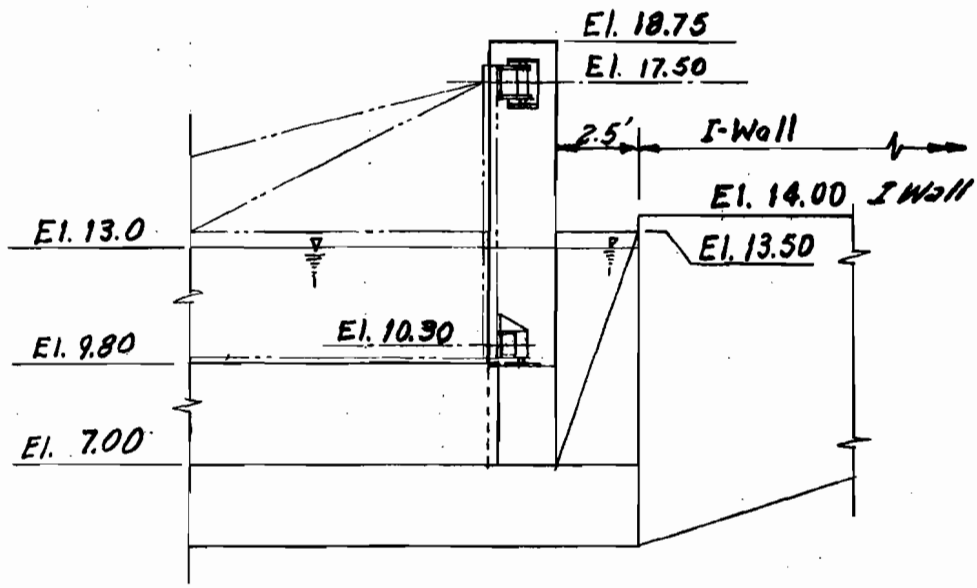
LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 26
Computed By: K.D.U.
Checked By: L.L.W

Column Design - Hinge Column (Design as a Beam)



Horizontal Forces on Column (Water at El. 13.0 + wind)

Water ; Gate, $F_{WG} = (9.0\ ft.)(3.20\ ft.)^2(.0625\ K/ft^2)(.5) = 2.88\ K$

Column, $F_{WC} = (2.0\ ft)(6.00\ ft)^2(.0625\ K/ft^2)(.5) = 2.25\ K$

Wall, $F_{WW} = (6.00\ ft)^2(.0625\ K/ft^2)(2.5\ ft)(.5)(\frac{1}{8}) = 0.94\ K$

$H_W = \Sigma$ Water Forces $= 6.07\ K$ (USE)

Wind ; Gate, $F_{AG} = (9.0\ ft.)(.5\ ft.)(.050\ K/ft^2) = 0.23\ K$

Column, $F_{AC} = (5.75\ ft.)(2.0\ ft)(.050\ K/ft^2) = 0.58\ K$

Wall, $F_{AW} = (2.50\ ft.)(.5\ ft.)(.050\ K/ft^2) = 0.06\ K$

Σ Wind Forces $= 0.87\ K$

$V_A = 75\% H_{W+A} = 5.21\ K$ $\quad H_{W+A} = \Sigma$ Water + Wind $= 6.94\ K$

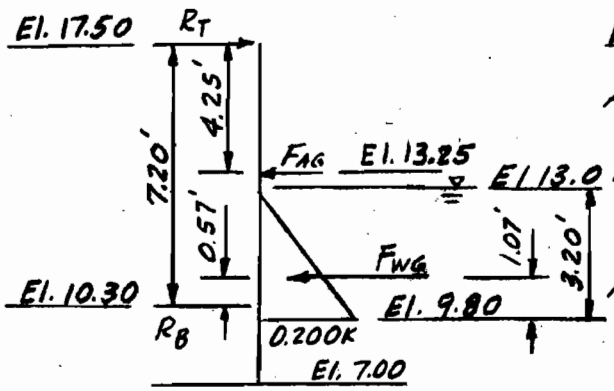
Fig B - 26

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 27
Computed By : K.D.U.
Checked By : L.L.W.



Water @ El. 13.0 With Wind

$F_{WG} = (0.32^k/ft)(9') = 2.88^k$

$R_T = \frac{2.88(0.57)+(2.95)(0.23)}{7.2}$

$= 0.32^k$

$R_B = \frac{(4.25)(0.23)+2.88(6.63)}{7.2}$

$= 2.79^k$

Water @ El. 13.0 Without Wind

$F_{WG} = (0.32^k/ft)(9') = 2.88^k$

$R_T = \frac{(0.57')}{(7.2)}(2.88^k)$

$= 0.23^k$

$R_B = \frac{(6.63)}{(7.20)}(2.88^k)$

$= 2.65^k$

$F_{AG} = 0.23^k$

Moments on Column (Water at El. 13.0), Σ @ El. 7.00

Water only: R_T, M_{R_T} = (10.50 ft.)(.23 k) = 2.42 ft.-k

R_B, M_{R_B} = (3.30 ft.)(2.65 k) = 8.75 ft.-k

Column, M_C = (2.00 ft.)(2.25 k) = 4.50 ft.-k

Wall, M_W = (3.00 ft.)(0.94 k) = 2.82 ft.-k

M_W = Σ Water Moments = 18.49 ft.-k (USE)

Water & Wind: R_T, M_{R_T} = (10.50 ft.)(0.32) = 3.36 ft.-k

R_B, M_{R_B} = (3.30 ft.)(2.79) = 9.21 ft.-k

Column, M_C = (8.63 ft.)(.58 k) = 5.00 ft.-k

Wall, M_W = (6.25 ft.)(.06 k) = 0.38 ft.-k

Σ Water + Wind Moments = 17.95 ft.-k

M_{W+A} = 75% Σ Water + Wind Moments = 13.58 ft.-k

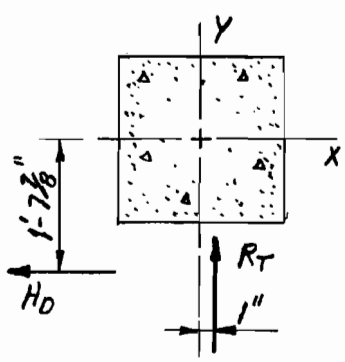
Fig B – 27

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 28
Computed By : K.D.U.
Checked By : LLW

<u>Moment on Column</u> (Weight of Gate) $H_D = 4.22^k$ (p.29)

$M_G = (10.50 ft.)(4.22^k) = 44.31$ ft-k



$H_D = 4.22^k$

$R_T = 0$ (with no Wind or Water)

$R_T = 0.23^k$ (with Water, No Wind)

<u>Torsional Moment on Column</u> (Maximum M occurs when $R_T = 0$)

Σ Moment about Centroid of Column +↺

$M_T = (1.66 ft.)(4.22^k) = 7.01$ ft-k = 84,120 in-lbs.

$M_{T_W} = 7.01$ ft-k $- (.08 ft.)(.23^k) = 6.99$ ft-k = 83,880 in-lbs. (With Water)

<u>Shear on Column</u> (Water at El. 13.0, No Wind), $H_W = 6.07^k$

$$v_T = \frac{5 M_T}{b^2 h} = \frac{5(83{,}880 \text{ in-lbs.})}{(24 \text{ in.})^3} = 30.34 \text{ psi}$$

$$v_D = \frac{H_D}{bd} = \frac{4{,}220 \text{ lbs}}{(24 \text{ in.})(21 \text{ in.})} = 8.37 \text{ psi}$$

$$v_W = \frac{H_W}{bd} = \frac{6{,}070 \text{ lbs.}}{(24 \text{ in.})(21 \text{ in.})} = 12.04 \text{ psi}$$

$V = v_T + v_D + v_W = 50.75$ psi < 60 psi O.K.

Fig B-28

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 29
Computed By : K.D.U.
Checked By : LLW

Reinforcement Design

From Table 1 Reinf. Conc. Design Handbook

$f_s = 20{,}000$ psi

$f_c' = 3{,}000$ psi

$a = 1.44$

Maximum Moment on Column (Water at El. 13.0), $f_s = 18{,}000$ psi

$M_{MAX} = M_W + M_G = 18.49 \text{ ft.-k} + (4.22 \text{ k})(10.50') = 62.80 \text{ ft.-k}$

$$A_S = \frac{M_{MAX}}{ad} = \frac{62.80 \text{ ft.-k}}{(1.44)(21 \text{ in})} = 2.08 \text{ in.}^2$$

Minimum Area of Steel, A_{SM}

$A_{SM} = 0.0025\, bd = (0.0025)(24 \text{ in.})(21 \text{ in.}) = 1.26 \text{ in.}^2$

Use 3-#9 each face ; $A_S = 8.00 \text{ in.}^2$, $\Sigma_o = 8 \times 3.544 \text{ in.} = 28.35 \text{ in.}$

Bond Check (Reinf. Conc. Design Handbook)

$U_c = 165$ psi (From Table 14a, Top Bars)

$$U = \frac{V}{\Sigma_o \frac{7}{8} d} = \frac{H_D + H_W}{\Sigma_o \frac{7}{8} d} = \frac{4{,}220 \text{ lbs.} + 6{,}070 \text{ lbs.}}{(28.35 \text{ in.})(.875)(21 \text{ in.})} = 19.75 \text{ psi O.K.}$$

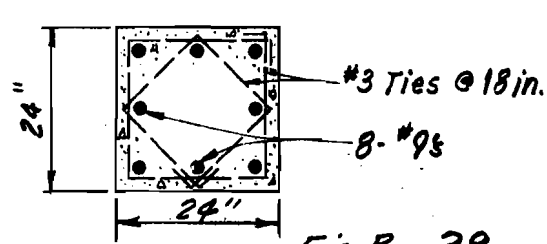
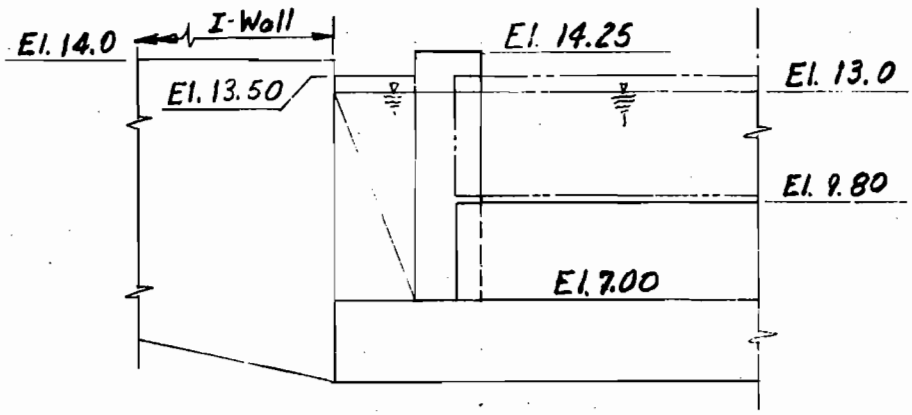


Fig B-29

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 30
Computed By : K.D.V.
Checked By : LLW

Column Design (Design as a Beam)



Horizontal Forces on Column (Water at El. 13.0 + Wind)

Water : Gate, F_{WG} = (9.46 ft.)(3.20 ft.)^2(0.0625 K/ft.^{2})(0.5) = 3.03 K

Column, F_{WC} = (1.54 ft.)(6.00 ft.)^2(0.0625 K/ft.^{2})(0.5) = 1.73 K

(0.46 ft.)(2.80 ft.)^2(0.0625 K/ft.^{2})(0.5) = 0.11 K

Wall, F_{WW} = (2.5 ft.)(6.00 ft.)^2(0.0625 K/ft.^{2})(0.5)($\frac{1}{3}$) = 0.94 K

(USE) H_W = ΣWater Forces = 5.81 K

Wind : Gate, F_{AG} = (9.75 ft.)(0.5 ft.)(0.05 K/ft.^{2}) = 0.24 K

Column, F_{AC} = (1.25 ft. x 0.5 ft. + 2.0 ft. x 0.75 ft.)(0.05 K/ft.^{2}) = 0.11 K

Wall, F_{AW} = (2.5 ft.)(0.5 ft.)(0.05 K/ft.^{2}) = 0.06 K

ΣWind Forces = 0.41 K

H_{W+A} = ΣWater + Wind Forces = 4.22 K

V_H = 75% H_{W+A} = 4.67 K

Fig B – 30

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 31
Computed By: K.D.U.
Checked By: LLW

Moments on Column (Water at El. 13.0 + Wind), Σ @ El. 7.00

Water : Gate, M_{WG} = (3.87 ft.)(3.03 K) = 11.73 ft-k

Column, M_{WC} = (2.00 ft.)(1.73 k) + (0.93 ft.)(0.11 K) = 3.56 ft-k

Wall, M_{WW} = (3.00 ft.)(0.94 K) = 2.82 ft-k

(USE) M_W = Σ Water Moments = 18.11 ft-k

Wind : Gate, M_{AG} = (6.25 ft.)(0.24 K) = 1.50 ft-k

Column, M_{AC} = (6.625 ft.)(0.03 K) + (6.88 ft.)(0.08 K) = 0.75 ft-k

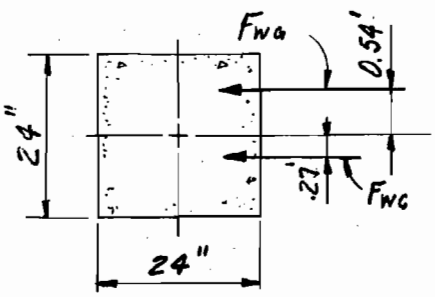
Wall, M_{AW} = (6.25 ft.)(0.06 K) = 0.38 ft-k

Σ Wind Moments = 2.63 ft-k

Σ Water + Wind Moments = 20.74 ft-k

M_{W+A} = 75 % Σ Water + Wind Moments = 15.56 ft.-K

Torsional Moment on Column (Maximum with Water at El. 13.0)



F_{WG} = 3.03 K

F_{WC} = (1.54 ft.)(3.20 ft.)²(.0625 K/ft³)(.5) = .49 K

Σ Moments about Centroid of Column +↻

M_T = (3.03 K)(0.54 ft.) - (0.49 K)(0.27 ft.) = 1.50 ft-k = 18 050 in.-lbs.

Fig B-31

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 32
Computed By: K.D.V.
Checked By: LLW

Reinforcement Design

From Table 1, Reinf. Conc. Design Handbook

$f_s = 18{,}000$ psi

$f_c' = 3{,}000$ psi

$a = 1.44$

Maximum Moment on Column (Water at El. 13.0), $f_s = 18{,}000$ psi

$M_{MAX} = M_w = 18.11$ ft.-k

$$A_s = \frac{M_{MAX}}{ad} = \frac{18.11 \text{ ft.-k}}{(1.44)(21 \text{ in.})} = 0.60 \text{ in.}^2$$

Minimum Area of Steel, A_{SM}

$$A_{SM} = 0.0025\, bd = (0.0025)(24 \text{ in.})(21 \text{ in.}) = 1.26 \text{ in.}^2$$

Use 3-#7 each face ; $A_s = 4.80 \text{ in.}^2$, $\Sigma_o = 8 \times 2.749 \text{ in.} = 21.99$ in.

Torsion Check (Design of Conc. Struct., 7th Ed., by Winter, etal)

$$V_T = \frac{n M_T}{b^2 h} = \frac{5\,(18{,}050 \text{ in-lbs.})}{(24 \text{ in.})^3} = 6.53 \text{ psi} < 60 \text{ psi} \quad \text{O.K.}$$

Shear Check

$$v = \frac{H_w}{bd} + V_T = \frac{5810 \text{ lbs.}}{(24 \text{ in})(21 \text{ in.})} + 6.53 \text{ psi} = 18.06 \text{ psi} < 60 \text{ psi} \quad \text{O.K.}$$

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 33
Computed By: K.D.V.
Checked By: LLW

Bond Check (Reinf. Conc. Design Handbook)

U_c = 165 psi (From Table 14a, Top Bars)

$$U = \frac{H_w}{\Sigma_o \, 7/8 \, d} = \frac{58101bs}{(21.99\,in.)(.875)(21\,in.)} = 1438 \text{ psi} \quad O.K.$$

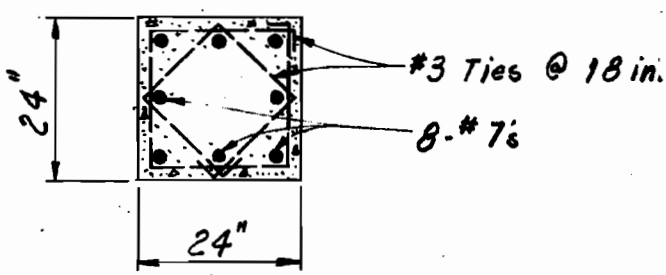


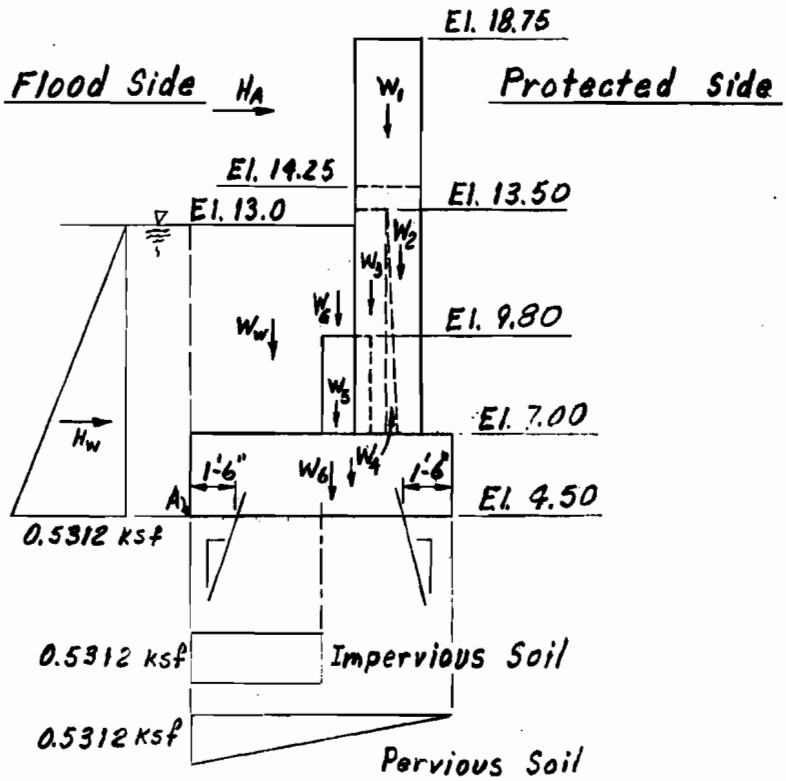
Fig B-33

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 34
Computed By : K.D.U.
Checked By : LLW



Load Cases

Case I Water at El. 13.0, No wind, Impervious Soil

Case II Water at El. 13.0, No wind., Pervious Soil

Case III No Water or Wind, 1 Train axle on slab edge, Flood Side

Case IV No Water or Wind, 1 Train axle on slab edge, Protected Side

Case V No Water or Wind, 2 Train axles on slab, Flood Side

Case VI No Water or Wind, 2 Train axles on slab, Protected Side

Note: Wind load is not critical, therefore wind does not consider in design.

Fig B-34

LAKE PONT. & VIC. (HURR. PROT.) Sheet No 35
G D M #2 Computed by TST.
SOUTH POINT TO GIWW Checked by LLW

Foundation Design (Swing Gate)

Moment About x-x

Item	Computation	F_x (K)	F_y (K)	Arm (ft)	M_x (ft-K)
Gate Wt., W_G		3.14		-4.34	-13.63
Col. & Hinge	(2)(2)(11.75)(0.15)	7.05		-6.00	-42.30
pedestal Wt, W_1	(1.5)(1.58)(2.8)(0.15)	1.00		-4.25	-4.25
Col. Wt., W_2	(2)(2)(7.25)(0.15)	4.35		-6.00	-26.10
Wall Wt., W_3	(1)(6.5)(5)(0.15)	4.88		-5.50	-26.84
	2(1)(2)(6.5)(0.15)	3.90		-4.00	-15.60
Wall Wt., W_4	(6.5)(0.27)(5)(0.5)(0.15)	0.66		-6.09	-4.02
Sill Bm, W_5	(1.5)(2.8)(19.3)(0.15)	12.16		-4.75	-57.76
Base slab, W_6	(8)(2.5)(27)(0.15)	81.00		-4.00	-324.00
subtotal Concrete only		118.14			-514.50
Water Wt., W_w	(6)(5)(27)(0.0625)	50.63		-2.50	-126.56
	-(1)(2.8)(19)(0.0625)	-3.33		-4.50	14.99
Water Force, H_w	(8.5)²(0.5)(27)(0.0625)		-60.96	2.83	-172.52
uplift Imp. Soil	(8.5)(4)(27)(0.0625)	-57.38		-2.00	114.76
CASE I TOTAL		108.06	-60.96		-683.83
Water Wt., W_w	(6)(5)(27)(0.0625)	50.63		-2.50	-126.56
	-(1)(2.8)(19)(0.0625)	-3.33		-4.50	14.99
Water Force, H_w	(8.5)²(0.5)(27)(0.0625)		-60.96	2.83	-172.52
uplift, perv. soil	(8.5)(8)(0.5)(27)(0.0625)	-57.38		-2.67	153.20
CASE II TOTAL		108.06	-60.96		-645.39
1 Axle, Floodside	Train - Cooper 80	80.00		0.00	0.00
Half Gate Wt.		-1.57		4.25	-6.67
CASE III TOTAL		196.57			-521.17
1 Axle, Prot. side	Train - Cooper 80	80.00		-8.00	-640.00
Half Gate Wt.		-1.57		4.25	-6.67
CASE IV TOTAL		196.57			-1161.17
2 Axles, Floodside	Train - Cooper 80	160.00		-2.50	-400.00
Half Gate Wt.		-1.57		4.25	-6.67
CASE V TOTAL		276.57			-921.17
2 Axles, Prot. side	Train - Cooper 80	160.00		-5.50	-880.00
Half Gate Wt.		-1.57		4.25	-6.67
CASE VI TOTAL		276.57			-1401.17

LAKE PONT. & VIC. (HURR PROT.) Sheet No 36
GDM #2 Computed by TST
SOUTH POINT TO GIWW Checked by LLW

Foundation Design (Swing Gate)
Moment About y-y

Item	Computation	F_z (k)	F_x (k)	Arm (ft)	M_y (ft-k)
Base slab, W_b	(8)(2.5)(27)(0.15)	81.00		-13.50	-1093.50
Col. & hinge Pedestal Wt., W_1	(2)(2)(11.75)(0.15)+(1.58)(1.5)(2.8)(0.15)	8.05		-3.50	-28.18
Col. Wt., W_2	(2)(2)(7.25)(0.15)	4.35		-23.50	-102.23
Wall Wt., W_3	(1)(6.5)(2.5)(0.15)+½(0.271)(6.5)(2.5)(0.15)	2.77		-1.25	-3.46
Wall Wt., W_{3A}	(1)(6.5)(2)(0.15)	1.95		-0.50	-0.98
Wall Wt., W_4	(1)(6.5)(2.5)(0.15)+½(0.271)(6.5)(2.5)(0.15)	2.77		-25.75	-71.33
Wall Wt., W_{4A}	(1)(6.5)(2)(0.15)	1.95		-26.50	-51.68
Sill Bm, W_5	(1.5)(2.8)(19.3)(0.15)	12.16		-13.50	-164.16
Subtotal Concrete only		115.00			-1515.52
Water Wt.-sill	(6)(5)(27)(0.0625)-(1)(2.8)(19)(0.0625)	47.30		-13.50	-638.55
Gate Wt. (Closed)		3.14		-3.50	-10.99
uplift, Imp. soil	(8.5)(27)(4)(0.0625)	-57.38		-13.50	774.63
CASE I TOTAL		108.06			-1390.43
Water Wt.-sill	(6)(5)(27)(0.0625)-(1)(2.8)(19)(0.0625)	47.30		-13.50	-638.55
Gate Wt. (Closed)		3.14		-3.50	-10.99
uplift, perv soil	(8.5)(27)(8)(0.5)(0.0625)	-57.38		-13.50	774.63
CASE II TOTAL		108.06			-1390.43
Gate Wt. (opened)		1.57		-3.50	-5.50
1 Axle, Floodside	2(40)	80.00		-13.50	-1080.00
CASE III TOTAL		196.57			-2601.02
Gate Wt. (opened)		1.57		-3.50	-5.50
1 Axle, Prot. side	2(40)	80.00		-13.50	-1080.00
CASE IV TOTAL		196.57			-2601.02

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 37
G D M #2 Computed by TST
SOUTH POINT TO G I W W Checked by LLW

Foundation Design (Swing Gate)
Moment About y-y (Cont'd)

Item	Computation	F_z (K)	F_x (K)	Arm (ft)	M_y (ft-K)
Gate Wt. (opened)		1.57		-3.50	-5.50
2 Axles, Floodside	2(80)	160.00		-13.50	-2160.00
CASE V TOTAL		276.57			-3681.02
Gate Wt. (opened)		1.57		-3.50	5.50
2 Axles, protside	2(80)	160.00		-13.50	2160.00
CASE VI TOTAL		276.57			-3681.02

Moment About z-z Axis

Item	Computation	F_z (K)	F_y (K)	Arm (ft)	M_z (ft-K)
Far side	Water Force				
On Wall & Col.	$\frac{1}{2}(6)^2(4.5)(0.0625)$		-5.06	24.75	-125.24
On gate @ Col.	$\frac{1}{2}(6)^2(9.0)(0.0625)$		-10.125	23.50	-237.94
On gate @ Hinge	$\frac{1}{2}(6)^2(9.0)(0.0625)$		-10.125	3.42	-34.63
Near side					
On wall & Col.	$\frac{1}{2}(6)^2(4.5)(0.0625)$		-5.06	2.25	-11.39
On Base Slab	(2.5)(27)(0.45313)		-30.59	13.50	-412.97
CASE I & II TOTAL			-60.96		-822.17
CASE III, IV, V & VI TOTAL			—		—

LAKE PONT. & VIC (HURR. PROT.) Sheet No 38
G. D. M #2 Computed by TST
SOUTH POINT TO GIWW Checked by LLW

Foundation Design (Swing Gate)

Summation of Moments & Forces

CASE	F_x (K)	F_y (K)	F_z (K)	M_x (ft-k)	M_y (ft-k)	M_z (ft-k)
I	0.00	-60.96	108.06	-683.83	-1390.43	-822.17
II	0.00	-60.96	108.06	-645.39	-1390.43	-822.17
III	0.00	0.00	196.57	-521.17	-2601.02	0.00
IV	0.00	0.00	196.57	-1161.17	-2601.02	0.00
V	0.00	0.00	276.57	-921.17	-3681.02	0.00
VI	0.00	0.00	276.57	-1401.17	-3681.02	0.00

Results From Hrennikoff 3-D Pile Analysis

CASE	Max Pile A	Max Pile B_1	Max. Pile B_2	Max. Pile C
I	-22.60	21.50	8.60	49.60
II	-22.10	24.90	5.20	49.10
III	28.90	50.10	3.50	22.50
IV	21.20	-7.00	59.80	30.20
V	37.90	53.80	21.20	33.40
VI	32.10	11.60	63.50	39.20

(-) Tension , (+) Compression

Pile A — Front row batter pile
Pile B_1 — Front row Vertical pile
Pile B_2 — Rear row Vertical pile
Pile C — Rear row batter pile

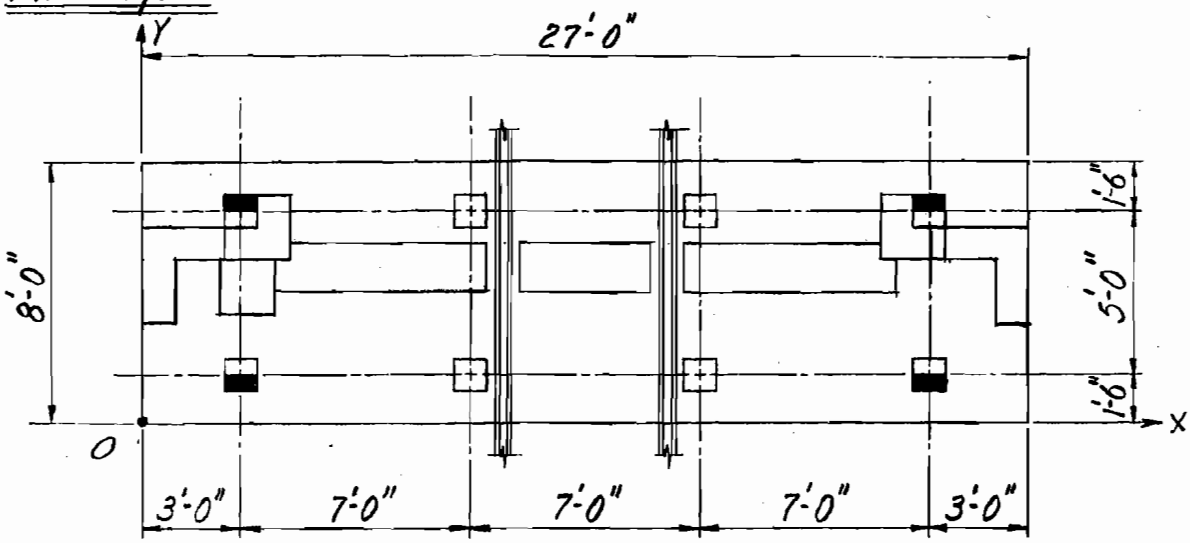
LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

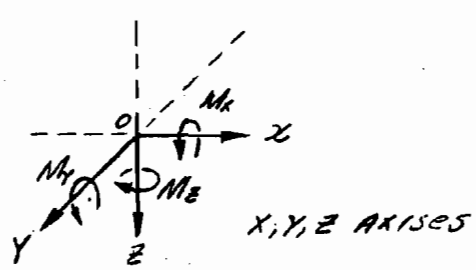
SOUTH POINT TO G.I.W.W.

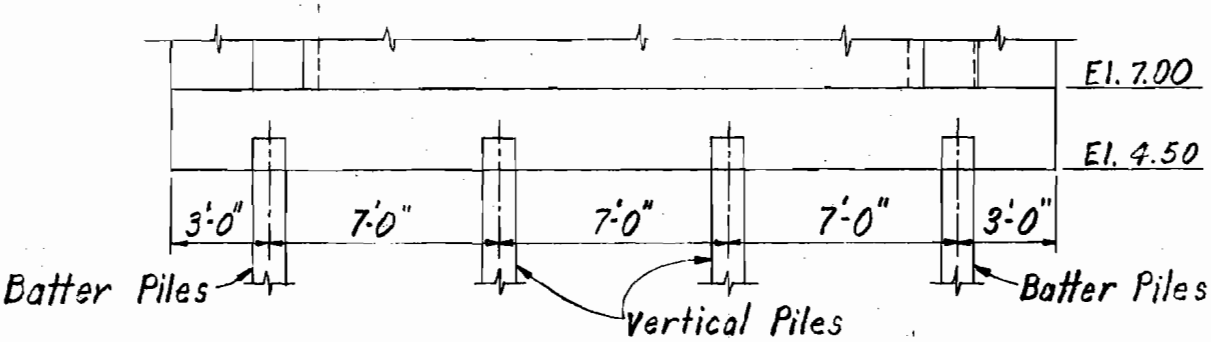
Sheet No. 39
Computed By: K.D.U.
Checked By: LLW

Pile Layout



PLAN





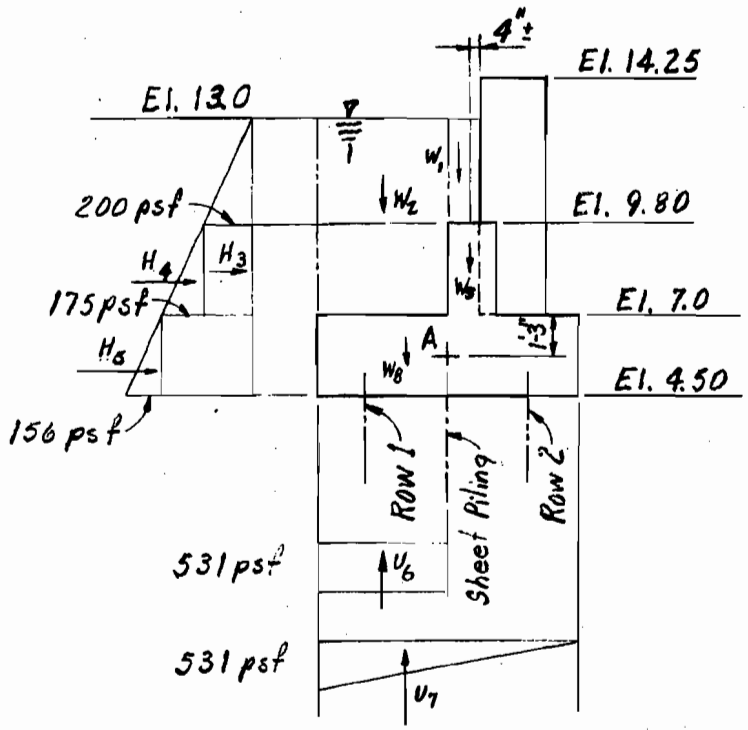
ELEVATION

Fig B - 39

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 40
Computed By: K.D.U.
Checked By: LLW

Base Slab Design



Forces Acting Between Columns

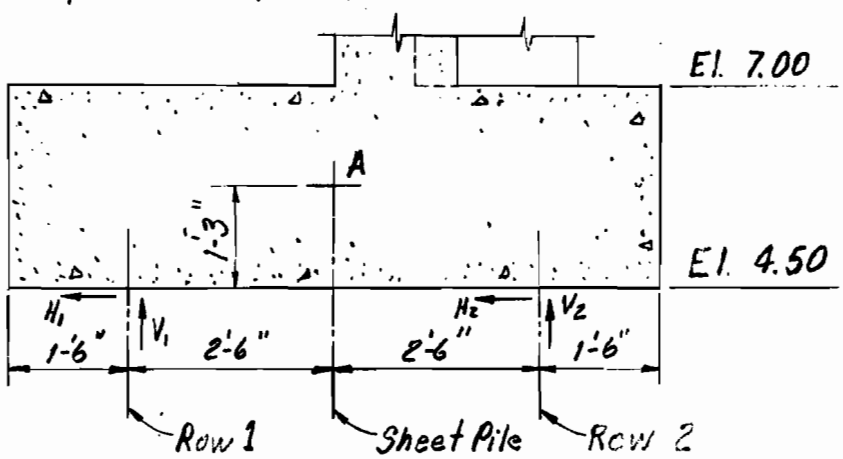
W_S = 2.80 ft. x 1.5 ft. x 18.0 ft. x 0.150 Ksf = 11.34 K ↓
W_8 = 2.50 ft. x 8.0 ft. x 18.0 ft. x 0.150 Ksf 54.00 K ↓
W_1 = 3.20 ft. x 1.0 ft. x 18.0 ft. x 0.0625 Ksf = 3.60 K ↓
W_2 = 6.0 ft. x 4.0 ft. x 18.0 ft. x 0.0625 Ksf = 27.00 K ↓
H_3 = 3.20 ft. x .0625 Ksf x 2.80 ft. x 18.0 ft. = 10.08 K →
H_4 = 2.80 ft. x .0625 Ksf x 2.80 ft. x .5 x 18.0 ft. = 4.41 K →
H_5 = 2.50 ft. x .0625 Ksf x 2.50 ft. x .5 x 18.0 ft. = 3.52 K →
U_6 = 8.50 ft. x .0625 Ksf x 4.0 ft. x 18.0 ft. = 38.25 K ↑
U_7 = 8.50 ft. x .0625 ksf x 8.0 ft x .5 x 18.0 ft. = 38.25 K ↑

Fig B-40

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 41
Computed By : K.D.U.
Checked By : LLW

Pile Loadings For Group C (2 Vertical Piles each Row in Gate Opng.)



Forces Between Columns - Pile Loadings, CASE I

$V_1 = 2 \times 21.50^k = 43.0^k \uparrow$

$H_1 = 2 \times 1.30^k = 2.60^k \leftarrow$

$V_2 = 2 \times 8.60^k = 17.20^k \uparrow$

$H_2 = 2 \times 1.30^k = 2.60^k \leftarrow$

Forces Between Columns - Pile Loadings, CASE II

$V_1 = 2 \times 24.90^k = 49.80^k \uparrow$

$H_1 = 2 \times 1.40^k = 2.80^k \leftarrow$

$V_2 = 2 \times 5.20^k = 10.40^k \uparrow$

$H_2 = 2 \times 1.40^k = 2.80^k \leftarrow$

LAKE PONT. & VIC. (HURR. PROT.)

G.D.M. #2

SOUTH POINT TO G.I.W.W.

Sheet No. 42
Computed By: K.D.U.
Checked By: LLW

Σ Moments about Point A (Centroid of Base Slab) +)

Item	V (K)	H (K)	$\bar{X}$ (ft.)	M (ft-K)
W_s	11.34		0.75	8.50
W_B	54.00		0.00	–
W_1	3.60		0.33	1.19
W_2	27.00		2.00	-54.00
H_3		10.08	2.65	26.71
H_4		4.41	2.18	9.61
H_5		3.52	0.42	-1.48
	95.94	18.01		-9.47
U_6	-38.25		2.00	76.50
V_1	-43.00		2.50	107.50
H_1		-2.60	1.25	3.25
V_2	-17.20		2.50	-43.00
H_2		-2.60	1.25	3.25
CASE I :	-2.51	12.81		138.03
U_7	-38.25		1.33	50.87
V_1	-49.80		2.50	124.50
H_1		-2.80	1.25	3.50
V_2	-10.40		2.50	-26.00
H_2		-2.80	1.25	3.50
CASE II :	-2.51	12.41		146.90

Fig B-42

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 43
Computed By : K.D.U.
Checked By : LLW

Torsional Analysis, M_T Maximum with CASE II Loading

$M_T = (146.90 \text{ ft.-k})(.5) = 73.45 \text{ ft.-k}$ (Moment divides equally in Base Slab @ ends of Gate Opening.)

$M_T = 881400 \text{ in.-lbs.}$

Shear Caused by Torsional Moment, v_T

$$v_T = \frac{5 M_T}{b^2 h} = \frac{5(881400 \text{ in.-lbs.})}{(30 \text{ in.})^2 (96 \text{ in.})} = 51.01 \text{ psi} \quad \text{O.K.}$$

Shear Check, V Maximum with CASE II Loading

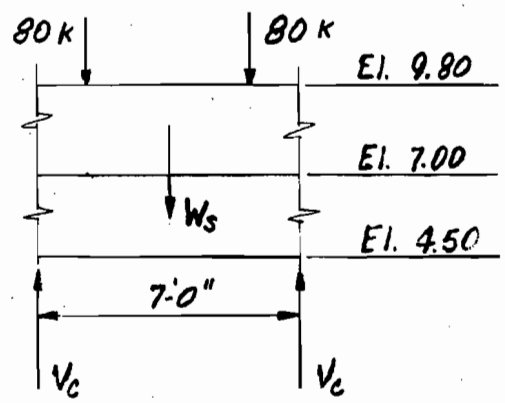
$$v_v = \frac{V}{bd} = \frac{-2510 \text{ lbs.}}{(96 \text{ in.})(26 \text{ in.})} = -1.01 \text{ psi}$$

$$v_{MAX.} = v_T + v_v = 50.00 \text{ psi} \quad \text{O.K.}$$

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 44
Computed By : K.D.U.
Checked By : LLW

Shear Check, Case V or VI (Free-body between Vertical Piles)



$V_{c_b} = 53.80 + 21.20$

$V_{c_b} = 75.00^K$

$V_{c_s} = 11.60 + 63.50$

$V_{c_s} = 75.10^K$

$W_s = (8.0\ ft.)(2.5\ ft.)(.150\ K/ft^3)(7.0\ ft.) + (1.5\ ft.)(2.8\ ft.)(.150\ K/ft.^3)(7.0\ ft.)$

$W_s = 25.41^K$

$\Sigma V = 80K + 80K + 25.41K - 150.10K = 35.31K$

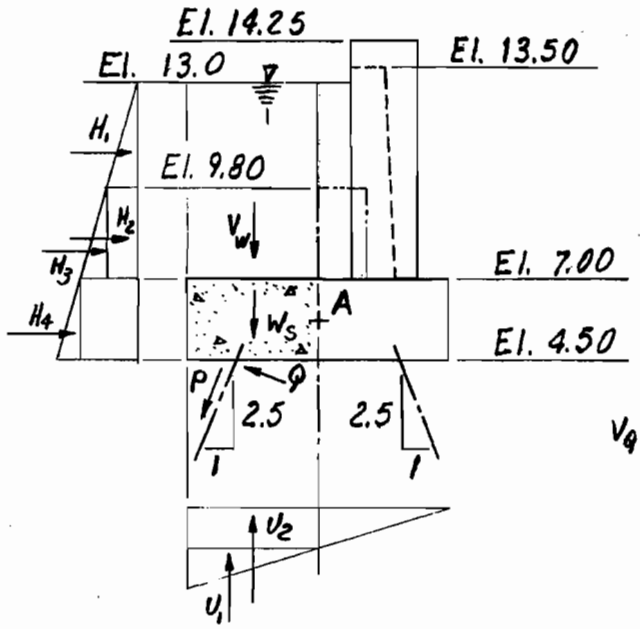
$v = \frac{V(.5)}{bd} = \frac{(35310\ lbs.)(.5)}{(96\ in.)(26\ in.)} = 7.07\ psi$ O.K.

Fig B-44

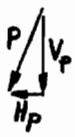
LAKE PONT. & VIC. (HURR. PROT.)
G.D.M #2
SOUTH POINT TO G.I.W.W.

Sheet No. 45
Computed By: K.D.U.
Checked By: LLW

Transverse Top Reinforcement - Consider CASE II
(Assume 6.0 width of Slab affected by Pile in Tension



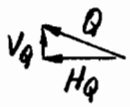
$P = -22.10\ k$



$V_P = \frac{2.5}{2.693} P = 20.52\ k$

$H_P = \frac{1}{2.693} P = 8.21\ k$

$Q = -1.40\ k$



$V_Q = \frac{1}{2.693} Q = 0.52\ k$

$H_Q = \frac{2.5}{2.693} Q = 1.30\ k$

Forces which cause Rotational Moment(R) in Slab

Force

$H_1 = (3.20\ ft.)^2(.0625\ k/ft.^3)(.5)(6.0\ ft.) = 1.92\ k$

$H_2 = (3.20\ ft.)(.0625\ k/ft.^3)(2.80\ ft.)(6.0\ ft.) = 3.36\ k$

$H_3 = (2.80\ ft.)^2(.0625\ k/ft.^3)(.5)(6.0\ ft.) = 1.47\ k$

Rotational Moment, M_R (Assume @ A)

$M_R = (1.92\ k)(5.12\ ft.) + (3.36\ k)(2.65\ ft.) + (1.47\ k)(2.18\ ft.)$

$M_R = 21.94\ ft.\text{-}k$

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 46
Computed By: K.D.U.
Checked By: LLW

Forces acting on Free-Body Diagram

$V_W = (6.0\ ft.)(4.0\ ft.)(6.0\ ft.)(.0625\ K/ft.^3) = 9.00\ K$

$W_S = (2.5\ ft.)(4.0\ ft.)(6.0\ ft.)(.150\ K/ft.^3) = 9.00\ K$

$H_4 = (2.50\ ft.)^2(.0625\ K/ft.^3)(.5)(6.0\ ft.) = 1.17\ K$

$U_1 = (8.5\ ft.)(.0625\ K/ft.^3)(.5)(4.0\ ft.)(6.0\ ft.)(.5) = 3.19\ K$

$U_2 = (8.5\ ft.)(.0625\ K/ft.^3)(.5)(4.0\ ft.)(6.0\ ft.) = 6.38\ K$

Σ Moments about Pt. A $+\circlearrowleft$ (Add M_R)

$M = (9.00\ K)(2.0\ ft.) + (9.00\ K)(2.0\ ft.) + (1.17\ K)(.42\ ft.) - (3.19\ K)(2.67\ ft.)$
$- (6.38\ K)(2.0\ ft.) + (20.52\ K)(2.5\ ft.) - (8.21\ K)(1.25\ ft.)$
$- (0.52\ K)(2.5\ ft.) - (1.30\ K)(1.25\ ft.) + 21.94\ ft.\text{-}K$

$M = 75.27\ ft.\text{-}K$

$A_s = \frac{M}{ad} = \frac{75.27\ ft.\text{-}k}{(1.44)(26\ in.)} = 2.01\ in.^2$ (Over 6 ft. width)
$= 0.34\ in.^2/ft.$

Minimum Area of Steel, A_{SM}

$A_{SM} = 0.0025\ bd = (.0025)(72\ in.)(26\ in.) = 4.68\ in.^2$ (6 ft. width)

$= 0.78\ in.^2/ft.$

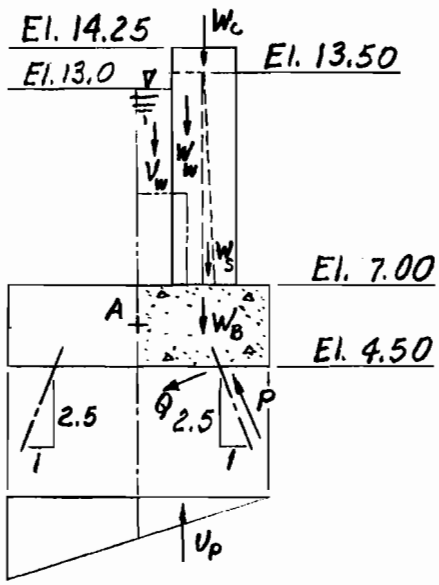
Use #6 @ 12 each face

Fig B-46

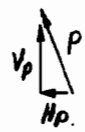
LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 4.7
Computed By : K.D.U.
Checked By : LLW

Transverse Bottom Reinforcement - Consider CASE II
(Assume 6.0 ft. width of Slab affected by Pile in Compression)



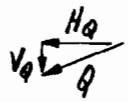
$P = 49.10^K$



$$V_p = \frac{2.5}{2.693} P = 45.58^K$$

$$H_p = \frac{1}{2.693} P = 18.23^K$$

$Q = -1.20^K$



$$V_Q = \frac{1}{2.693} Q = 0.45^K$$

$$H_Q = \frac{2.5}{2.693} Q = 1.11^K$$

Forces acting on Free-Body Diagram

$W_c = (7.25\ ft.)(2.0\ ft.)(2.0\ ft.)(.150\ K/ft.^3) = 4.35\ K$

$W_w = (6.50\ ft.)(1.0\ ft.)(2.5\ ft.)(.150\ K/ft.^3) = 2.44\ K$

$W_s = (6.50\ ft.)(.27\ ft.)(.5)(2.5\ ft.)(.150\ K/ft.^3) = 0.33\ K$

$W_B = (2.50\ ft.)(4.0\ ft.)(6.0\ ft.)(.150\ K/ft.^3) = 9.00\ K$

$U_p = (8.50\ ft.)(.0625\ K/ft.^3)(.5)(4.0\ ft.)(6.0\ ft.)(.5) = 3.19\ K$

$V_w = (6.0\ ft.)(1.0\ ft.)(6.0\ ft.)(.0625\ K/ft.^3) = 2.25\ K$

Fig B-47

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 48
Computed By: K.D.U.
Checked By: LLW

Σ Moments about Point A $\circlearrowright$ (Add M_R)

$$M = (45.58\,k)(2.50\,ft.) - (18.23\,k)(1.25\,ft.) - (0.45\,k)(2.50\,ft.)$$
$$-(1.11\,k)(1.25\,ft.) - (4.35\,k)(2.0\,ft.) - (2.44\,k)(1.50\,ft.)$$
$$-(0.33\,k)(2.09\,ft.) - (9.00\,k)(2.0\,ft.) + (3.19\,k)(1.33\,ft.)$$
$$-(2.25\,k)(0.50\,ft.) + 21.94\,ft.\text{-}k$$

$$M = 82.66\,ft.\text{-}k$$

$$A_s = \frac{M}{ad} = \frac{82.66\,ft.\text{-}k}{(1.44)(26\,in.)} = 2.21\,in.^2 \text{ (Over 6 ft. width)}$$
$$= 0.37\,in^2/ft.$$

Minimum Area of Steel, A_{SM}

$$A_{SM} = 0.0025\,bd = (.0025)(72\,in.)(26\,in.) = 4.68\,in.^2 \text{ (6 ft. width)}$$
$$= 0.78\,in^2/ft.$$

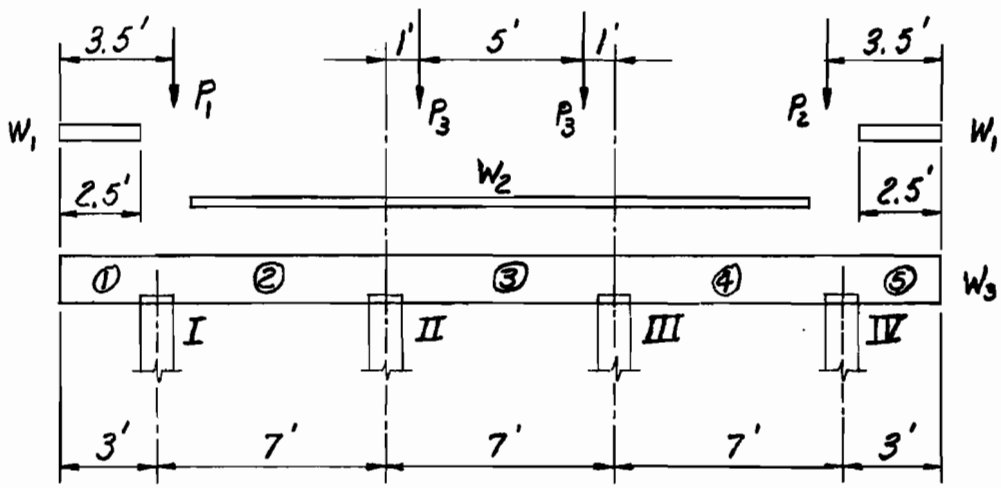
Use #6 @ 12 each face

Fig B – 48

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 49
Computed By: K.D.U.
Checked By: LLW

Longitudinal Reinforcement - Consider CASE VI



Loads

P_1 (Column) $= (7.25\ ft.)(2.0\ ft.)(2.0\ ft.)(.150\ K/ft.^3) = 4.35\ K$

P_2 (Column + Gate) $= (11.75\ ft.)(2.0\ ft.)(2.0\ ft.)(.150\ K/ft.^3) + 3.14\ K = 10.19\ K$

P_3 (2 Train Wheels) $= (2)(40\ K) = 80\ K$

W_1 (Wall) $= [(6.5\ ft.)(1.0\ ft.) + (6.5\ ft.)(.27\ ft.)(.5)](.150\ K/ft.^3) = 1.11\ K/ft.$

W_2 (Sill Beam) $= (2.8\ ft.)(1.5\ ft.)(.150\ K/ft.^3) = 0.63\ K/ft.$

W_3 (Base Slab) $= (2.5\ ft.)(8.0\ ft.)(.150\ K/ft.^3) = 3.00\ K/ft.$

(Reference: Ten Division Influence Lines For Continuous Beams by Anger)

Fig B-49

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 50
Computed By: K.D.U.
Checked By: LLW

Calculation of Moments at Supports

M_{W_1} (Cantilever) = (1.75 ft.)(1.11 k/ft)(2.5 ft.) = 4.86 ft.-k

M_{W_3} (Cantilever) = (3.0 k/ft.)(3.0 ft.)^2(.5) = 13.5 ft.-k

Ref. P.	Load	Support I	Support II		Support III		Support IV
		M (ft.-k)	Factor	M (ft.-k)	Factor	M (ft.-k)	M (ft.-k)
134	W_1 (Left)	-4.86	+.2667	-1.30	-.0667	0.32	—
	W_1 (Right)	—	-.0667	0.32	+.2667	-1.30	-4.86
	W_3 (Left)	-13.50	+.2667	-3.60	-.0667	0.90	—
	W_3 (Right)	—	-.0667	0.90	+.2667	-3.60	-13.50
82	P_1 (@1)	—	-.0264	-0.11	+.0066	0.03	—
	P_2 (@1)	—	+.0066	0.07	-.0264	-0.27	—
	P_3 (@11)	—	-.0390	-3.12	-.0150	-1.20	—
	P_3 (@19)	—	-.0150	-1.20	-.0390	-3.12	—
78	W_3 ($W_3 l^2$)	—	-.1000	-14.70	-.1000	-14.70	—
	W_2 ($W_2 l^2$)	—	-.1000	-3.09	-.1000	-3.09	—
	Total M's	-18.36		-25.83		-26.03	-18.36

Fig B-50

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 51
Computed By: K.D.U.
Checked By: LLW

Area of Steel (Design), A_s

$$A_s = \frac{M}{ad} = \frac{26.03 \text{ ft.-k}}{(1.44)(26 \text{ in.})} = 0.70 \text{ in.}^2 \quad \text{(over 8 ft. width)}$$

Minimum Area of Steel, A_{sm}

$$A_{sm} = 0.0025\, bd = (.0025)(96 \text{ in.})(26 \text{ in.}) = 6.24 \text{ in.}^2 \quad \text{(8 ft. Width)}$$
$$= 0.78 \text{ in}^2/\text{ft.}$$

Use #6 @ 12 each face

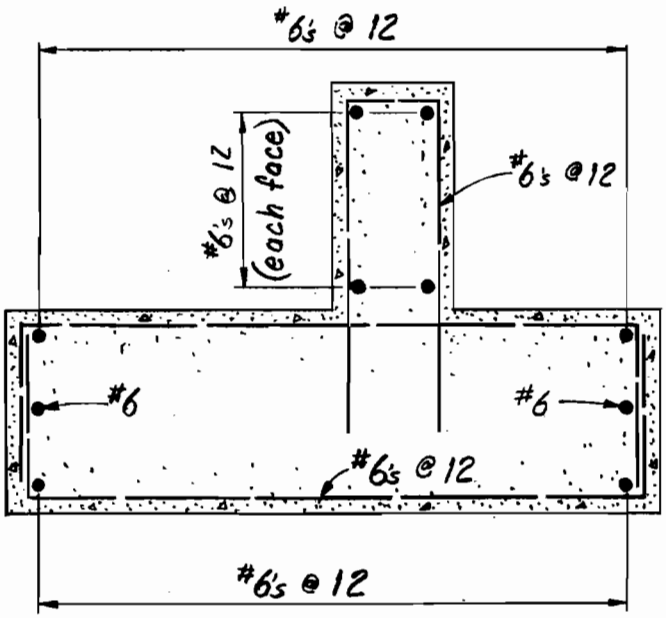
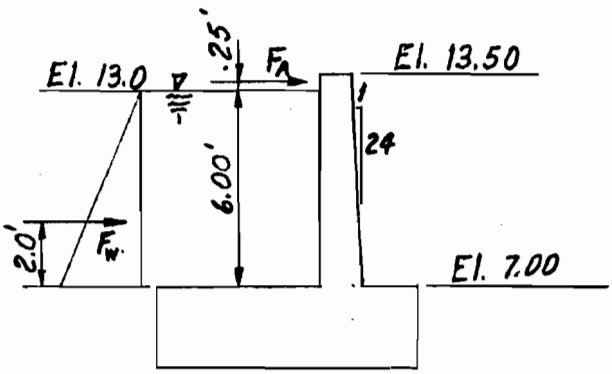


Fig B-51

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 52
Computed By : K.D.U.
Checked By : L L W

T-Wall Design (Water at El. 13.0 + Wind)



Horizontal Forces on Wall

Water ; $F_W = (6.00\ ft.)^2(.0625\ K/ft.^2)(.5) = 1.13\ K$

Wind ; $F_A = (1ft.)(.5ft.)(.05\ K/ft.^2) = 0.03\ K$

$H_{W+W} = \Sigma$ Water + Wind Forces $= 1.16\ K$

$V = 75\%\ H_{W+W} = 0.87\ K < F_W$ (Use)

Moments on Wall

Water ; $M_W = (2.0\ ft.)(1.13\ K) = 2.26\ ft.\text{-}K$

Wind ; $M_A = (6.25\ ft.)(.03K) = 0.19\ ft.\text{-}K$

$M_{W+W} = \Sigma$ Water + Wind Moments $= 2.45\ ft.\text{-}K$

$M = 75\%\ M_{W+W} = 1.84\ ft.\text{-}K < M_W$ (Use)

Water @ El. 13.0, No Wind

Water; $M_W = (2.0')(1.13^K) = 2.26\ ft\text{-}K$

LAKE PONT. & VIC. (HURR. PROT.)
G.D.M. #2
SOUTH POINT TO G.I.W.W.

Sheet No. 53
Computed By : K.D.U.
Checked By : LLW

Reinforcement Design

From Table 1 Reinf. Conc. Design Handbook :

$f_s = 20{,}000$ psi

$f_c = 3{,}000$ psi

$a = 1.44$

Maximum Moment, $M_w = 2.26$ ft.-k

$d = 12'' + \frac{78''}{24} - 3'' = 12.25''$ use $d = 12''$

$$A_s = \frac{M_w}{ad} = \frac{2.26 \text{ ft.-k}}{(1.44)(12 \text{ in.})} = 0.13 \text{ in.}^2$$

Minimum A_s

$A_s = (0.0025)(bd) = (0.0025)(12 \text{ in.})(12 \text{ in.}) = 0.36 \text{ in.}^2$

Use #6 @12 Vertically each face, $A_s = 0.44 \text{ in.}^2$, $\Sigma o = 2.4$ in.

Minimum A_s (Temperature, Horizontal)

$A_s = (0.0025)(bt) = (0.0025)(5.25 \text{ in.})(78 \text{ in.}) = 2.97 \text{ in.}^2$

$\frac{A_s}{2} = 1.49 \text{ in.}^2$ each face

Use #5 @12 Horizontally each face

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO GIWW

APPENDIX C
HYDROLOGY AND HYDRAULICS

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
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APPENDIX C
HYDROLOGY AND HYDRAULICS

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No.	Title
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LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
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SOUTH POINT TO GIWW

APPENDIX C
HYDROLOGY AND HYDRAULICS

1. General. This appendix presents hydrologic and hydraulic design criteria and analyses pertinent to and associated with the New Orleans East levee from South Point to the Gulf Intracoastal Waterway (GIWW). The levee intersects the New Orleans East lakefront levee at South Point and the New Orleans East back levee at the GIWW. The overall plan of improvement is described in the main text of this memorandum.

2. Tidal hydraulics. The Hydrology and Hydraulic analysis design memorandum for the Lake Pontchartrain Barrier Plan was presented previously in a series of three separate reports entitled "Design Memorandum No. 1," and subtitled "Part I - Chalmette," approved 27 October 1966; "Part II - Barrier," approved 18 October 1967; and "Part III - Lakeshore," approved 6 March 1969. These memorandums presented detailed descriptions and analyses of the tidal hydraulic methods and procedures used in the tidal hydraulic design of the features for the plan and include the essential data, assumptions, and criteria used, and the results of studies which provide the bases for determining surges, routing, wind tides, wave runup, overtopping, frequencies, and also the climatology pertinent to the area.

a. Design hurricane.

(1) Selection of design hurricanes. The standard project hurricane (SPH) was selected as the design hurricane (Des H) due to the urban nature of the project area. A design hurricane of lesser intensity than the SPH would indicate a lower levee grade and would expose the project area to disastrous flooding in the event an SPH would occur.

(2) Design hurricane characteristics. The Des H for the project area has a central pressure index of 27.4 inches of mercury and a maximum overwater windspeed of 100 m.p.h. at a radius of 30 nautical miles. In order to give the project area protection equal to other segments of the overall Lake Pontchartrain hurricane protection project, it was necessary to consider hurricanes approaching from two different directions. Hurricane parameters for each of

the hurricanes are identical. One hurricane, on a track designated Track A, approaches from a southerly direction and is used mainly to determine the elevation of protective structures from South Point to U. S. Highway 90. The other, on a track designated Track F, approaches from a southeasterly direction and is used primarily to develop the grade elevation for the protective structures from the GIWW to U. S. Highway 90. SPH isovel patterns and critical path for Track A are shown on plate 4 of DM No. 1, Part III - Lakeshore. The SPH isovel patterns and critical path for Track F are shown on plate 6 of DM No. 1, Part II - Barrier.

b. Design windtide levels and levee heights. During the time maximum windtide levels are against the protective levee, the winds are parallel to or leeward of the levee and no wave runup will occur. Prior and subsequent to that time, the winds will be generally perpendicular to the protective embankment, but the height of the wave runup at such time will not exceed the levee design grade. Consequently, wave runup is not the controlling factor in determining the design elevation of the levee. The design elevation was determined by providing 1 foot of freeboard above the maximum windtide level. Table C-1 summarizes the elevations of design windtide levels and the design elevation of the protective levees.

TABLE C-1

DESIGN HURRICANE
WINDTIDE LEVELS AND
DESIGN ELEVATIONS OF PROTECTIVE STRUCTURES

Location	Windtide level ft. m.s.l.	Elev. of protective levees ft. m.s.l.	Critical track
South Point to Hwy. 90 (Sta. 666+00 to Sta. 939+29)	8.5-11.5	12.5	A & F
Hwy. 90 to GIWW (Sta. 939+29 to Sta. 1102+98)	11.5-12.8	12.5-14.0	F

c. Frequency estimates. The procedure for determining frequency estimates is described in paragraph 9a of DM No. 1, Part I - Chalmette. The Des H has a recurrent frequency of once in about 300 years over Lake Pontchartrain and about once in 200 years over Lake Borgne.

3. Description of drainage area. The New Orleans East unpumped drainage area is composed of partially submerged marsh at an average elevation of 0.0. This area consists of about 22 square

miles which are almost entirely undeveloped and are now gravity drained through four existing drainage structures, which are discussed in the next paragraph. The entire drainage area is subject to periodic inundation from extreme high tides or by hurricane flooding.

4. Existing drainage structures. One of the four existing drainage structures is included in the New Orleans East lakefront levee reach from Paris Road to South Point and was discussed in DM No. 2, Supplement No. 5B. The other existing structures consist of four 36" Ø culverts 120 feet in length at station 797+30, four 42" Ø CMP culverts 143 feet in length at station 925+27, and six 42" Ø CMP culverts 120 feet in length at station 1055+74. All culverts in these structures have a flap gate on the discharge end. These structures do not meet current design criteria for such works in that they do not include positive cutoff, culvert lengths are too short to extend beyond the enlarged embankment, and they are in a state of bad repair. These structures cannot be modified to meet current standard design criteria, and accordingly, it is necessary to provide new structures to replace-in-kind those now serving the drainage area.

5. Proposed replacement drainage structures. Since the existing drainage structures cannot be used, replacement drainage structures will be constructed. These structures will hydraulically replace-in-kind the existing structures and will be placed at the same invert elevations.

a. Drainage structure at station 799+00. A new drainage structure will be constructed at station 799+00 to replace the existing structure at station 797+30. The new structure will consist of three 42" Ø CMP culverts 160 feet in length. The invert elevation will be -2.0. This structure will include sluice gates for positive cutoff, seepage collars around the culverts, a trash rack on the inlet side, and flap gates on the outer end. Details of this structure are shown on plate 64 of the main report.

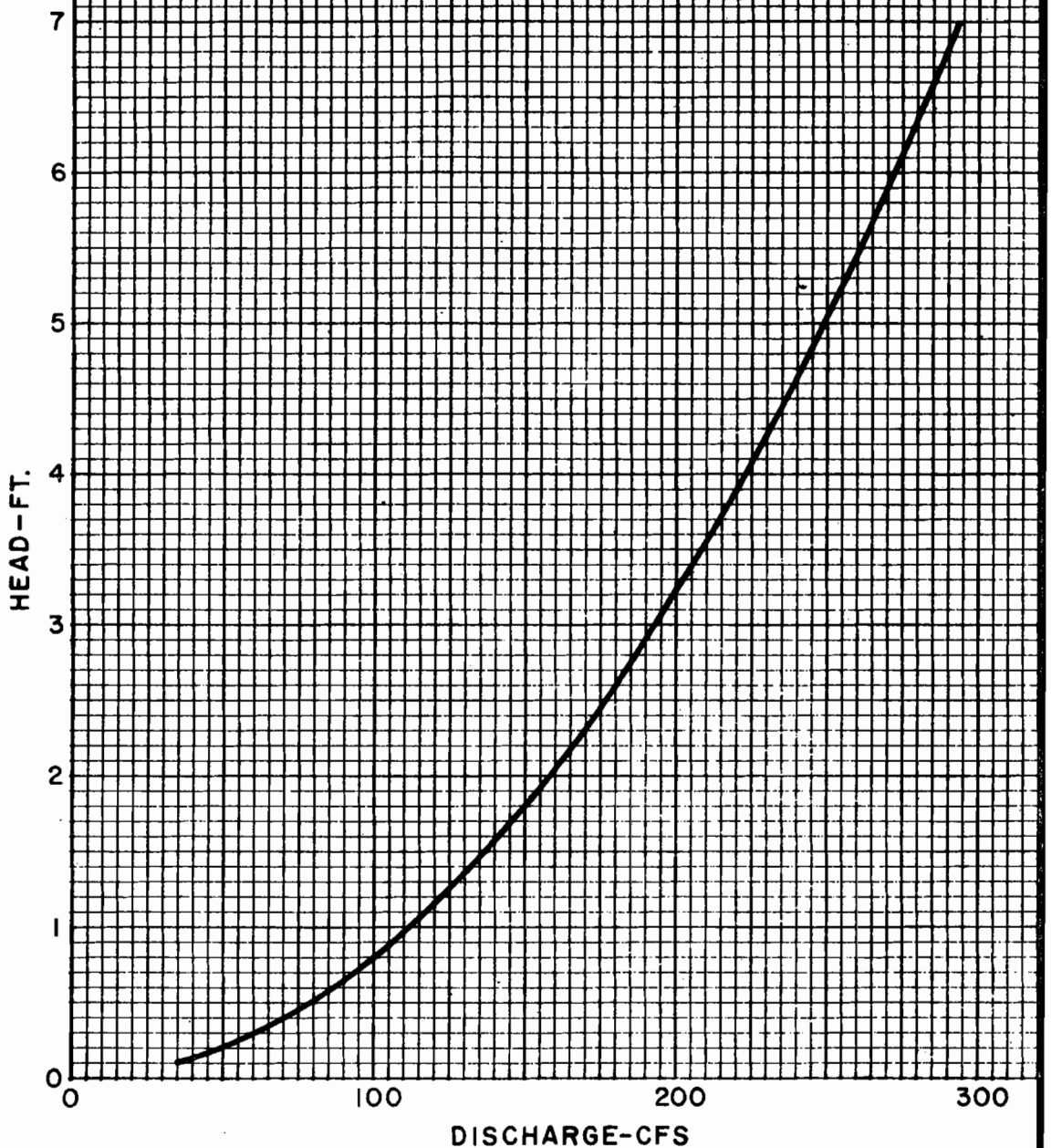
b. Drainage structure at station 927+00. A new drainage structure will be constructed at station 927+00 to replace the existing structure at station 925+27. The new structure will consist of three 48" Ø CMP culverts 160 feet in length. The invert elevation will be -2.0. This structure will include sluice gates for positive cutoff, seepage collars around the culverts, a trash rack on the inlet side, and flap gates on the outlet end. Details of this structure are shown on plate 64 of the main report.

c. Drainage structure at station 1054+00. A new drainage structure will be constructed at station 1054+00 to replace the existing structure at station 1055+74. The new structure will consist of four 54" Ø CMP culverts 192 feet in length. The invert elevation will be at -2.0. This structure will include sluice gates for positive cutoff, seepage collars around the culverts, a trash

rack on the inlet side, and flap gates on the outlet end. Details of this structure are shown on plate 68 of the main report.

6. Drainage system design. Construction of this new reach of levee necessitated an evaluation of the existing drainage pattern for the project area as well as a new drainage system design. This new system is designed to insure that the post-project drainage will at least replace-in-kind the pre-project drainage capabilities.

7. Hydraulic computations. Rating curves for the new drainage structures were computed using the orifice flow equation, $Q=CA(2gh)^{0.50}$, where Q is the discharge in cubic feet per second, C is the discharge coefficient, A is the cross-sectional area in square feet, and h is the differential head, in feet, on the culvert. Using submerged outlet conditions, an entrance loss of 20 percent difference in velocity heads across the structure, a loss through the sluice gate well of 20 percent difference in velocity heads across the structure, a roughness coefficient of 0.023 and the Manning formula, the friction losses were evaluated and "C" values were calculated for each new structure. These "C" values are as follows: station 799+00, 0.48; station 927+00, 0.51; and station 1054+00, 0.50. The discharge rating curves derived are shown on plates C-1, C-2, and C-3, respectively. The discharge rating curve for each replacement structure is equivalent to the rating curve for the existing structure it replaces.



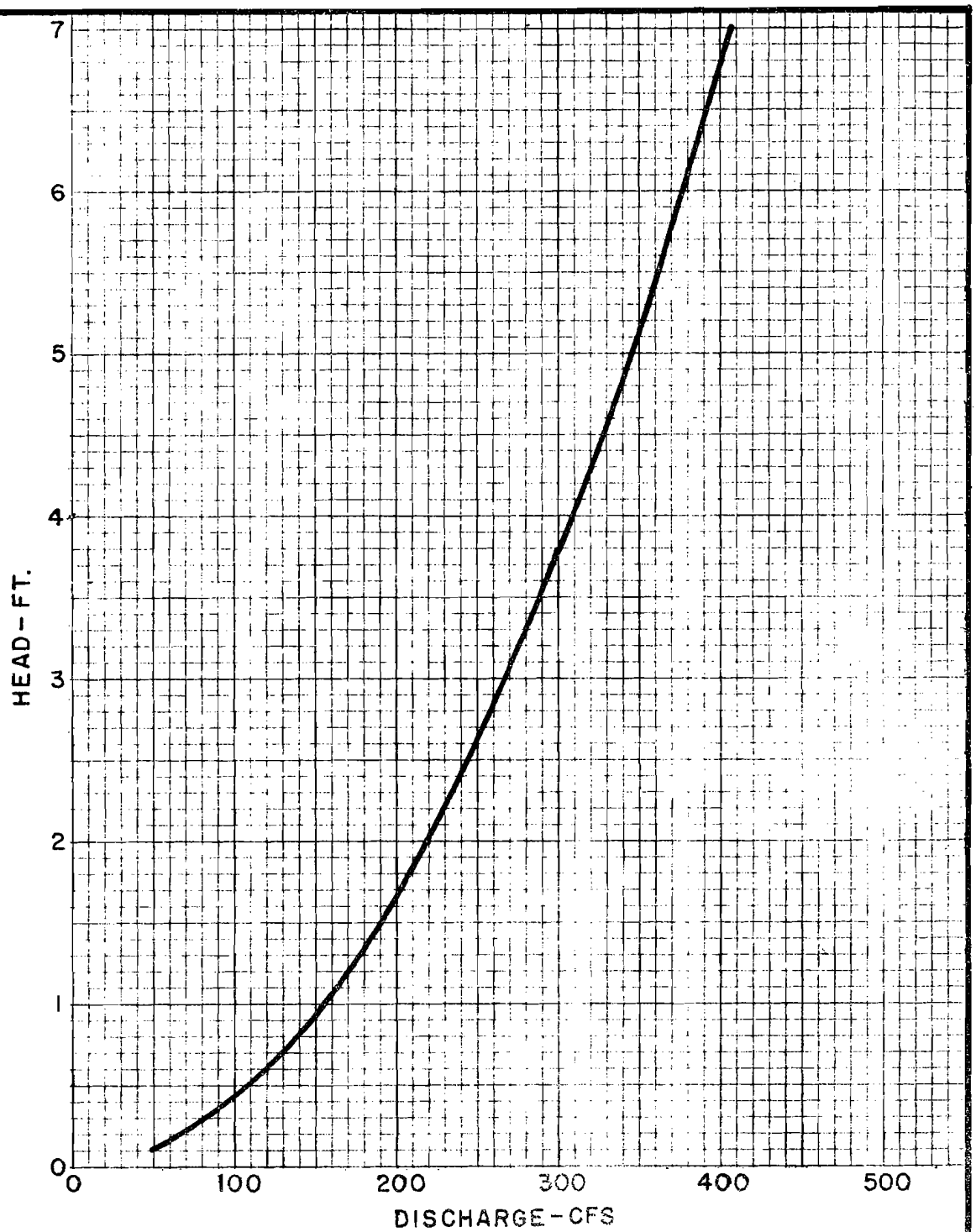
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

RATING CURVE
DRAINAGE STRUCTURE-STA. 799+00
3-42" Ø CMP LENGTH 160'

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

JANUARY 1973 FILE NO. H-2-26016

PLATE C-1



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

RATING CURVE
DRAINAGE STRUCTURE-STA. 927+00
3-48" Ø CMP LENGTH 160'

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

JANUARY 1973

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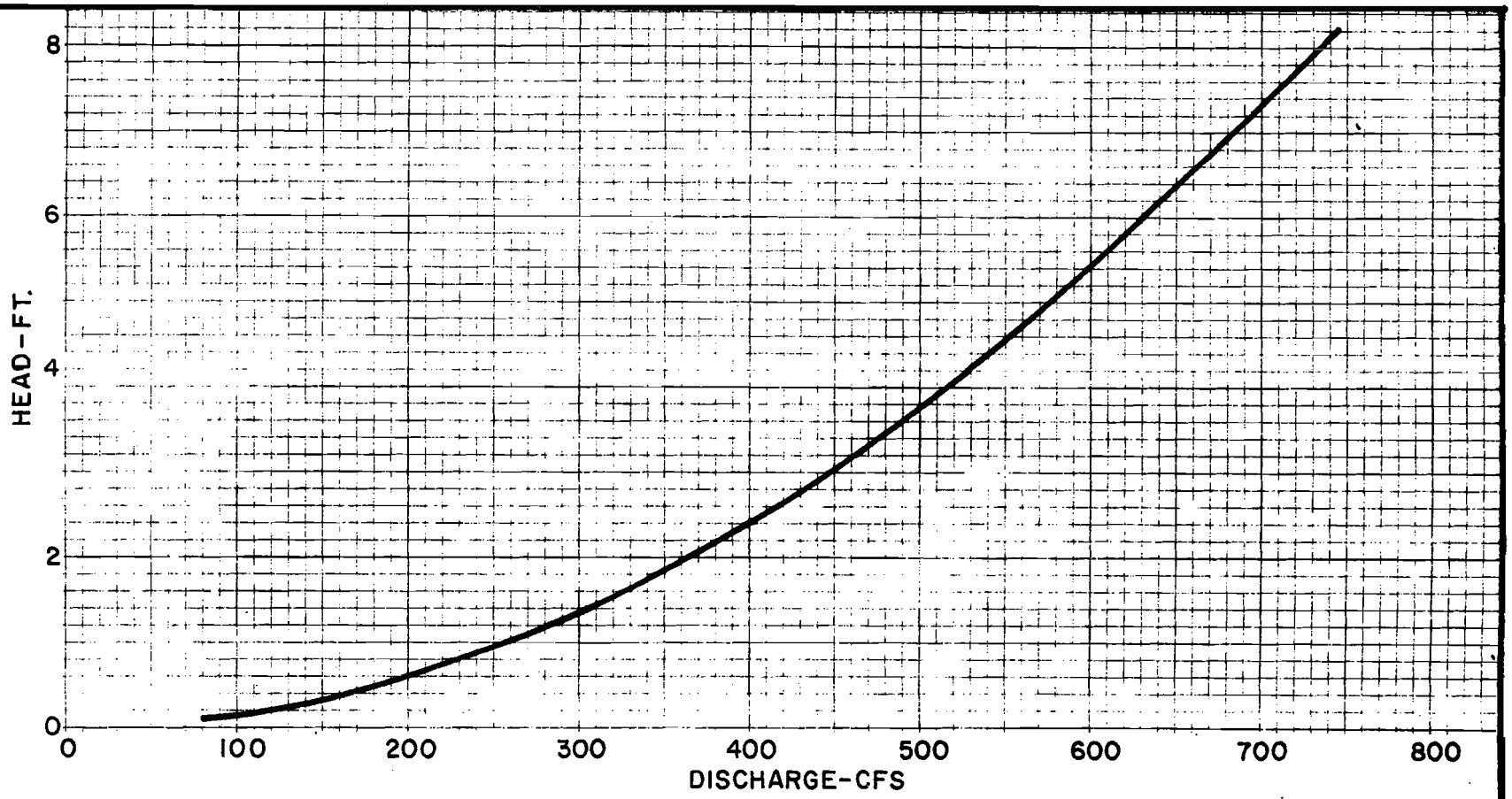
PLATE C-2



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 9

NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.

RATING CURVE
DRAINAGE STRUCTURE-STA.1054+00
4-54" Ø CMP LENGTH 192'

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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JANUARY 1973

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PLATE C-3