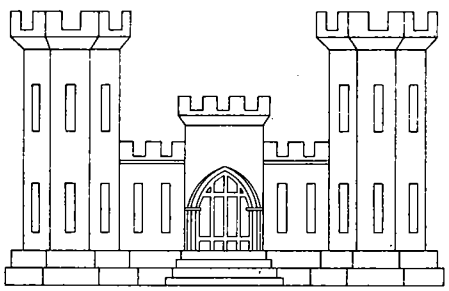
NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1 - GENERAL

SUPPLEMENT NO. 3

REACH C

PHOENIX TO BOHEMIA



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

MAY 1972

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

IN REPLY REFER TO
LMNED-PP

11 May 1972

SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject general design memorandum is submitted herewith for review, 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. Approval of this general design memorandum is recommended.

For William E. Ledy LTC
RICHARD L. HUNT
Colonel, CE
District Engineer

1 Incl (16 cys) fwd sep
GDM No. 1, Supp. No. 3

LMVED-TD (NOD 11 May 72) 1st Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 28 Jun 72

TO: HQDA (DAEN-CWE/DAEN-CWV) WASH DC 20314

1. Subject design memorandum is forwarded for review and approval pursuant to ER 1110-2-1150. Approval is recommended subject to the following comments.

2. General. A Statement of Findings should be added to the design memorandum in accordance with ER 1110-2-1150 and EC 1105-2-501.

3. Para 6, page 3, and Para 33, page 17. As levee settlements in the order of 2 to 4 ft could occur after the levee is raised to the net grade (el 17), requiring local interests to maintain the levee at the net grade by placement of additional lifts is considered beyond the scope of normal levee maintenance. Based on expected settlement and stability limitations, an overbuild in grade should be made when the levee is raised.

4. Para 30, page 16, and Para 42, page 20, and Plates 7 and 14. As indicated in paras 31 and 34, clay soils are desired for erosion resistance and seepage control. However, based on the borings in the borrow pit as shown on Plate 14, clays may be scarce in the designated borrow area above el -20.0. The potential borrow sources in the Pointe a la Hache Relief Outlet should be examined to insure that a sufficient quantity of clay is available.

5. Para 32, page 17, and Plate 51. a. The estimates of settlement at the three stations indicated on Plate 51 should be reexamined and checked based on the following comments. Specific comments are made with respect to the data at station 687+50, but are applicable in general to all three stations.

(1) Using the log plot to extend the observed data from 1970 to 1973, it is not apparent how the settlement at year 1973 of about 5.5 ft was obtained and consequently a settlement of 1.4 ft between 1970 and 1973. Assuming the original crown elevation of the initial fill was 15.0 ft (based on information obtained from NOD), a settlement of 5.5 ft at year 1973 would result in a crown elevation of 9.5 ft. The log plot on Plate 51 would indicate that a crown elevation of 9.5 ft would not be reached until about 8 years after construction or about 1976 in lieu of 1973.

(2) It is not apparent how the 2.6 ft estimated settlement after the final lift was obtained. If it was obtained by projecting the log plot on Plate 51 to a time of 20 years, as indicated in para 32, a resulting ultimate crown elevation of 8 ft would be obtained. Assuming an original crown elevation of 15.0 ft, this would indicate a total settlement of 7.0 ft in lieu of the 8.0 plus figure indicated.

b. The fourth and fifth sentences of para 32a indicate that the ultimate settlement of the levee after it is raised was assumed equal to that indicated by extending the log plot of the settlement data on Plate 51 to a time of 20 years after construction of the initial fill. This procedure would be acceptable if the levee were not to be raised higher than the initial fill. However, the levee is to be raised some 3 ft higher than the initial fill and therefore more ultimate settlement of the raised levee than calculated by the above procedure could occur. This should be considered in reevaluating the settlement data.

c. The settlement computations referred to in para 32c should be presented in the design memorandum. The calculated total settlements of the initial embankment as constructed and the total settlement of the embankment at the higher grade should be presented.

6. Para 33, Page 17. Settlement devices should be provided at a number of representative locations along the levee to monitor and obtain field settlement data. These devices should be located on the levee crown with plates or plugs set on the surface of the existing fill.

7. Para 35c, Page 18. The degree of compaction of the fill placed in the levee enlargement should be specified.

8. Para 61, Pages 27-31. The cost estimate should be broken down into Federal and non-Federal costs.

9. Table 1, Page 29. Estimated land costs are approved; however, no costs were included for relocation assistance that will occur by reason of PL 91-646. If rights-of-way for Reach C were acquired by local interests after 1 Jan 71, any relocations assistance costs incurred because of PL 91-646 should be shown as a Federal cost. After 30 Jun 72, relocations assistance under PL 91-646 will be a non-Federal cost.

LMVED-TD (NOD 11 May 72) 1st Ind 28 Jun 72
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

The design memorandum should show the appropriate apportionment of any PL 91-646 costs that may be applicable to Reach C, and also indicate that local interests will be reimbursed for such costs should Congress decide to extend the Federal responsibility for same beyond 30 Jun 72.

10. Para 62, Page 32. The price level used in the GDM for future work is Apr 72 whereas the PB-3 with which comparison was made was based on, a price level of Jul 71. The explanation for change in estimates given in para 62 should be expanded to show the amount of change due to price level and the amount for other reasons.

11. Para 64, Page 35. The total amount of Federal funds required for completion of the second lift is shown to be $3,165,000 including contingencies, E&D, and S&A. The estimated Federal cost for construction of the second lift including contingencies is shown in Table 1, page 28, to be approximately $1,952,000. The purpose of the remaining 1,213,000 should be clearly explained.

12. Table 3, Page 37. The footnote which indicates that local interests have expended $8,806,000 conflicts with the information in para 10d which credits local interests with a value of $6,573,507 for levee construction work. This should be resolved.

13. Para 68, Page 37. It isnoted that the draft environmental statement reviewed by LMVD in Apr 72 showed annual benefits for Reach C of $835,000, annual costs of $405,400, and a benefit-cost ratio of 2.1. These figures should be revised to agree with the figures in para 68.

14. Plate 6. Plate number reference for the existing drainage structure at Station 548+60 is not correct. Apparently, it should be "See Plate 53."

15. Plate 7. Two lines are indicated as "Centerline Future East Bank Barrier Plan Levees" on the right side of this plate. This discrepancy should be resolved.

16. Plate 8. The design memorandum should state why the levee section changes on the protected side between station 801+27.2 and station 834+85.0.

LMVED-TD (NOD 11 May 72) 1st Ind 28 Jun 72
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

17. Plates 36 through 42. All depths of failure investigated on these plates are limited to the foundation above the Prodelta clays, i.e., above about el -43 to -50. Stability analyses should be made to determine the factors of safety for sliding in the Prodelta clays at various depths and the results presented in the design memorandum.

18. Plates 38 and 39. Based on the design shear strengths from Borings 8-CU, 8-CUT, and 8-CUTP, the shear strength at the bottom of stratum 10 for verticals 1 and 2 should be 1,000 psf in lieu of 750 psf as indicated in the tabulation.

19. Plates 41 and 42. The station limits for the stability analysis should agree with the cross sections on plate 8. Plate 41 should be revised to indicate "Station 495+00 to Station 801+27.2," and Plate 42 should be revised to read "Section 801+27.2 to 834+85."

20. Para 7b, Page A-16. Reference to structure locations middle of line 9 of subject paragraph apparently should read, "Plates 2, 3, 5, and 6," not Plates 2 and 7.

21. Table A-8. Such dissipation as is indicated by the velocities at the downstream end of the stilling basin and sacked concrete riprap is not realistic. The jet issuing from the pipes will tend to spread and dissipate very slowly. Velocities of 2 to 3 ft per second should be expected 100 to 200 ft downstream of the structures.

22. Plates A-16 and A-18. The routings shown are apparently for pumps only. Additional routings for pumps and gravity flow in combination should be shown; also, an analysis should be presented based on gravity outflow only.

FOR THE DIVISION ENGINEER:

Robert I Kaufman

ROBERT I. KAUFMAN
Acting Chief, Engineering Division

1 Incl (14 cy)
wd 2 cy

CF:
LMNED-PP
cy incl

DAEN-CWE-B (LMNED-PP, 11 May 72) 2nd Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

DA, Office of the Chief of Engineers, Washington, D.C. 20314 2 October 1972

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

1. Approved, subject to the comments of the Division Engineer and to the comment furnished in the following paragraph.

2. 1st indorsement, paragraph 21 and Plate 53. The information contained in the Waterway Experiment Station Research Report H-70-2 should be used by the Division Engineer to verify the design of protection at the drainage outlets during his review of the plans and specifications.

FOR THE CHIEF OF ENGINEERS:

1 Incl
wd

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

LMVED-TD (NOD 11 May 72) 3d Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 16 Oct 72

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

1. Referred to note approval subject to comments in 1st Ind.

2. In view of the comment in paragraph 2 of 2d Ind, approval of plans and specifications by LMVD will be required regardless of authority to approve which may be otherwise delegated.

FOR THE DIVISION ENGINEER:

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

LMNED-PP (11 May 72) 4th Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

DA, New Orleans District, Corps of Engineers, PO Box 60267, New Orleans, La. 70160 17 Nov 72

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

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

a. 1st Ind, para 2. Since Reach C is but one of several features comprising the New Orleans to Venice hurricane protection project, a statement of findings was not prepared. However, a statement of findings will be prepared for the entire project. In view of the extended period of time since preparation of the project survey report (1961) and the current national emphasis on environmental quality and social well-being objectives as they relate to water resource projects, the statement of findings will be prepared along with the final environmental statement for the New Orleans to Venice project; that is, subsequent to feedback from the various agencies, organizations, and individuals responding to the draft environmental statement. Not until full consideration is given to this feedback would a statement of findings for the project reflect, as intended, a valid personal concern by the District Engineer to best serve the public interest.

b. Para 3. Based on expected settlements and stability requirements an overbuild of 2 feet will be made when the levee is raised.

c. Para 4. Prior to construction, additional borrow borings will be taken to adequately determine the availability of clay material in the Pointe a la Hache Relief Outlet.

d. Para 5.

(1) The calculated settlements of the initial embankment as constructed and the total settlements of the design embankment are shown on inclosures 2 through 4.

(2) Inclosure 2 illustrates the time-settlement curve for the subreach from station 0+00 to station 159+00. The curve for the existing section indicates approximately 1.9 feet of settlement after 5 years--the projected time (1973) for the start of construction of the final levee lift. The ultimate settlement of the design section is 4.2 feet. If 90 percent consolidation is used for design calculations, 3.8 feet of settlement results. Subtracting the 1.9 feet of settlement that occurs during the first 5 years of the existing section, the subreach is expected to settle 1.9 feet (3.8-1.9) after the final lift.

(3) Inclosures 3 and 4 show the time-settlement curves for the two remaining subreaches. Using the same procedure described above, the subreach from station 159+00 to station 495+00 is expected to settle 2.0 feet and the subreach from station 495+00 to station 834+85 is expected to settle 2.1 feet.

e. Para 6. Settlement devices will be provided in each levee subreach to monitor settlements which will occur following construction of the final lift.

f. Para 7. The fill for levee enlargement will be semicompacted or uncompacted as indicated on plate 8 of the design memorandum.

g. Para 8. Paragraph 9 of the GDM presents the required non-Federal costs for the Reach C project broken down by lands and damages, relocations, and cash contribution and/or equivalent construction work. Paragraph 10d further outlines the cost sharing consequences of taking into account the interim construction work actually accomplished by local interests. Paragraphs 53 and 54 restate that the costs for lands, damages, and relocations are a non-Federal responsibility. In view of the above and the potential for future non-Federal construction work in connection with the Reach C levee, the cost estimate (pages 27-31) was not broken down to specify Federal and non-Federal costs.

h. Para 9. As indicated in table 1, page 29 of the design memorandum, the major portion of all rights-of-way required for construction of the Reach C levee were acquired by local interests in about 1967. Therefore, relocations assistance in accordance with PL 91-646 is not applicable. With respect to future rights-of-way requirements, no costs are anticipated for relocation assistance that would occur by reason of PL 91-646.

i. Para 10. Reasons for the difference between the design memorandum and PB-3 (effective 1 July 1971) cost estimates should be revised as follows:

(1) Levees and floodwalls. The decrease of $157,000 reflects the net effect of a decrease of $272,000 due to general refinements in design of the levee enlargement plan based on the more detailed design procedures used in preparation of this memorandum, and an increase of $115,000 due to price level increases for the period July 1971 - April 1972.

(2) Engineering and design. The decrease of $289,000 reflects a reduction proportionate to the net decrease in construction cost. Also, engineering and design cost incurred by local interests for construction of the interim levee was less than originally estimated.

(3) Supervision and administration. The decrease of $145,000 reflects a reduction proportionate to the net decrease in construction cost. Also, supervision and administration cost incurred by local interests for construction of the interim levee was less than originally estimated.

(4) Lands and damages. In accordance with the PB-3, acquisition of all rights-of-way and easements for the entire Reach C project has been completed. The increase of $42,000 reflects the more detailed studies made during preparation of this design memorandum. Therefore, estimated increased land values during the period July 1971 - April 1972 did not contribute to the $42,000 increase in cost.

(5) Relocations. The increase of $1,710,000 reflects additional relocation items realized subsequent to the preparation of the design memorandum on which the PB-3 estimate is based; and cost estimate refinements based on the more detailed information available during preparation of this design memorandum. Price level increases for the period July 1971 - April 1972 did not contribute to the increased cost.

j. Para 11. The value of $1,213,000 is comprised of (1) $231,000 which represents the total Federal postauthorization planning funds expended through FY 72, and (2) $981,000 ($1,213,000-$231,000) which represents the estimated E&D and S&A funds for completion of all planning and design activities related to the Reach C project to include extensive auditing activities in connection with crediting the interim construction work accomplished by local interests.

k. Para 12. The value of $6,573,507 in paragraph 10d of the design memorandum represents creditable costs to local interests for interim levee construction (cost account number 11) and associated engineering and design, and supervision and administration. The value of $8,806,000 in table 3, page 37, represents total cost for the interim construction; that is, inclusive of associated lands, damages, and relocations. Accordingly, the values are correct as presented in the design memorandum.

l. Para 13. In accordance with LMVPD-R 3d indorsement dated 14 August 1972 to LMNED-PC letter dated 17 March 1972 subject: "Draft Environmental Statement - New Orleans to Venice, Hurricane Protection," the benefit-cost ratios for component parts of the New Orleans to Venice project are not listed in the environmental statement. The draft statement has been revised, however, in accordance with the referenced indorsement to include the current benefit-cost ratio for the overall project.

m. Para 14. We concur with this comment.

n. Para 15. The uppermost line represents the centerline of the proposed East Bank barrier plan levee and the lower of the two lines represents the associated baseline.

o. Para 16. As shown on plates 42 and 52, the sand core is larger for the levee reach between stations 801+27.2 and 834+85 than for the remainder of the Reach C levee. Therefore, based on stability requirements and the need for an appropriate clay cover over the sand core, the levee section changes on the protected side between these stations.

p. Para 17. Stability analyses were performed for various depths between elevation -43 and elevation -100 for the subreaches represented by stations 0+00 to 159+00, 159+00 to 400+56.8, and 400+56.8 to 834+85. For the first subreach, factors of safety ranged from 1.48 at elevation -64, to 2.32 at elevation -100. For the second subreach, factors of safety ranged from 1.49 at elevation -66, to 1.94 at elevation -100. The third subreach yielded factors of safety of 1.52 at elevation -62, and 2.25 at elevation -100. The above listed factors of safety were computed based on a 2-foot overbuild discussed in paragraph 1b of this indorsement.

q. Para 18. We concur with this comment. However, this revision does not require any further GDM changes.

r. Para 19. We concur with this comment. In addition, the word "Floodside" should be removed from the title block of plate 42.

s. Para 20. We concur with this comment.

t. Para 21. We concur with this comment. Table 8, page A-19 of the design memorandum should be revised to show that the maximum average velocities, for the 100-year, 24-hour storm, at the downstream ends of the concrete stilling basin and sacked concrete riprap will be about 1.9 f.p.s. for the structures located at stations 89+50, 236+70, and 486+30, and 2.0 f.p.s. for the structures at stations 425+50 and 548+60.

u. Para 22. As indicated in paragraph 11, pages A-17 and 18 of the design memorandum, the routings shown on plates A-16 and A-18 are for the gravity drainage system only. Detailed information concerning hydraulic analyses for the pumping stations acting alone, and for pumps and gravity flow in combination was not presented in the design memorandum since the Federal responsibility, as it concerns

provisions for drainage in this project, extends only to the installation of gravity drainage structures to provide for drainage intercepted by construction of the project levee.

v. 2d Ind, para 2. This comment is noted.

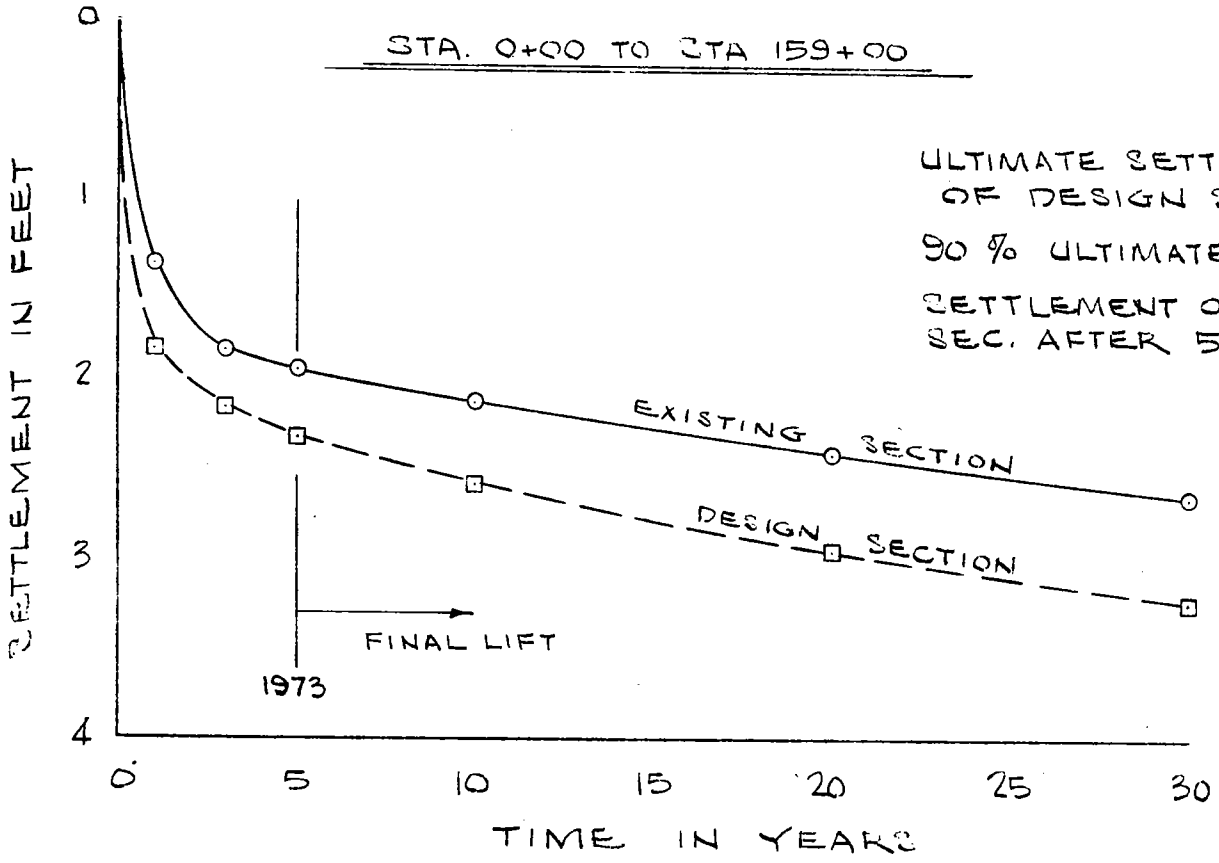
w. 3d Ind, para 2. This comment is noted.

FOR THE DISTRICT ENGINEER:

JEROME C. BAEHR
Chief, Engineering Division

3 Incl
Added 3 incl (16 cys)
2. Settlement curves, sta. 0+00 to sta. 159+00
3. Settlement curves, sta. 159+00 to sta. 495+00
4. Settlement curves, sta. 495+00 to sta. 834+85

Incl 2



ULTIMATE SETTLEMENT OF DESIGN SECTION	4.2 FT
90 % ULTIMATE SETT.	3.8
SETTLEMENT OF EXIST. SEC. AFTER 5 YRS.	− 1.9
	1.9 FT.

EXPECTED SETTLEMENT AFTER FINAL LIFT.

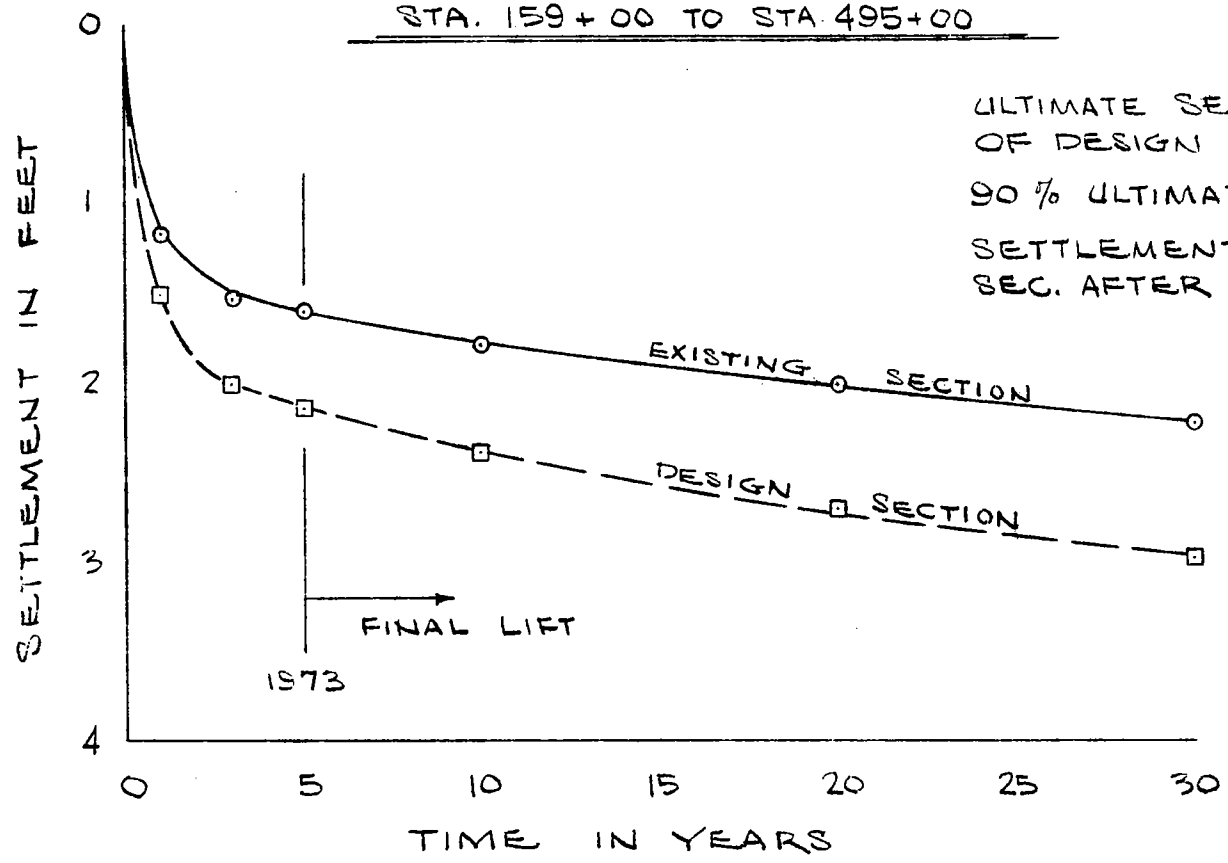
REACH C

SETTLEMENT VS TIME
STA. 0+00 TO STA. 159+00

LMNED-FS NOV. 72

Encl 3

STA. 159+00 TO STA 495+00



ULTIMATE SETTLEMENT OF DESIGN SECTION	4.0 FT.
90 % ULTIMATE SETT.	3.6
SETTLEMENT OF EXIST. SEC. AFTER 5 YRS.	-1.6
	2.0 FT.

EXPECTED SETTLEMENT AFTER FINAL LIFT.

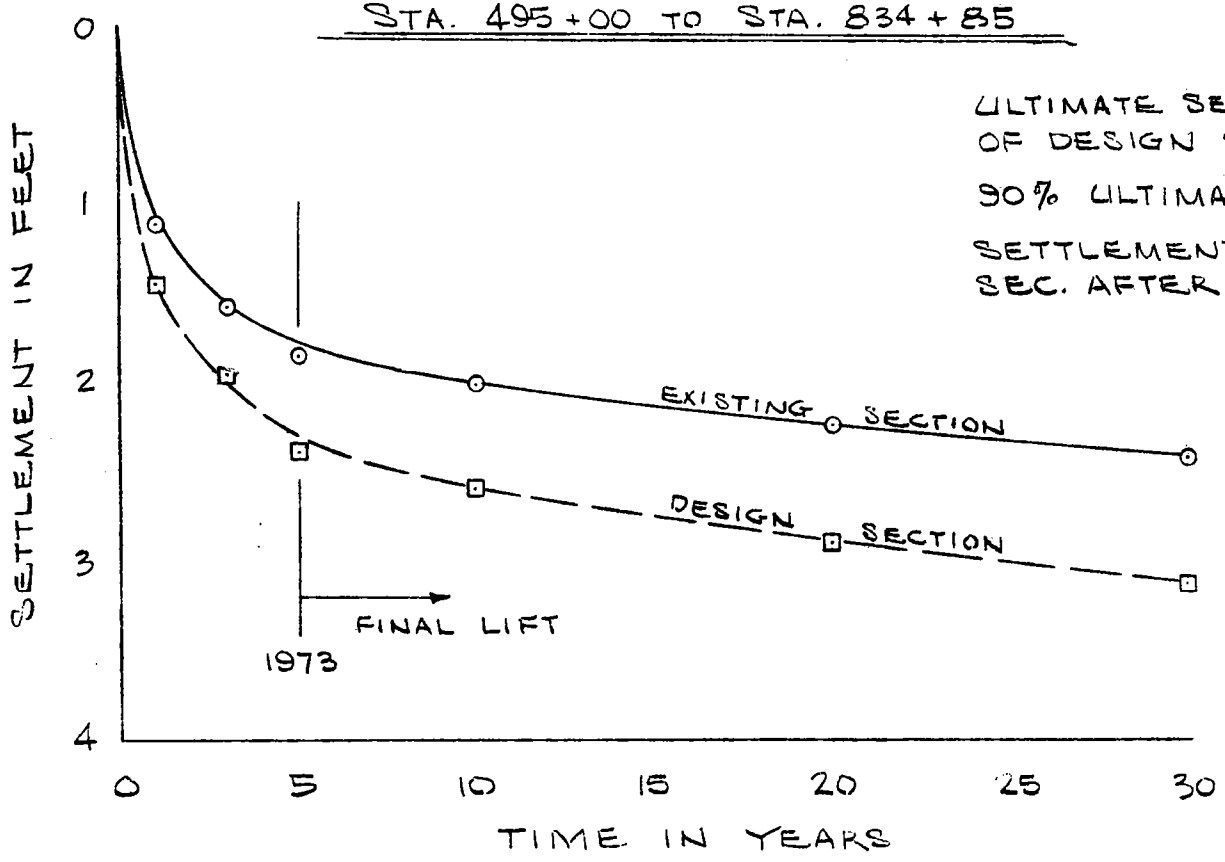
REACH C

SETTLEMENT VS. TIME
STA. 159+00 TO STA. 495+00

LMNED-FS Nov 72

page 4

STA. 495+00 TO STA. 834+85



ULTIMATE SETTLEMENT
OF DESIGN SECTION 4.3 FT.

90% ULTIMATE SETT. 3.9

SETTLEMENT OF EXIST.
SEC. AFTER 5 YRS. -1.8

2.1 FT

EXPECTED
SETTLEMENT
AFTER FINAL LIFT.

REACH C

SETTLEMENT VS. TIME
STA 495+00 TO STA. 834+85

LMNED-FS NOV. 72

LMVED-TD (NOD 11 May 72) 5th Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 19 Dec 72

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

1. The information furnished and actions described in the 4th Ind are satisfactory subject to the following comments.

2. Para 1b. Stability analyses should be performed to determine the effect of the proposed overbuild on stability.

3. Paras 1b and 1d. The additional settlement data presented on Incl 4 for the reach between Stations 495+00 and 834+85 show an ultimate settlement of the design section of 4.3 feet with a settlement of the existing initial section of 1.8 feet, 5 years after construction. This is considerably different from the data presented for Station 687+50 on Plate 51 of the DM which shows, based on field settlement data, that the existing initial fill should settle about 5.5 feet during the first 5 years after construction and that the settlement of the design section should be in the order of 8 feet. The reason for such large discrepancies is not apparent, particularly since para 32c of the DM states that computed settlements are substantially the same as those indicated by the field data. In view of the above, a thorough reexamination of the settlement studies should be made. If more than 2 feet of settlement is expected after the second lift, additional overbuild may be desirable unless limited by stability requirements. In any case, requiring local interests to place additional lifts to compensate for settlement is considered beyond the scope of normal maintenance.

4. Para 1h. Should relocation assistance occur because of the future right-of-way requirements, allocation of costs therefor should be in accordance with paragraph 9 of the 1st Ind to this chain of correspondence.

5. Para 1j. This paragraph states that $981,000 will be required for E&D and S&A to complete planning and design and for audit activities. These costs are about 50% of the estimated construction cost of the work required to complete reach C (listed in para 63, page 34 of the DM as $1,953,000.) In view of this, the E&D and S&A requirements should be reviewed and the estimate reduced accordingly.

FOR THE DIVISION ENGINEER:

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

3 Incl
nc

CF:
DAEN-CWE-B w cy of
3d, 4th & 5th Ind (14 cy)

LMNED-MP (11 May 72) 6th Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia

DA, New Orleans District, Corps of Engineers, PO Box 60267, New Orleans, Louisiana 70160 6 Feb 73

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

The proposed disposition of comments presented in the 5th indorsement of this chain of correspondence follows (paragraph numbers refer to like-numbered paragraphs in the 5th indorsement):

a. Para 2. Stability analyses were performed to determine the effect of the proposed overbuild. The minimum factor of safety was found to be 1.28--a condition considered satisfactory in view of the temporary nature of the overbuild.

b. Para 3. The data presented in paragraph 1d and inclosures 2 through 4 of the 4th indorsement are based on (1) a complete reevaluation of current settlement data; (2) current topographic survey data obtained from local interests; and (3) recalculations of ultimate settlement and time settlement curves for the three project subreaches. The information presented in the 4th indorsement is intended to supersede the settlement data presented on plate 51 of the general design memorandum. Local interests will not be required to place additional construction lifts to compensate for settlement.

c. Para 4. This comment is noted.

d. The E&D and S&A requirements for the Reach C project have been reviewed. In addition to the sum of $231,000 previously expended (thru FY 72), approximately $400,000 will be required to satisfy the remaining E&D and S&A requirements for the project.

FOR THE DISTRICT ENGINEER:

Walter S Mark
for JEROME C. BAEHR
Chief, Engieering Division

wd incl

LMVED-TD (NOD 11 May 72) 7th Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoneix to Bohemia

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 9 Mar 73

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

The information furnished and actions described in the 6th Ind are satisfactory.

FOR THE DIVISION ENGINEER:

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

CF:
DAEN-CWE-B w cy
6th Ind

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

STATUS OF DESIGN MEMORANDUMS

Design Memo No.	Title	Status
1	New Orleans to Venice, La., Design Memorandum No. 1 - General Design Reach B1 - Tropical Bend to Fort Jackson	Approved 8 Aug 67 Revised Aug 71 (Revision approved 16 Feb 72)
1	New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Reach B1 - Tropical Bend to Fort Jackson, Supplement No. 1, Alteration of Method of Constructing Stream Closures	Approved 2 Dec 68
2	New Orleans to Venice, La., Design Memorandum No. 2, Detail Design, Reach B1 - Tropical Bend to Fort Jackson, Empire Floodgate	Approved 9 Mar 71
1	New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 3, Reach C - Phoenix to Bohemia	Submitted 11 May 72
1	New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 2 - East Bank Barrier Levee Plan	Scheduled Aug 72
1	New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 4, Reach B2 - Fort Jackson to Venice	Scheduled Jun 72
1	New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 5, Reach A - City Price to Tropical Bend	Scheduled Oct 72

NEW ORLEANS TO VENICE, LOUISIANA
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APPENDIXES

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

PERTINENT DATA

Location of project		Mississippi River Delta, Coastal Louisiana, Plaquemines Parish
Hydrologic data		
Temperature:	Monthly means	
	Maximum	83° Fahrenheit
	Minimum	57° Fahrenheit
	Average annual	70° Fahrenheit
Annual precipitation:	Maximum	85.73 inches
	Minimum	31.04 inches
	Average annual	60.8 inches
Hydraulic design criteria--tidal		
Design hurricane		
Frequency		1 in 100 years
Central pressure index (CPI)		28.00 inches of mercury
Maximum 5-minute average wind		96 m.p.h.
Levees		
Method of construction (enlargement of existing interim levee)		Hauled fill
Levee length (approximate)		16.0 miles
Elevation		17.0[1]
Crown width		8 feet
Estimated first cost		
Levees and floodwalls		$ 8,340,000
Engineering and design		814,000
Supervision and administration		584,000
Relocations		2,098,000
Lands and damages		464,000
Total		$12,300,000

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

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

PROJECT AUTHORIZATION

1. Authority.

a. Public Law. Public Law 874-87th Congress, 2d Session, approved 23 October 1962, authorized the project "Mississippi River Delta at and below New Orleans, Louisiana, (renamed 'New Orleans to Venice, Louisiana,' after authorization)," substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 550, 87th Congress, 2d Session.

b. House Document. The report of the Chief of Engineers, dated 30 July 1962, submitted for transmittal to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers. The Chief of Engineers in his report concurred in the recommendations of the Board of Engineers for Rivers and Harbors. The recommendations of the Board are as follows:

> ...Accordingly, the Board recommended improvements along the Mississippi River below New Orleans, Louisiana, for prevention of hurricane tidal damages by increasing the heights of the existing back levees and modifying the existing drainage facilities where necessary in four separate reaches consisting of:
>
> Reach A on the west bank for about 15 miles between City Price and Empire;
>
> Reach B on the west bank for about 21 miles between Empire and Venice and with such modifications of the main levee as may be required;
>
> Reach C on the east bank for about 16 miles between Phoenix and Bohemia; and
>
> Reach E on the east bank for about 8 miles between Violet and Verret;
>
> generally in accordance with the plans of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable,....

2. Purpose and scope. This supplement presents the essential data, assumptions, criteria, and computations which were used to develop the plan, design, and cost for the New Orleans to Venice Reach C levee in sufficient detail to provide an adequate basis for preparing plans and specifications for this project feature without the need for additional design memorandums.

3. Local cooperation. The conditions of local cooperation as specified in the report of the Board of Engineers for Rivers and Harbors and concurred in, in the report of the Chief of Engineers, are as follows:

"...that prior to construction local interests give assurances satisfactory to the Secretary of the Army that they will, without cost to the United States:

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

"b. Accomplish all necessary alterations and relocations to roads, pipelines, cables, wharves, and other facilities required by the construction of the project;

"c. Bear 30 percent of the first cost, [for the entire New Orleans to Venice hurricane protection project], a sum presently estimated at $3,216,000 to consist of items listed in subparagraphs a and b above and a cash contribution presently estimated at $1,844,000, to be paid either in a lump sum prior to initiation of construction or in installments 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;

"d. Hold and save the United States free from damages due to the construction works;

"e. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army;

"f. Prevent any encroachment on ponding areas unless substitute storage capacity or equivalent pumping is provided promptly; and

"g. At least annually, notify those affected that the project will not provide complete protection from tidal flooding and that further local actions must be taken during hurricane emergencies."

INVESTIGATIONS

4. Investigations made in connection with the project document. Studies and investigations made in connection with the project document (H.D. No. 550, 87th Congress, 2d Session) consisted of: research of information which was available from previous reports and existing projects in the area; extensive research in history and records of hurricane damages and characteristics of hurricanes; extensive tidal hydraulics investigations; an economic survey; field topographic and hydrographic surveys of reconnaissance scope; and design and cost studies. A public hearing was held in New Orleans, Louisiana, on 13 March 1956 to determine the views of local interests. Appropriate Federal and state agencies were consulted. The District Engineer made a personal reconnaissance of the area.

5. Investigations made subsequent to project authorization. Studies and investigations made subsequent to project authorization include:

a. Aerial and topographic surveys of the project area;

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

c. Tidal hydraulic studies required for establishing design grades for protective works based on revised hurricane parameters furnished by the National Weather Service (formerly U. S. Weather Bureau) subsequent to project authorization;

d. Detailed design studies for construction of levee, gravity drainage structures, and drainage collection canal;

e. Determination of real estate requirements and costs;

f. Cost estimates for levee, gravity drainage structures, drainage canal, and relocations;

g. Economic evaluation of recommended protective works; and

h. Environmental studies required by the National Environmental Policy Act of 1969.

6. Planned future investigations. The plan presented herein provides for enlargement of the existing interim Reach C levee to final net grade in one lift. Immediately following construction, the project works will be transferred to local interests for maintenance purposes. Accordingly, additional investigations as they would relate to future Federal construction will not be required.

LOCAL COOPERATION

7. Status of local cooperation.

a. Assurances in connection with the items of local cooperation specified in the project document were requested from the Plaquemines Parish Commission Council on 7 January 1963. The act of assurances and supporting resolution adopted by the Commission Council on 6 March 1964 covering Reaches A, B, and C were accepted for and on behalf of the United States on 14 April 1965.

b. The Attorney General of the State of Louisiana in his opinion of 7 April 1971 stated that local assuring agencies for projects were not vested with adequate legal authority to comply with the provisions of Sections 210 and 305 of Public Law 91-646 (the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970"). However, in view of the 1 February 1972 passage of a state constitutional amendment, local agencies are now in a position to provide the additional assurances required by the act. Accordingly, the assurances of local cooperation for the New Orleans to Venice hurricane protection project are currently being revised.

c. Since construction of the New Orleans to Venice hurricane protection project was commenced prior to 1 January 1972, Section 221 of the Flood Control Act of 1970 (Public Law 91-611) is not applicable.

d. The principal officers of the Commission Council responsible for fulfillment of the conditions of local cooperation are as follows:

Plaquemines Parish Commission Council
Pointe a la Hache, Louisiana 70082
Mr. Chalin O. Perez, President
Mr. Clarence T. Kimble, Vice-President and Commissioner of Finance
Mrs. Edna Lafrance, Secretary-Treasurer

8. Views of local interests. The Plaquemines Parish Commission Council represents local interests and is in agreement with the plan presented herein.

9. Required non-Federal cost.

a. The total non-Federal responsibility for constructing the Reach C project feature in accordance with the plan presented herein is estimated to be $3,690,000 which includes $2,562,000 for lands, damages, and relocations, and a cash contribution and/or equivalent work valued at $1,128,000.

b. A breakdown of the required non-Federal costs is shown below:

Lands and damages -	$ 464,000
Relocations -	2,098,000
Cash contribution and/or equivalent work -	1,128,000
Total	$3,690,000

10. Special arrangements with local interests.

a. The Plaquemines Parish Commission Council requested that, as a means of expediting construction on Reach C, they be permitted to proceed with construction of this reach on a modified alinement--the alinement presented in this memorandum. This action was outlined in "New Orleans to Venice, La., Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson," approved 8 August 1967, and in the revised design memorandum approved 16 February 1972.

b. The Commission Council had prepared, by the Louisiana Department of Highways, a set of plans for initiating construction of the levee. Work for constructing the levee embankment to an interim grade of 14 feet m.s.l. (mean sea level)[1] was completed in September 1968. Completion of the levee by local interests to the above grade prevented approximately $5 million of major flood damages within Reach C which would have otherwise occurred during Hurricane Camille in August 1969. Also, due to price escalations since September 1968, savings in excess of $3 million have been realized as a direct result of the interim construction work by local interests. Design of the interim levee was coordinated with and approved by the New Orleans District.

c. Since the alinement of the interim levee constructed by local interests and the project alinement presented herein are coincident, the total estimate of cost for constructing Reach C has been computed by adding to the creditable costs borne by local interests the estimated cost for enlarging the levee to the dimensions presented in this design memorandum. The determination of credit to local interests for work applicable to the hurricane protection project is based on the following policies:

(1) Credit toward the required non-Federal cash contribution will be allowed for the cost of constructing the existing levee embankment, drainage canal, and gravity drainage

[1]Unless otherwise specified, all elevations herein are in feet and refer to mean sea level datum.

structures. Credit will also be allowed for engineering and design, and supervision and administration costs associated with these construction items.

(2) Credit toward the required non-Federal cost will be allowed for the cost of all relocations accomplished in conjunction with the interim levee construction, excluding costs for any betterments. Specifically, these relocations are comprised of pipeline, powerline, and facility relocations, access ramps across the interim levee, highway crossings, and access bridges across the drainage canal.

(3) Credit toward the required non-Federal cost will be allowed for the value of all severances, easements, and rights-of-way required for construction of the interim levee embankment. With respect to the drainage canal rights-of-way, the Louisiana Department of Highways possesses the instrument of ownership; therefore, credit will be allowed only for the value of a 2-year construction easement, during which time the canal was excavated and relocations were accomplished across the canal.

(4) All potentially creditable costs borne by local interests will be reviewed and audited by the New Orleans District to insure that the costs are reasonable and truly representative of the value of the work involved.

d. Local interests are responsible for $3,690,000--30 percent of the total cost of constructing Reach C. Allowing credit for the value of lands, damages, and relocations leaves a required cash contribution of $1,128,000. However, since local interests have accomplished levee construction work having a determined value of $6,573,507 (includes $186,000 for engineering and design, and supervision and administration), no cash contribution is necessary with respect to Reach C. The balance of $5,445,507 ($6,573,507 - $1,128,000) may be applied to the cash contribution required of local interests for other features of the New Orleans to Venice hurricane protection project. The final apportionment of costs will be made after all actual costs and values have been determined.

LOCATION OF PROJECT AND TRIBUTARY AREA

11. Location of project. The Reach C project area is located in the Mississippi River delta region of coastal Louisiana. The area is specifically located on the left descending bank of the Mississippi River from the vicinity of Phoenix to Bohemia, La. The Reach C project area is situated on alluvium and is presently provided a substantial degree of protection from gulf tides by the existing interim hurricane protection levee. The area still remains vulnerable, however, to the ravages of major tropical storms and hurricanes. A general plan, index map, and vicinity map are shown on plate 1.

12. Tributary area. The project area comprises approximately 4,500 acres of land, which are bounded by the interim Reach C hurricane protection levee and the Mississippi River east levee. Interior drainage is accomplished by gravity through a network of canals, and gated structures in the project levee. In addition, local interests have recently constructed two pumping stations along the levee alinement--one at Bellevue and the other at Pointe a la Hache.

PROJECT PLAN

13. Project plan. The project plan, shown on plates 1 through 7, provides for the construction of a hurricane protective levee with appurtenant features from the vicinity of Phoenix to Bohemia, Louisiana. The existing 16 miles of interim earth levee will be enlarged and raised from its elevation of approximately 14 to a net elevation of 17. As a result of the levee enlargement plan presented herein, existing pipeline bridge supports, 21 access ramps, 2 highway crossings, 2 pipelines, and 6 electrical powerlines will require modification. Interior drainage is presently provided by a gravity drainage system consisting of corrugated metal pipe culverts, with independent flap and vertical slide gates, which discharge through the existing levee at five locations. The existing drainage structure operating towers will require minor modifications to meet the final levee wave berm grade.

DEPARTURES FROM PROJECT DOCUMENT PLAN

14. Departures from project document plan. The project document plan (H.D. 550, 87th Congress, 2d Session) recommends enlargement of the existing back levee system and modification of the existing drainage facilities where necessary in four reaches. The Reach C feature of the project document plan has been revised as follows:

a. Revision of levee grades. The net levee grade for Reach C was revised upward in accordance with the results of tidal hydraulic studies utilizing the latest hurricane parameters developed by the National Weather Service subsequent to project authorization.

b. Modification of levee alinement. The Plaquemines Parish Commission Council requested that the project document alinement be relocated riverward to an alinement adjacent to a proposed relocation of Louisiana Highway 39. The new alinement was presented in "New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson," approved 8 August 1967, and in the revised design memorandum approved 16 February 1972.

HYDROLOGY AND HYDRAULICS

15. Hydrology and hydraulics.

a. General. The detailed hydrology and hydraulic analyses for Reach C are presented in appendix A. Section I presents the climatology and hydrology of the area. Section II presents the detailed descriptions and analyses of the tidal hydraulic procedures used in the tidal hydraulic design. Included in the descriptions and analyses are the essential data, assumptions and criteria used, and the results of studies which provide the bases for determining surges, routings, wind tide levels, wave runup, overtopping, and frequency of the design hurricane. Section III presents data relative to interior drainage of the project area.

b. Hurricanes of record. Since 1856, about 20 hurricanes have caused flooding in or near the project area. However, reliable hurricane surge heights are available only since 1915. Some of the most severe hurricanes which were critical to the area and caused high stages occurred during September 1915, September 1956 (Flossy), September 1965 (Betsy), and August 1969 (Camille). Some observed stages experienced at or near the project area during these hurricanes were: 1915, 12.0 feet at Pointe a la Hache and 7.6 feet at Buras; 1956 (Flossy), 12.1 feet at Ostrica lock, 10.7 feet at Bohemia, 10.3 feet at Pointe a la Hache, and 9.9 feet at Davant; 1965 (Betsy), 14.8 feet at Bohemia, 14.4 feet at West Pointe a la Hache, and 12.6 feet at Ostrica lock; and 1969 (Camille), 15.1 feet at Ostrica lock, 12.6 feet at Buras, and 12.2 feet at Port Sulphur.

c. Frequencies. Stages critical to the project area are generated by hurricanes that approach the project area from any direction within a 50-mile midgulf coastal subzone. Therefore, in the computations used to determine stage frequencies, observed hurricanes were utilized in conjunction with synthetic hurricanes to reflect stage probabilities for the protective structures within the project area. The determination of probabilities of occurrence is based on previously approved and accepted methods.

d. Design hurricane. A hurricane that would produce the 100-year stage was selected as the design hurricane. A hurricane of lesser intensity, which would indicate a lower levee grade and an increased frequency, would expose the protected area to hazards to life and property and would be disastrous in the event a hurricane occurred with the intensity and destructive capability of the design hurricane. The design hurricane for the project area has a central pressure index of 28.00 inches of mercury and a maximum windspeed of 96 m.p.h. 30 feet above the ground surface at a radius of 30 nautical miles from the hurricane center. The forward speed of the design hurricane is 11 knots and is assumed to progress along a track critical to the project area.

e. Design hurricane wave characteristics. The data used to determine design hurricane wave characteristics for the project area are as follows:

Pertinent factors	Phoenix to Davant	Davant to Bohemia
Length of fetch, miles	5	5
Windspeed, m.p.h.	96	96
Stillwater level, feet m.s.l.	13.0	14.0
Average depth of fetch, feet	11.5	12.5
Depth at toe of structure, feet	11.5	12.5

From the above data, the design wave height for the protective structures was computed to be 5.7 feet. The project is designed to prevent overtopping by waves of height equal to the deepwater significant wave or the highest one-third of the waves in a wave train.

f. Design elevation of protective structures. The design runup and elevations of protective structures are as follows:

Location	Design runup feet	Design elevation of structures feet m.s.l.
Phoenix to Davant		
Levee	4.0	17.0
Floodwall	7.0	20.0
Davant to Bohemia		
Levee	3.0	17.0
Floodwall	6.0	20.0

The design wave runup and design elevations of the protective structures listed above are dependent on the flood side levee configurations.

g. Interior drainage.

(1) An adequate gravity drainage system has been provided by local interests in conjunction with construction of the interim Reach C levee. This system will not be adversely affected when the existing levee is modified to provide the grade and cross section required for protection against the design hurricane.

(2) Local interests have recently constructed two pumping stations along the project levee alinement with a combined capacity of 880 c.f.s. Analyses indicate that these

pumping stations are capable of providing adequate drainage for the project area should the gravity drainage system become inoperative or the ponding area be impaired. Detailed information regarding interior drainage is presented in appendix A, section III, of this design memorandum.

GEOLOGY

16. Physiography. The project area is located within the Central Gulf Coastal Plain. More specifically, the area is situated on the deltaic plain of the Mississippi River, a region of extremely low relief. Dominant physiographic features are the natural levees of the Mississippi River and its abandoned distributaries, and the marshlands and inland bodies of water that lie between the natural levee ridges. Elevations range from a maximum of approximately 5 along the crests of the natural levees to a minimum approaching mean sea level in the marshlands between the natural levee ridges. The numerous inland bodies of water vary in depth from 1 to 6 feet. The Mississippi River channel, in the vicinity of the project area, varies in depth from 70 to 190 feet below mean sea level.

17. General geology.

a. For this project, only the geologic history since the end of the Pleistocene epoch is relevant. At that time, with sea level about 450 feet below its present level, the Mississippi River began to aggrade the final entrenchment which it had cut to the west of the project area during the last glacial period. Initial alluvial sedimentation was confined to the central portion of the alluvial valley. Concomitantly, downwarping of the Pleistocene prairie surface and some faulting occurred resulting in a gulfward dip of the prairie surface averaging about 3 feet per mile and increasing southward towards the coastline. Only minor amounts of dissection occurred on the Pleistocene surface as a result of estuaries and small streams. Sedimentation was insignificant in the project area prior to the time sea level reached about 200 feet below its present stand. Most of the project area stood above sea level and only coarse fluvial materials were deposited in the deep entrenchment. The continued rise in sea level resulted in the reworking and redepositing of minor amounts of fluvial sediments in the project area. When sea level reached within tens of feet of its present level, the first marine and fluvial marine sediments of any significance were carried into the project area.

b. About 5,000 years ago, sea level reached its present stand and the Mississippi River began to migrate laterally back and forth across the deltaic plain. Deltaic marine sediments were first carried into the project area about 3,500 years ago when the Mississippi occupied the Teche course near the western

margin of the valley. The first major advance of sediments into the project area occurred approximately 2,800 years ago when the Mississippi River shifted eastward and began to develop the LaLoutre-St. Bernard Delta. About 1,500 years ago, the Mississippi River shifted westward to the Lafourche course and for a period of several hundred years the project area was subjected to only minor amounts of sedimentation, and deltaic deterioration and subsidence became important. When the river again shifted eastward about 1,200 years ago and began to occupy the present Plaquemine course, sedimentation again became the predominant process in the project area. With the construction of levees along the Mississippi River, floodwaters have been eliminated from the area and at present no sediments are being introduced into the project area. Subsidence and erosion have become the dominant factors, particularly in the marshlands and inland bodies of water, and unless sediment laden water is introduced into the area, the land mass along the edges of the project area will continue to decrease.

18. Subsidence and erosion. Progressive subsidence and downwarping have been occurring in the project area since the end of the Pleistocene epoch. The surface of the Pleistocene has been downwarped towards the south and west to a maximum of about 500 feet at the edge of the continental shelf which is about 30-40 miles south of Buras, La. At present, the rate of subsidence within the project area varies from about 0.5 to 1.0 foot per century at the northern limit to approximately 5 feet or more per century along the seaward-facing extremities of the area, gulfward of the project alinement. In addition, as a result of subsidence and wave erosion, the seaward-facing edges of the shoreline and the shorelines of the canals, ponds, lakes, and bays within the marshlands are retreating.

19. Investigations performed. General type borings extending to approximate elevations varying between -45 and -80, and 5-inch core undisturbed borings extending to approximate elevations varying between -80 and -240 were made in association with this project. In addition, the logs of borings made in conjunction with other projects as well as other geologic information were available for the interpretation of subsurface conditions in the area.

20. Foundations conditions. The subsurface, as shown on plate 9, consists of Recent deposits that vary in depth from approximately 112 feet at the upstream end of the project to about 131 feet at the downstream end. The Recent deposits are underlain by Pleistocene (Prairie formation) deposits. Generally, the Recent consists of a 6- to 12-foot surface layer of very soft to soft marsh deposits with organic material and peat. The marsh deposits consist generally of clays with organic matter and peat, underlain by interdistributary deposits of very soft to soft clays containing lenses and layers of silt and silty sands. The interdistributary

deposits vary in thickness from 38 feet in the vicinity of station 10+00 to about 50 feet at approximate station 650+00. Underlying the interdistributary clays at elevations varying between -110.0 in the vicinity of station 10+00, and -119.0 near station 800+00 are medium to stiff prodelta clays. The prodelta clays overlie a thin wedge of nearshore sands with shell and shell fragments which thickens from a minimum of about 2 feet at station 10+00 to a maximum of about 12 feet near station 800+00. The entire sequence of Recent sediments is underlain by stiff to very stiff Pleistocene clays at elevations ranging from -112.0 at station 10+00 to -131.0 at station 800+00.

21. Mineral resources. Extensive oil and gas production occur in the vicinity of the project area and it is expected that future exploration will also take place. However, existing and future exploration and production will not be adversely affected by the project, nor will the project be adversely affected by exploration and production.

22. Conclusions. Enlargement of the existing levees can be accomplished along the project alinement with suitable materials obtained from surrounding borrow areas. Significant settlement can be anticipated because of the presence of a thick sequence of very soft to soft interdistributary clays.

SOILS AND FOUNDATIONS INVESTIGATIONS AND DESIGN

23. General. This section covers the soils and foundations investigations and design for raising the existing interim Reach C hurricane protection levee.

24. Field investigations. Two 5-inch diameter undisturbed borings approximately 110 feet in depth were made at the locations shown on plates 5 and 7. Nine additional undisturbed borings approximately 100 feet in depth were made at the locations indicated on plates 2, 4, and 7. The nine additional undisturbed borings were equally divided between three locations, each location having a levee centerline boring and a boring at the levee toe on each side of the centerline. A total of 31 general type core borings, 1 7/8 inch I.D., were made at the locations indicated on plates 2 through 7. Twenty-four of the general type borings extended approximately 50 feet in depth. The remaining seven borings extended to 80 feet in depth. Logs of all the above borings are shown on plates 10 through 13. Two general type borings were made in the recommended borrow area in the Pointe a la Hache Relief Outlet. The logs of the borrow borings and related data are shown on plate 7.

25. Laboratory tests. Visual classifications were made on all samples obtained from the soils borings and water content determinations were made on all cohesive samples. Unconfined compression (UC), unconsolidated-undrained (Q), consolidated-undrained (R) (some with measured pore pressure), consolidated-drained (S), and consolidation (C) tests were performed on representative samples from the undisturbed borings. Liquid and plastic limits were determined for the tested samples. Results of laboratory tests are shown on plates 15 through 35.

26. Foundation conditions. The subsurface along this project alinement consists of Recent deposits of very soft to medium clay soils with silt and sand layers. The upper 10 to 15 feet of soil consists of very soft organic clays with areas of peat. Medium to stiff clays exist between elevations -55 and -115. Below these soils is a layer of nearshore sands underlain by the Pleistocene formation. The top of the Pleistocene varies from elevation -112 at the upper end of the project to elevation -131 near the lower end. A generalized soil and geologic profile is shown on plate 9.

27. Types of protective works. The Reach C levee will consist of an earthen levee (with a sand core) throughout the reach, except in the vicinity of the two pumping stations constructed by local interests. The existing sand core levee will be enlarged primarily with hauled fill placed in one lift. At the pumping station locations (station 241+77 and station 551+38), cantilever I-type floodwalls of steel sheet piling have been driven through the existing levee and capped with concrete. The floodwalls extend for approximately 105 feet on each side of the pumping stations. Construction of both pumping stations, including the cantilever I-type floodwalls, was the responsibility of local interests; however, the designs were reviewed and approved by the New Orleans District.

28. Design considerations. The primary problem to be resolved was that of raising the existing interim levee to the required final grade and section while assuring a 1.3 factor of safety for stability. Stability analyses indicate that the condition governing design is a 2- to 3-foot depression located between the existing levee and the existing relocated highway. However, subsequent to accomplishment of the original field surveys, local interests essentially filled the depression for the entire length of the project levee. Drainage was maintained through grates located at the culverts passing under the relocated highway. Filling the depression has served to slightly increase the appropriate factors of safety computed herein. The levee design sections, however, did not require any modifications.

29. Stability analyses.

a. Levees. Based on varying soil conditions, the Reach C levee was divided into three subreaches--station 0+00 to station 159+00, station 159+00 to station 495+00, and station 495+00 to station 834+85.0 (end of project). Undisturbed borings were made at stations 14+06 (borings 30 CUT, 30 CU, and 30 CUTP), 303+05 (borings 8 CUT, 8 CU, and 8 CUTP), and 687+50 (borings 21 CUT, 21 CU, and 21 CUTP). Stability of the proposed levee sections was investigated for each subreach using soil properties and strengths derived from the appropriate set of undisturbed borings. Stability was determined by the method of planes based on a minimum factor of safety of 1.3 with respect to shear strength. Stability was investigated at various depths in the foundation, and factors of safety with respect to shear strength were determined for various assumed failure planes. The water conditions, assigned foundation stratification, design shear strengths, critical failure surfaces, and their corresponding analyses are shown on plates 37 through 42. Berms on the flood side of the levee are not necessary for levee shear stability, but are provided as a means of dissipating a portion of the wave energy and thus reducing the required levee grade. The control lines indicated on the stability plates are those required to maintain the indicated factors of safety. Material will not be removed from inside the appropriate control lines.

b. Bohemia spillway canal. Between stations 801+09.5 and 834+85 at the lower end of Reach C, the spillway canal parallels the levee. Because of this condition, a stability computation was performed in addition to the ones calculated as generally representative of the subreach between stations 495+00 and 834+85.0. The results shown on plate 42 indicate factors of safety in excess of the required minimum of 1.3. The assigned foundation stratification and design shear strengths were those determined from the set of undisturbed borings at station 687+50.

c. Gravity drainage structures. Five drainage structures have been constructed by local interests along the Reach C alinement. Conventional stability computations were made for three structures--one in each subreach--which represented the most critical condition in the respective subreach. The stability analyses were based on the foundation stratifications, design shear strengths, and water conditions appropriate for the respective subreaches. In addition, a surcharge was added to the passive wedges. The surcharge was computed by dividing the total weight of concrete and sacked riprap above the soil by an assumed failure width. Routine stability computations were made assuming the culverts were non-existent, which is a conservative assumption. Two of the structures, one at station 89+50 and the other at station 425+50, satisfied the

requirement for a 1.3 factor of safety (see plates 43 and 44). The third structure, at station 548+60, did not meet the 1.3 criteria by conventional stability computations, assuming an infinite width. It was necessary, therefore, to perform a mass stability analysis at this location. The result of this analysis indicates a factor of safety in excess of 1.3 with respect to shear stability (see plate 45).

d. Pumping stations. As previously mentioned, two pumping stations have been recently constructed along the project alinement by local interests. One is located at station 241+77 near Bellevue, the other at station 551+38 near Pointe a la Hache. Stability of the levee sections adjacent to the connecting cantilever I-type floodwalls was analyzed. The most critical condition was found at the Pointe a la Hache pumping station. Computations for this location indicate a factor of safety of 1.42, assuming levee failure into the discharge canal (see plate 46). The assigned foundation stratification and design shear strengths used in the above computations are those appropriate to the subreaches containing the pumping stations.

e. Pointe a la Hache boat harbor. Stability of the levee was analyzed with respect to the recently completed Pointe a la Hache boat harbor located at approximate station 660+00. The computations shown on plate 47 indicate that the factor of safety satisfies the required minimum of 1.5, assuming failure into the boat slip.

f. Highway crossings. At the upper end of Reach C, highways cross the levee at two locations. One crossing (Old Louisiana Highway 39) is located at station 0+50 adjacent to the Mississippi River east levee; the other (relocated Louisiana Highway 39) is located at approximate station 8+54. For the latter crossing, boring 30 CUT, taken at station 14+06, was used to assign the design shear strengths and stratification. For the highway crossing at station 0+50, boring 30CUT was used for the design shear strengths and stratification below elevation -4.0. Above elevation -4.0, the shear strengths are equivalent to those represented by boring 25 MHULT (Mississippi River baseline station 1632+00), as shown in "Mississippi River Levees and Banks, Mile 66 to Mile 10, Soils Report - Part I, Soils Data, Volume I - East Bank." Results of the stability analyses at critical locations on the highway crossings indicate that no berm is required for the crossing located immediately adjacent to the Mississippi River levee. However, stability berms are required for the highway crossing at station 8+54. The stability analyses are shown on plates 48 and 49. Detailed plans at the crossings are shown on plate 50, and profiles and sections are shown on plate 56.

g. Access ramps. Twenty-one access ramps across the existing Reach C interim levee will be raised to accommodate the enlarged levee proposed in this design memorandum. Since the net profile of the ramp sections is above the net levee sections required for stability, the factors of safety with respect to stability at the ramp locations exceed the required minimum of 1.3. Detailed profiles and sections of the proposed access ramps are shown on plate 56.

h. Pipeline bridges.

(1) Near the lower end of Reach C, overhead pipe crossings are located at stations 517+00, 538+00, 578+43, and 601+85. Each crossing consists of various size pipelines supported by trusses. The trusses are supported by footings which are founded on pilings.

(2) As stated in paragraph 28 of this design memorandum, the depression between the landside levee toe and the relocated highway has been filled by local interests. This action has obviated the need for adding approximately 3.5 feet of soil in the depression for a distance of 30 feet on each side of the pipeline bridges, and installing a culvert to maintain drainage. These alterations would have been required in the vicinity of the pipeline bridges to raise the minimum factor of safety from 1.3 to 1.5 with respect to shear strength.

(3) The 1.49 safety factor for the flood side levee stability in the vicinity of the pipeline bridges is considered adequate.

30. Sources of fill material. The levee will be enlarged primarily with hauled fill obtained from the Pointe a la Hache Relief Outlet (see plate 7). Data relative to the two general type borings located in the borrow area and representative of the soil conditions are shown on plate 14. In addition, excess material above the levee design section, as shown on plate 8, will be used for construction of the final levee section.

31. Erosion protection. Because of the relatively short duration of hurricane flood stages and the resistant nature of the clayey soils, erosion protection other than sodding is not considered necessary along the major length of the levee. In the vicinity of the two pumping stations, adequate erosion protection is provided by riprap along the flood side of the cantilever I-type floodwalls (see plate 55). Erosion protection at the existing gravity drainage structures consists of sacked concrete riprap (see plate 53).

32. Settlement.

a. Estimates of settlement beneath the Reach C levee crown are based on a series of actual field readings taken over a period of approximately 2.5 years. Readings obtained from three undisturbed boring locations (stations 14+06, 303+05, and 687+50) were plotted on a semilogarithmic grid and yielded straight lines (see plate 51). A time-settlement curve was then plotted on an arithmetic scale, also shown on plate 51, to obtain the slope of the time-settlement curve beyond the last field readings. It was assumed that the ultimate settlement indicated in the log plot would equal the ultimate settlement obtained when the levee is raised to its final grade. It was further assumed that ultimate settlement would be reached 20 years subsequent to construction of the design levee.

b. The results of the above analysis, as shown on plate 51, indicate that the subreach represented by the field readings taken at station 687+50 will settle approximately 2.6 feet after the final lift. The upper end of Reach C, based on the readings at station 14+06, will settle about 1.9 feet. The subreach represented by the readings at station 303+05 will settle approximately 1.8 feet after completion of the final lift. The range of settlement is due to the varying thicknesses of peat layers throughout the reach, as evidenced by the geologic soil profile shown on plate 9.

c. Consolidation test data from the undisturbed borings are plotted on plates 15 through 25. Settlement computations, based on this data, indicate settlements substantially the same as those indicated by the field readings.

33. Settlement observations. Immediately following construction the project works will be transferred to local interests for maintenance purposes. Therefore, settlement observations as they would relate to future Federal construction will not be necessary.

34. Seepage. Approximately 10 feet of clay cover above the sand core will be provided on the flood side of the levee. Due to the relatively short duration of hurricane headwaters, this is considered sufficient to prevent seepage.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

35. Levees.

a. The general location of the Reach C protective system is shown on plate 1. The detailed alinement and profile of the levee and features contiguous thereto are shown on plates 2 through 7. The project levee will extend from a junction with the Mississippi River east levee near Phoenix, thence along the alinement of the existing interim levee to a junction with the Mississippi River levee in the vicinity of Bohemia. The total length of the levee is approximately 16 miles.

b. The existing interim levee (sand core with clay blanket) was constructed to elevation 14.0 by contract between the Louisiana Department of Highways, as agent for the Plaquemines Parish Commission Council, and the joint venture Atlas Construction Company--Jahncke Service, Inc., during the period 1966-68, under State Project 46-06-21. The alinement and design of the existing levee were coordinated with the New Orleans District. Typical interim levee design sections are shown on plate 52.

c. Enlargement of the existing levee to elevation 17.0 will be accomplished primarily with hauled fill obtained from the Pointe a la Hache Relief Outlet. Excess material above the levee design section will also be used. Typical levee design sections are shown on plate 8. At stations 10+33.17 and 801+27.2 (see plates 2 and 7, respectively), curves with minimum radii of 100 feet will be provided.

36. Drainage structures.

a. Five gravity drainage structures were constructed by local interests in conjunction with the interim levee construction. The structures provide drainage outlets for the area between the Reach C hurricane protective levee and the Mississippi River east levee. Three structures, each containing one 6-foot diameter culvert, were constructed at stations 89+50, 236+70, and 486+30. One structure consisting of three 6-foot diameter culverts was constructed at station 548+60. The remaining structure, consisting of four 6-foot diameter culverts, was constructed at station 425+50. Each structure contains corrugated metal pipe culverts, reinforced concrete U-frame inlet basins and stilling basins, and automatic flap gates. The inlet and stilling basins contain provisions for stoplogs which may be installed for maintenance of the culverts. Independent vertical lift slide gates in reinforced concrete operating towers have also been provided. Each operating tower contains one vertical vault per culvert. Access to the vaults for inspection purposes is accomplished through manholes located in the top slab of each vault. Each top slab is removable permitting access to

the slide gates for maintenance and repair purposes. Design of the drainage structures was reviewed by the New Orleans District prior to construction and all recommendations were incorporated by local interests into the final design. Structure locations are shown on plates 2 and 7. Design details are shown on plate 53.

b. The existing drainage structure operating towers will be raised in order to meet the final levee wave berm grade (see plate 54).

37. Drainage collection canal. A drainage collection canal located riverward of the Reach C levee was constructed by local interests and serves the area inclosed by the Reach C and Mississippi River east levees. Location of the canal is shown on plates 2 through 7. Detailed information regarding the drainage canal is presented in appendix A, section III of this design memorandum. The canal design section is shown on plate 52.

38. Pumping stations.

a. The two pumping stations (one at station 241+77 near Bellevue, the other at station 551+38 near Pointe a la Hache), recently constructed by local interests, include provisions for protection from design hurricane tides at these locations. A continuous protective system is provided by the floodwalls between the discharge basins and the adjacent levees; the discharge basin sidewalls; and the backwalls of the discharge basins. The critical structure loadings resulting from design hurricane-induced stage differentials are transmitted from the discharge basin backwalls through longitudinal shear walls and ultimately distributed to all the structural components of the pumping stations. Therefore, essentially the entire pumping station is used to resist these loads. Plans at the pumping stations are shown on plate 55.

b. The floodwalls between stations 240+72 and 242+82 and stations 550+33 and 552+43 are I-type cantilever sheet pile walls consisting of PZ-27 steel sheet pile capped with concrete. The sheet piling extends from elevations 13.0 to -20.0, and the concrete cap is provided between elevations 10.0 and 20.0. In order to provide a seepage cutoff, the sheet piling was extended below the elevation required for stability purposes. Seepage cutoff is also provided under the discharge basin side and backwalls to obtain a continuous diaphragm. A wave berm has been constructed along the floodwall alinement to dissipate hurricane wave forces on the floodwalls. The floodwalls are designed to withstand loading from an 8-foot broken wave. A typical floodwall section is shown on plate 55.

c. Since the pumping stations and connecting floodwalls are an integral part of the Reach C hurricane protective system, the structural designs were coordinated with and approved by the New Orleans District.

OTHER CONSTRUCTION PLANS CONSIDERED

39. Alternative levee construction plans. The plan of improvement recommended herein provides for enlargement of the existing sand core levee constructed by local interests subsequent to project authorization. However, alternative levee plans were considered during preparation of this memorandum to demonstrate that the sand core type levee is in fact the most economical method of construction for the Reach C project feature. The alternative plans considered were: hauling material from the Pointe a la Hache Relief Outlet for construction of a new levee; and a new levee based on a construction plan of successive hydraulic clay fill lifts and shapeups utilizing borrow material from the marsh area located north of the proposed levee. Sufficient analyses were accomplished to determine that the most economical and practicable method of construction is a pumped sand core with a clay blanket (recommended plan). Estimated costs show that a new haul fill levee plan would be about 140 percent more costly than the recommended project plan, while the hydraulic clay fill levee would be approximately 180 percent more costly.

40. Alternative interim levee enlargement plan. In addition to the recommended method of enlarging the existing interim levee by hauling fill from a borrow area in the Pointe a la Hache Relief Outlet, an alternative method was considered. The alternative method would accomplish the levee enlargement with hydraulic fill obtained from the marsh area north of the project levee. However, the extensive effluent ponding system and attendant costs which would be necessary to obtain the required quantity of embankment render this method uneconomical as well as impracticable.

ACCESS ROADS

41. Access roads. Access during construction will be provided by the relocated Louisiana Highway 39 in conjunction with existing ramps across the levee which are accessible from the relocated highway. The existing levee crown will provide construction access for placing the hauled material. Access to the levee as described above will also be used for maintenance purposes.

42. Sources of construction materials. In addition to the information presented herein relative to borrow material for the Reach C levee, supplemental information concerning construction materials sources is contained in "New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson," revised 30 August 1971.

COORDINATION WITH OTHER AGENCIES

43. Louisiana Wild Life and Fisheries Commission.

a. Review and recommendations.

(1) The Director, Louisiana Wild Life and Fisheries Commission, was informed by letter dated 1 October 1971 of the Reach C levee plan and was requested to furnish views and comments. The Director in his letter of response dated 7 October 1971 states "...We feel our original letter reports [27 March 1963 and 16 May 1963] would be sufficient in establishing our interest and recommendations regarding the proposed work...." In the original letter reports of 27 March 1963 and 16 May 1963, the Louisiana Wild Life and Fisheries Commission requested that plans for the Reach C levee provide continued road access to existing fishing and hunting facilities, and hunter and fisherman access points; and that consideration be given to developing a public boat-launching area. Copies of correspondence from the Commission are included in appendix B.

(2) In the Director's letter response of 7 October 1971, he also states "...because of the absence of sufficient discharges of waters from the Mississippi River into the marshes on either side possibly at some later date some consideration could be given to establishing fresh water introduction features in the levee system of the hurricane protection project...."

b. Proposed actions.

(1) Twenty-one roads providing access to commercial and industrial facilities, and fish, wildlife, and recreational resources were raised to cross over the Reach C interim levee. These access ramps will be modified to accommodate the dimensions of the design levee section as proposed in this design memorandum. Further, 10 access bridges across the drainage canal have also been constructed as part of the Reach C project plan.

(2) A current study, in accordance with the Federal Water Project Recreation Act (P.L. 89-72), indicates justification for a public boat-launching facility in the Reach C project area. By letter dated 15 October 1971, local interests (Plaquemines Parish Commission Council) were informed of the opportunity to include a public boat-launching facility in the project plan with the proviso that they bear not less than one-half of the separable cost, and bear fully the cost of operation, maintenance, and replacement of the facility. The Commission Council was invited to furnish comments relative to this proposal. By letter dated 18 January 1972, the Commission Council President states that the Council "...has under construction a large marina at Lower Pointe a la Hache which should be in operation within the next two months,

and which will accommodate our fishing industries and provide boat launching facilities for commercial and recreational purposes on the east bank [of the Mississippi River]...additional facilities in this area would serve no purpose." A copy of the 18 January 1972 letter is included in appendix B.

(3) The authorized Mississippi Delta Region, La., project consists of four control structures with appurtenant channels for the diversion of fresh water from the Mississippi River into adjacent marsh areas. Based on the currently proposed locations for the control structures, provisions in the Reach C levee alinement are not required to accommodate the diversion of fresh water to these marsh areas. It appears at this time that appropriate structural features will be required in the Reach A levee alinement. This matter will be the subject of further discussion in "New Orleans to Venice, Louisiana, General Design Memorandum No. 1, Supplement No. 5, Reach A - City Price to Tropical Bend," currently underway.

44. U. S. Department of the Interior, Fish and Wildlife Service.

a. Review and recommendations. The Regional Director, U. S. Fish and Wildlife Service, Atlanta, Georgia, was informed by letter dated 1 October 1971 of the proposed Reach C levee plan and requested to furnish views and comments. By letter dated 8 November 1971, the Regional Director states "...our previous reports ... will suffice in establishing the fish and wildlife implications of the hurricane protection plan...." Based on extensive coordination between the U. S. Fish and Wildlife Service and the Louisiana Wild Life and Fisheries Commission regarding the New Orleans to Venice project, the previous reports of the former agency reflect essentially the same views as those provided by the Louisiana Wild Life and Fisheries Commission.

b. Proposed actions. Since the U. S. Fish and Wildlife Service comments are essentially the same as those provided by the Louisiana Wild Life and Fisheries Commission, proposed actions are the same as those presented in paragraph 43b above.

45. Environmental Protection Agency, Air and Water Programs Division.

a. Review and recommendations. By letter dated 15 October 1971, the Environmental Protection Agency, Region VI, Dallas, Texas, was informed of the project plan and requested to furnish views and comments. In a letter response dated 26 November 1971, a representative of the Environmental Protection Agency, Air and Water Programs Division, states "...We would like to know more about the construction methods and methods that will be used to protect environmental values during and after construction of the project ... An Environmental Statement that would

include this project would permit our agency to evaluate more fully the potential adverse effects on environmental values within our area of responsibility...." A copy of the 26 November 1971 letter is included in appendix B.

b. Proposed actions. Preparation of a draft environmental statement for the entire New Orleans to Venice hurricane protection project is underway. Subsequent to completion, a copy of the draft statement will be furnished to the Environmental Protection Agency for review and comments.

46. State of Louisiana Stream Control Commission.

a. Review and recommendations. The Louisiana Stream Control Commission, by letter dated 15 October 1971, was informed of the proposed Reach C levee plan and requested to furnish views and comments. As it relates to the Reach C levee plan, the Commission's 19 January 1972 letter of response states "...State and federal water pollution control and health laws, rules, and regulations should be complied with by the contractor." A copy of the Commission's letter of response is included in appendix B.

b. Proposed actions. Plans and specifications for the Reach C levee work proposed in this memorandum will include requirements that the construction contractor comply with appropriate state and Federal water pollution control and health laws.

47. Louisiana State Board of Health.

a. Review and recommendations. The President, Louisiana State Board of Health, was informed by letter dated 15 October 1971 of the project plan for Reach C and requested to furnish views and comments. At the direction of the President, State Board of Health, the Louisiana Air Control Commission responded to the above request. The Commission states "...If there will be such materials, [combustible materials] we believe that any contract could provide for compliance with the Louisiana Air Control Commission's standards and regulations...." A copy of the response is included in appendix B.

b. Proposed actions. Plans and specifications for the Reach C levee work proposed in this memorandum will include requirements that the construction contractor comply with appropriate Louisiana Air Control Commission's standards and regulations.

ENVIRONMENTAL ANALYSIS

48. General.

a. The existing interim Reach C levee will be enlarged using fill from the Pointe a la Hache Relief Outlet and by standard construction procedures. The only potential damage to the adjacent ecosystem would be as a result of the erosion of fill material by rain or material drift due to wind action. Normally such material from exposed soil faces at construction sites has the potential for filling drainage channels and collecting in streams and water bodies with some interference with the existing biota. In this case, the natural erosion per mile will be small and the immediate presence of large marsh areas which can readily assimilate the relatively small quantities of material involved will result in almost negligible temporary damages. There will be no long-term damages caused by the project.

b. There will be short- and long-range benefits from this project in that the human portion of the adjacent ecosystem will be protected from severe flood damages caused by hurricane-induced tides.

49. Environmental statement. The environmental statement for the entire New Orleans to Venice hurricane protection project will be made available to the President, Council on Environmental Quality in about November 1972.

50. Enhancement. Construction of the Reach C protective works will alter the existing terrain only to the extent of superimposing a hurricane protective levee with required contiguous features. Essentially all borrow material will be acquired from the Pointe a la Hache Relief Outlet. With respect to beautification measures, it should be noted that the relocated Louisiana Highway 39 is situated on the protected side and parallel and immediately adjacent to the project levee. Accordingly, measures beyond those normally associated with levee construction; i.e., grading and sodding, are not warranted.

51. Recreation resources. As discussed in paragraph 43b(2) above, construction of a public boat-launching facility has been excluded from the Reach C project plans based on the response of local interests.

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

REAL ESTATE REQUIREMENTS

53. Real estate requirements. All rights-of-way and easements required for construction of the Reach C levee will be furnished by local interests without cost to the United States. There will be no acquisition by the United States. Rights-of-way limits are shown on plates 2 through 7.

RELOCATIONS

54. General. The authorizing law specifies that local interests will accomplish, prior to the initiation of construction and without cost to the United States, "...all necessary alterations and relocations to roads, pipelines, cables, wharves, and other facilities required by the construction of the project;...."

55. Pipelines.

a. Relocation of the following pipelines was accomplished by local interests in conjunction with construction of the interim levee:

Description	Approximate location (station)
United Pipeline Co.	
One 2-inch water line	517+00
One 2-inch gas line	"
One 8-inch gas line	"
One 20-inch gas line	"
Union Texas Petroleum Corp.	
One 3-inch gas line	538+00
Perry R. Bass, Inc.	
One 2-inch gas line	538+00
One 2-inch water line	"
One 4-inch water line	"
One 4-inch gas line	"
One 6-inch oil line	"
One 6-inch gas line	"
One 14-inch gas line	"
One 2-inch oil line	578+43
One 3-inch oil line	"
One 4-inch oil line	"
Two 4-inch gas lines	"
Southern Natural Gas Co.	
One 8-inch gas line	538+00
One 20-inch gas line	601+85

The pipeline owners accomplished the relocations by the construction of pipeline bridges. The designs were reviewed and approved by the New Orleans District. The pipeline bridge locations are shown on plates 5 and 6 and details of a typical bridge are shown on plate 55.

b. The existing pipeline bridge supports will be encased in concrete to elevation 10.5 to meet the final levee wave berm grade. Details of this modification are shown on plate 55.

c. The Texas Pipeline Company owns a 6-inch oil line located at approximate station 398+75. The pipeline was relocated during construction of the interim levee to cross beneath the levee at approximate elevation -11.5. This method of relocation was proposed to the New Orleans District on 9 December 1966 and disapproved by letter to the Plaquemines Parish Commission Council on 27 December 1966. The pipeline will be removed from its present location and relocated to cross over the enlarged levee recommended in this design memorandum. See plate 54 for modification details.

d. A 2-inch water line, owned by the Suburban Rod and Gun Club, which crosses the existing levee surface at station 424+40 will be relocated to accommodate the enlarged levee.

56. Facilities. Facilities which were relocated by local interests in conjunction with construction of the interim levee are as follows:

Description	Approximate location (station)
Suburban Rod & Gun Club facilities	425+00
United Gas Pipeline Co. facilities	516+00
Plaquemines Parish-Adema Canal public boating facilities	534+00
Perry R. Bass facilities	537+00

57. Electrical powerlines.

a. Eight 20KV and two 34.5KV distribution lines and one 115KV transmission line were relocated in conjunction with the interim levee construction by local interests. The locations of these powerlines are shown on plates 2 through 7.

b. As a result of raising the existing levee crown to elevation 17.0, five 20KV distribution lines and the 115KV transmission line must be further raised to provide sufficient clearance for construction and maintenance purposes. The locations of these powerlines are shown on plates 2, 3, 4, and 7.

58. Highway crossings. The old Louisiana State Highway 39 located immediately adjacent to the Mississippi River levee and the relocated State Highway 39 cross the project interim levee at stations 0+50 and 8+54, respectively. These crossings will be raised to accommodate the design levee. The design of these crossings has been coordinated with and approved by the Louisiana Department of Highways. Locations of the crossings are shown on plate 2, and design details are shown on plate 56. The plans at the crossings are shown on plate 50.

59. Access ramps. Twenty-one roads providing access to commercial and industrial facilities, and fish, wildlife, and recreational resources were raised in conjunction with construction of the interim levee by local interests. The existing ramps will be raised to accommodate the enlarged levee proposed in this design memorandum. Locations of the access ramps are shown on plates 2 through 7. Design details are shown on plate 56.

60. Access bridges. To provide access across the drainage canal, 10 access bridges were constructed at the locations shown on plates 2 through 7. Design details are shown on plate 52.

ESTIMATE OF COST

61. General. The estimated first cost for the Reach C hurricane protection levee is $12,300,000. This estimate consists of $8,340,000 for levees and floodwalls, $464,000 for lands and damages, $2,098,000 for relocations, $814,000 for engineering and design, and $584,000 for supervision and administration. Costs related to construction of the existing Reach C interim levee are based on July 1967 price levels. Costs related to the levee enlargement plan presented in this design memorandum are based on April 1972 price levels. The detailed estimate of first cost is shown in table 1.

TABLE 1
DETAILED ESTIMATE OF FIRST COST
REACH C

Cost acct. No.	Description	Estimated quantity	Unit	Unit price $	Estimated amount $
11	Levees and floodwalls				
	First lift levee (14' elevation) (Jul 1967 price levels)				
	Clearing and grubbing	Job	Lump sum		7,900
	Embankment	Job	Lump sum		5,139,645
	Seeding & fertilizing	Job	Lump sum		79,118
	Subtotal, levee				5,226,663[1]

TABLE 1 (cont'd)

Cost acct. No.	Description	Estimated quantity	Unit	Unit price $	Estimated amount $
	Drainage structures				
	72" corrugated metal pipe	2,902.47	l.f.	120.00	348,296
	18" corrugated metal pipe	228	l.f.	15.00	3,420
	Operating towers	Job	Lump sum		73,000
	72" slide gates	10	each	12,000.00	120,000
	72" flap gates	10	each	8,000.00	80,000
	Class "A" conc.(headwalls)	275	c.y.	545.90	150,227
	Steel reinforcement (headwalls)	40,428	lb.	0.30	12,128
	Sacked conc. revetment	850	c.y.	75.00	63,750
	Gravel base course	434	c.y.	10.00	4,350
	Portable power unit	1	each	3,000.00	3,000
	Treated timber piles	534.5	l.f.	5.00	2,673
	Subtotal, drainage structures				860,844[1]
	Drainage canal	Job	Lump sum		300,000[2]
	Second lift levee (17' elevation) (Apr 1972 price levels)				
	Clearing	350	acre	75.00	26,250
	Embankment	925,000	c.y.	1.65	1,526,250
	Seeding & fertilizing	450	acre	150.00	67,500
	Operating tower modifications	Job	Lump sum		10,050
	Subtotal				1,630,050
	Contingencies 20%+				322,443
	Subtotal, second lift levee				1,952,493
	Subtotal, levees and floodwalls				8,340,000
30	Engineering & design 10%+				814,000
31	Supervision & administration 7%+				584,000
	Total, levees and floodwalls				9,738,000

TABLE 1 (cont'd)

Cost acct. No.	Description	Estimated quantity	Unit	Unit price $	Estimated amount $
01	Lands and damages (Jul 1967 price levels, unless otherwise noted)				
	Rights-of-way	90	acre	250.00	22,500
	Rights-of-way	320	acre	500.00	160,000
	Construction easement	30	acre	62.50	1,875
	Construction easement	105	acre	125.00	13,125
	Construction easement	140	acre	50.00	7,000
	Borrow area rights-of-way (Apr 72 price levels)	48	acre	500.00	24,000
	Severance		Lump sum		132,000
	Subtotal, lands and damages				360,500
	Contingencies 20%+				71,100
	Acquisition cost by others				32,400
	Total lands and damages				464,000
02	Relocations				
	First lift levee relocations (Jul 1967 price levels)				
	Pipelines				
	United Gas Pipeline Co. Two 2", one 8", & one 20"	Job	Lump sum		152,513
	Texas Pipeline Co., one 6"	Job	Lump sum		5,627[3]
	United Texas Pet.Corp., one 3"	Job	Lump sum		12,629
	Perry R. Bass, Inc., three 2", one 3", five 4", two 6", & one 14"	Job	Lump sum		332,160
	Southern Natural Gas Co., one 8" & one 20"	Job	Lump sum		279,758
	Subtotal pipelines				782,687[4]
	Facilities				
	Suburban Rod & Gun Club		Lump sum		55,000
	United Gas Pipeline Co.		Lump sum		10,000
	Perry R. Bass		Lump sum		226,000
	Plaquemines Parish-Adema Canal public boating		Lump sum		53,000
	Subtotal				344,000
	Contingencies 20%+				69,000
	Subtotal facilities				413,000

TABLE 1 (cont'd)

Cost acct. No.	Description	Estimated quantity	Unit	Unit price $	Estimated amount $
	Powerlines				
	Distribution lines	Job	Lump sum		4,945
	Transmission lines(includes temporary loop line)	Job	Lump sum		64,778
	Subtotal powerlines				69,723[4]
	Ramps & highway crossings	Job	Lump sum		214,614[1]
	Engineering & design 10%+				21,386
	Supervision & administration 7%+				16,000
	Subtotal, ramps & highway crossings				252,000
	Access bridges	8	each	25,360	202,880
	Access bridges	2	each	7,000	14,000
	Subtotal				216,880
	Contingencies 10%+				21,710
	Subtotal				238,590
	Engineering & design 10%+				23,000
	Supervision & administration 7%+				17,000
	Subtotal access bridges				278,590
	Total relocations, first lift				1,796,000
	Second lift levee relocations (Apr 1972 price levels)				
	Pipelines				
	Texas Pipeline Co., one 6"	350	l.f.	30.00	10,500[5]
	Suburban Rod & Gun Club, one 2"	300	l.f.	3.30	1,000
	Pipeline bridge support modifications				1,000
	Subtotal pipelines				12,500
	Powerlines				
	Distribution lines	Job	Lump sum		2,400
	Transmission line	Job	Lump sum		3,900
	Subtotal, powerlines				6,300

TABLE 1 (cont'd)

Cost acct. No.	Description	Estimated quantity	Unit	Unit price $	Estimated amount $
	Ramps & highway crossings	90,000	c.y.	2.20	198,000
	Subtotal, second lift relocations				216,800
	Contingencies 20%±				42,200
	Subtotal				259,000
	Engineering & design 10%±				25,000
	Supervision & administration 7%±				18,000
	Total, second lift relocations				302,000
	Total, all relocations				2,098,000
	TOTAL PROJECT COST				12,300,000

[1]Represents actual contract prices for work approved in connection with levee construction accomplished by local interests.

[2]Represents Government estimate for drainage canal construction by the Louisiana Department of Highways prior to the levee contract.

[3]Represents actual contract price for relocating pipeline, excluding that portion of the cost related to relocating the pipeline under the project levee.

[4]Represents actual contract prices for relocations, excluding betterments, performed under contract between the Louisiana Department of Highways, an agent for the Plaquemines Parish Commission Council, and the utility owners.

[5]Removal of the pipeline from its present location under the levee is not included as a portion of the cost for relocating this pipeline.

62. Comparison of estimates.

a. GDM versus PB-3. The current estimate of $12,300,000 for the Reach C hurricane protection levee represents an increase of $1,161,000 over the latest PB-3 effective 1 July 1971. The estimate presented in the PB-3 is based on the estimate included in New Orleans to Venice, La., General Design Memorandum No. 1, Reach B1 - Tropical Bend to Fort Jackson, approved 8 August 1967, appropriately escalated to July 1971 price levels. Table 2 shows a comparison of the project document, PB-3, and general design memorandum estimates. Reasons for the difference between the design memorandum and PB-3 estimates are as follows:

(1) Levees and floodwalls. The decrease of $157,000 reflects general refinements in design of the levee enlargement plan based on the more detailed design procedures used in preparation of this memorandum.

(2) Engineering and design. The decrease of $289,000 reflects a reduction proportionate to the decreased construction cost. Also, engineering and design cost incurred by local interests for construction of the interim levee was less than originally estimated.

(3) Supervision and administration. The decrease of $145,000 reflects a reduction proportionate to the decreased construction cost. Also, supervision and administration cost incurred by local interests for construction of the interim levee was less than originally estimated.

(4) Lands and damages. The increase of $42,000 reflects the more detailed studies and appraisals made during preparation of this design memorandum.

(5) Relocations. The increase of $1,710,000 reflects additional relocation items realized subsequent to the preparation of the design memorandum on which the PB-3 estimate is based; and cost estimate refinements based on more detailed cost information available during preparation of this design memorandum.

b. GDM versus project document. The estimate of $12,300,000 for the Reach C levee also represents an increase of $9,471,000 over the project document estimate. Reasons for the difference between the design memorandum and project document estimates are as follows:

(1) Levees and floodwalls. The increase of $6,046,000 is comprised of the $157,000 decrease described in paragraph 62a(1) above and an increase of $6,203,000 which

TABLE 2
COMPARISON OF ESTIMATES
REACH C

Cost acct. No.	Feature	Project document	PB-3 eff. 1 Jul 71	General design memorandum	Difference GDM - PB-3	Difference GDM - proj. document
		$	$	$	$	$
11	Levees and floodwalls	2,294,000	8,497,000	8,340,000	- 157,000	+6,046,000
30	Engineering & design	162,400	1,103,000	814,000	- 289,000	+ 651,600
31	Supervision & administration	185,600	729,000	584,000	- 145,000	+ 398,400
	Subtotal	2,642,000	10,329,000	9,738,000	- 591,000	+7,096,000
01	Lands and damages	91,000	422,000	464,000	+ 42,000	+ 373,000
02	Relocations	96,000	388,000	2,098,000	+1,710,000	+2,002,000
	Subtotal	187,000	810,000	2,562,000	+1,752,000	+2,375,000
	TOTAL	2,829,000	11,139,000	12,300,000	+1,161,000	+9,471,000

reflects added costs for constructing the protective works to a higher net grade, based on hurricane parameters developed by the National Weather Service subsequent to preparation of the project document; an additional increase in the height of the project works above natural ground of approximately 1 foot resulting from releveling by the U. S. Coast and Geodetic Survey (now the National Ocean Survey) in 1965; and a review of design procedures, and price escalations subsequent to preparation of the project document estimate.

(2) Engineering and design. The increase of $651,600 is comprised of the decrease of $289,000 described in paragraph 62a(2) above, and an increase of $940,600 which reflects a current engineering and design percentage greater than that used in the project document as well as a proportionate increase based on increases in construction costs subsequent to preparation of the project document estimate.

(3) Supervision and administration. The increase of $398,400 is comprised of the decrease of $145,000 described in paragraph 62a(3) above and an increase of $543,400 which reflects a proportionate increase based on increases in construction costs subsequent to preparation of the project document estimate.

(4) Lands and damages. The increase of $373,000 is comprised of the increase of $42,000 described in paragraph 62a(4) above and an increase of $331,000 which reflects a reanalysis of requirements and escalation of costs subsequent to preparation of the project document estimate.

(5) Relocations. The increase of $2,002,000 is comprised of $1,710,000 as described in paragraph 62a(5) above and $292,000 as a result of a reanalysis of requirements and price escalations subsequent to preparation of the project document estimate.

SCHEDULES FOR DESIGN AND CONSTRUCTION

63. Schedules for design and construction. The sequence of contracts and the schedules for design and construction are shown below:

	Preparation of plans & specifications:		Construction			Estimated construction cost (including
Contracts	Start	Complete	Advertise	Award	Complete	contingencies)
Second lift (includes clearing, seeding, fertilizing, & operating tower modifications)	Oct 72	Mar 73	Apr 73	May 73	May 75	$1,953,000

64. Funds required by fiscal year. To maintain the schedules for design and construction, Federal funds will be required by fiscal year as follows:

Total estimated cost through	FY 72	$ 231,000[1]
Funds required for	FY 73	234,000[2]
	FY 74	1,468,000[2]
	FY 75	1,232,000[2]
TOTAL		$3,165,000

[1]Planning funds only.
[2]Construction funds including contingencies and E&D & S&A during construction.

OPERATION AND MAINTENANCE

65. Operation and maintenance. As specified in the authorizing act, local interests will be required to maintain and operate the completed hurricane protection works in accordance with regulations prescribed by the Secretary of the Army. The estimated annual maintenance cost of the Reach C levee embankment is $20,000. The estimated annual operation and maintenance cost of the drainage structures is $10,000, which includes $3,000 for the single culvert structures ($1,000 for each structure), $3,000 for the three-culvert structure, and $4,000 for the four-culvert structure. The total estimated annual replacement cost of the drainage structures is $35,000, based on a replacement interval of 25 years. Accordingly, the total estimated annual operation, maintenance, and replacement cost for this project is $65,000.

ECONOMICS

66. Benefits.

a. The New Orleans to Venice, Louisiana, hurricane protection project is being designed to provide protection from flooding by hurricane-generated surges having a return frequency of once in 100 years on the average. In Reach C, the project works will provide protection to the 4,500 acres which comprise the Reach C project area. In 1970, there were approximately 530 acres of urban development along the Mississippi River within this reach.

b. Benefits consist of noncrop flood damages prevented on existing and future development, and intensified land use.

c. A detailed analysis of the benefits for Reach C is presented in New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson, revised 30 August 1971. The data presented herein on flood damages prevented represent updatings of those presented in the above-referenced design memorandum. The data on benefits from intensified land use are the same as those previously presented. In response to comments by the office of the Chief of Engineers on the Reach B1 design memorandum, a restudy is currently in progress relative to intensified land use in the New Orleans to Venice, Louisiana, project area. Upon completion of this analysis, a revision of intensified land-use benefits for all reaches of the project will be prepared. The Reach C portion of the project is, however, economically justified on the basis of flood damages prevented alone, the B/C ratio being 1.4 to 1.

d. Average annual flood damages prevented on existing development and future development amount to $465,000 and $184,000, respectively. Total average annual flood damages prevented are $649,000. Increases in these benefits over those reported in the Reach B1 design memorandum reflect the ENR price level change between July 1971 and April 1972.

e. Intensified land-use benefits amounting to $221,000 annually are as previously shown in the Reach B1 design memorandum.

f. The total average annual benefits are, therefore, $870,000.

67. Project first costs and annual charges. First costs and annual charges for the Reach C levee are displayed in table 3.

TABLE 3
ESTIMATE OF PROJECT COSTS AND ANNUAL CHARGES
REACH C

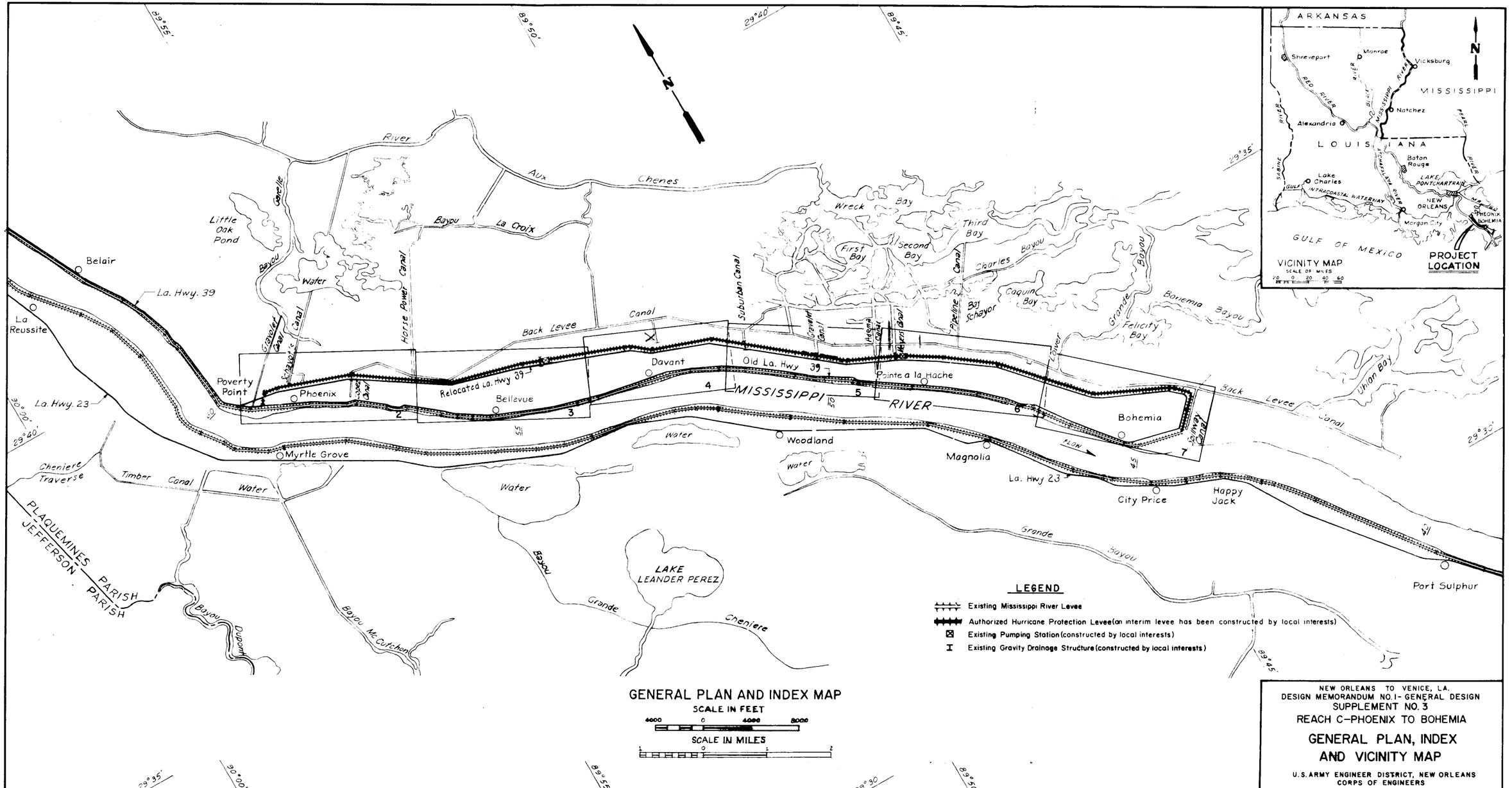
	Federal	Non-Federal	Total
	$	$	$
Construction	9,738,000	-	9,738,000
Lands, damages, relocations	-	2,562,000	2,562,000
	9,738,000	2,562,000	12,300,000
Cash contribution	-1,128,000	1,128,000	-
First cost	8,610,000	3,690,000	12,300,000
Interest during construction[1]	-	253,000	253,000
Total project investment	8,610,000	3,943,000	12,553,000
Annual economic costs			
Interest (2 7/8%)	247,500	113,400	360,900
Amortization (100 years)	15,400	7,100	22,500
Operation and maintenance	-	30,000	30,000
Replacements	-	35,000	35,000
Economic loss on lands	-	13,500	13,500
Total annual economic costs	262,900	199,000	461,900

[1]Interest during construction was based on total expenditure of $8,806,000 by local interests during 1966-68 (2 years). This work provides a substantial level of protection.

68. Economic justification. The average annual benefits of $870,000 and average annual charges of $461,900 result in a benefit-cost ratio of 1.9 for the Reach C portion of the New Orleans to Venice project.

RECOMMENDATIONS

69. Recommendations. The plan of improvement presented herein for the Reach C levee consists of enlargement of the existing interim levee (earthen levee with sand core) constructed by local interests subsequent to project authorization. The existing levee, extending for a distance of approximately 16 miles from Phoenix to Bohemia, will be enlarged with hauled fill material. The plan also provides for five gravity drainage structures and a landside drainage collection canal which have also been constructed by local interests. Additionally, local interests have accomplished numerous relocations in conjunction with construction of the interim levee; however, further relocations and modifications will be required to accommodate the enlarged protective system. This plan is considered to be the best means of accomplishing the project objectives and is recommended for approval.



GENERAL PLAN AND INDEX MAP

SCALE IN FEET

4000 0 4000 8000

SCALE IN MILES

0 1 2

LEGEND

- Existing Mississippi River Levee
- Authorized Hurricane Protection Levee (an interim levee has been constructed by local interests)
- Existing Pumping Station (constructed by local interests)
- Existing Gravity Drainage Structure (constructed by local interests)

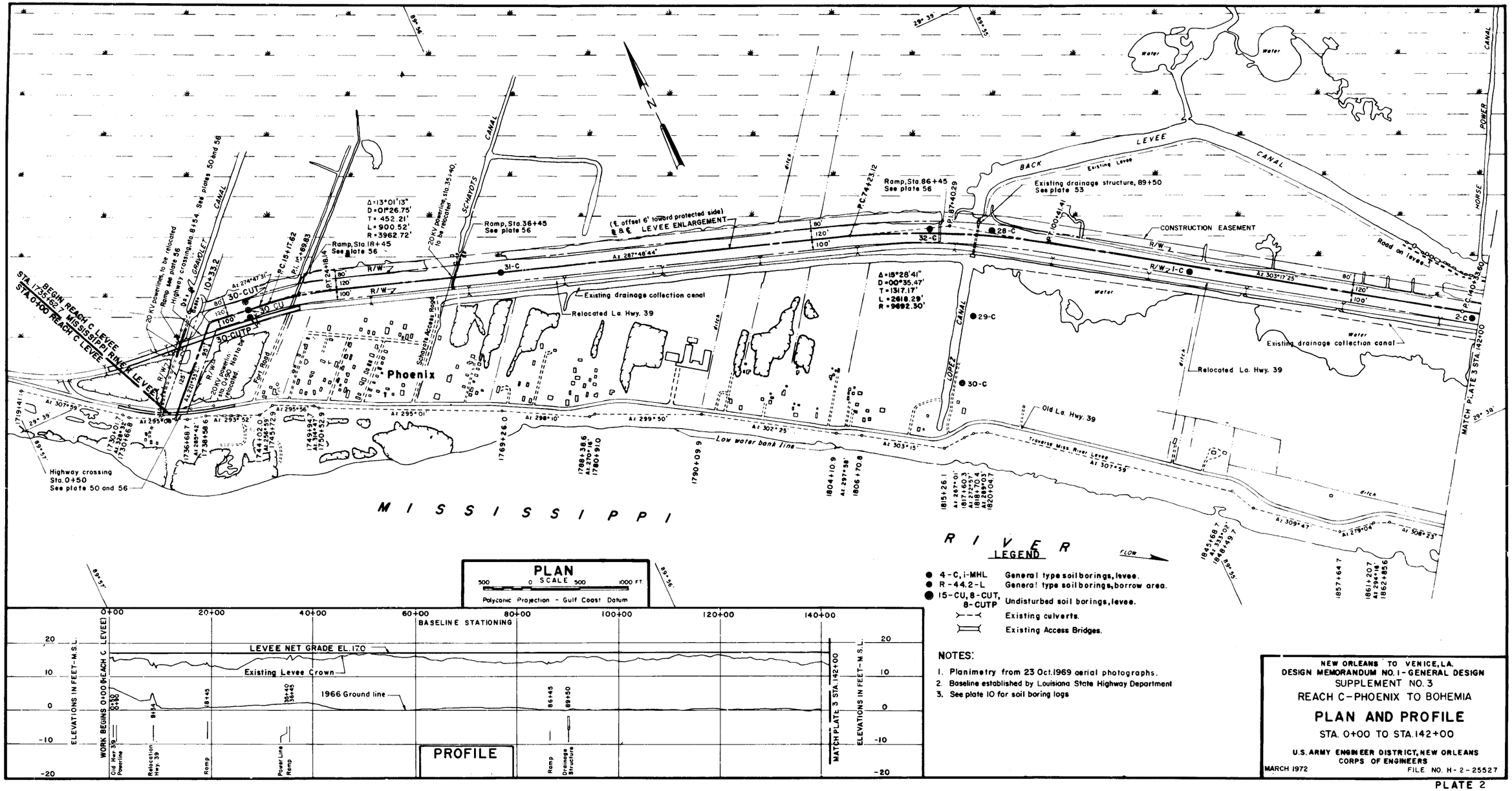
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1- GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

GENERAL PLAN, INDEX AND VICINITY MAP

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

MARCH 1972 FILE NO. H-2-25527

PLATE 1



PLAN

SCALE 0 500 1000 FT

Polyconic Projection - Gulf Coast Datum

PROFILE

● 4-C, I-MHL General type soil borings, levee.
● R-44.2-L General type soil borings, borrow area.
● 15-CU, 8-CUT, 8-CUTP Undisturbed soil borings, levee.
Existing culverts.
Existing Access Bridges.

FLOW

NOTES:

1. Planimetry from 23 Oct. 1969 aerial photographs.
2. Baseline established by Louisiana State Highway Department
3. See plate 10 for soil boring logs

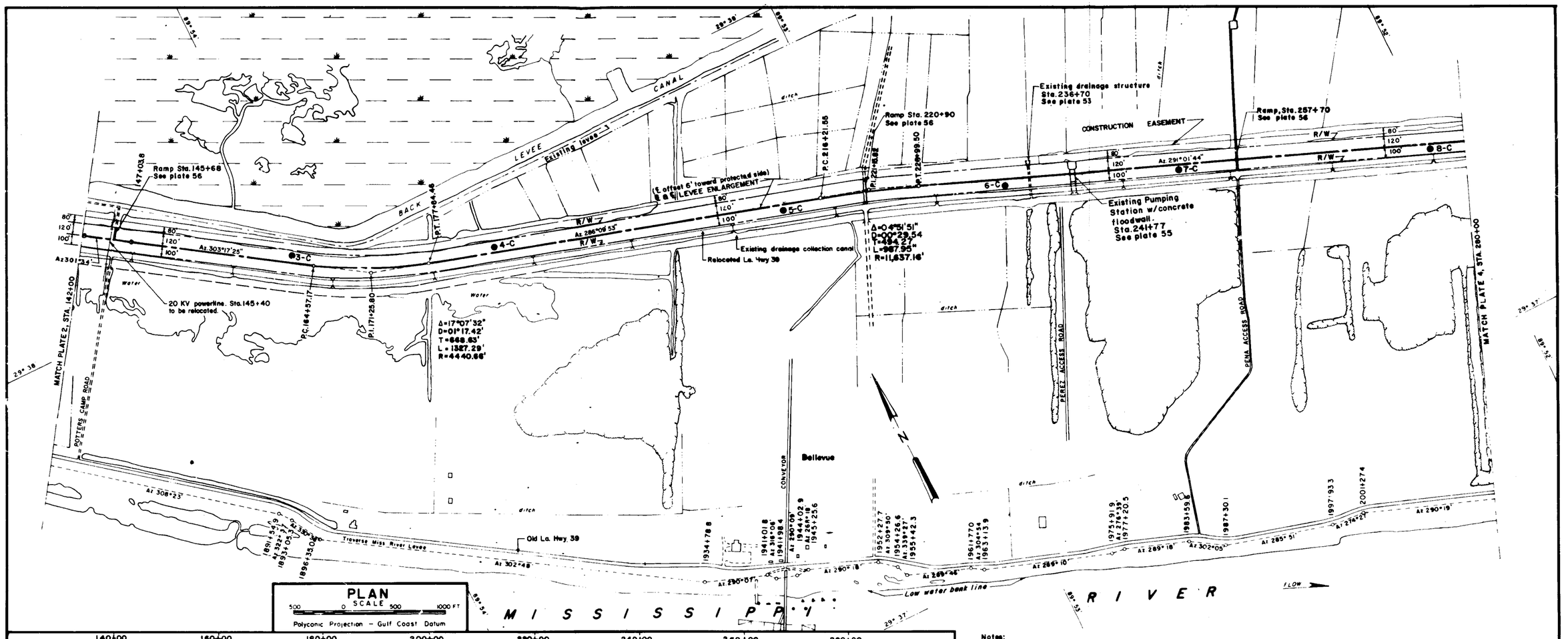
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

PLAN AND PROFILE

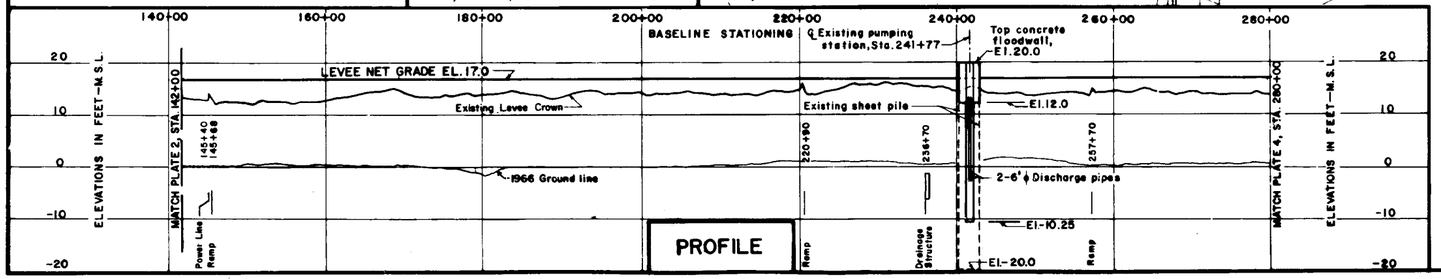
STA. 0+00 TO STA. 142+00

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE 2



PLAN
SCALE 500 0 500 1000 FT
Polyconic Projection – Gulf Coast Datum



Notes:
1. See plate 2 for Legend.
2. Planimetry from 23 Oct 1969 aerial photographs.
3. Baseline established by Louisiana State Highway Department.
4. See plates 10 and 11 for Soil Boring Logs.

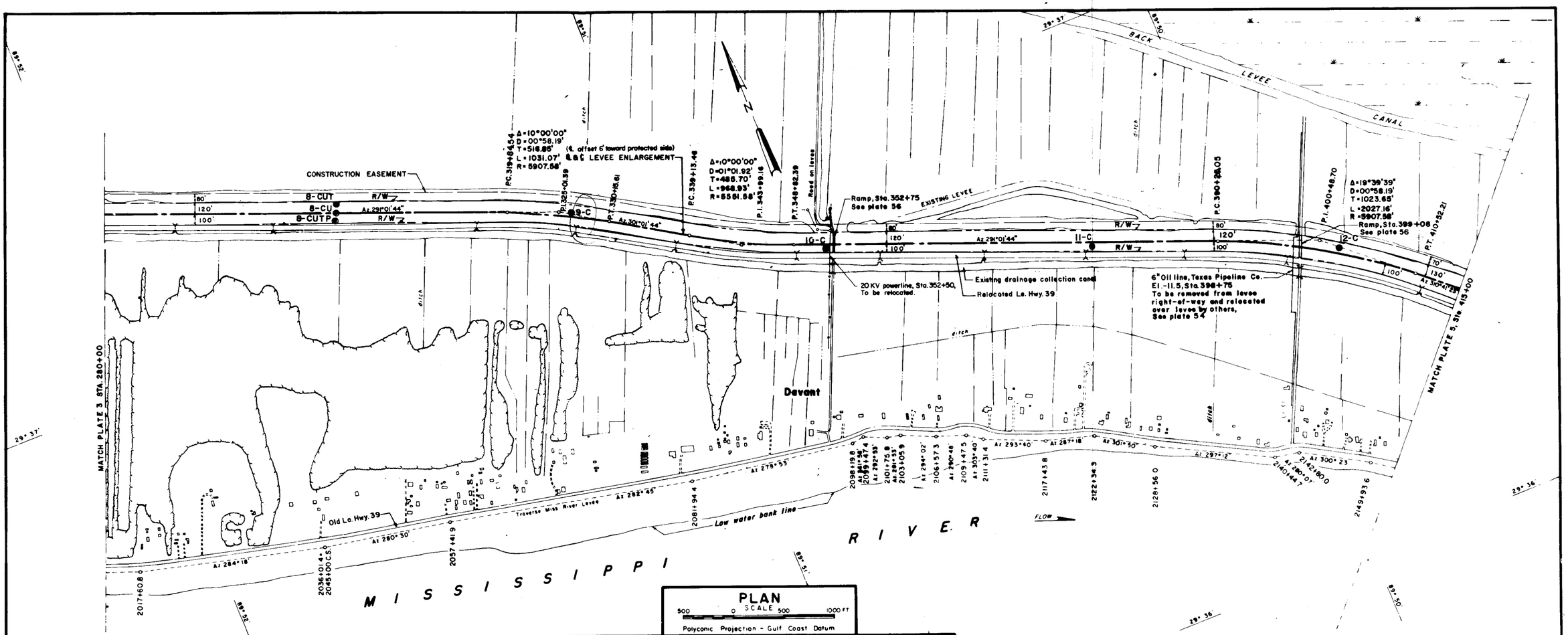
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C – PHOENIX TO BOHEMIA

PLAN AND PROFILE

STA. 142+00 TO STA. 280+00

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS,
MARCH 1972
FILE NO. H-2-25527

PLATE 3



Notes:

1. See plate 2 for Legend.
2. Planimetry from 23 Oct 1969 aerial photographs.
3. Baseline established by Louisiana State Highway Department.
4. See plates 11 and 12 for Soil Boring Logs.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

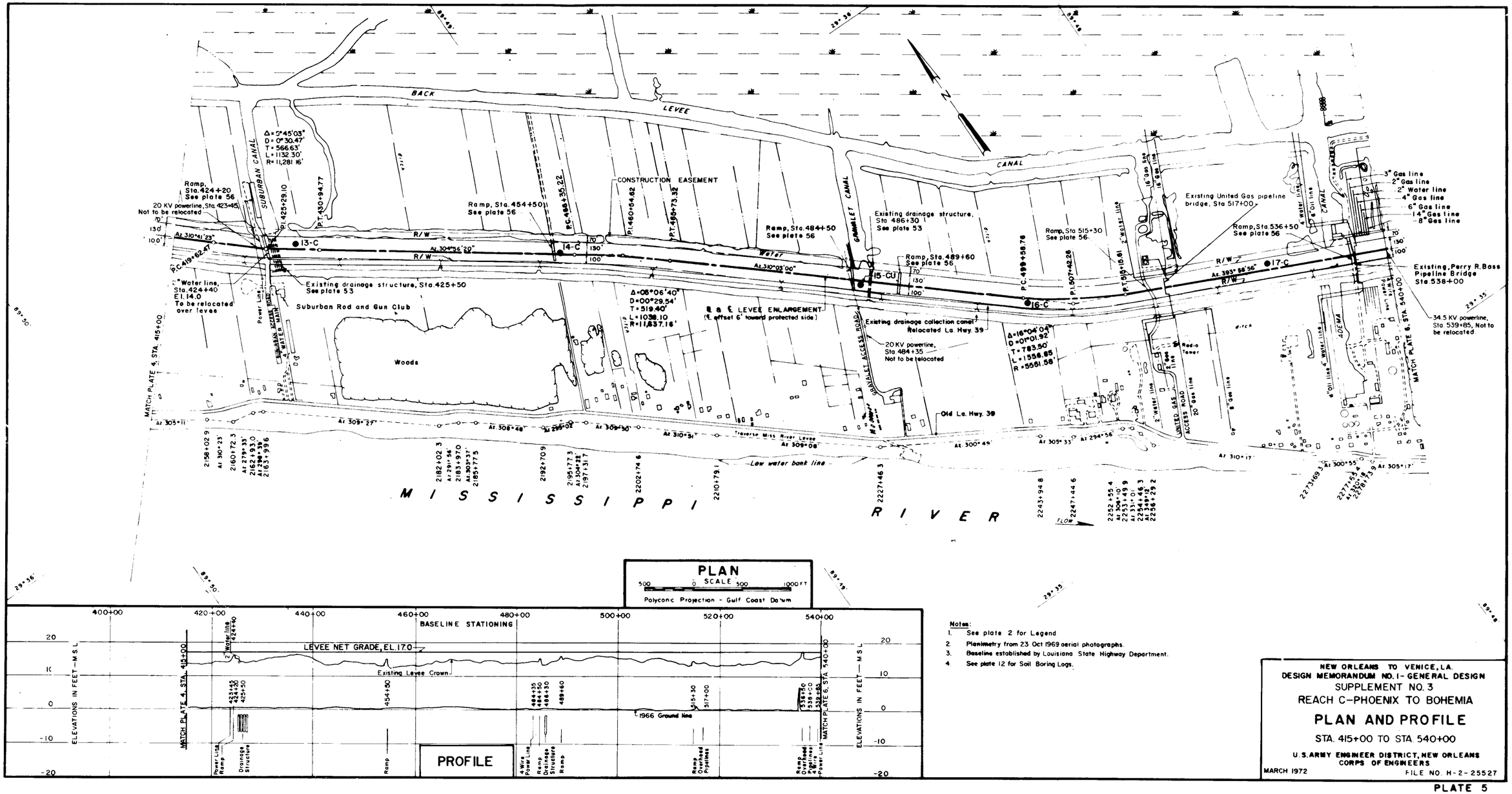
PLAN AND PROFILE

STA. 280+00 TO STA. 415+00

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

MARCH 1972 FILE NO. H-2-25527

PLATE 4



Notes:

1. See plate 2 for Legend
2. Planimetry from 23 Oct 1969 aerial photographs.
3. Baseline established by Louisiana State Highway Department.
4. See plate 12 for Soil Boring Logs.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1- GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

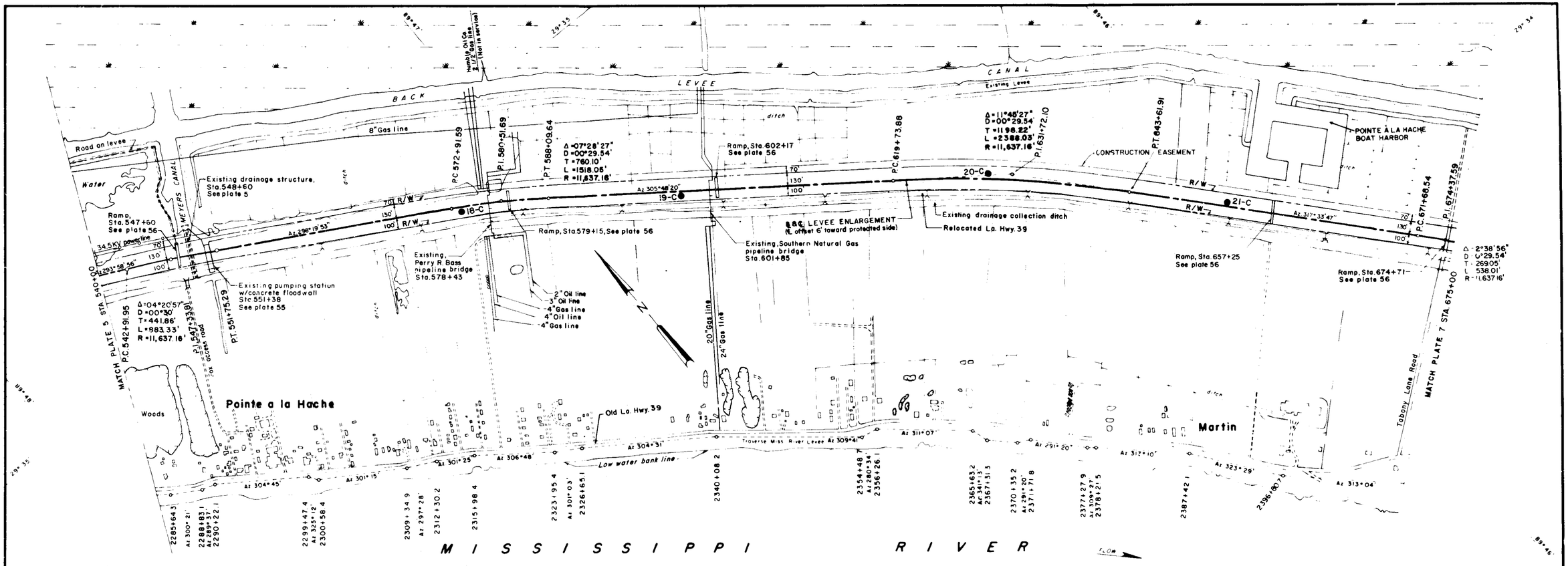
PLAN AND PROFILE

STA. 415+00 TO STA. 540+00

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

MARCH 1972 FILE NO. H-2-25527

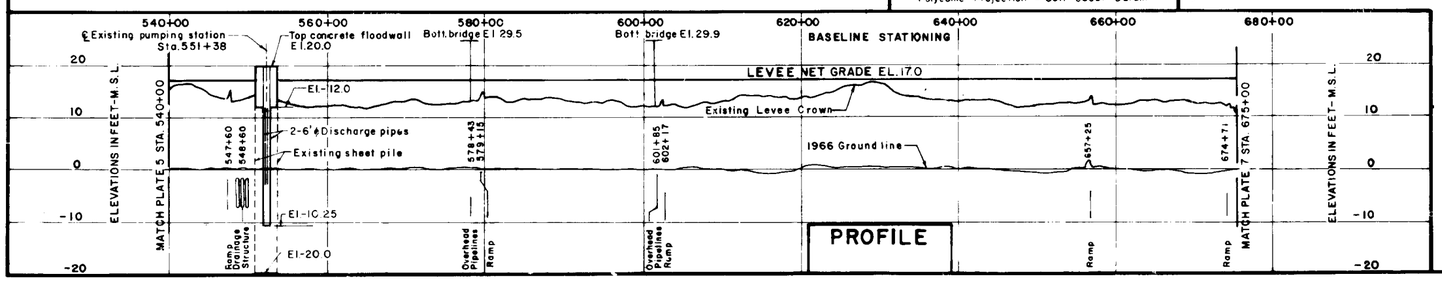
PLATE 5



PLAN

SCALE 500 0 500 1000 FT

Polyconic Projection - Gulf Coast Datum



Notes:

1. See plate 2 for Legend.
2. Planimetry from 23 Oct 1969 aerial photographs.
3. Baseline established by Louisiana State Highway Department.
4. See plate 12 for Soil Boring Logs.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

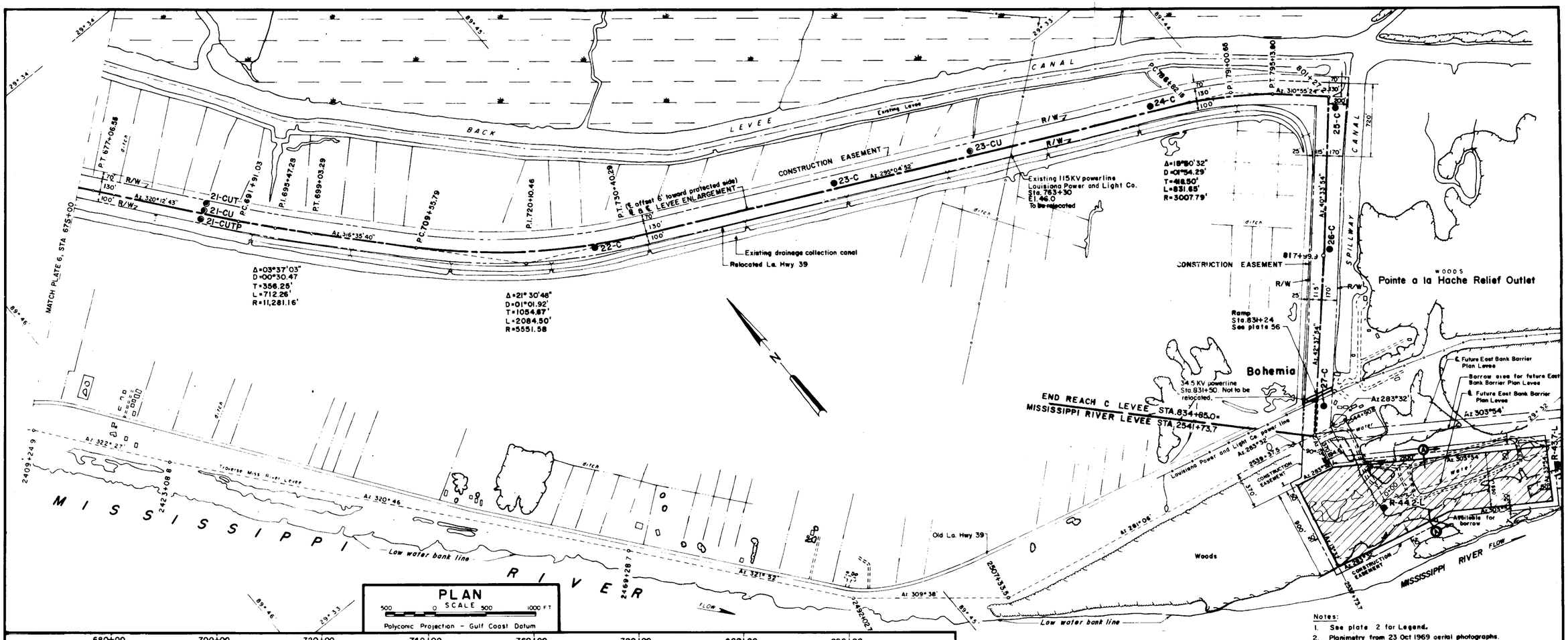
PLAN AND PROFILE

STA. 540+00 TO STA. 675+00

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

MARCH 1972 FILE NO. H-2-25527

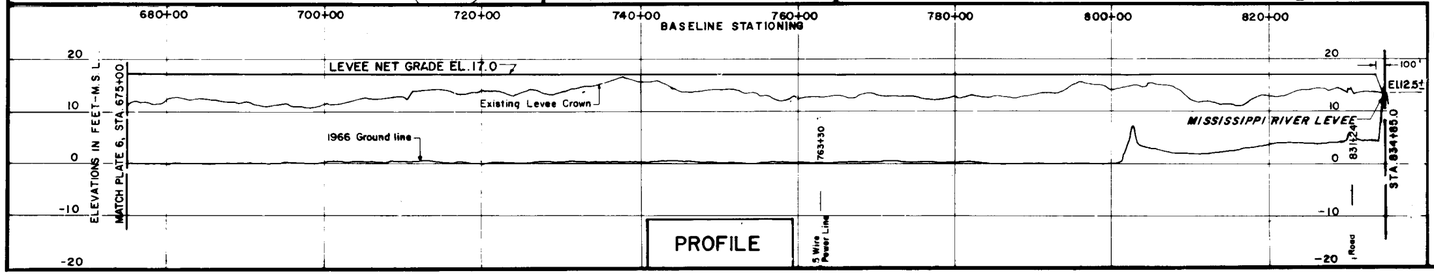
PLATE 6



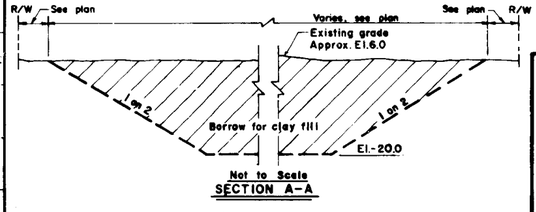
PLAN

SCALE 500 0 500 1000 FT

Polyconic Projection – Gulf Coast Datum



PROFILE



Not to Scale

SECTION A-A

Notes:

1. See plate 2 for Legend.
2. Planimetry from 23 Oct 1969 aerial photographs.
3. Baseline established by Louisiana State Highway Department.
4. See plate 13 and 14 for Soil Boring Logs.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C – PHOENIX TO BOHEMIA

PLAN AND PROFILE

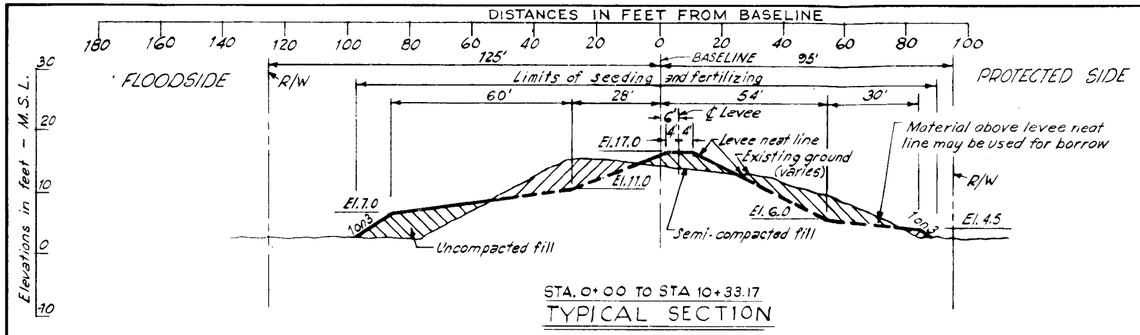
STA. 675+00 TO STA. 834+85

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

MARCH 1972

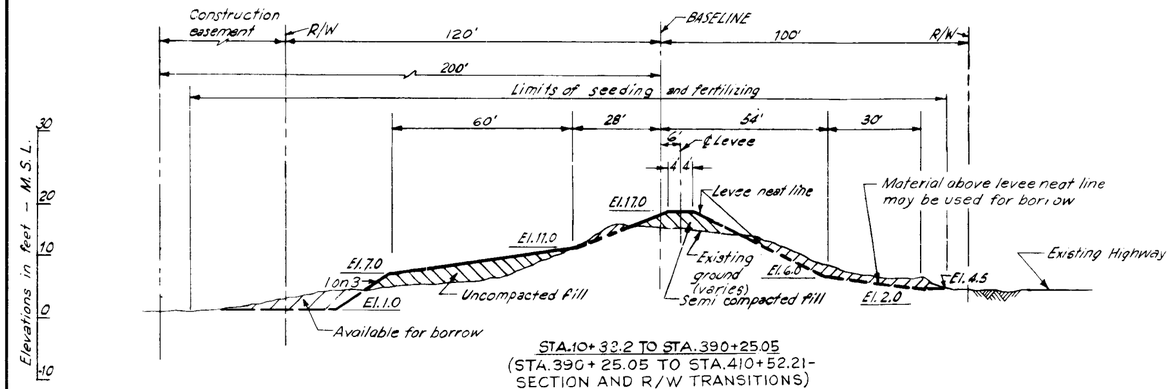
FILE NO. H-2-25527

PLATE 7



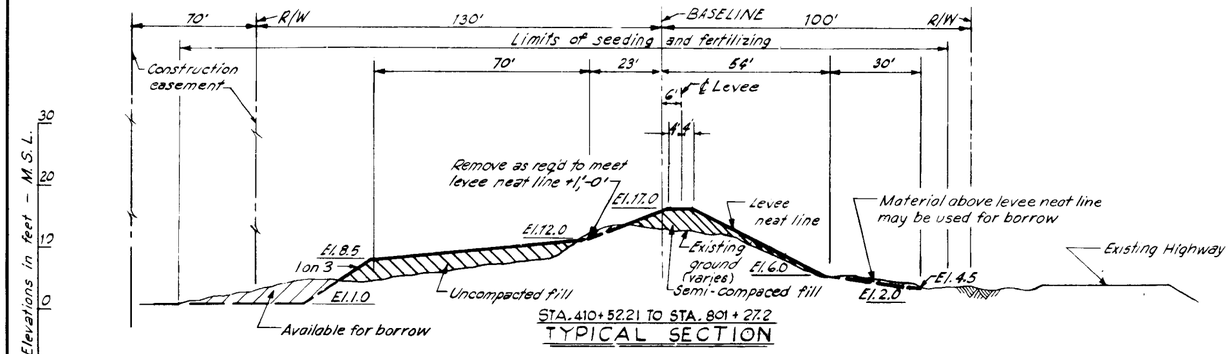
STA. 0+00 TO STA 10+33.17

TYPICAL SECTION



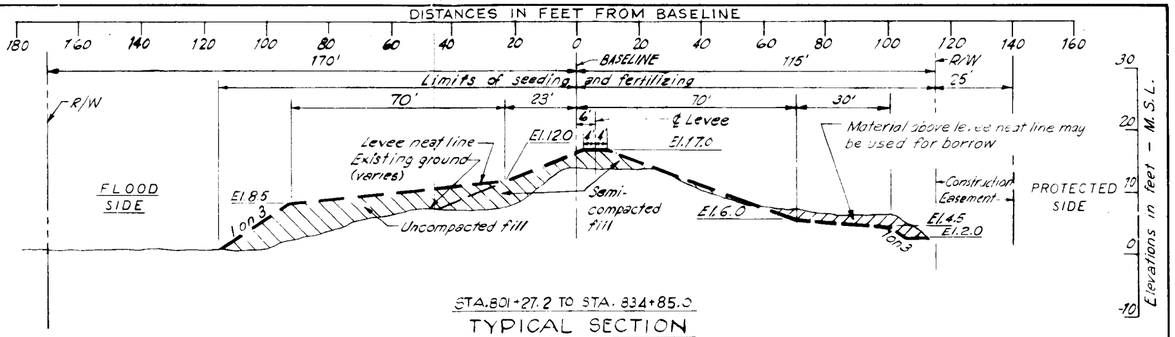
STA.10+33.2 TO STA.390+25.05
(STA.390+25.05 TO STA.410+52.21-
SECTION AND R/W TRANSITIONS)

TYPICAL SECTION



STA. 410+52.21 TO STA. 801 + 27.2

TYPICAL SECTION



STA.801+27.2 TO STA. 834+85.0

TYPICAL SECTION

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

LEVEE DESIGN SECTIONS

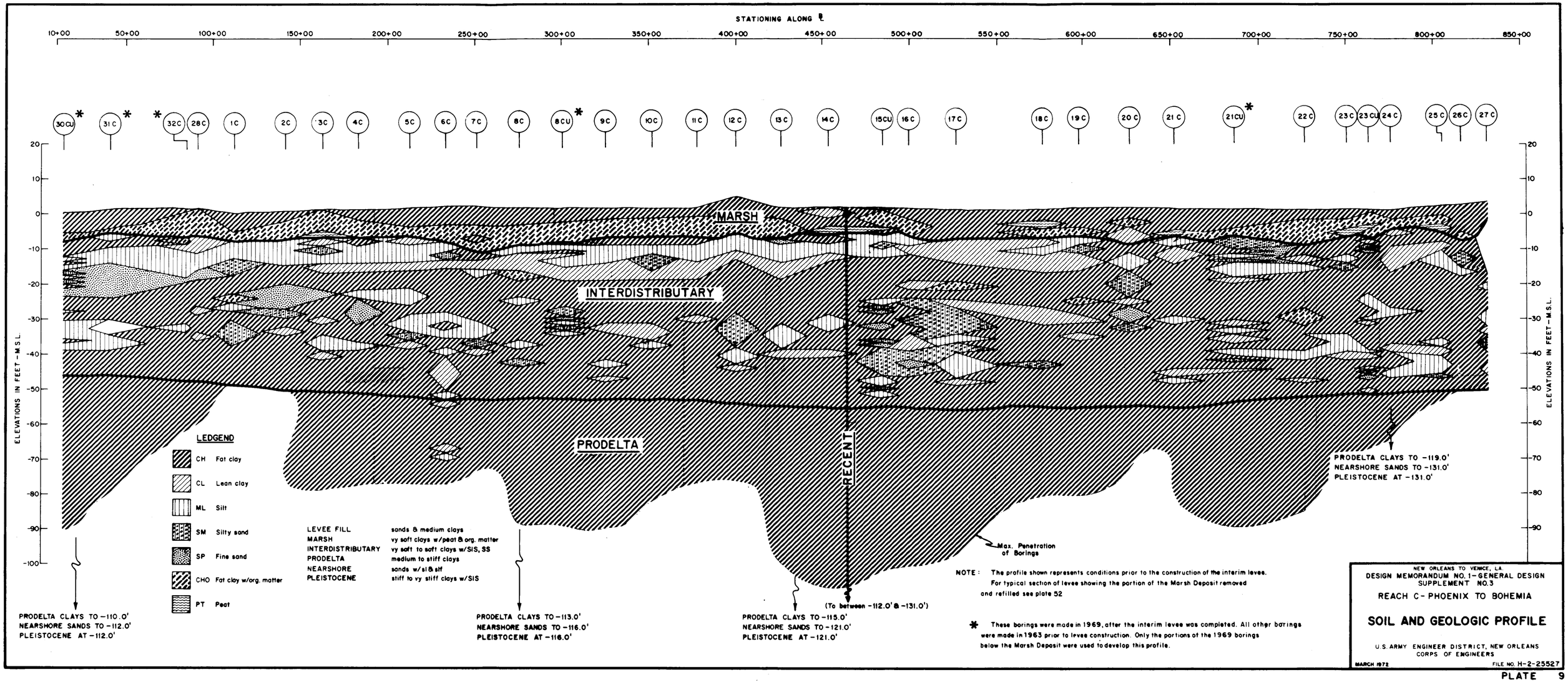
STATION 0+00 TO STATION 834+85.0

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

MARCH 1972

FILE NO. H-2-25527

PLATE 8



NOTE: The profile shown represents conditions prior to the construction of the interim levee. For typical section of levee showing the portion of the Marsh Deposit removed and refilled see plate 52

* These borings were made in 1969, after the interim levee was completed. All other borings were made in 1963 prior to levee construction. Only the portions of the 1969 borings below the Marsh Deposit were used to develop this profile.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

SOIL AND GEOLOGIC PROFILE

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

MARCH 1972

FILE NO. H-2-25527

PLATE 9

BOR. 30-CUT
STA. 14+06
70 FT LEFT OF B/L LEVEE
26+27 MAY 69

BOR. 30-CU
STA. 14+06
B.L. LEVEE
19-21 MAY 69

BOR. 30-CUTP
STA. 14+06
70 FT. RIGHT OF LEVEE B.L.
21-23 MAY 69

BOR. 31-C
STA. 41+06
C.L. LEVEE
ON B.L.
14 MAY 1969

BOR. 32-C
STA. 85+06
C.L. LEVEE
ON B.L.
13 MAY 1968

BOR. 30-C
STA. 90+96
1560 FT. RT. OF. B.L.
22 MAY 63

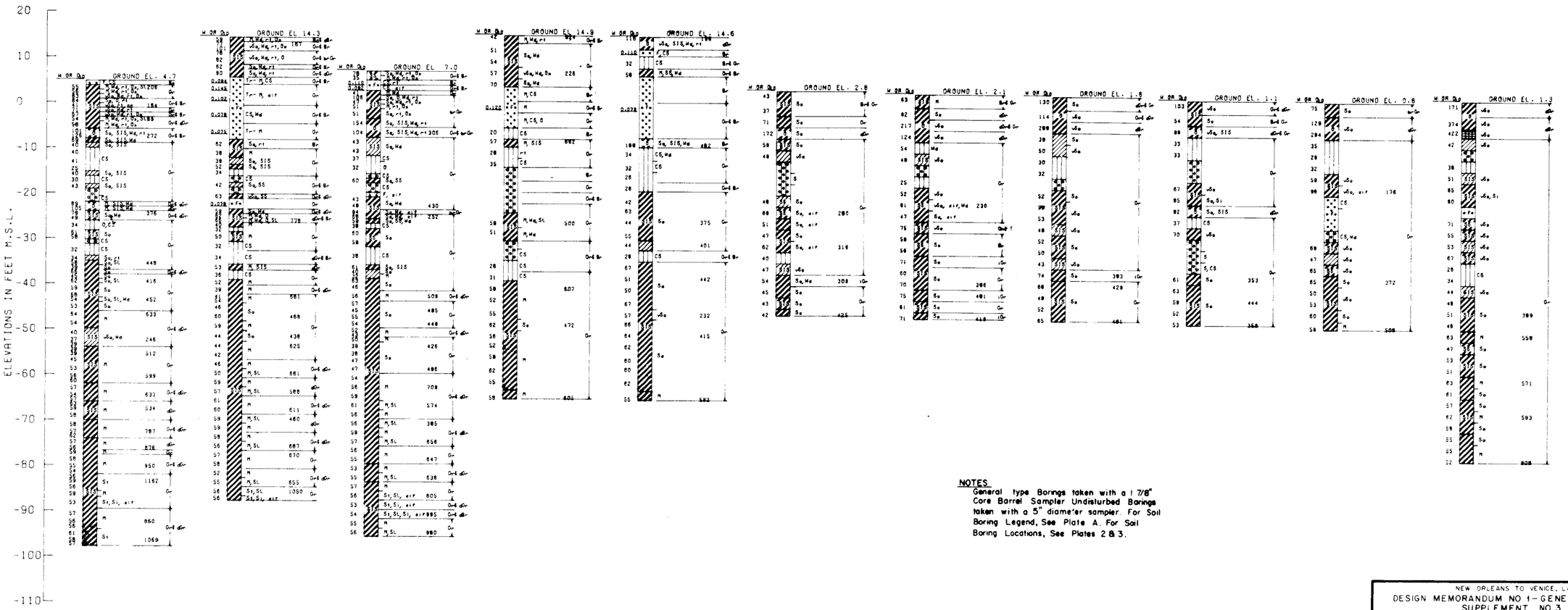
BOR. 29-C
STA. 90+96
780 FT. RT. OF B.L.
5 MAY 63

BOR. 28-C
STA. 90+96
20 FT. LT. OF B.L.
21 MAY 63

BOR. 1-C
STA. 112+36
130 FT. RT. OF B.L.
11 APRIL 1963

BOR. 2-C
STA. 141+76
120 FT. RT. OF B.L.
5 APRIL 1963

BOR. 3-C
STA. 163+02
100 LT. OF B.L.
9 APRIL 1963



NOTES
General type Borings taken with a 1 7/8" Core Barrel Sampler Undisturbed Borings taken with a 5" diameter sampler. For Soil Boring Legend, See Plate A. For Soil Boring Locations, See Plates 2 & 3.

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

GENERAL AND UNDISTURBED BORINGS ALONG BASELINE

STA. 0+00 TO STA. 170+00
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972 FILE NO. H-2-25527

PLATE 10

BOR. 4-C
STA. 182+80
20 FT. RT. OF B.L.
8 APRIL 1963

BOR. 5-C
STA. 212+82
15 FT. RT. OF B.L.
4 APRIL 1963

BOR. 6-C
STA. 233+77
25 FT. RT. OF B.L.
4 APRIL 1963

BOR. 7-C
STA. 251+77
25 FT. RT. OF B.L.
2 APRIL 1963

BOR. 8-C
STA. 276+67
25 FT. RT. OF B.L.
2 APRIL 1963

BOR. 8-CUT
STA. 303+05
60 FT. LEFT OF B/L LEVEE
7 MAY 69

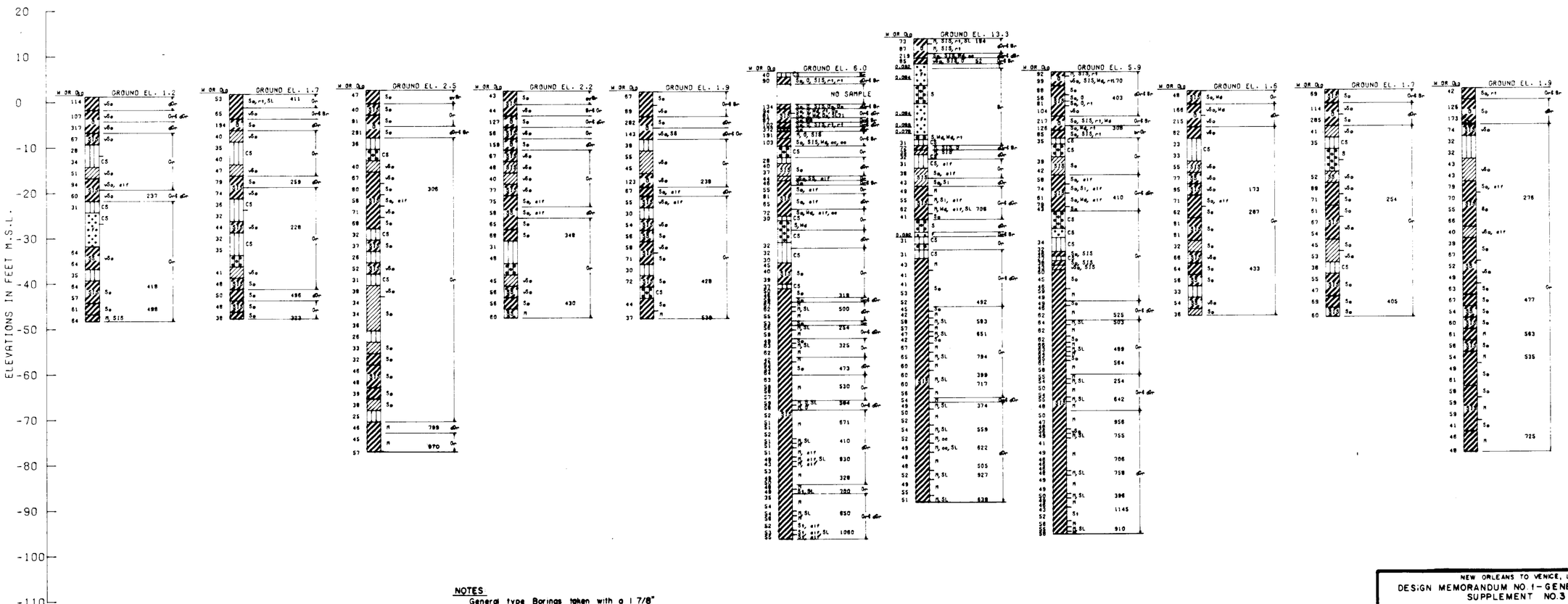
BOR. 8-CU
STA. 303+05
B.L. LEVEE
6-8 MAY 69

BOR. 8-CUTP
STA. 303+05
70FT. RT OF LEVEE B.L.
8 MAY 1969-12 MAY 1969

BOR. 9-C
STA. 325+94
10 FT. RT. OF B.L.
3 APRIL 1963

BOR 10-C
STA. 352+16
10 FT. RT. OF B.L.
18 MARCH 1963

BOR. 11-C
STA. 378+05
ON B.L.
19 MARCH 63



NOTES

General type Borings taken with a 1 7/8" Core Barrel Sampler. Undisturbed Borings taken with a 5" diameter sampler. For Soil Boring Legend, See Plate A. For Soil Boring Locations, See Plates 3 & 4.

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

GENERAL AND UNDISTURBED BORINGS ALONG BASELINE

STA. 170+00 TO STA. 390+00

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

MARCH 1972

FILE NO. H-2-25527

PLATE 11

BOR. 12-C
STA. 402+87
ON B.L.
20 MARCH 63

BOR. 13-C
STA. 427+32
25 FT. LT. OF B.L.
20 MARCH 63

BOR. 14-C
STA. 454+30
10 FT. RT. OF B.L.
22 MAR 63

BOR. 15-CU
STA. 484+92
20 FT. RT. OF B.L.
27-28 FEB. 1-5 MAR. 1963

BOR. 16-C
STA. 502+84
20 FT. RT. OF B.L.
21 MARCH 63

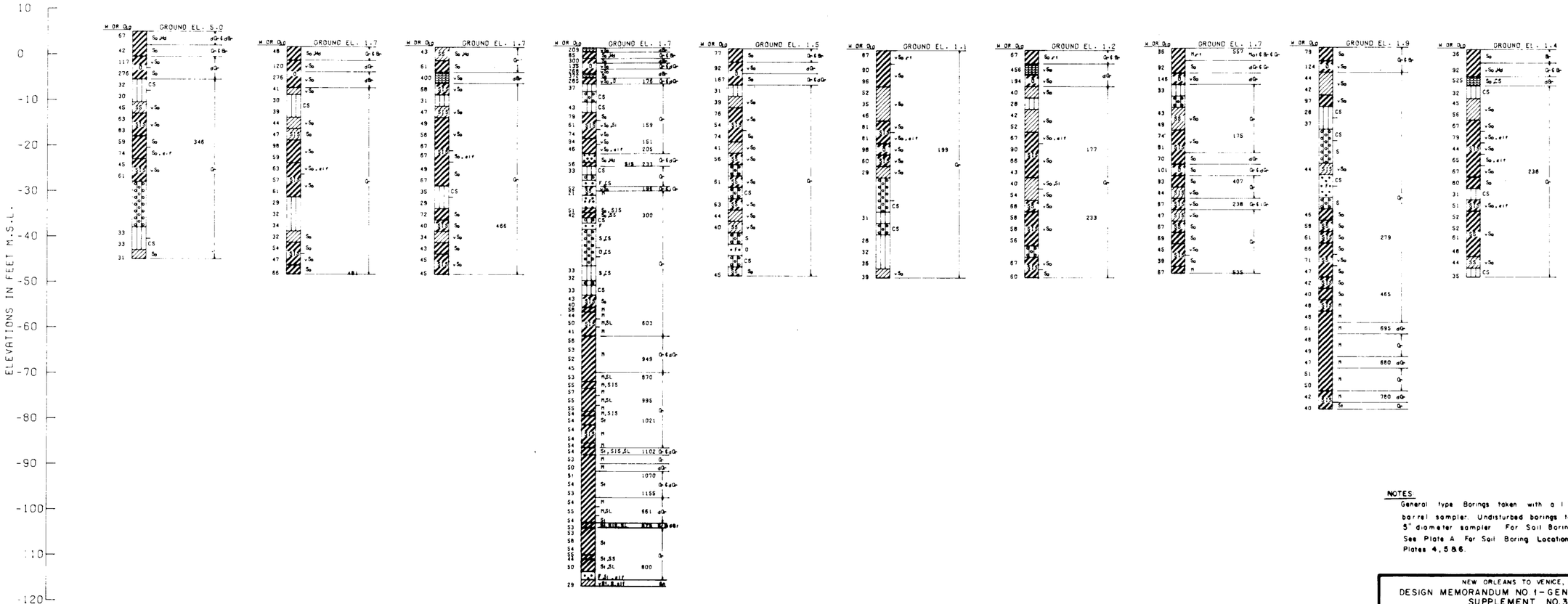
BOR. 17-C
STA. 526+76
20 FT. RT. OF B.L.
21 MARCH 63

BOR. 18-C
STA. 576+86
10 FT. RT OF B.L.
22 MARCH 63

BOR. 19-C
STA. 597+90
ON B.L.
3 MARCH 63

BOR. 20-C
STA. 627+04
ON B.L.
3 MAR 63

BOR. 21-C
STA. 652+49
ON B.L.
25 MAR 63



NOTES

General type Borings taken with a 1 7/8" core barrel sampler. Undisturbed borings taken with a 5" diameter sampler. For Soil Boring Legend, See Plate A. For Soil Boring Locations, See Plates 4, 5 & 6.

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

GENERAL AND UNDISTURBED BORINGS ALONG BASELINE

STA. 390+00 TO STA. 670+00

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972 FILE NO. H-2-25527

PLATE 12

BOR. 21-CUT
STA. 687+50
60. FT. LEFT OF B/L LEVEE
14-15 MAY 69

BOR. 21-CU
STA. 687+50
B.L. LEVEE
9-13 MAY 69

BOR. 21-CUTP
STA. 687+50
70 FT. RT. OF LEVEE B/L
15-19 MAY 69

BOR. 22-C
STA. 727+34
ON B.L.
27 MARCH 63

BOR. 23-C
STA. 751+55
ON B.L.
26 MAR 63

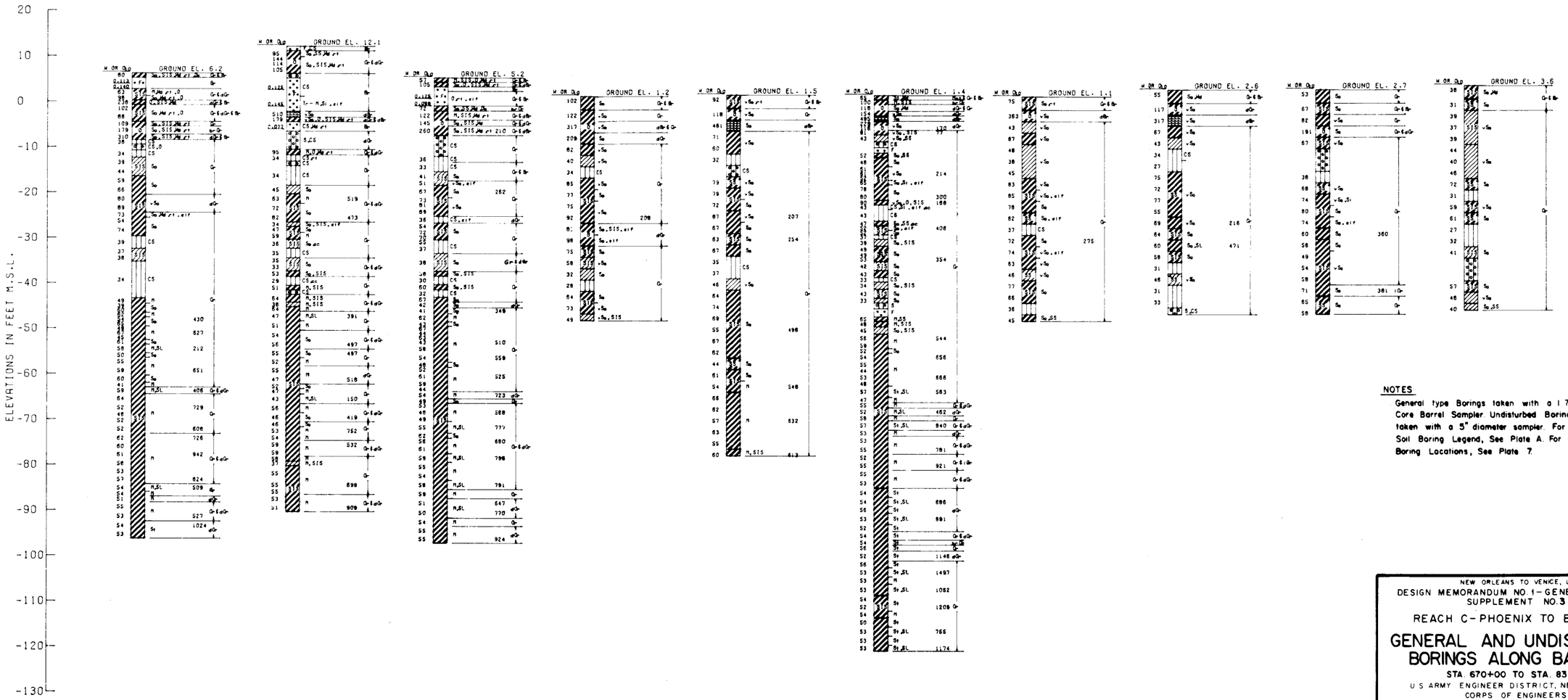
BOR. 23-CU
STA. 764+20.7
ON B.L.
14-17 MAY 1963

BOR. 24-C
STA. 776+35
ON B.L.
27 MAR 63

BOR. 25-C
STA. 802+10
80 FT. LT OF B.L.
29 MAR 63

BOR. 26-C
STA. 816+80
110 FT. LT OF B.L.
1 APRIL 63

BOR. 27-C
STA. 832+00
120 FT. LT. OF B.L.
10 MAR 63



NOTES

General type Borings taken with a 1 7/8" Core Barrel Sampler. Undisturbed Borings taken with a 5" diameter sampler. For Soil Boring Legend, See Plate A. For soil Boring Locations, See Plate 7.

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

GENERAL AND UNDISTURBED BORINGS ALONG BASELINE

STA. 670+00 TO STA. 834+85

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

MARCH 1972

FILE NO. H-2-25527

PLATE 13

BOR. R-43.7-L

STA. 18+00

225 FT. R.S. OF B.L.

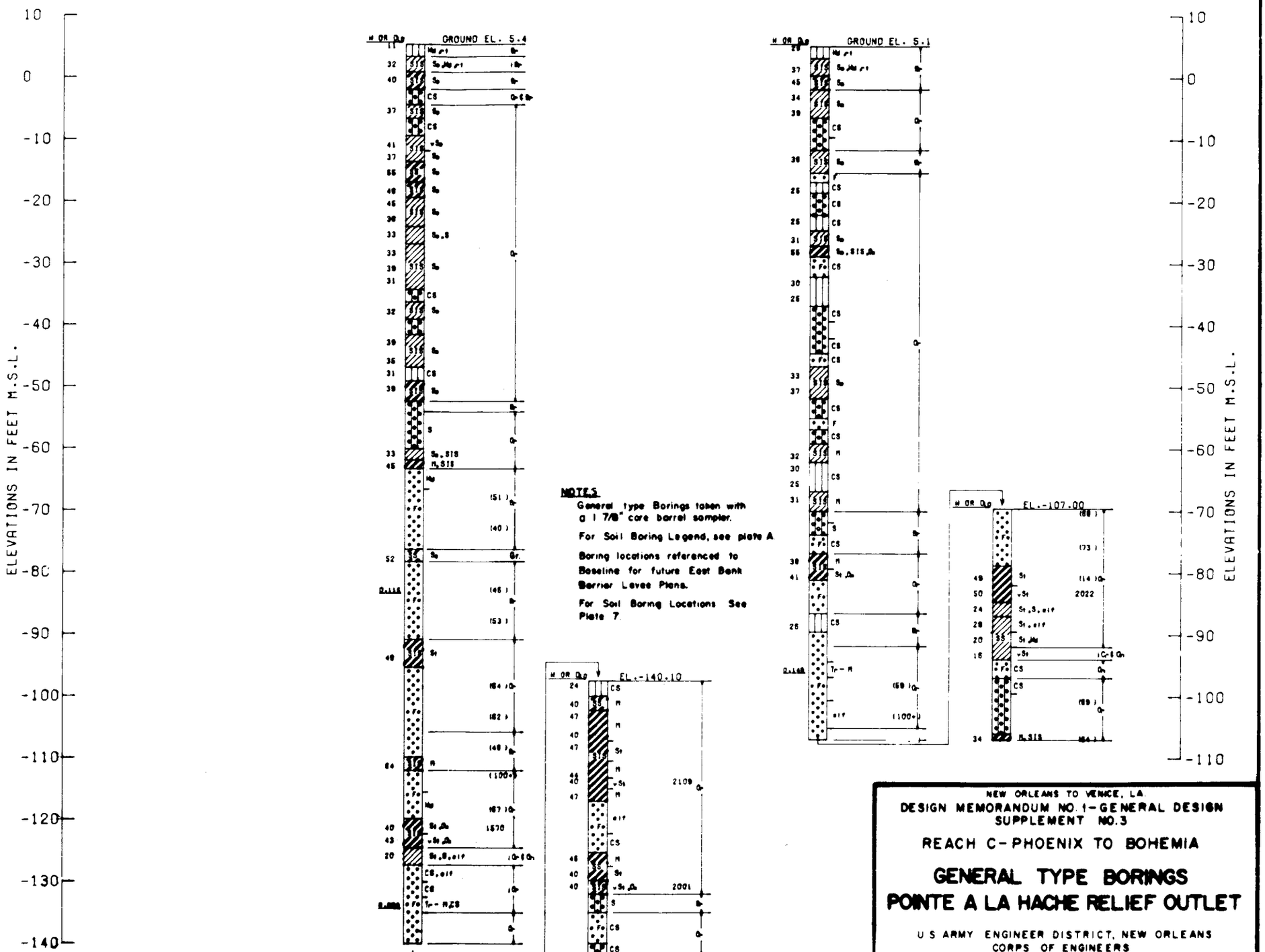
19-23 DEC 69

BOR. R-44.2-L

STA. 0+00

125 FT. R.S. OF B.L.

17-18 DEC 69



NOTES

General type Borings taken with a 1 7/8" core barrel sampler.

For Soil Boring Legend, see plate A

Boring locations referenced to Baseline for future East Bank Barrier Levee Plans.

For Soil Boring Locations See Plate 7.

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO. 1-GENERAL DESIGN SUPPLEMENT NO. 3

REACH C-PHOENIX TO BOHEMIA

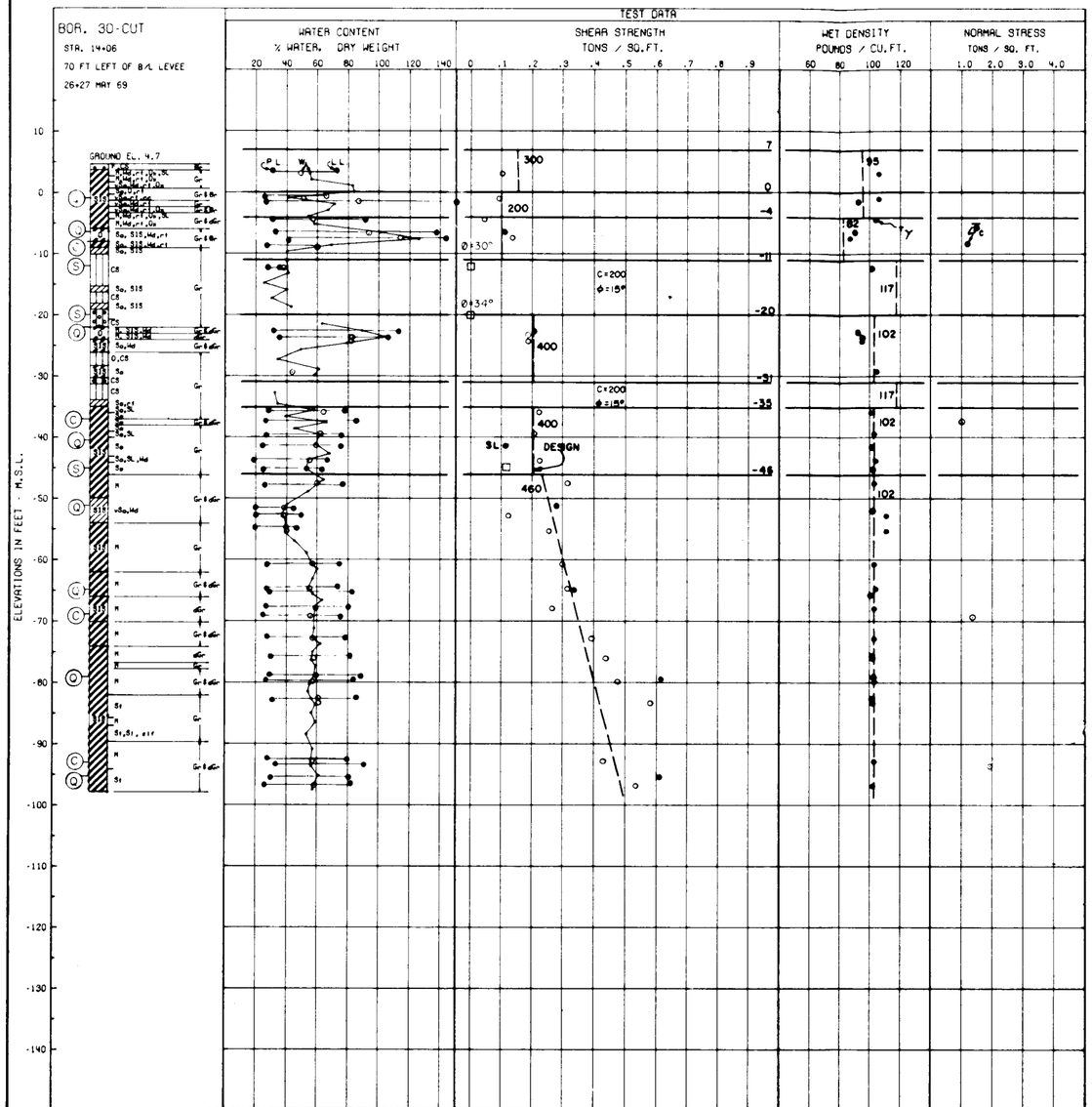
GENERAL TYPE BORINGS
POINTE A LA HACHE RELIEF OUTLET

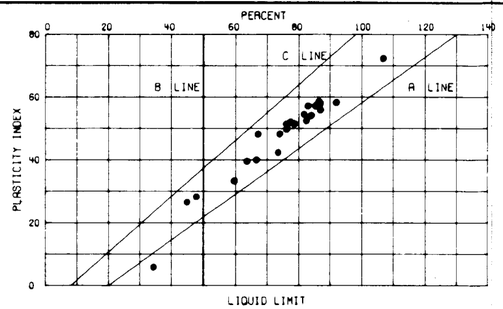
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972

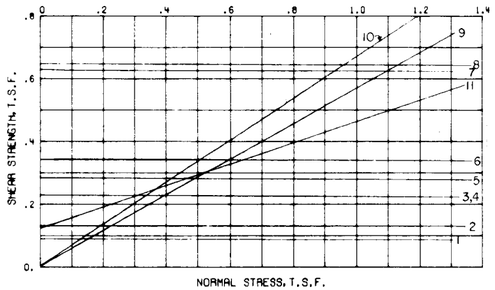
FILE NO. H-2-25527

PLATE 4



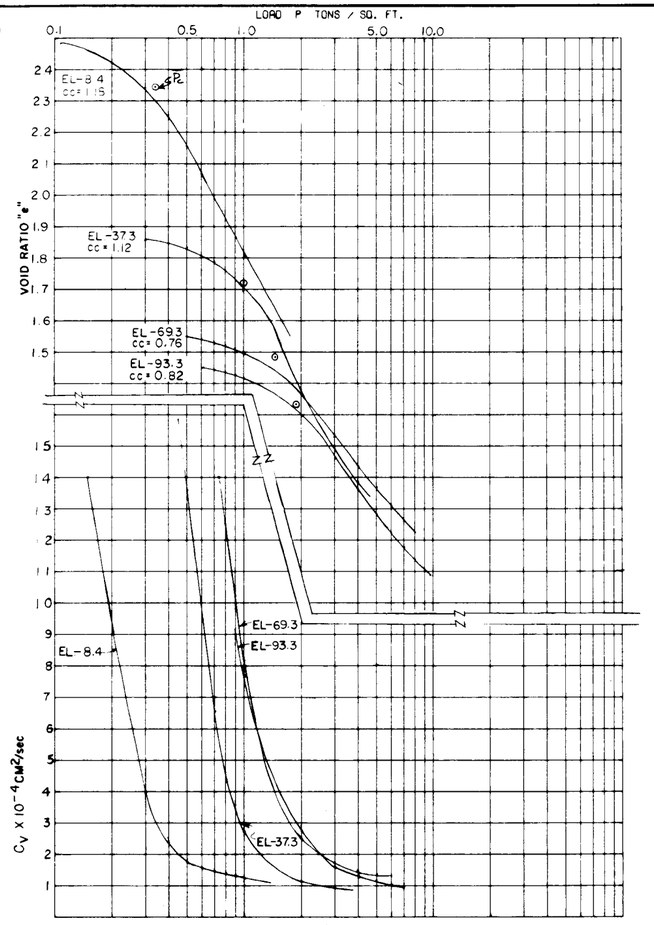


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
30-CUT	1	-1.5	U	0°	.090	CH
	2	-6.7			.130	CH
	3	-22.7			.230	CH
	4	-41.3			.230	CH
	5	-51.5			.285	CL
	6	-65.2			.340	CH
	7	-79.0			.620	CH
	8	-95.5			.645	CH
	9	-12.4	S	30°	0.0	ML
	10	-20.2		34°	0.0	SM
	11	-45.2		19°	.12	CH



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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

UNDISTURBED BORING 30-CUT DATA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972

FILE NO. H-2-25527

PLATE 15

BOR. 30-CU
STA. 14+06
B.L. LEVEE
19-21 MAY 69

ELEVATIONS IN FEET - M.S.L.

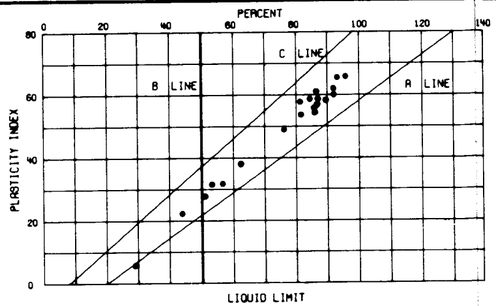
TEST DATA

WATER CONTENT
% WATER, DRY WEIGHT

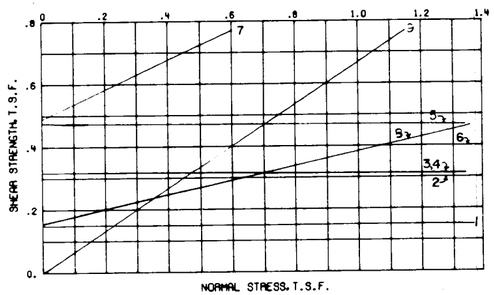
SHEAR STRENGTH
TONS / SQ.FT.

WET DENSITY
POUNDS / CU.FT.

NORMAL STRESS
TONS / SQ. FT.



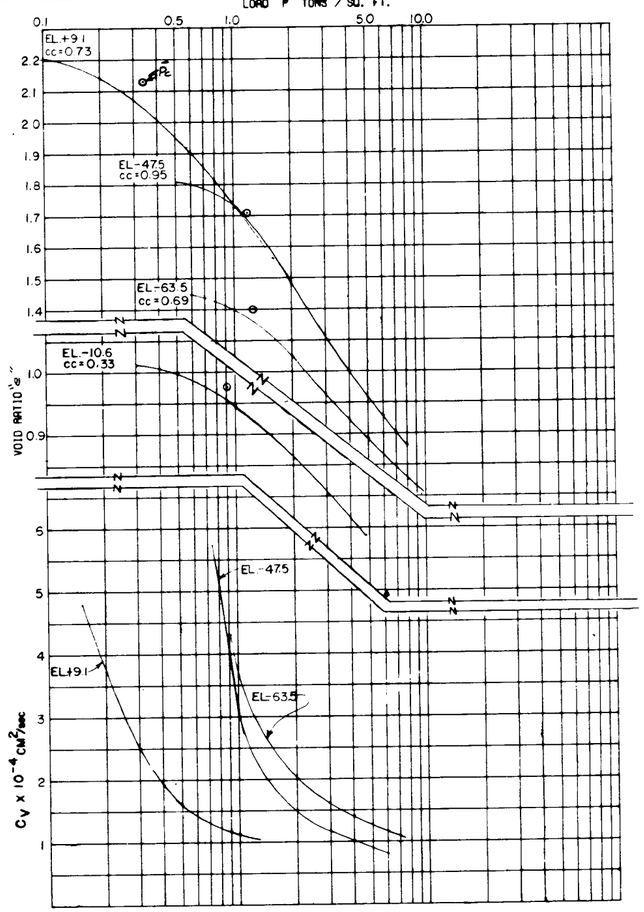
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
30-CU	1	+6.5	Q	0°	0.15	CH
	2	-11.5			0.30	CH
	3	-26.6			0.32	CH
	4	-49.6			0.32	CH
	5	-61.7			0.475	CH
	6	-70.7			0.40	CH
	7	-34.0	R	18°*	0.10	ML
	8	-51.7	R	13°	0.16	CH
	9	+0.6	S	34°	0.0	SP

*BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



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 3 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 2

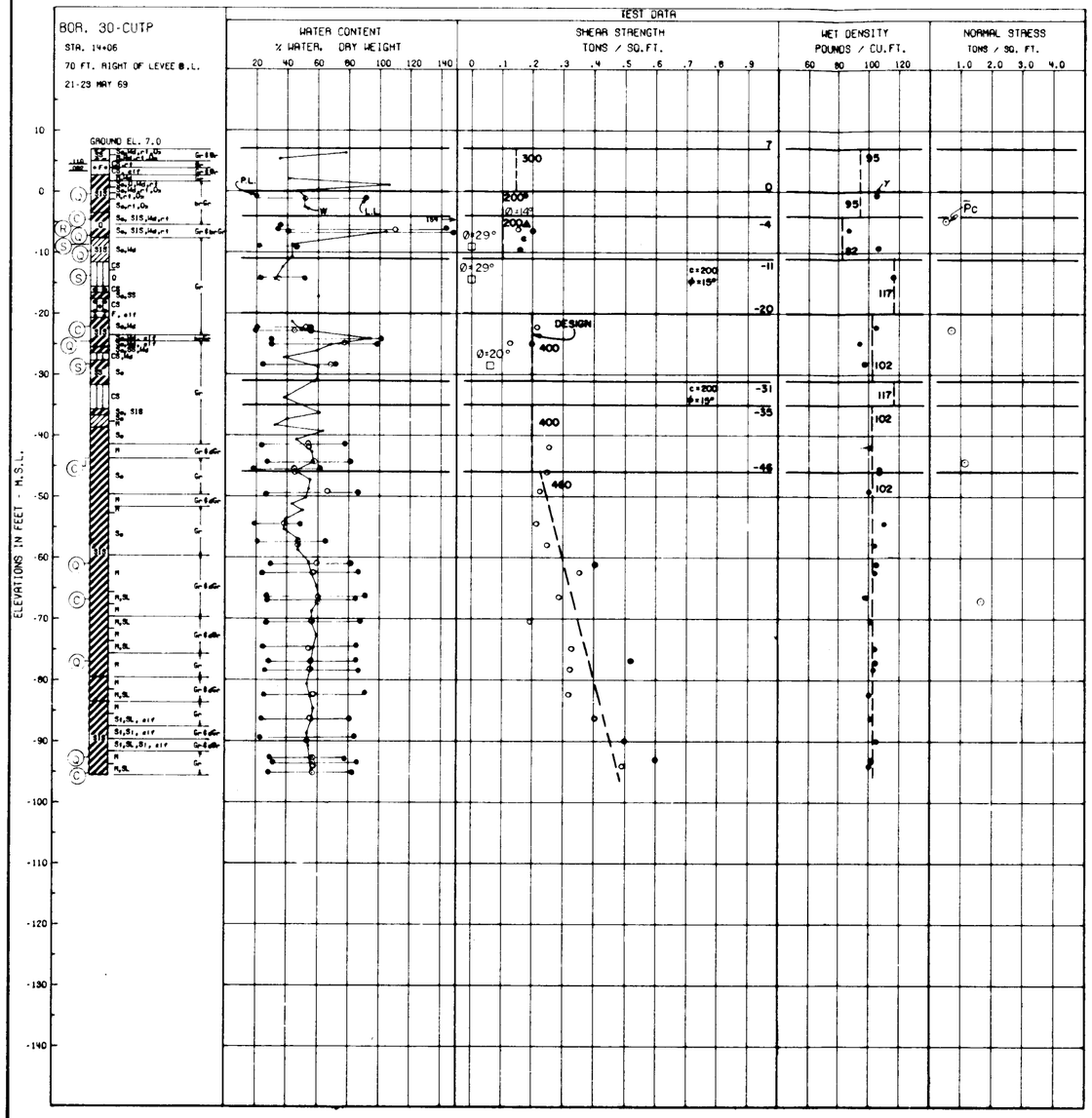
NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

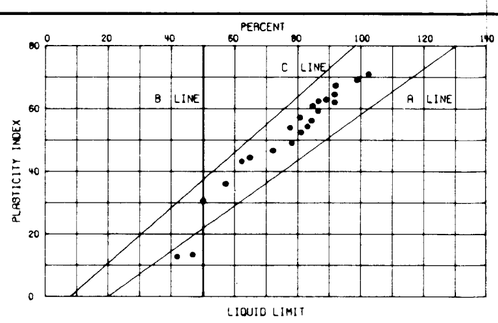
UNDISTURBED BORING 30-CU DATA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

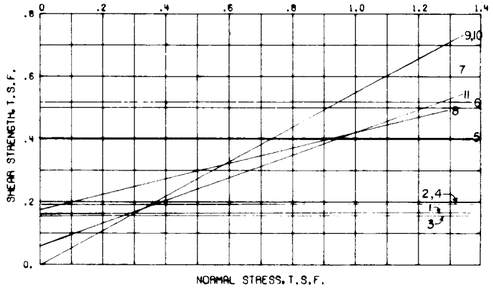
MARCH 1972 FILE NO. H-2-25527

PLATE 16



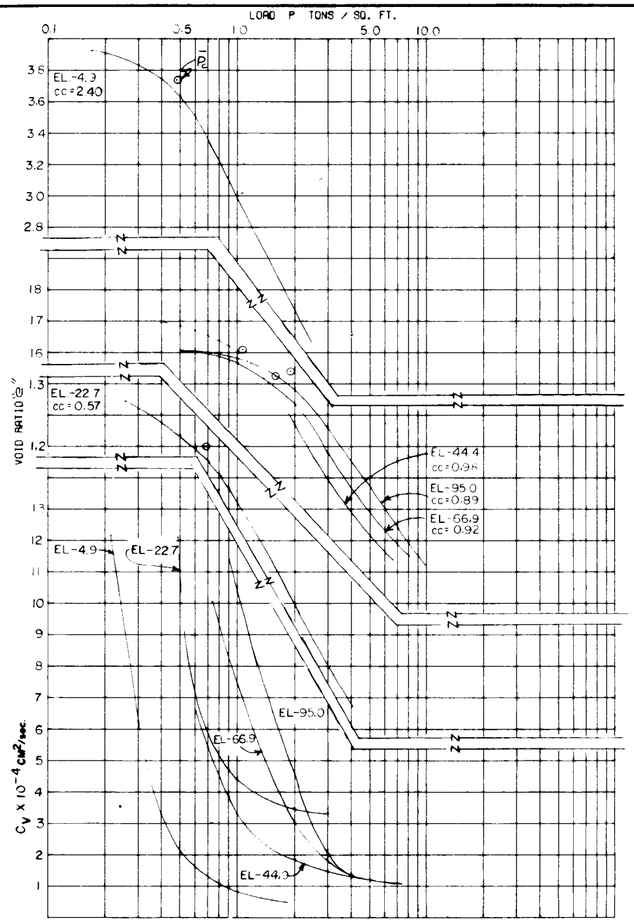


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
30-CUTP	1	-0.8	Q	0	.170	CH
	2	-6.7			.195	CH
	3	-9.9			.160	CL
	4	-25.1			.200	CH
	5	-61.1			.405	CH
	6	-76.9			.520	CH
	7	-93.2			.600	CH
	8	-5.7	R	14°	.180	CH
	9	-9.0	S	29°	0.0	CL
	10	-13.9	S	29°	0.0	ML
	11	-28.4	S	20°	.060	CH



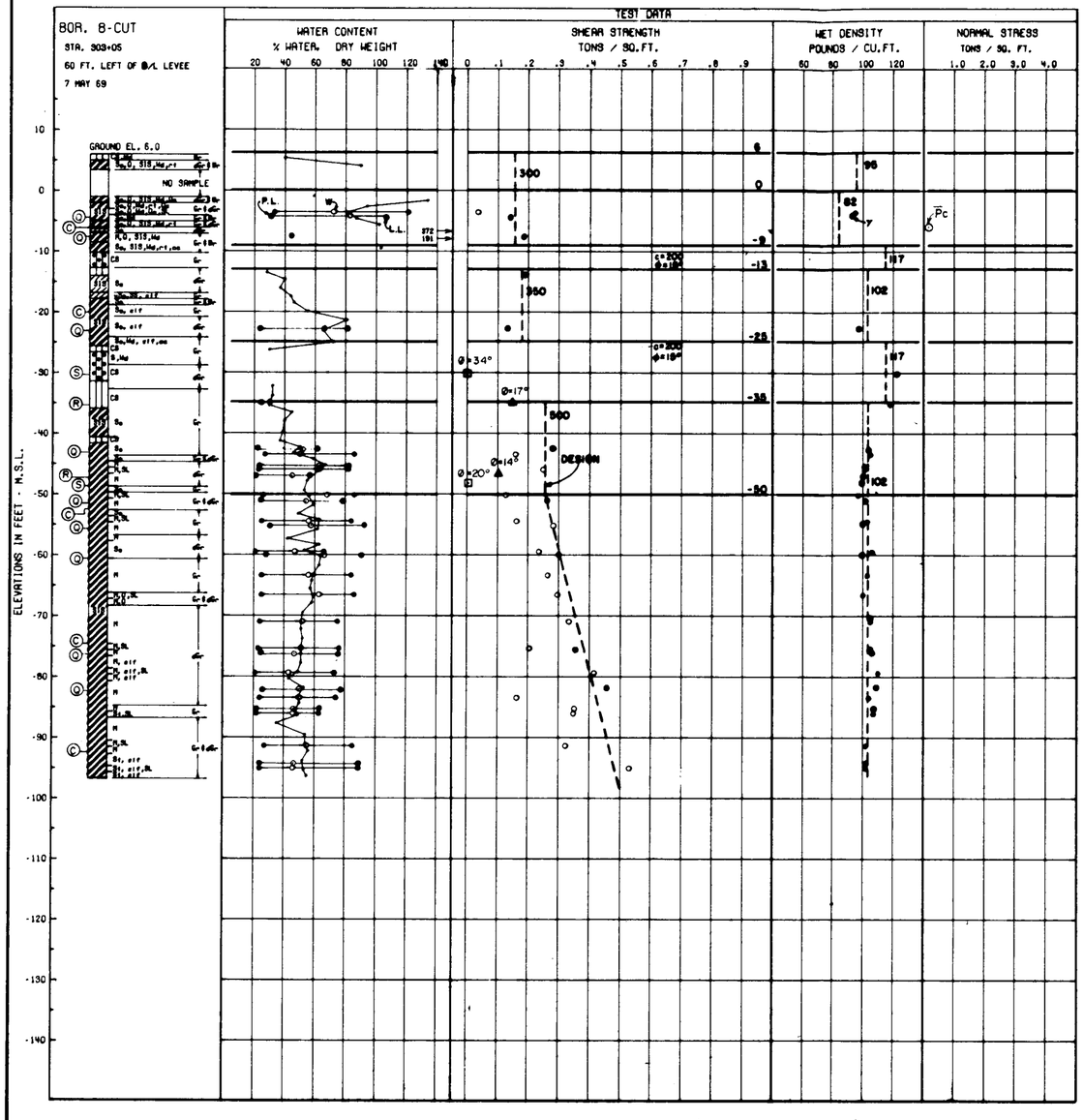
CONSOLIDATION DATA

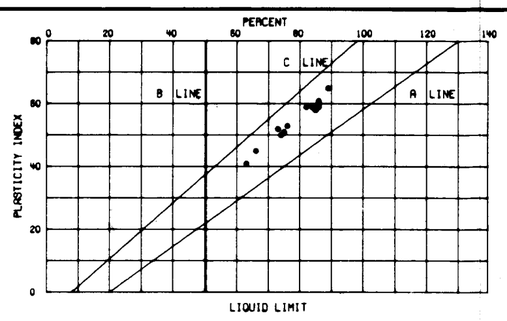
NOTES:

C - (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

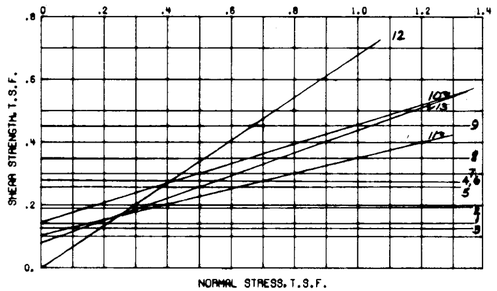
NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO 1-GENERAL DESIGN SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA
UNDISTURBED BORING
30-CUTP DATA
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO H-2-25527

PLATE 17





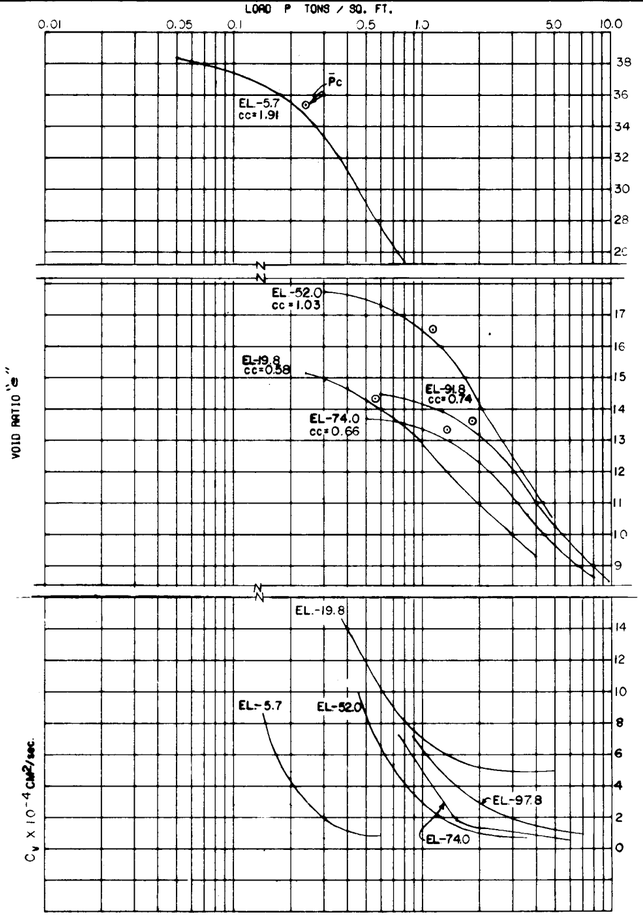
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH ϕ	STRENGTH C · TSF	CLASS
8-CUT	1	-4.1	Q	0°	0.145	CH
	2	-7.5			0.195	CH
	3	-22.7			0.13	CH
	4	-42.3			0.28	CH
	5	-51.1			0.26	CH
	6	-54.9			0.28	CH
	7	-59.9			0.30	CH
	8	-75.8			0.35	CH
	9	-82.1			0.45	CH
	10	-35.0	R	*20°	0.15	ML
	11	-46.9		14°	0.10	CH
	12	-30.0	S	34°	0	SM
	13	-47.8		20°	0.08	CH

*BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



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 3 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATE 4

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

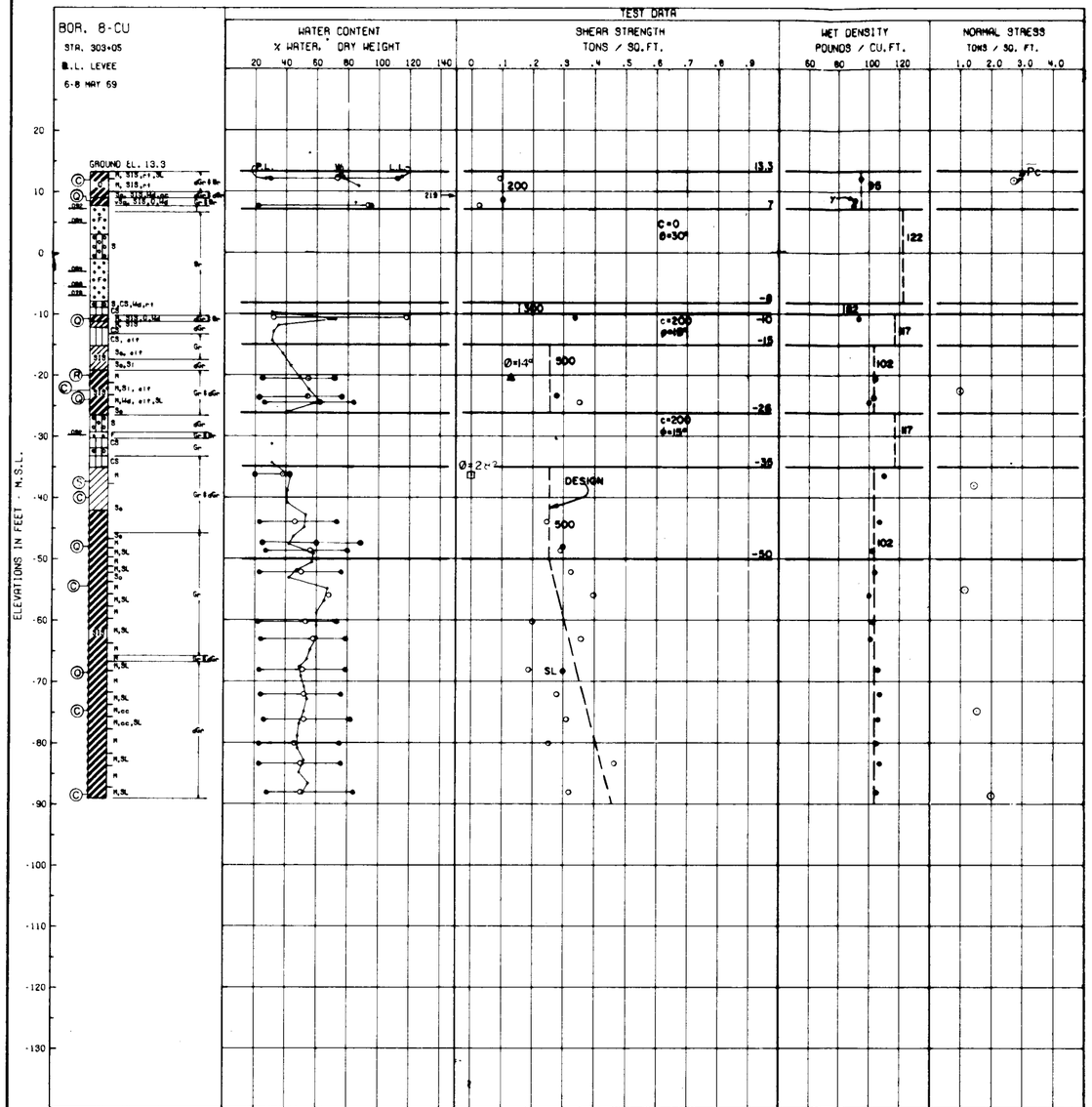
UNDISTURBED BORING 8-CUT DATA

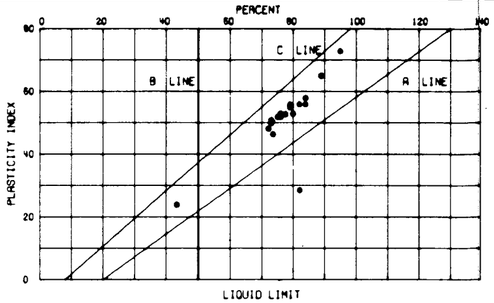
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972

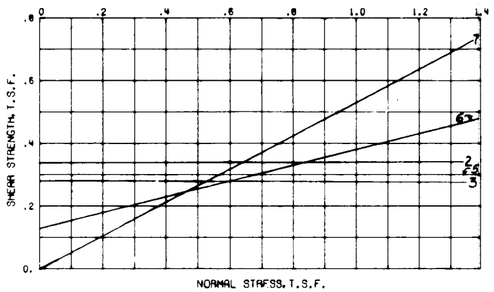
FILE NO. H-2-25527

PLATE 18



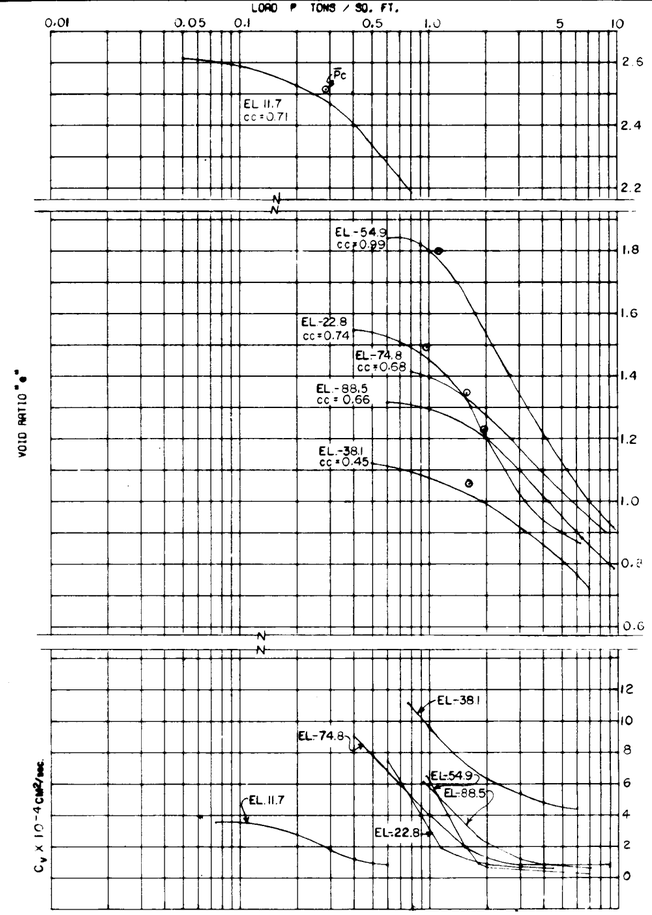


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
8-CU	1	+8.6	Q	0	0.10	CH
	2	-10.6			0.34	CH
	3	-23.6			0.28	CH
	4	-47.8			0.30	CH
	5	-68.5			0.30	CH
	6	-20.5	R	14°	0.13	CH
	7	-36.3	S	28°	0	CL



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

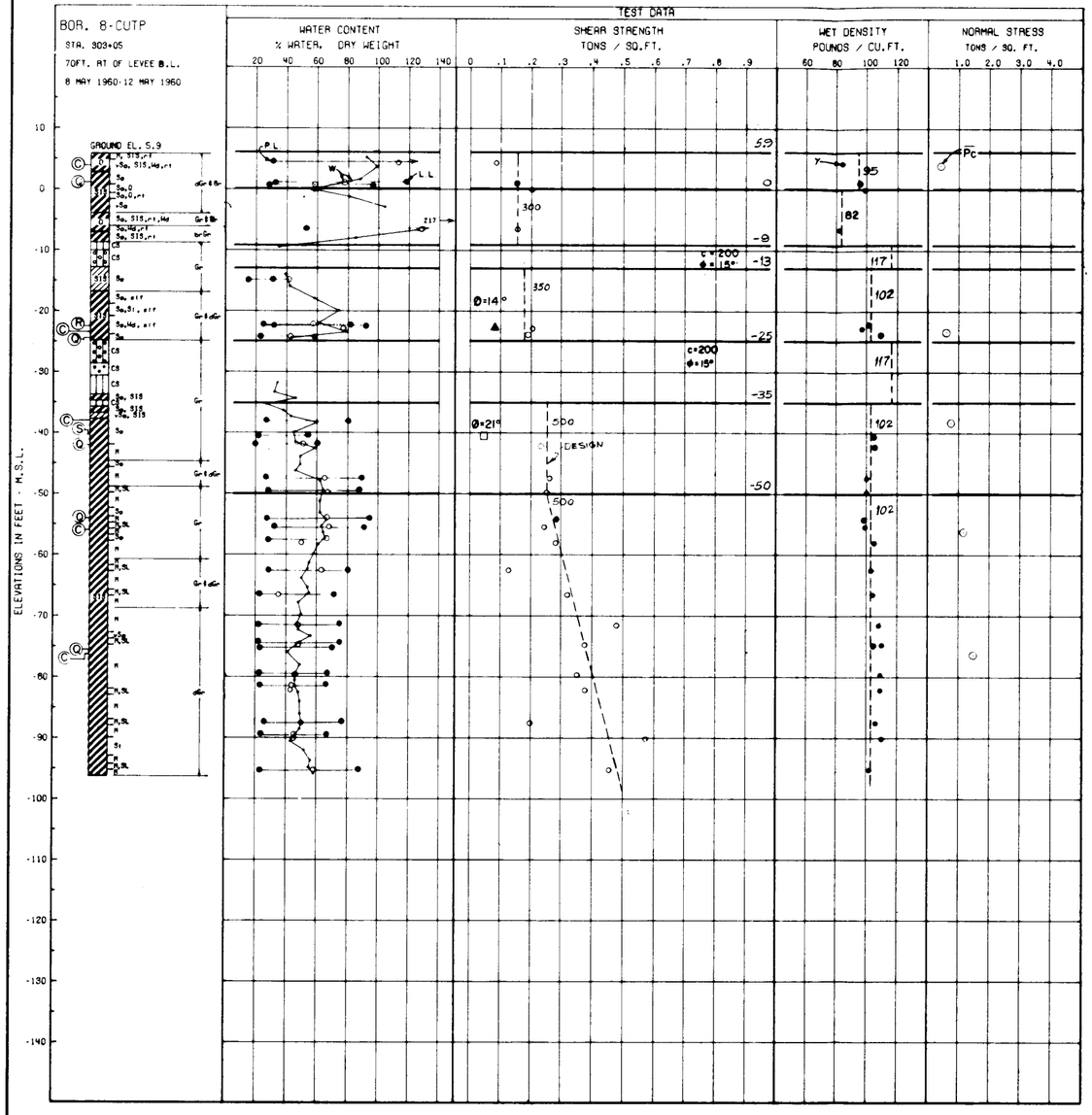
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO 1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

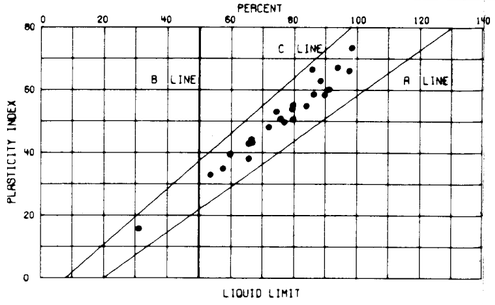
UNDISTURBED BORING 8-CU DATA

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

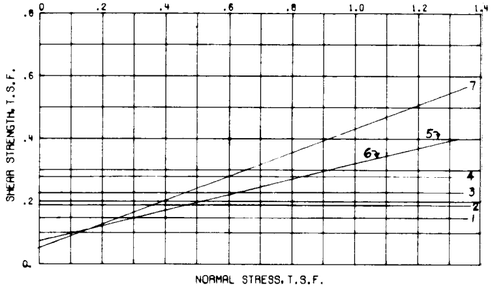
MARCH 1972 FILE NO. H-2-25527

PLATE 19



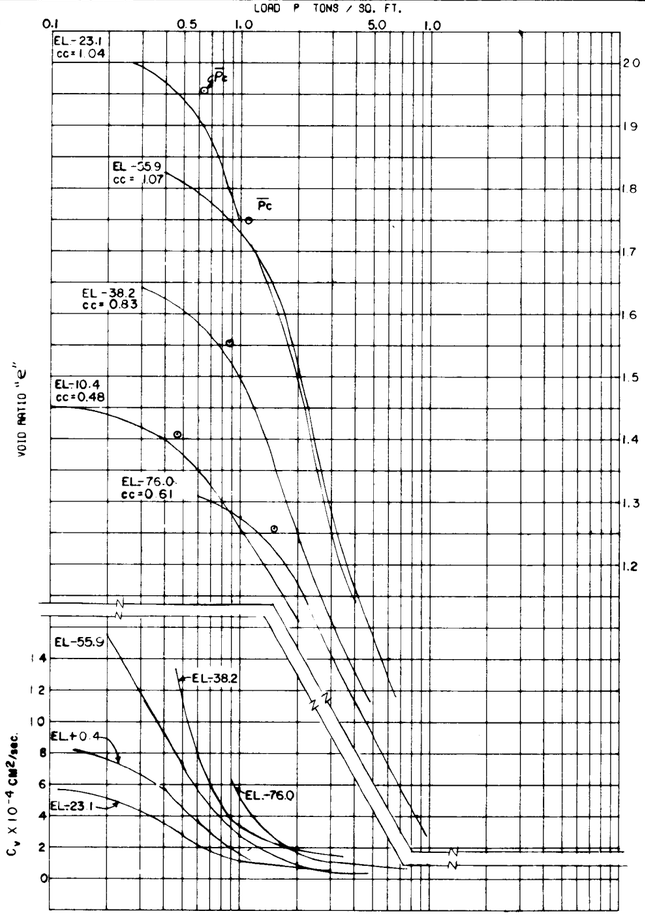


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
8-CUTP	1	1.2	Q	0°	0.15	CH
	2	-23.8			0.19	CH
	3	-41.8			0.23	CH
	4	-54.1			0.26	CH
	5	-75.1			0.40	CH
	6	-22.0	R	14.0°	0.08	CH
	7	-40.1	S	21.0°	0.05	CH



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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

UNDISTURBED BORING 8 - CUTP DATA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972 FILE NO. H-2-25587

PLATE 20

BOR. 15-CU

STA. 484+92

20 FT. RT. OF 1969 B/L

27-28 FEB. 1-5 MAR. 1963

GROUND EL. 1.7

TEST DATA

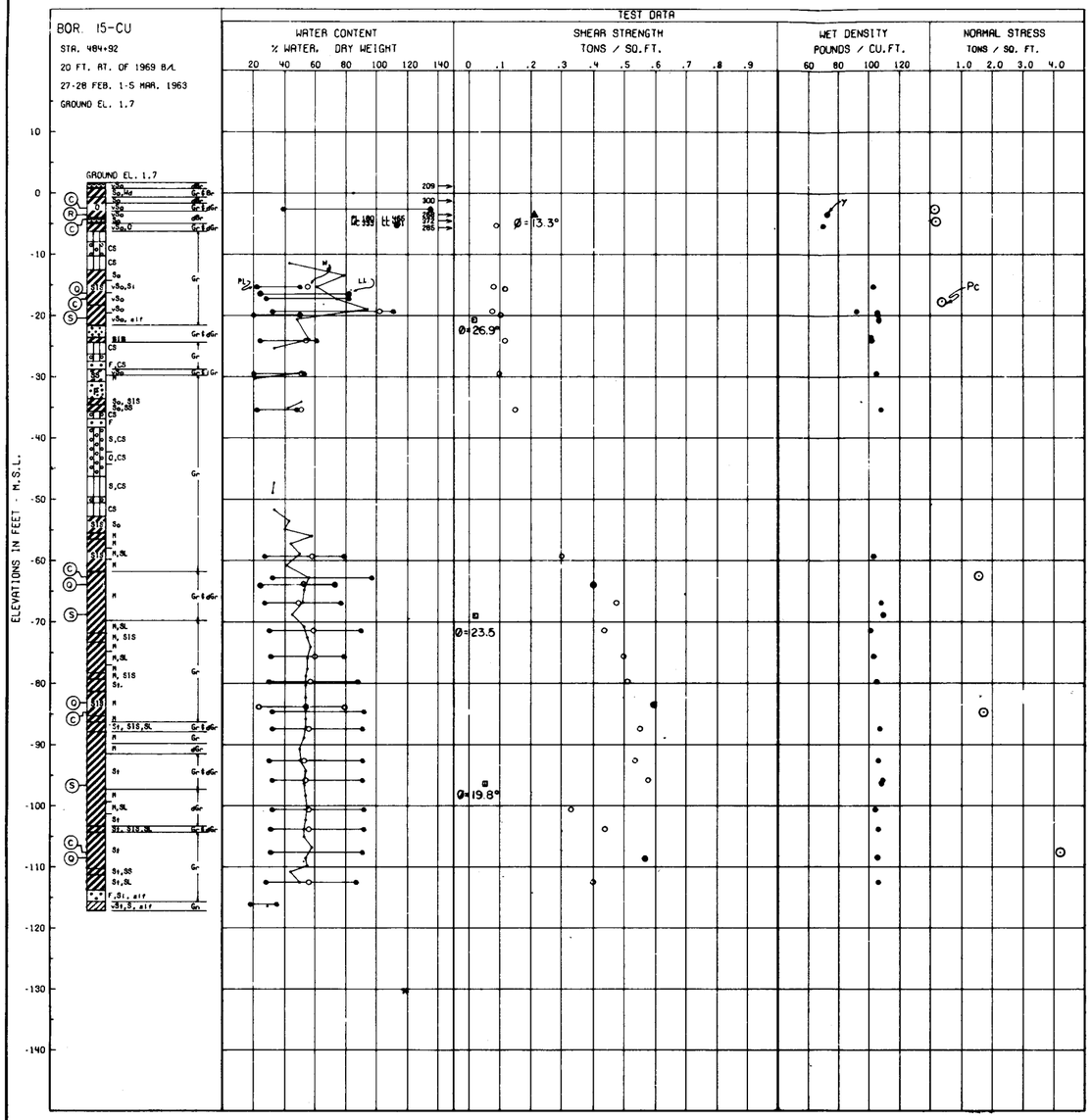
WATER CONTENT % WATER, DRY WEIGHT

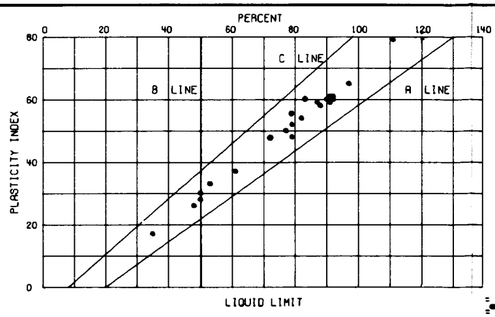
SHEAR STRENGTH TONS / SQ.FT.

WET DENSITY POUNDS / CU.FT.

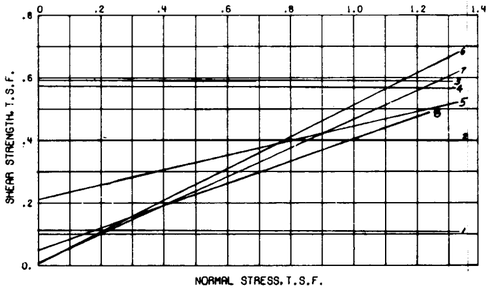
NORMAL STRESS TONS / SQ. FT.

ELEVATIONS IN FEET - M.S.L.



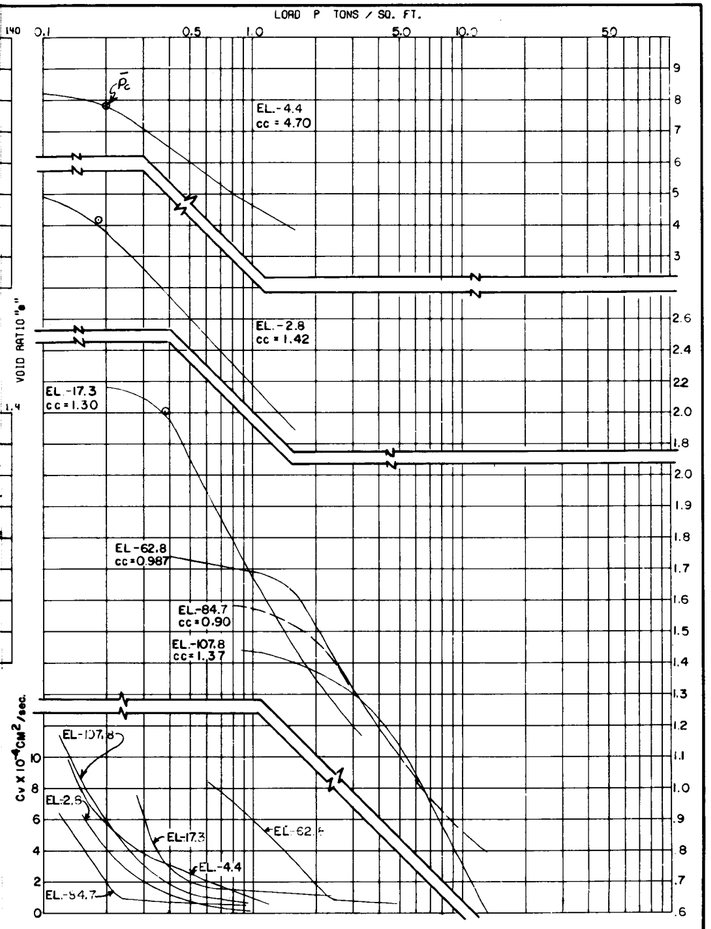


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
15-CU	1	-16.3	Q	0°	.11	CH
	2	-63.0			.40	CH
	3	-83.7			.59	CH
	4	-108.6			.57	CH
	5	-3.5	R	13.3°	.21	CH
	6	-20.4	S	26.7°	.01	CH
	7	-68.8		23.5°	.02	CH
	8	-96.7		19.8°	.05	CH



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

NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

UNDISTURBED BORING 15 - CU DATA

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

MARCH 1972

FILE NO. H-2-25527

PLATE 21

BOR. 21-CUT
STA. 687+50
60. FT. LEFT OF ℄ L. LEVEE
14-15 MAY 69

GROUND EL. 6.2

ELEVATIONS IN FEET - M.S.L.

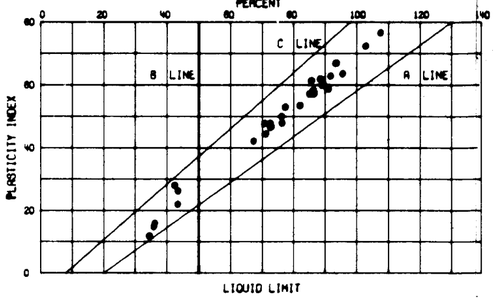
TEST DATA

WATER CONTENT
% WATER. DRY WEIGHT

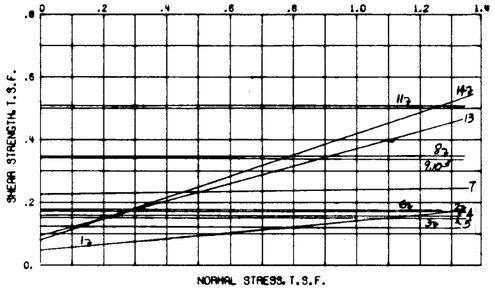
SHEAR STRENGTH
TONS / SQ.FT.

WET DENSITY
POUNDS / CU.FT.

NORMAL STRESS
TONS / SQ. FT.



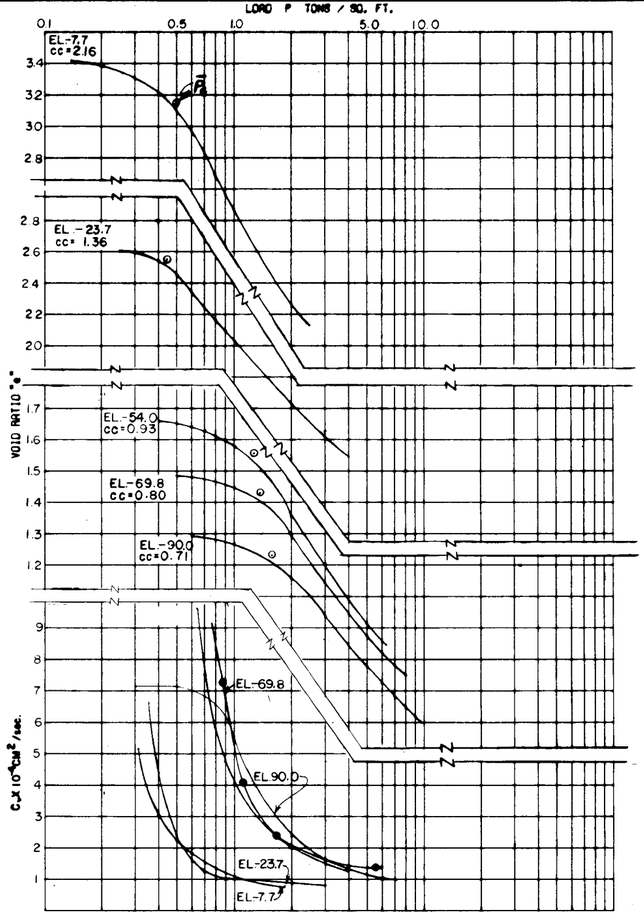
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
21-CUT	1	-2.2	Q	5.5°	0.04	CH
	2	-3.7		0	0.17	CH
	3	-5.2		0	0.12	CH
	4	-18.9		0	0.16	CH
	5	-22.8		0	0.15	CH
	6	-29.2		0	0.175	CH
	7	-46.0		1.0°	0.225	CH
	8	-59.6		0	0.345	CH
	9	-66.0		0	0.34	CH
	10	-75.8		0	0.34	CH
	11	-86.5		0	0.51	CH
	12	-15.1	R	15°	0.13	CL
	13	38.9		14°	0.10	ML
	14	21.9	S	19°	0.08	CH

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



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 7

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

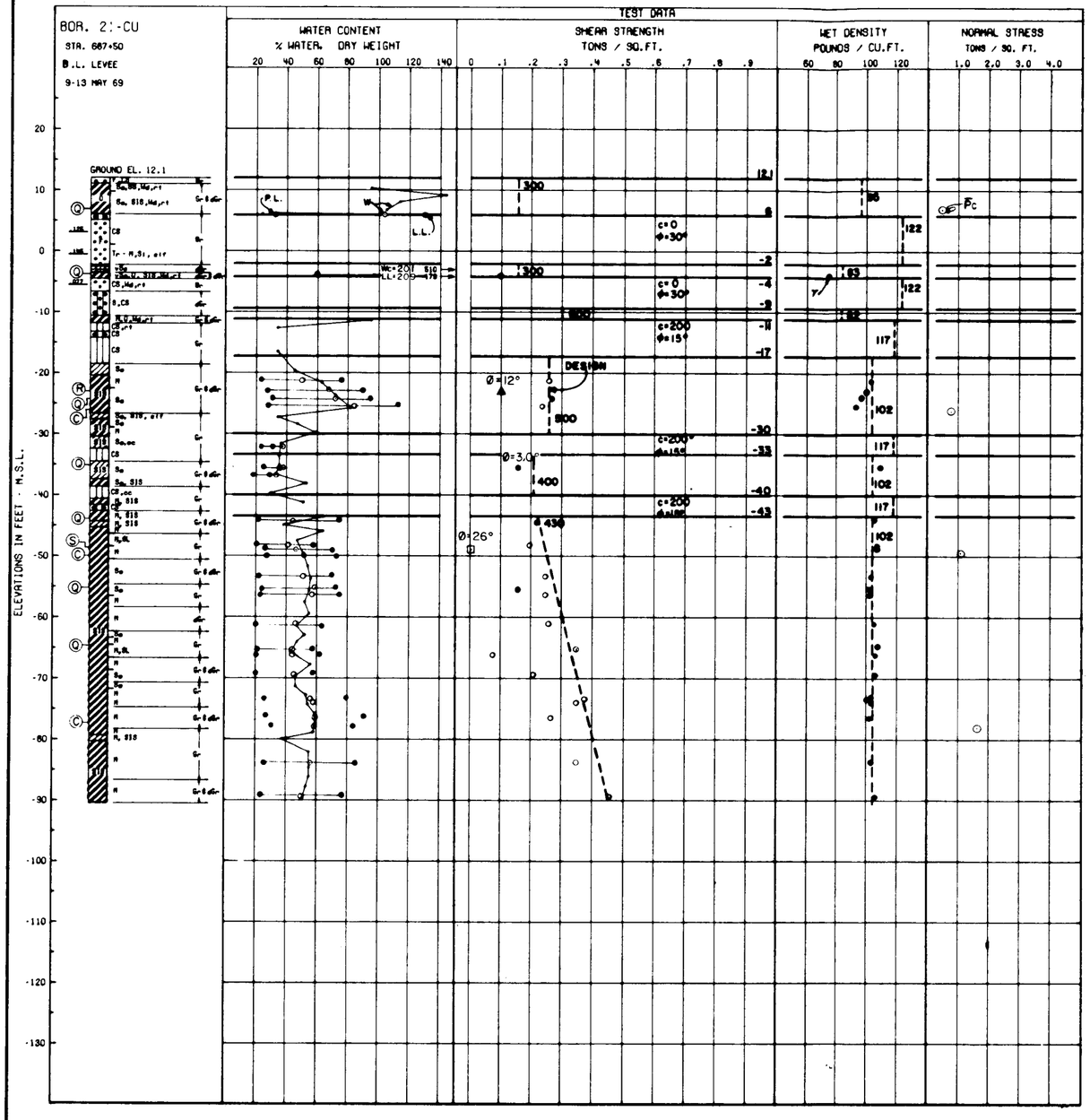
UNDISTURBED BORING
21-CUT DATA

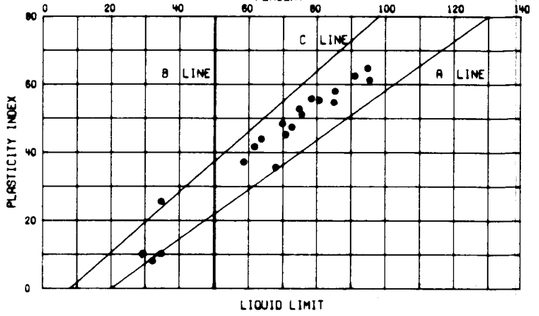
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO H-2-25527

PLATE 22

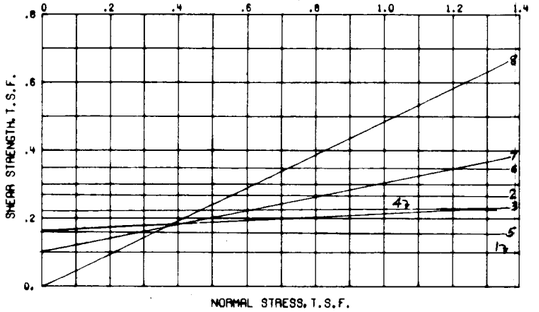
BOR. 21-CU
STA. 667+50
B.L. LEVEE
9-13 MAY 69

TEST DATA



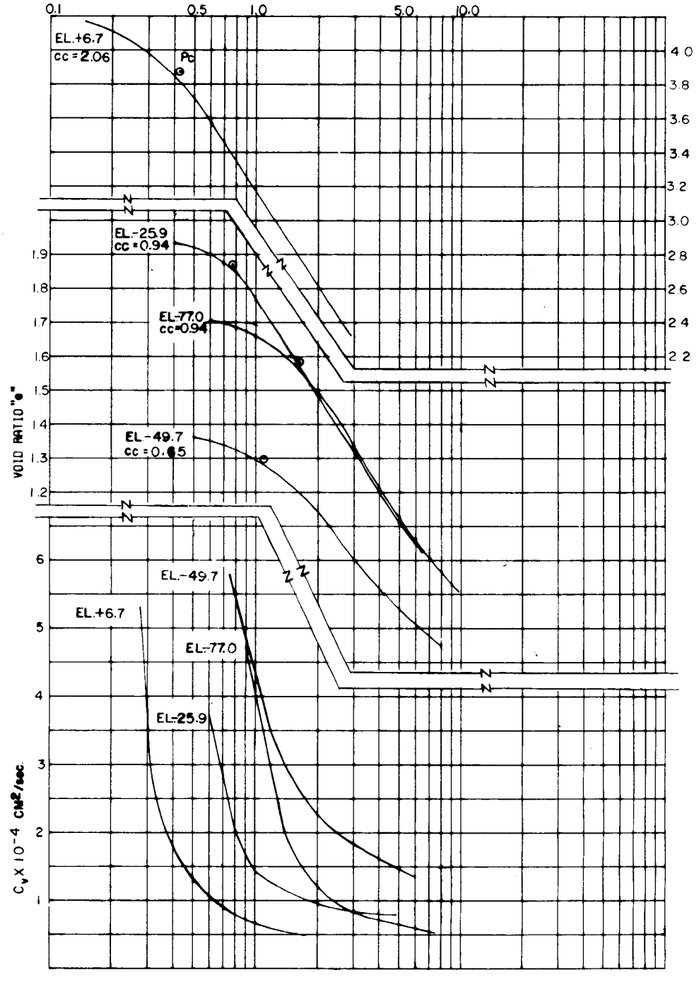


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
21-CU	1	-4.0	Q	0	0.10	CH
	2	-24.1		0	0.27	CH
	3	-35.3		3	0.16	CL
	4	-43.9		0	0.22	CH
	5	-55.2		0	0.16	CH
	6	-55.2		0	0.38	CH
	7	-22.9	R	12	0.10	CH
	8	-48.8	S	26	0.0	CH



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 7

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

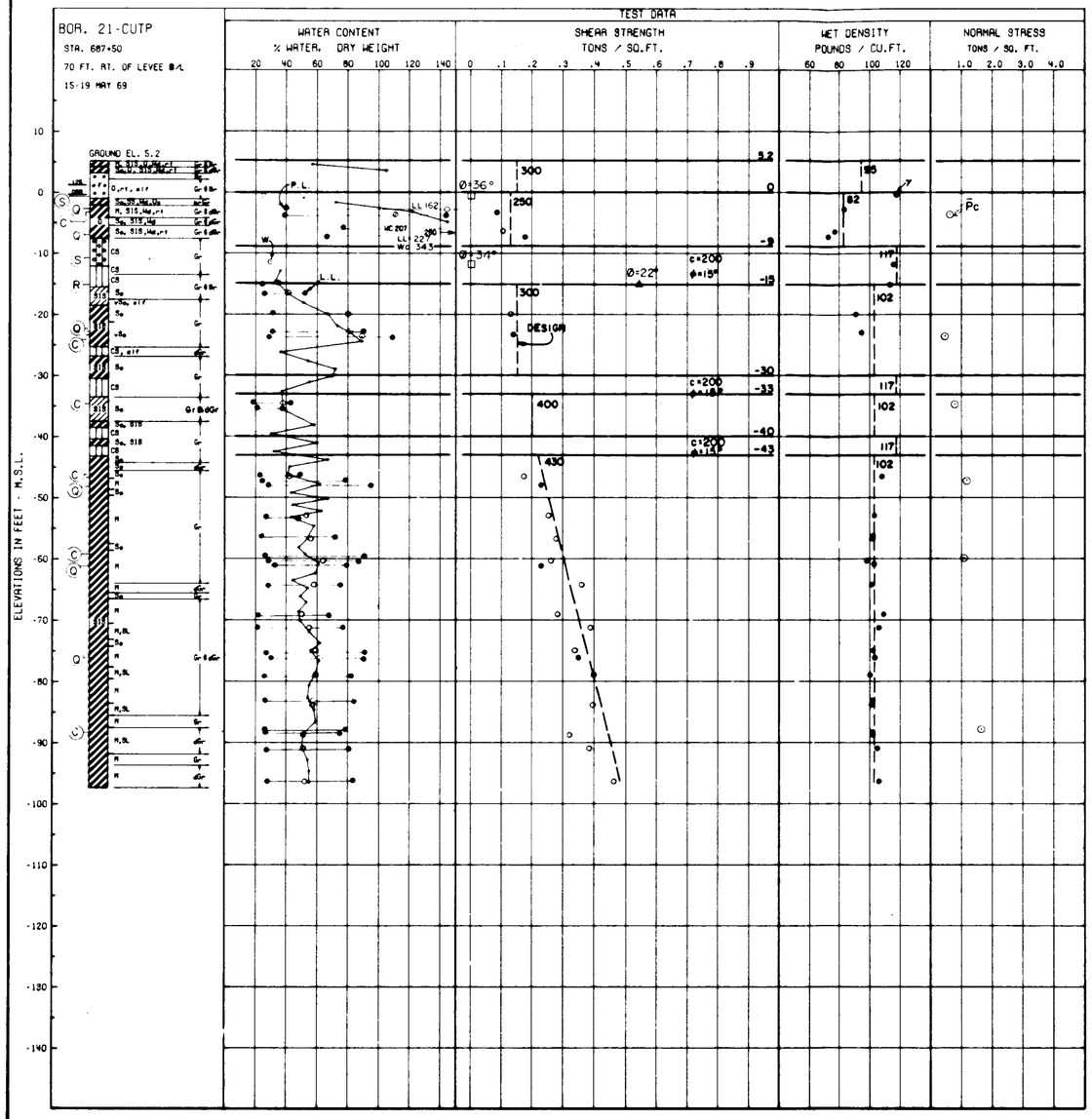
UNDISTURBED BORING 21 - CU DATA

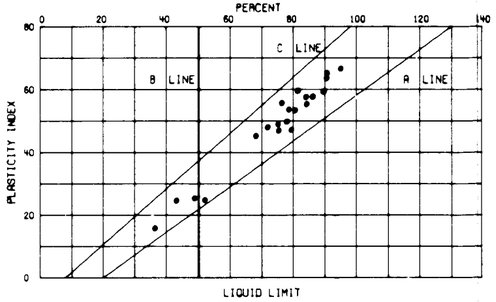
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972

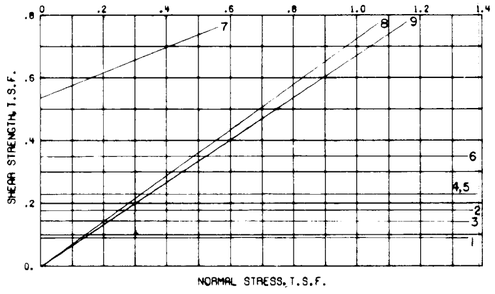
FILE NO. H-2-25587

PLATE 23





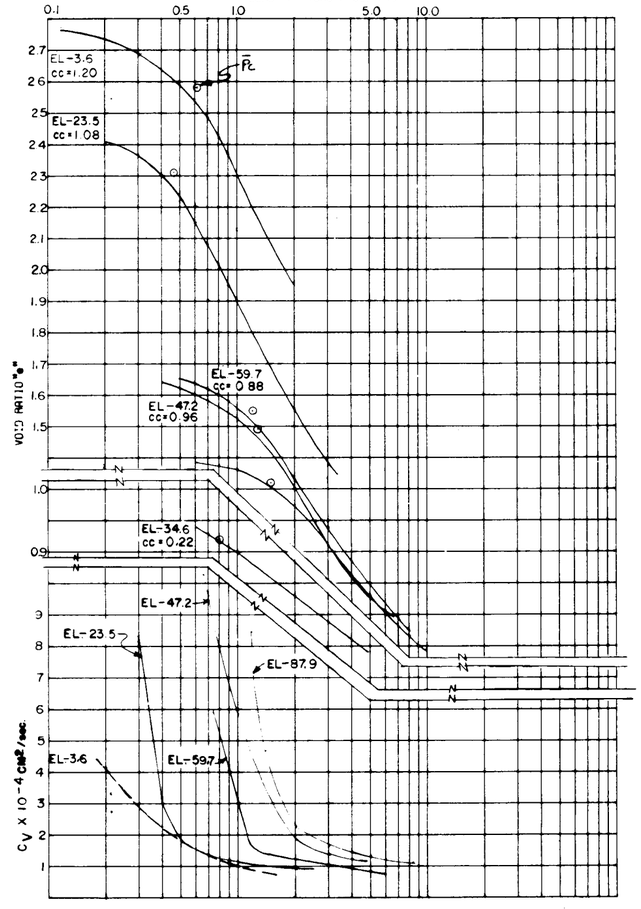
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
21-CUTP	1	-2.7	Q	0°	0.09	CH
	2	-7.0			0.18	CH
	3	-22.7			0.14	CH
	4	-47.9			0.23	CH
	5	-60.8			0.23	CH
	6	-76.8			0.35	CH
	7	-15.1	R	20°●	0.05	ML
	8	-0.2	S	36°	0.0	SP
	9	-11.6	S	34°	0.0	SM

● BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



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 7

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

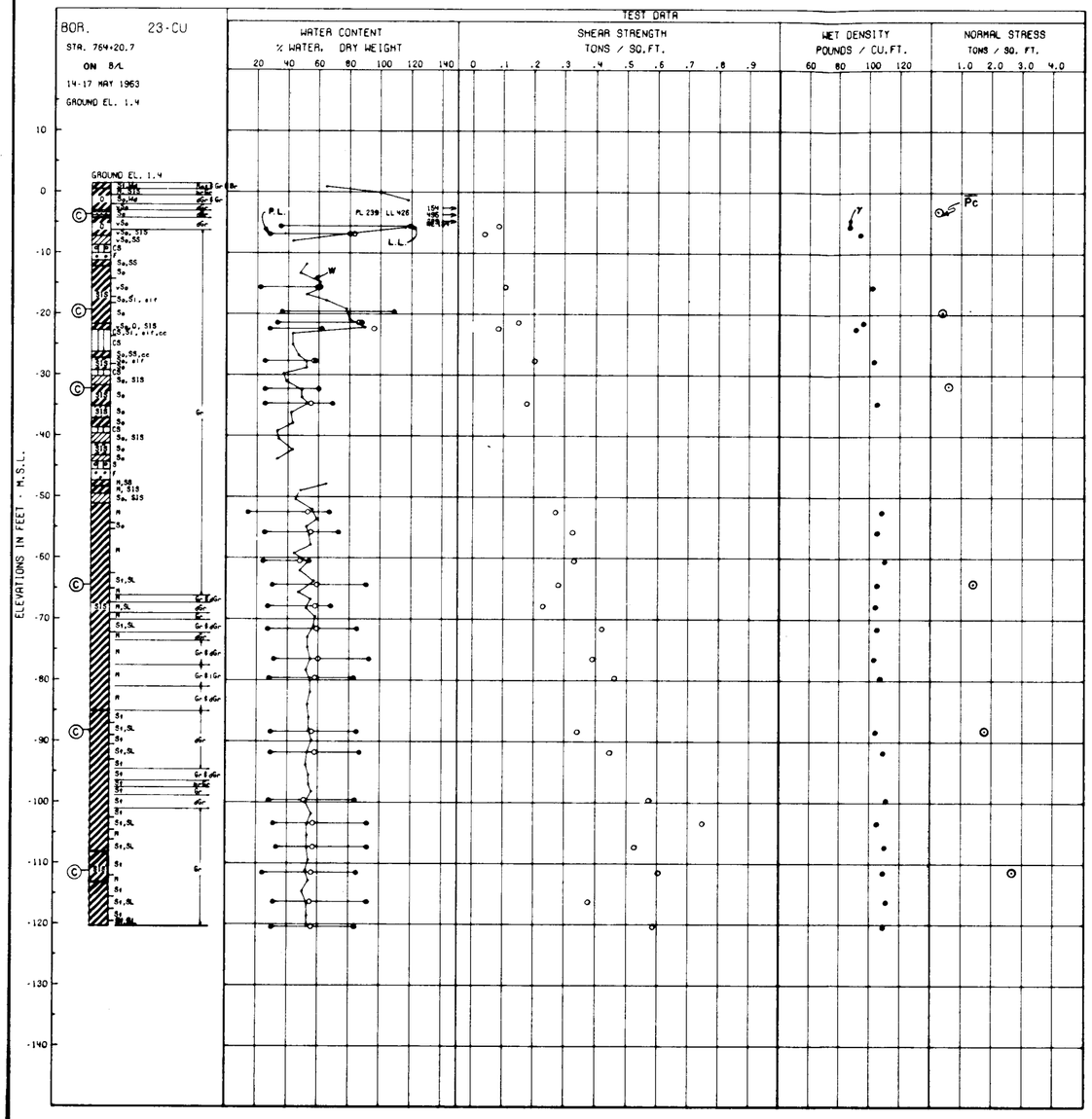
UNDISTURBED BORING 21-CUTP DATA

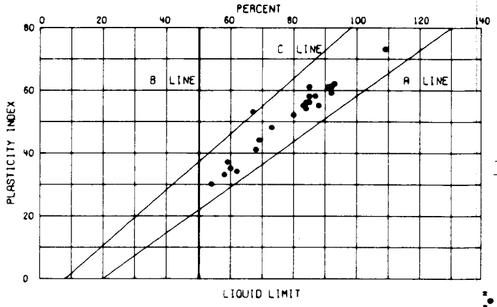
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MARCH 1972

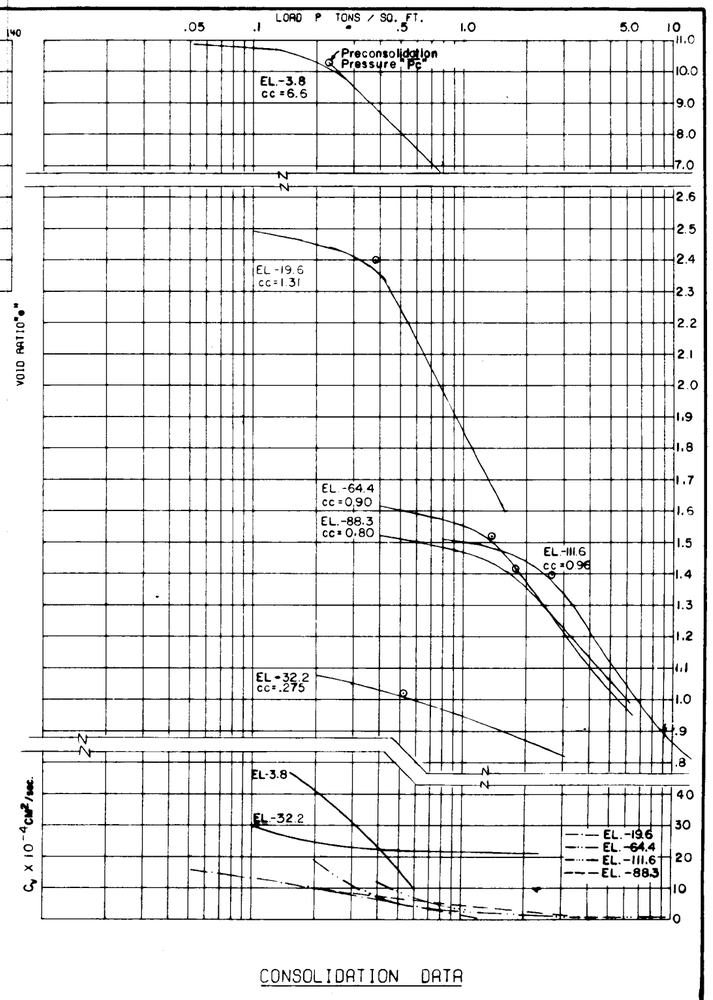
FILE NO. H-2-25527

PLATE 24





PLASTICITY CHART



CONSOLIDATION DATA

NOTES

⊙-(UC) UNCONFINED COMPRESSION 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 7.

NEW ORLEANS TO VENICE, LA

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

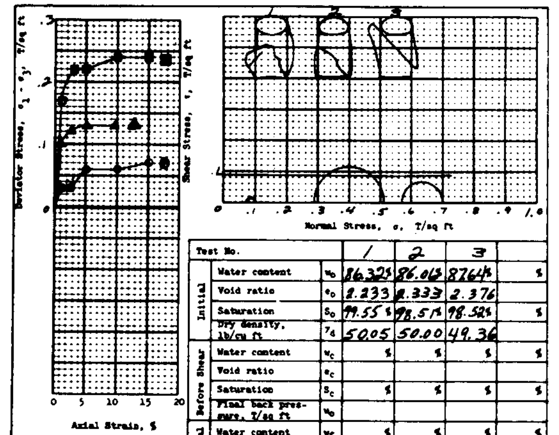
UNDISTURBED BORING 23 - CU DATA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS

MARCH 1972

FILE NO. H-2-25527

PLATE 25



Test No.		1	2	3	
Initial: Water content	w_o	86.32%	86.01%	87.64%	%
Void ratio	e_o	2.233	2.333	2.376	
Saturation	S_o	99.55%	98.51%	98.52%	%
Dry density, lb/cu ft	γ_d	50.05	50.00	49.36	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.07	0.29	0.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.03	0.22	0.13	
Time to failure, min	t_f	1.00	12.57	18.00	
Rate of strain, percent/min		0.70	0.26	0.28	
Wet density, lb/cu ft		93.26	93.02	92.68	
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	

Axial Strain, %

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.09 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification vSo(Gr)CH4;lns & few thin ars ML; dv;rt;org;ars

LL 151 | PL 26 | PI 125 | G_s 2.6672

Remarks NOD TESTING SECTION

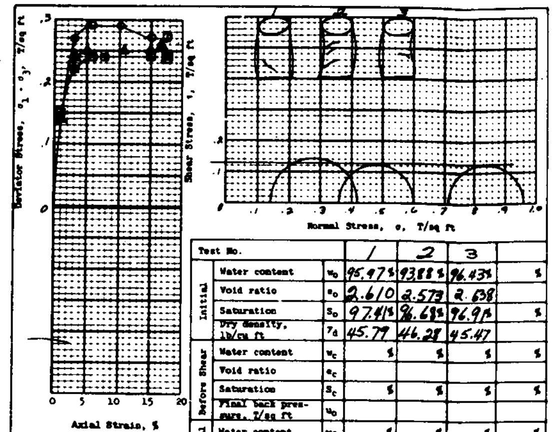
Project M.R.L. Below N.O.-Hurr.Prot.-N.O. to Venice, La. Reach "C" GDM

Area Sta. 14+06-70'L. of C/L Levee

Boring No. 30-CUT | Sample No. 2-D

Depth 6.2 El -1.5 | Date 5 Sept 69

TRIAXIAL COMPRESSION TEST REPORT 07H



Test No.		1	2	3	
Initial: Water content	w_o	95.47%	93.88%	96.43%	%
Void ratio	e_o	2.610	2.573	2.638	
Saturation	S_o	97.41%	96.68%	96.91%	%
Dry density, lb/cu ft	γ_d	45.79	46.28	45.47	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.14	0.36	0.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.29	0.24	0.26	
Time to failure, min	t_f	8.60	8.47	7.27	
Rate of strain, percent/min		0.67	0.67	0.67	
Wet density, lb/cu ft		89.74	89.72	89.32	
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°; tan φ = 0; c = 0.13 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr & Br) CH4+ OA; lns & few thin lys ML; dv;rt&rts

LL 138 | PL 32 | PI 106 | G_s 2.6502

Remarks NOD Testing Section

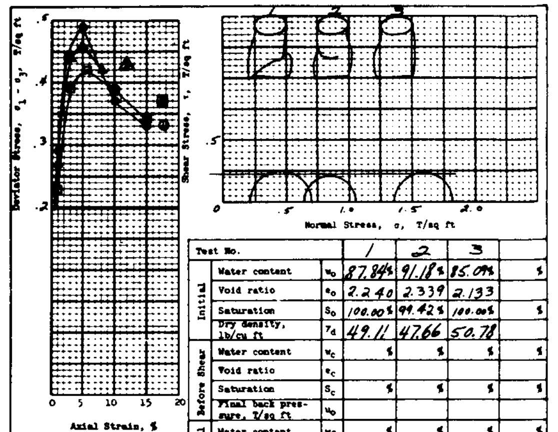
Project M.R.L. Below N.O. - Hurr. Prot.- N.O. to Venice,La. Reach "C" GDM

Area Sta. 14+06 - 70' L. of C.L. Levee

Boring No. 30-CUT | Sample No. 4-A

Depth 11.4 El -6.7 | Date 5 Sept 69

TRIAXIAL COMPRESSION TEST REPORT 07H



Test No.		1	2	3	
Initial: Water content	w_o	87.84%	91.18%	85.09%	%
Void ratio	e_o	2.240	2.339	2.133	
Saturation	S_o	100.00%	99.42%	100.00%	%
Dry density, lb/cu ft	γ_d	49.11	47.66	50.78	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.21	0.64	1.36	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.49	0.42	0.46	
Time to failure, min	t_f	7.31	21.28	18.59	
Rate of strain, percent/min		0.68	0.27	0.27	
Wet density, lb/cu ft		92.24	91.11	93.99	
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°; tan φ = 0; c = 0.23 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr&dGr)CH4-OB;lns&lys ML;dw

LL 114 | PL 31 | PI 83 | G_s 2.5487

Remarks NOD Testing Section

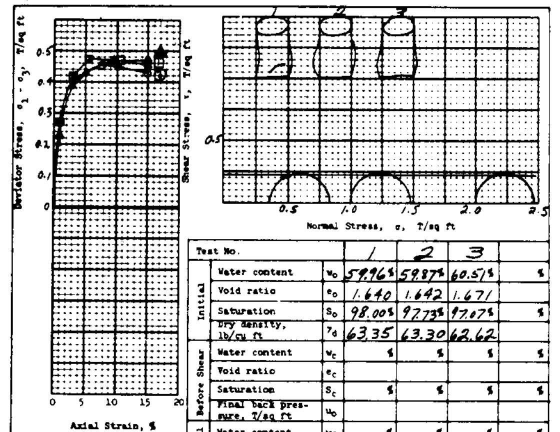
Project M.R.L. Below N.O. - Hurr. Prot. - N.O. to Venice,La. Reach "C" GDM

Area Sta. 14+06 - 70' L. of C.L. Levee

Boring No. 30-CUT | Sample No. 8A

Depth 27.4 El -22.7 | Date 5 Sept 69

TRIAXIAL COMPRESSION TEST REPORT 07H



Test No.		1	2	3	
Initial: Water content	w_o	59.96%	59.87%	60.51%	%
Void ratio	e_o	1.640	1.642	1.671	
Saturation	S_o	98.00%	97.73%	97.07%	%
Dry density, lb/cu ft	γ_d	63.35	63.30	62.62	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.36	1.00	2.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.47	0.46	0.46	
Time to failure, min	t_f	8.80	13.65	11.07	
Rate of strain, percent/min		0.65	0.66	0.67	
Wet density, lb/cu ft		101.34	101.20	100.51	
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°; tan φ = 0; c = 0.23 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr)CH4;lns & few thin lys ML;dw;org stks.

LL 77 | PL 25 | PI 52 | G_s 2.6830

Remarks NOD Testing Section

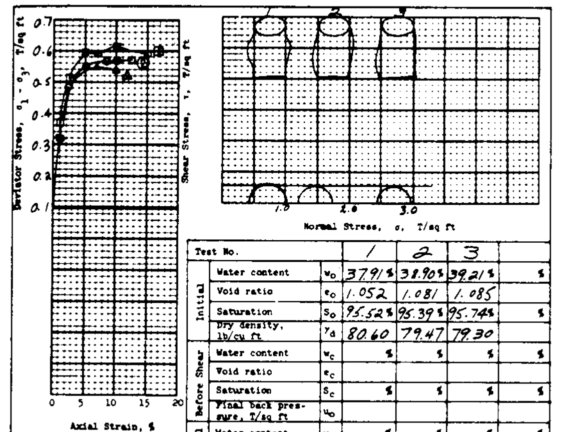
Project M.R.L. Below N.O. - Hurr. Prot. - N.O. to Venice,La. Reach "C" GDM

Area Sta. 14+06 - 70' L. of C.L. Levee

Boring No. 30-CUT | Sample No. 12-D

Depth 46.0 El -41.3 | Date 5 Sept 69

TRIAXIAL COMPRESSION TEST REPORT 07H



Test No.		1	2	3	
Initial: Water content	w_o	37.91%	38.90%	39.21%	%
Void ratio	e_o	1.052	1.081	1.085	
Saturation	S_o	95.52%	95.39%	95.74%	%
Dry density, lb/cu ft	γ_d	80.60	79.47	79.30	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.43	1.21	2.43	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.59	0.57	0.55	
Time to failure, min	t_f	19.11	31.28	25.08	
Rate of strain, percent/min		0.26	0.27	0.27	
Wet density, lb/cu ft		111.15	110.38	110.39	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.42	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.285 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification vSo(Gr&dGr)CL 6;lns& lys ML;spks;dw;org stks

LL 45 | PL 19 | PI 26 | G_s 2.6516

Remarks NOD Testing Section

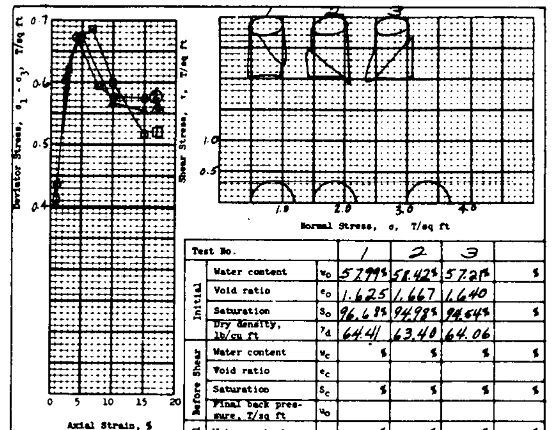
Project M.R.L. Below N.O. - Hurr. Prot. N.O. to Venice, La. Reach "C" GDM

Area Sta. 14+06-70' L. of C.L. Levee

Boring No. 30-CUT | Sample No. 15-B

Depth 56.2 El -51.5 | Date 5 Sept 69

TRIAXIAL COMPRESSION TEST REPORT 07H



Test No.		1	2	3	
Initial: Water content	w_o	57.99%	58.42%	57.21%	%
Void ratio	e_o	1.625	1.667	1.640	
Saturation	S_o	96.68%	94.98%	94.64%	%
Dry density, lb/cu ft	γ_d	64.41	63.40	64.06	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.69	0.67	0.67	
Time to failure, min	t_f	10.05	6.41	7.42	
Rate of strain, percent/min		0.67	0.67	0.67	
Wet density, lb/cu ft		101.76	100.44	100.71	
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°; tan φ = 0; c = 0.34 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr & dGr) CH4;ars ML;spks dv

LL 84 | PL 30 | PI 54 | G_s 2.7149

Remarks NOD Testing Section

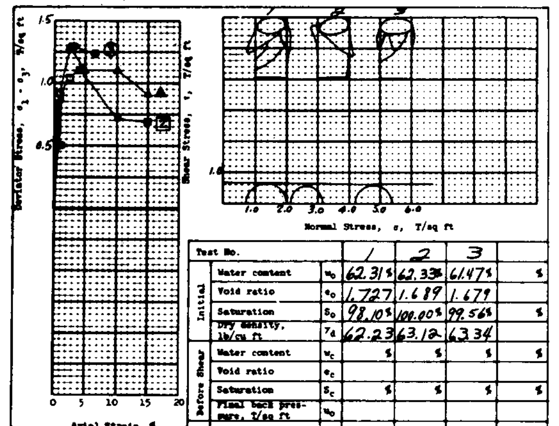
Project M.R.L. Below N.O. - Hurr Prot. - N.O. to Venice, La. Reach "C" GDM

Area Sta. 14+06 - 70' L. of C.L. Levee

Boring No. 30-CUT | Sample No. 18-D

Depth 69.9 El -65.2 | Date

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial: Water content	w_o	62.31%	62.33%	61.47%	%
Void ratio	e_o	1.727	1.689	1.679	
Saturation	S_o	98.10%	100.00%	99.56%	%
Dry density, lb/cu ft	γ_d	62.23	63.12	63.34	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.71	2.07	4.14	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	1.29	1.11	1.29	
Time to failure, min	t_f	4.40	16.27	13.90	
Rate of strain, percent/min		0.66	0.26	0.26	
Wet density, lb/cu ft		101.00	102.47	102.28	
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°; tan φ = 0; c = 0.645 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification St(Gr&dGr)CH4;lns&few thin lys ML; spks dv

LL 82 | PL 30 | PI 52 | G_s 2.7190

Remarks NOD Testing Section

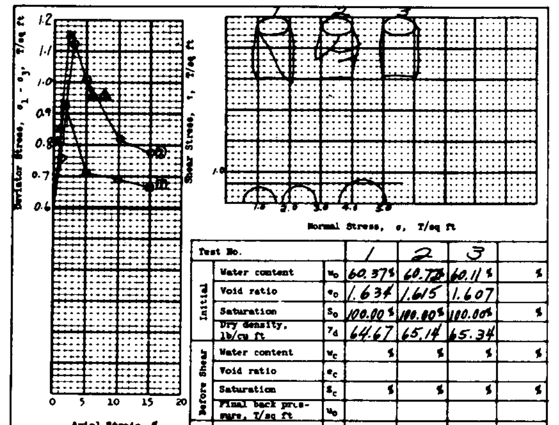
Project M.R.L. Below N.O. - Hurr. Prot.- N.O. Venice, La. Reach "C" GDM

Area Sta. 14+06 - 70'L. of C.L. Levee

Boring No. 30-CUT | Sample No. 26-B

Depth 100.2 El -95.5 | Date

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial: Water content	w_o	60.37%	60.72%	60.11%	%
Void ratio	e_o	1.634	1.615	1.607	
Saturation	S_o	100.00%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	64.67	65.14	65.34	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.57	1.79	3.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.93	1.12	1.56	
Time to failure, min	t_f	3.17	13.80	10.49	
Rate of strain, percent/min		0.66	0.25	0.26	
Wet density, lb/cu ft		103.71	104.69	104.63	
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°; tan φ = 0; c = 0.62 T/sq ft

Method of saturation ______

[ ] Controlled stress [X] Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr&dGr)CH4;lns ML; spks dv (yellow Cast)

LL 90 | PL 30 | PI 60 | G_s 2.7327

Remarks NOD Testing Section

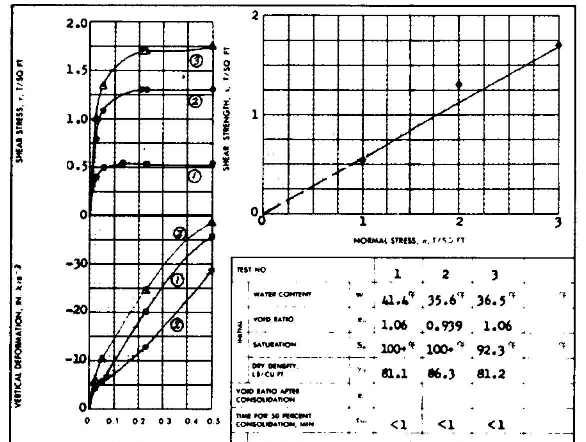
Project M.R.L. Below N.O.-Hurr. Prot.- N.O. to Venice, La. Reach "C" GDM

Area Sta. 14+06 - 70' L. of C.L. Levee

Boring No. 30-CUT | Sample No. 22-B

Depth 83.7 El -79.0 | Date

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial: Water content	w	41.4%	35.6%	36.5%	%
Void ratio	e	1.06	0.939	1.06	
Saturation	S	100+%	100+%	92.3%	%
Dry density, lb/cu ft	γ_d	81.1	86.3	81.2	
Void ratio after consolidation	e				
Time for 50 percent consolidation, min	t_{50}	<1	<1	<1	
Final: Water content	w	31.5%	29.2%	32.6%	%
Void ratio	e				
Saturation	S	%	%	%	%
Normal stress, T/sq ft	σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft	τ_{max}	0.54	1.30	1.70	
Actual time to failure, min	t_f	780	1200	1200	
Rate of strain, in./min		.00018	.00018	.00018	
Ultimate shear stress, T/sq ft	τ_{ult}				

Horiz. Deformation, in

Shear Strength Parameters: φ = 30°; tan φ = 0.577; c = 0 T/sq ft

[ ] Controlled stress [X] Controlled strain

Type of specimen UNDISTURBED | 3.00 in. square | 0.557 in. thick

Classification SILT (ML), gray, contains organic matter

LL 34 | PL 28 | PI 6 | G 2.68

Remarks

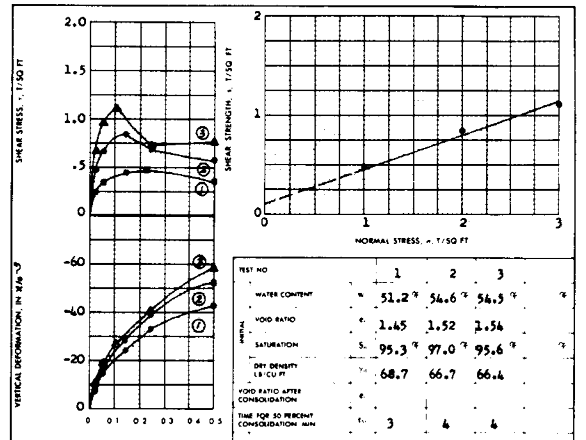
Project NEW ORLEANS TO VENICE, LA. - 1969 REACH C, GDM

Area Sta. 14+06; 70' Left of ℄ Levee

Boring No. 30-CUT | Sample No. 5-C

Depth / El -12.4 | Date 29 July 1969

GDA DIRECT SHEAR TEST REPORT



Test No.		1	2	3	
Initial: Water content	w	51.2%	54.6%	54.5%	%
Void ratio	e	1.45	1.52	1.54	
Saturation	S	95.3%	97.0%	95.6%	%
Dry density, lb/cu ft	γ_d	68.7	66.7	66.4	
Void ratio after consolidation	e				
Time for 50 percent consolidation, min	t_{50}	3	4	4	
Final: Water content	w	43.9%	41.1%	36.6%	%
Void ratio	e				
Saturation	S	%	%	%	%
Normal stress, T/sq ft	σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft	τ_{max}	0.47	0.84	1.11	
Actual time to failure, min	t_f	1200	780	600	
Rate of strain, in./min		.00019	.00019	.00019	
Ultimate shear stress, T/sq ft	τ_{ult}				

Shear Strength Parameters: φ = 19°; tan φ = 0.344; c = 0.12 T/sq ft

[ ] Controlled stress [X] Controlled strain

Type of specimen UNDISTURBED | 3.00 in. square | 0.557 in. thick

Classification PLASTIC CLAY (CH), contains 1/16" silt seams, gray

LL 64 | PL 25 | PI 39 | G 2.70

Remarks

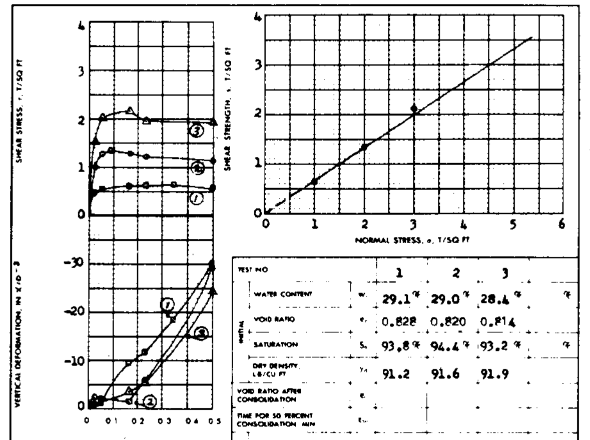
Project NEW ORLEANS TO VENICE, LA. - '69 REACH "C", GDM

Area STA. 14+06, 70' L of ℄ Levee

Boring No. 30-CUT | Sample No. 13-D

Depth / El -45.2 | Date 4 August 1969

GDA DIRECT SHEAR TEST REPORT



Test No.		1	2	3	
Initial: Water content	w	29.1%	29.0%	28.4%	%
Void ratio	e	0.828	0.820	0.814	
Saturation	S	93.8%	94.4%	93.2%	%
Dry density, lb/cu ft	γ_d	91.2	91.6	91.9	
Void ratio after consolidation	e				
Time for 50 percent consolidation, min	t_{50}				
Final: Water content	w	27.8%	27.8%	28.4%	%
Void ratio	e				
Saturation	S	%	%	%	%
Normal stress, T/sq ft	σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft	τ_{max}	0.64	1.34	2.11	
Actual time to failure, min	t_f	1920	540	960	
Rate of strain, in./min		.00019	.00019	.00019	
Ultimate shear stress, T/sq ft	τ_{ult}				

Shear Strength Parameters: φ = 34°; tan φ = 0.674; c = 0 T/sq ft

[ ] Controlled stress [X] Controlled strain

Type of specimen UNDISTURBED | 3.00 in. square | 0.557 in. thick

Classification SILTY SAND (SM), gray

LL - | PL - | PI - | G 2.67 From 7-B

Remarks

Project NEW ORLEANS TO VENICE, LA. - 1969 REACH C, GDM

Area STA. 14+06; 70' L of ℄ Levee

Boring No. 30-CUT | Sample No. 7-C

Depth / El -20.2 | Date 30 July 1969

GDA DIRECT SHEAR TEST REPORT

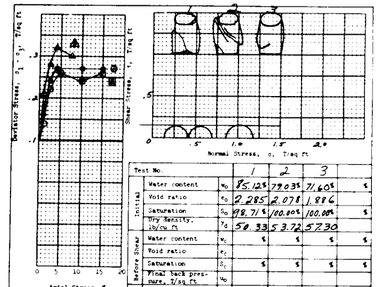
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 30 CUT

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

MARCH 1972 | FILE NO. H-2-25527

PLATE 26



Test No.		1	2	3	
Initial	Water content	w_o	85.12%	79.03%	71.60%
	Void ratio	e_o	2.285	2.078	1.886
	Saturation	S_o	98.71%	100.00%	100.00%
	Dry density, lb/cu ft	γ_d	58.33	63.72	67.30
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	$(\sigma_1-\sigma_3)_{max}$	0.27	0.26	0.32
	Time to failure, min	t_f	6.01	18.13	15.33
	Rate of strain, percent/min		0.67	0.27	0.27
	Wet density, lb/cu ft		93.18	96.17	98.32
	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°
tan ϕ = 0
c = 0.15 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 3" Undisturbed

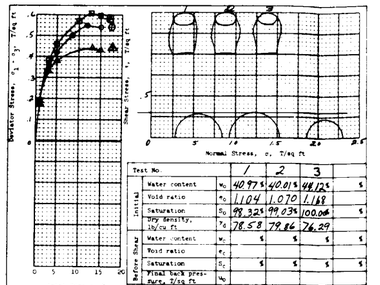
Classification So(Gr&Gr/CH&;lns&sars ML;few ars SP;rt;dv;lrg org

LL 96 | PL 30 | PI 66 | G_s 2.6522

Remarks NOD Testing Section

Project M.R.L. Below N.O. Burr. Prot. N.O. to Venice,La. Reach "C" GDM
Area Sta. 144+06 on C.L. Levee
Boring No. 30-CU | Sample No. 3-B
Depth 7.0 | Date 22 Aug 69
El -5.5

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial	Water content	w_o	40.7%	40.0%	48.1%
	Void ratio	e_o	1.104	1.070	1.188
	Saturation	S_o	98.32%	99.03%	100.00%
	Dry density, lb/cu ft	γ_d	78.58	79.86	76.29
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	0.29	0.93	1.86
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.55	0.61	0.44
	Time to failure, min	t_f	7.43	18.57	20.21
	Rate of strain, percent/min		0.67	0.67	0.66
	Wet density, lb/cu ft		110.78	111.80	109.95
	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°
tan ϕ = 0
c = 0.30 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 3" Undisturbed

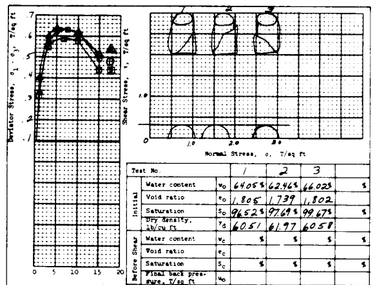
Classification M(Gr;CBR;slt lys MI

LL 45 | PL 23 | PI 22 | G_s 2.6530

Remarks NOD Testing Section

Project M.R.L. Below N.O. Burr. Prot. N.O. to Venice,La. Reach "C" GDM
Area Sta. 144+06 on C.L. Levee
Boring No. 30-CU | Sample No. 7-D
Depth 25.0 | Date 22 Aug 69
El -14.5

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial	Water content	w_o	64.05%	62.46%	66.02%
	Void ratio	e_o	1.806	1.739	1.802
	Saturation	S_o	96.52%	97.69%	99.67%
	Dry density, lb/cu ft	γ_d	60.51	61.77	60.58
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	0.43	1.21	2.43
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.63	0.64	0.59
	Time to failure, min	t_f	11.24	7.50	9.77
	Rate of strain, percent/min		0.66	0.67	0.67
	Wet density, lb/cu ft		99.26	100.66	100.68
	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°
tan ϕ = 0
c = 0.32 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 3" Undisturbed

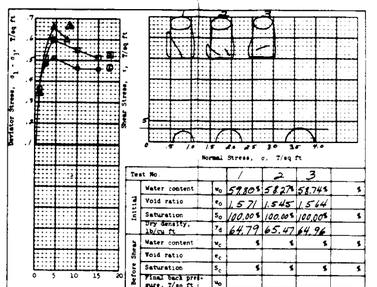
Classification M(Gr&CBR;slt lys MI

LL 87 | PL 26 | PI 61 | G_s 2.7200

Remarks NOD Testing Section

Project M.R.L. N.O. HURR. PROT. N.O. to Venice, La. Reach "C" GDM
Area Sta. 144+06 on C.L. Levee
Boring No. 30-CU | Sample No. 11-C
Depth 40.9 | Date 22 Aug 69
El -26.5

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial	Water content	w_o	58.20%	58.27%	58.74%
	Void ratio	e_o	1.571	1.545	1.554
	Saturation	S_o	100.00%	100.00%	100.00%
	Dry density, lb/cu ft	γ_d	64.79	65.47	64.96
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	0.57	1.64	3.29
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.51	0.60	0.66
	Time to failure, min	t_f	6.22	15.76	16.65
	Rate of strain, percent/min		0.67	0.27	0.27
	Wet density, lb/cu ft		103.54	103.62	103.11
	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°
tan ϕ = 0
c = 0.32 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 3" Undisturbed

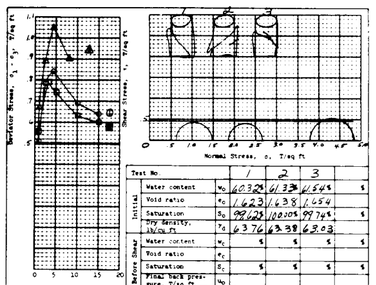
Classification M(Gr)CH&;lns&sars ML spks dv

LL 82 | PL 24 | PI 58 | G_s 2.6672

Remarks NOD Testing Section

Project M.R.L. Below Burr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 144+06 on C.L. Levee
Boring No. 30-CU | Sample No. 17-B
Depth 66.8 | Date 22 Aug 69
El -59.5

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial	Water content	w_o	60.32%	61.33%	61.64%
	Void ratio	e_o	1.623	1.638	1.654
	Saturation	S_o	99.62%	100.00%	99.74%
	Dry density, lb/cu ft	γ_d	63.76	63.38	63.03
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	0.64	.86	3.73
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.94	0.79	1.05
	Time to failure, min	t_f	6.25	12.94	15.80
	Rate of strain, percent/min		0.68	0.27	0.27
	Wet density, lb/cu ft		102.22	102.74	101.81
	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°
tan ϕ = 0
c = 0.475 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 3" Undisturbed

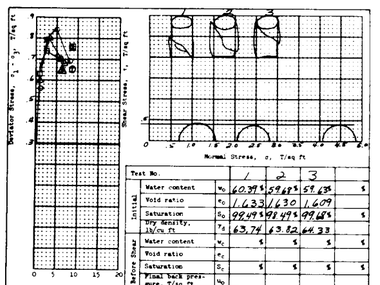
Classification M(dGr/CH&;few lns ML;few org stns

LL 87 | PL 28 | PI 59 | G_s 2.6806

Remarks NOD Testing Section

Project M.R.L. Below N.O. Burr. Prot. N.O. to Venice,La. Reach "C" GDM
Area Sta. 144+06 on C.L. Levee
Boring No. 30-CU | Sample No. 20-B
Depth 61.9 | Date 22 Aug 69
El -54.4

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial	Water content	w_o	60.39%	59.88%	59.63%
	Void ratio	e_o	1.633	1.630	1.609
	Saturation	S_o	99.49%	98.48%	99.68%
	Dry density, lb/cu ft	γ_d	63.74	63.82	64.33
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	0.71	2.07	4.07
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.84	0.74	0.80
	Time to failure, min	t_f	18.94	9.91	12.61
	Rate of strain, percent/min		0.27	0.27	0.27
	Wet density, lb/cu ft		102.24	101.91	102.68
	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°
tan ϕ = 0
c = 0.40 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 3" Undisturbed

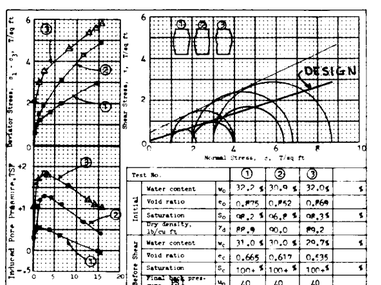
Classification M(dGr)CH&;few lns ML;spks dv

LL 82 | PL 28 | PI 54 | G_s 2.6959

Remarks NOD Testing Section

Project M.R.L. below N.O. Burr. Prot. N.O.to Venice,La. Reach "C" GDM
Area Sta. 144+06 on C.L. Levee
Boring No. 30-CU | Sample No. 22-C
Depth 56.9 | Date 22 Aug 69
El -50.1

TRIAXIAL COMPRESSION TEST REPORT



Test No.		①	②	③	
Initial	Water content	w_o	32.2%	30.9%	32.0%
	Void ratio	e_o	0.875	0.842	0.868
	Saturation	S_o	98.2%	96.8%	98.3%
	Dry density, lb/cu ft	γ_d	89.9	90.0	89.2
Before Shear	Water content	w_c	31.0%	30.0%	29.7%
	Void ratio	e_c	0.865	0.817	0.835
	Saturation	S_c	100%	100%	100%
	Final back pressure, T/sq ft	u_b	40	40	40
	Dry density lb/cu ft	γ_d	100.1	103.1	101.6
	Void ratio	e_f			
	Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	3.00	4.80	4.70
	Time to failure, min	t_f	214	214	214
	Rate of strain, percent/min		0.07	0.07	0.07
	$\sigma_1 - \sigma_3$		1.2	2	3.4
	Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$	0.04	0.04	0.04
	Initial diameter, in	D_o	1.39	1.40	1.40
	Initial height, in	H_o	3.00	3.00	3.00

Shear Strength Parameters
ϕ = 18°
tan ϕ = 0.325
c = 0.10 T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification CLAY (CL), gray

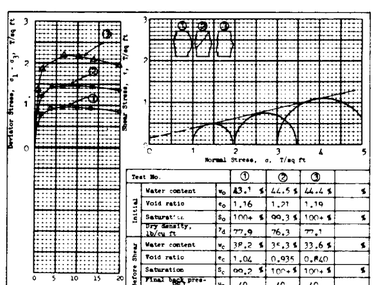
LL 29 | PL 22 | PI 7 | G_s 2.67

Remarks See attached plot for effective values

* Based on Deviator Stress at Maximum Pore Pressure

Project NEW ORLEANS TO VENICE - 1969
REACH "C"; GDM
Area
Boring No. 30-CU | Sample No. 13-B
Depth -34.0 | Date 15 July, 1969
El

JL TRIAXIAL COMPRESSION TEST REPORT



Test No.		①	②	③	
Initial	Water content	w_o	43.1%	44.5%	44.4%
	Void ratio	e_o	1.16	1.21	1.19
	Saturation	S_o	100%	99.3%	100%
	Dry density, lb/cu ft	γ_d	77.9	76.3	77.1
Before Shear	Water content	w_c	38.2%	34.3%	33.6%
	Void ratio	e_c	1.04	0.936	0.940
	Saturation	S_c	99.2%	100%	100%
	Final back pressure, T/sq ft	u_b	40	40	40
	Dry density lb/cu ft	γ_d	82.7	82.1	81.6
	Void ratio	e_f			
	Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.95	1.47	2.10
	Time to failure, min	t_f	240	288	192
	Rate of strain, percent/min		0.04	0.04	0.04
	Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$			
	Initial diameter, in	D_o	1.40	1.39	1.40
	Initial height, in	H_o	3.00	3.00	3.00

Shear Strength Parameters
ϕ = 13°
tan ϕ = 0.21
c = 0.16 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

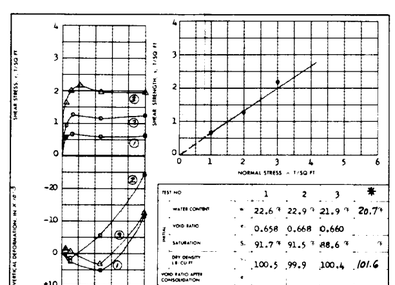
Classification PLASTIC CLAY (CH), gray, homogeneous

LL 53 | PL 21 | PI 32 | G_s 2.70

Remarks

Project NEW ORLEANS TO VENICE - 1969
REACH "C"; GDM
Area
Boring No. 30-CU | Sample No. 17-B
Depth -51.7 | Date 15 July, 1969
El

JL TRIAXIAL COMPRESSION TEST REPORT



SHEAR STRENGTH PARAMETERS
ϕ = 26°
tan ϕ = 0.488
c = 0

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO		1	2	3	*
INITIAL	WATER CONTENT %	22.6	22.9	21.9	20.7
	VOID RATIO	0.658	0.668	0.660	
	SATURATION %	91.7	91.5	88.6	
	DRY DENSITY LB CU FT	100.5	99.9	100.4	101.6
	VOID RATIO AFTER CONSOLIDATION				
	TIME FOR 50 PERCENT CONSOLIDATION MIN				
FINAL	WATER CONTENT %	15.3	17.1	19.2	13.8
	VOID RATIO				
	SATURATION %				
	NORMAL STRESS T/SQ FT	1.0	2.0	3.0	1.5
	MAXIMUM SHEAR STRESS T/SQ FT	0.66	1.26	2.18	1.09
	ACTUAL TIME TO FAILURE MIN	420	420	660	
	RATE OF STRAIN IN/MIN	.00018	.00018	.00018	
	ULTIMATE SHEAR STRESS T/SQ FT				

TYPE OF SPECIMEN UNDISTURBED 3.00 IN SQUARE 0.550 IN THICK
CLASSIFICATION CANL (SP), gray, contains a trace of clay
LL — PL — PI — G_s 2.67
REMARKS Check test at σ_3 of 1.5 TSF being performed
* Results of check test at σ_3 = 1.5 TSF
PROJECT NEW ORLEANS TO VENICE, LA. - 1969
REACH C, GDM
AREA
BORING NO 30-CU SAMPLE NO 6-D
DEPTH +0.6 DATE 23 July 1969
EL
GDA DIRECT SHEAR TEST REPORT

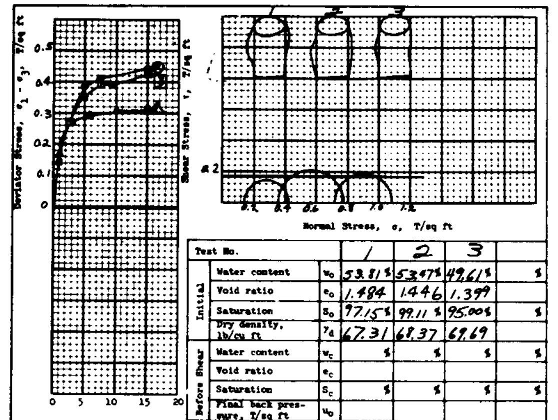
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO.3
REACH C - PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 30 CU

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

MARCH 1972 | FILE NO. H-2-25527

PLATE 27

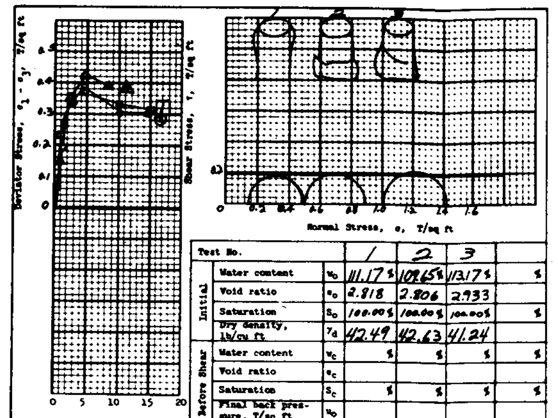


Test No.		1	2	3	
Initial: Water content	w_o	53.81%	53.47%	49.61%	%
Void ratio	e_o	1.484	1.446	1.399	
Saturation	S_o	97.15%	99.11%	95.00%	%
Dry density, lb/cu ft	γ_d	67.31	68.37	69.69	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.14	0.36	0.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.29	0.42	0.39	
Time to failure, min	t_f	8.47	10.76	10.75	
Rate of strain, percent/min		0.67	0.68	0.68	
Wet density, lb/cu ft.		103.53	104.92	104.27	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.17 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification M(br Gr)CH4;lns ML;rt & ox ars
LL 92 PL 20 PI 72 G_s 2.6835
Remarks NOD Testing Section
Project M.R.L. Below N.O.-Hurr. Prot.- N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70' Rt. of Levee C.L.
Boring No. 30-CUTP Sample No. 3-B
Depth 7.8 El -0.8 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

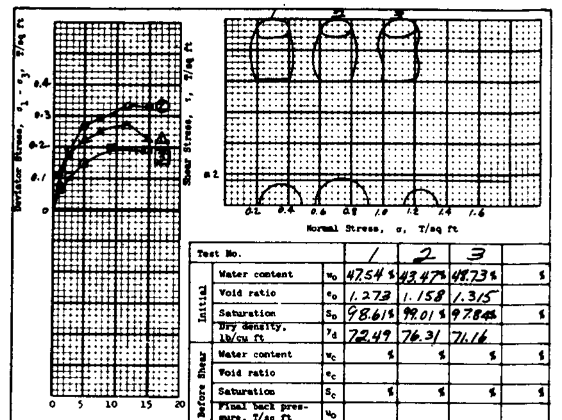


Test No.		1	2	3	
Initial: Water content	w_o	111.17%	109.65%	113.17%	%
Void ratio	e_o	2.818	2.806	2.933	
Saturation	S_o	100.00%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	42.49	42.63	41.24	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.14	0.50	1.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.36	0.38	0.43	
Time to failure, min	t_f	6.08	15.65	18.61	
Rate of strain, percent/min		0.67	0.26	0.64	
Wet density, lb/cu ft.		89.74	89.38	87.93	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.195 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification So(Gr&brGr)CH4 OA; lns silt;dw;rt
LL 149 PL 40 PI 109 G_s 2.6027
Remarks NOD Testing Section
Project M.R.L. Below N.O. - Hurr. Prot.- N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70' Rt. of Levee C/L
Boring No. 30-CUTP Sample No. 4-D
Depth 13.7 El -6.7 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

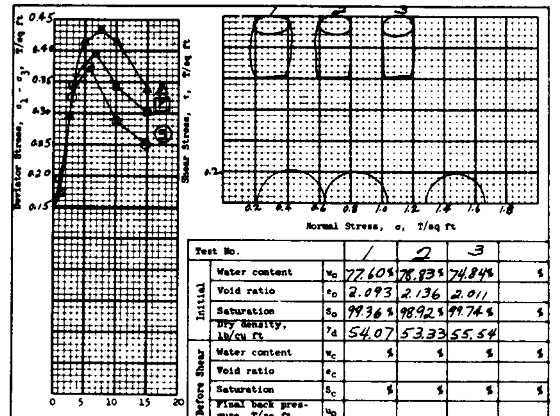


Test No.		1	2	3	
Initial: Water content	w_o	47.54%	43.47%	48.73%	%
Void ratio	e_o	1.273	1.158	1.315	
Saturation	S_o	98.61%	99.01%	97.84%	%
Dry density, lb/cu ft	γ_d	72.49	76.31	71.16	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
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	$(\sigma_1-\sigma_3)_{max}$	0.28	0.34	0.20	
Time to failure, min	t_f	17.20	17.54	13.37	
Rate of strain, percent/min		0.67	0.66	0.67	
Wet density, lb/cu ft.		106.94	109.48	105.84	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.16 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification So(Gr)CL6;lns & alt thin lys ML; dw;few org stks
LL 42 PL 19 PI 23 G_s 2.6430
Remarks NOD Testing Section
Project M.R.L. Below N.O.- Hurr. Prot. - N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70'Rt. of Levee C/L
Boring No. 30-CUTP Sample No. 5-C
Depth 16.9 El -9.9 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

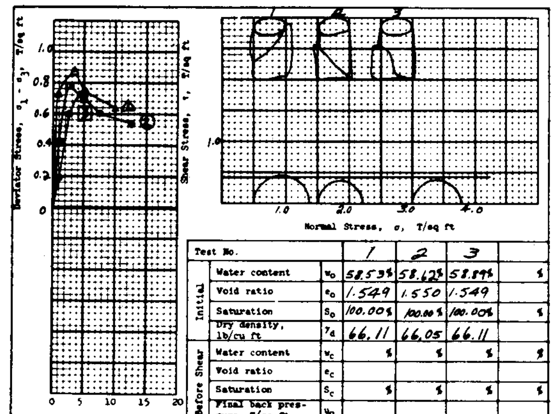


Test No.		1	2	3	
Initial: Water content	w_o	77.60%	78.83%	74.84%	%
Void ratio	e_o	2.093	2.136	2.011	
Saturation	S_o	99.36%	98.92%	99.74%	%
Dry density, lb/cu ft	γ_d	54.07	53.33	55.54	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.21	0.64	1.29	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.43	0.39	0.37	
Time to failure, min	t_f	10.63	9.59	8.25	
Rate of strain, percent/min		0.69	0.68	0.69	
Wet density, lb/cu ft		96.03	95.37	97.11	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.20 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification So(Gr)CH4;lns silt;dw;few slf;org ars
LL 99 PL 30 PI 69 G_s 2.6848
Remarks NOD Testing Section
Project M.R.L. Below N.O.- Hurr. Prot. - N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70' Rt. of Levee C/L
Boring No. 30-CUTP Sample No. 9-B
Depth 32.1 El -25.1 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

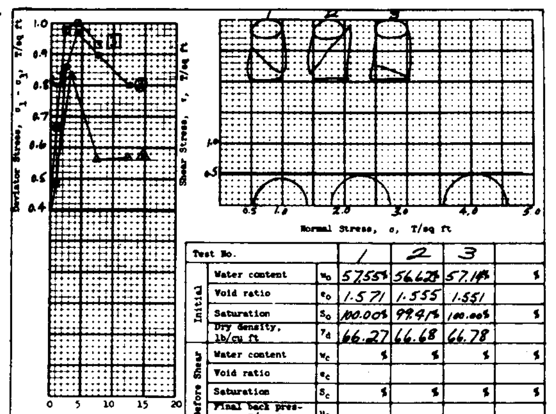


Test No.		1	2	3	
Initial: Water content	w_o	58.53%	58.62%	58.89%	%
Void ratio	e_o	1.549	1.550	1.549	
Saturation	S_o	100.00%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	66.11	66.05	66.11	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.89	0.73	0.79	
Time to failure, min	t_f	5.28	15.88	9.80	
Rate of strain, percent/min		0.67	0.27	0.27	
Wet density, lb/cu ft		104.81	104.78	105.04	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.405 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr&dGr)CH4;few lns silt
LL 81 PL 29 PI 52 G_s 2.7084
Remarks NOD Testing Section
Project M.R.L. Below N.O.-Hurr. Prot.- N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70' Rt. of Levee C/L
Boring No. 30-CUTP Sample No. 18-B
Depth 68.1 El -61.1 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

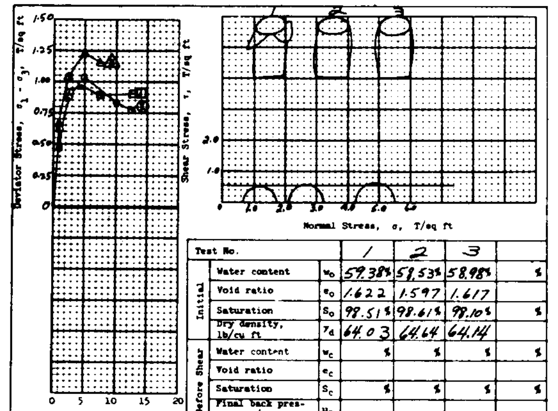


Test No.		1	2	3	
Initial: Water content	w_o	57.55%	56.62%	57.14%	%
Void ratio	e_o	1.571	1.555	1.551	
Saturation	S_o	100.00%	99.41%	100.00%	%
Dry density, lb/cu ft	γ_d	66.27	66.68	66.78	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.57	1.79	3.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.84	0.97	1.04	
Time to failure, min	t_f	5.25	16.28	16.21	
Rate of strain, percent/min		0.68	0.26	0.27	
Wet density, lb/cu ft.		104.41	104.43	104.94	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.52 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr)CH4;few lns ML
LL 85 PL 29 PI 56 G_s 2.7307
Remarks NOD Testing Section
Project M.R.L. Below N.O.-Hurr. Prot.- N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70' Rt. of Levee C/L
Boring No 30-CUTP Sample No. 22-B
Depth 83.9 El -76.9 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

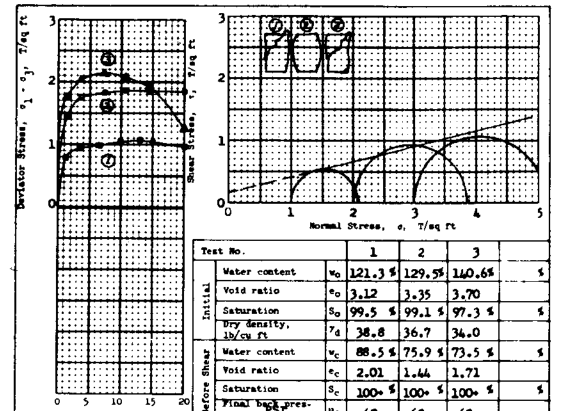


Test No.		1	2	3	
Initial: Water content	w_o	59.38%	59.53%	58.98%	%
Void ratio	e_o	1.622	1.597	1.617	
Saturation	S_o	98.51%	98.61%	98.10%	%
Dry density, lb/cu ft	γ_d	64.03	64.64	64.14	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.71	2.14	4.29	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.99	1.04	1.23	
Time to failure, min	t_f	6.58	19.27	19.01	
Rate of strain, percent/min		0.66	0.26	0.27	
Wet density, lb/cu ft		102.05	102.47	101.96	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.60 T/sq ft
Method of saturation ____
[ ] Controlled stress
[X] Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns&few lys ML
LL 78 PL 29 PI 49 G_s 2.6851
Remarks NOD Testing Section
Project M.R.L. Below N.O. - Hurr. Prot.- N.O. to Venice, La. Reach "C" GDM
Area Sta. 14+06 70' Rt. of Levee C/L
Boring No. 30-CUTP Sample No. 26-B
Depth 100.2 El -93.2 Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H

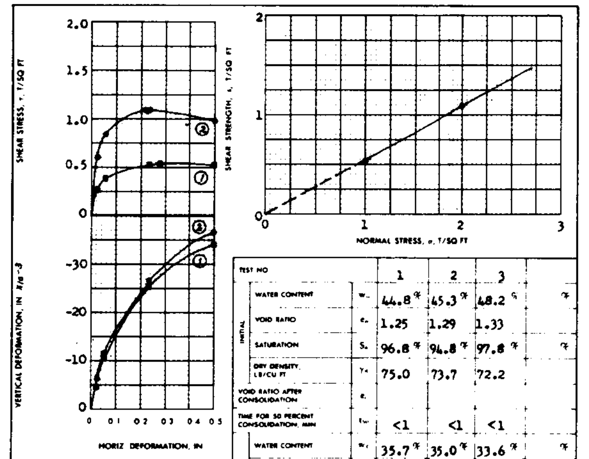


Test No.		1	2	3	
Initial: Water content	w_o	121.3 %	129.5%	140.6%	%
Void ratio	e_o	3.12	3.35	3.70	
Saturation	S_o	99.5 %	99.1 %	97.3 %	%
Dry density, lb/cu ft	γ_d	38.8	36.7	34.0	
Before Shear: Water content	w_c	88.5 %	75.9 %	73.5 %	%
Void ratio	e_c	2.01	1.44	1.71	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	68	68	68	
Dry density lb/cu ft	γ_d	53.1	65.4	59.0	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	1.06	1.87	2.13	
Time to failure, min	t_f	266	214	142	
Rate of strain, percent/min		0.05	0.05	0.05	
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	

Axial Strain, %

Shear Strength Parameters
ϕ = 14 °
tan ϕ = 0.249
c = 0.18 T/sq ft
Method of saturation BP
[ ] Controlled stress
[x] Controlled strain

Type of test R Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains 1/16" to 1/2" dia. roots
LL 186 PL 37 PI 149 G_s 2.56
Remarks
Project NEW ORLEANS TO VENICE, LA. - '69 REACH "C", GDM
Area STA. 14+06, 70' R of levee ℄
Boring No. 30-CUTP Sample No. 4-C
El -5.7 Date 23 July 1969
TES TRIAXIAL COMPRESSION TEST REPORT

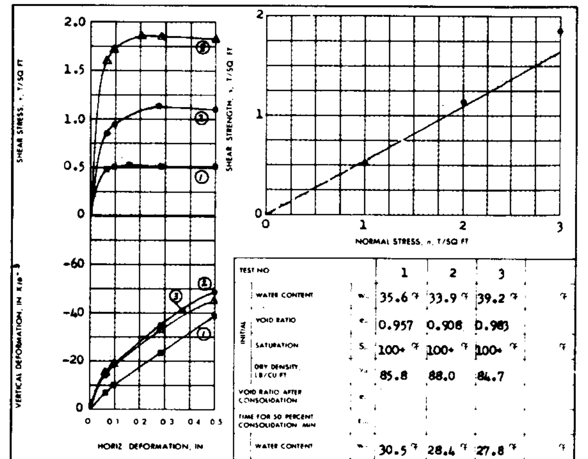


TEST NO		1	2	3	
Initial: Water content	w_o	44.8 %	45.3 %	48.2 %	%
Void ratio	e_o	1.25	1.29	1.33	
Saturation	S_o	96.8 %	94.8 %	97.8 %	%
Dry density, lb/cu ft	γ_d	75.0	73.7	72.2	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}	<1	<1	<1	
Final: Water content	w_f	35.7 %	35.0 %	33.6 %	%
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}	0.53	1.09	*	
Actual time to failure, min	t_f	1560	1200		
Rate of strain, in/min		.00018	.00018		
Ultimate shear stress, T/sq ft	τ_{ult}				

Horiz deformation, in

Shear strength parameters
ϕ = 29°
tan ϕ = 0.554
c = 0 T/sq ft
[ ] Controlled stress
[X] Controlled strain

Type of specimen UNDISTURBED 3.00 in square 0.557 in thick
Classification LEAN CLAY (CL), gray, homogeneous
LL 47 PL 23 PI 24 G 2.70
Remarks * Shear Stress not recorded; equipment malfunction
Project NEW ORLEANS TO VENICE, LA. - 1969 REACH "C" ; GDM
Area Sta. 14+06 ; 70' Right of Levee ℄
Boring No 30-CUTP Sample No 5-B
El -9.0 Date 5 August 1969
GDA DIRECT SHEAR TEST REPORT

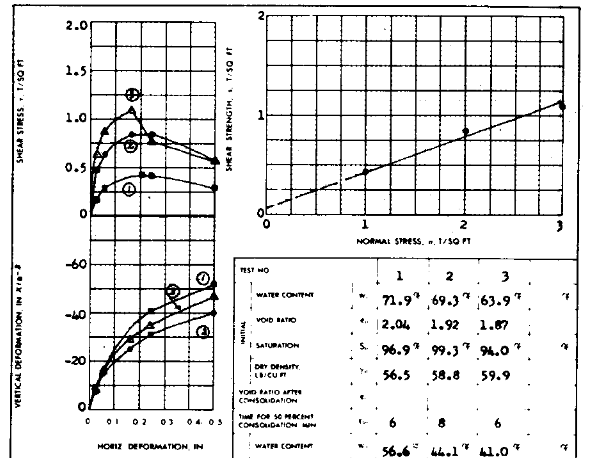


TEST NO		1	2	3	
Initial: Water content	w_o	35.6 %	33.9 %	39.2 %	%
Void ratio	e_o	0.957	0.908	0.983	
Saturation	S_o	100+ %	100+ %	100+ %	%
Dry density, lb/cu ft	γ_d	85.8	88.0	84.7	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}				
Final: Water content	w_f	30.5 %	28.4 %	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}	0.52	1.13	1.86	
Actual time to failure, min	t_f	660	1290	900	
Rate of strain, in/min		.00020	.00020	.00020	
Ultimate shear stress, T/sq ft	τ_{ult}				

Horiz deformation, in

Shear strength parameters
ϕ = 29°
tan ϕ = 0.554
c = 0 T/sq ft
[ ] Controlled stress
[X] Controlled strain

Type of specimen UNDISTURBED 3.00 in square 0.550 in thick
Classification SILT (ML), gray
LL 34 PL 24 PI 10 G 2.69
Remarks
Project NEW ORLEANS TO VENICE, LA. - 1969 REACH "C"; GDM
Area Sta. 14+06; 70' Right of Levee ℄
Boring No 30-CUTP Sample No 6-C
El -13.9 Date 4 August 1969
WJH DIRECT SHEAR TEST REPORT



TEST NO		1	2	3	
Initial: Water content	w_o	71.9 %	69.3 %	63.9 %	%
Void ratio	e_o	2.04	1.92	1.87	
Saturation	S_o	96.9 %	99.3 %	94.0 %	%
Dry density, lb/cu ft	γ_d	56.5	58.8	59.9	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}	6	8	6	
Final: Water content	w_f	56.6 %	44.1 %	41.0 %	%
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}	0.42	0.84	1.09	
Actual time to failure, min	t_f	1140	900	900	
Rate of strain, in/min		.00019	.00019	.00019	
Ultimate shear stress, T/sq ft	τ_{ult}				

Horiz deformation, in

Shear strength parameters
ϕ = 20°
tan ϕ = 0.364
c = 0.06 T/sq ft
[ ] Controlled stress
[X] Controlled strain

Type of specimen UNDISTURBED 1: 3.00 / 2 & 3: 3.00 in square 0.557 / 0.625 in thick
Classification PLASTIC CLAY, (CH), gray, contains sandy silt strata with clay *
LL 72 PL 25 PI 47 G 2.75
Remarks * in unused portion of sample
Project NEW ORLEANS TO VENICE, LA. - 1969
Area
Boring No 30-CUTP Sample No 10-A
El -28.4 Date 6 August 1969
GDA DIRECT SHEAR TEST REPORT

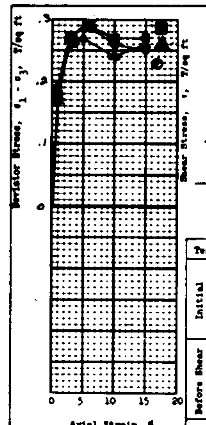
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

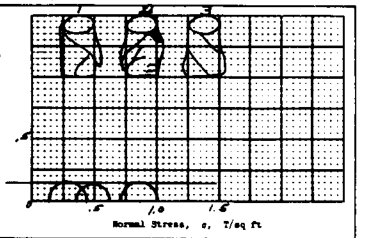
DETAIL SHEAR STRENGTH DATA BORING 30 CUTP

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE 28

TRIAXIAL COMPRESSION TEST REPORT — Sample 3-D2

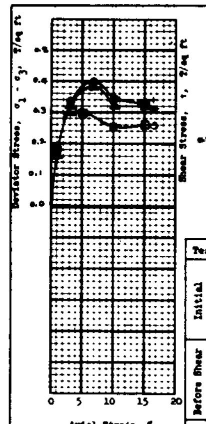


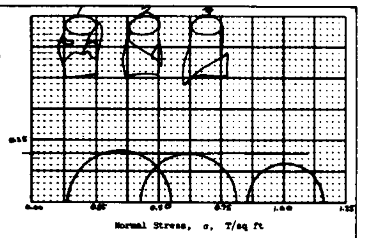


Test No.		1	2	3	
Initial: Water content	w_o	80.03%	81.86%	84.96%	%
Void ratio	e_o	2.239	2.288	2.418	
Saturation	S_o	96.85%	96.97%	95.19%	%
Dry density, lb/cu ft	γ_d	52.20	51.44	49.46	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.14	0.36	0.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.29	0.27	0.29	
Time to failure, min	t_f	8.38	6.99	8.22	
Rate of strain, percent/min		0.68	0.69	0.69	
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°; tan φ = 0; c = 0.146 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification So(Gr&Br,CH4;lns ML;dw;org ars
LL 107 — PL 31 — PI 76 — G_s 2.7089
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr.Prot.N.O.to Venice,La. Reach "C" GDM
Area 303+05-60'Lt.of C.L. Levee
Boring No. 8-CUT — Sample No. 3-D2
Depth 10.1 — El -4.1 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 4-D

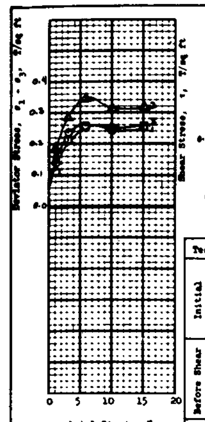


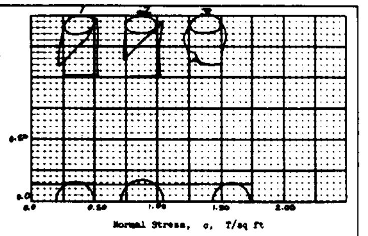


Test No.		1	2	3	
Initial: Water content	w_o	217.7%	234.26%	209.75%	%
Void ratio	e_o	5.276	5.698	5.037	
Saturation	S_o	97.38%	97.00%	98.84%	%
Dry density, lb/cu ft	γ_d	23.46	21.98	24.39	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
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	$(\sigma_1-\sigma_3)_{max}$	0.40	0.38	0.30	
Time to failure, min	t_f	9.38	9.49	4.66	
Rate of strain, percent/min		0.69	0.69	0.69	
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°; tan φ = 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(Gr&Br, CH 4 OC lns ML;dw
LL 169 — PL 45 — PI 124 — G_s 2.3644
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr.Prot. N.O. to Venice,La. Reach "C" GDM
Area 303+05-60'Lt.of C.L. Levee
Boring No. 8-CUT — Sample No. 4-D
Depth 13.5 — El -7.5 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 8-C

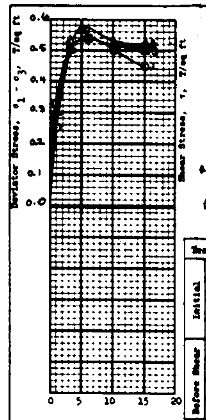


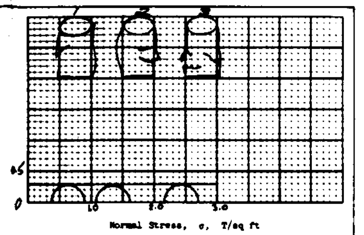


Test No.		1	2	3	
Initial: Water content	w_o	66.36%	66.82%	65.43%	%
Void ratio	e_o	1.810	1.830	1.783	
Saturation	S_o	97.52%	97.10%	97.61%	%
Dry density, lb/cu ft	γ_d	59.07	58.64	59.64	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.21	0.71	1.43	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.26	0.34	0.26	
Time to failure, min	t_f	8.20	8.30	8.29	
Rate of strain, percent/min		0.69	0.69	0.69	
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°; tan φ = 0; c = 0.13 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification So(dGr)CH4;lns&ars ML;few slf
LL 81 — PL 24 — PI 57 — G_s 2.6596
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area 303+05-60' Lt. of C.L. Levee
Boring No. 8-CUT — Sample No. 8-C
Depth 28.7 — El -22.7 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 13-B

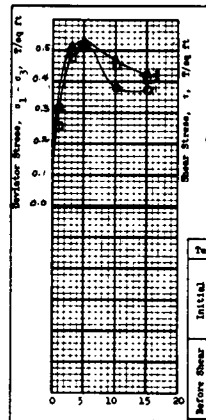


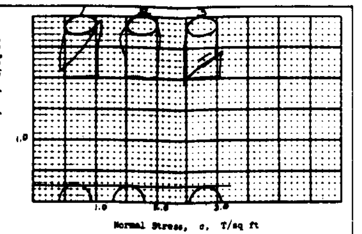


Test No.		1	2	3	
Initial: Water content	w_o	52.67%	51.29%	52.86%	%
Void ratio	e_o	1.457	1.396	1.479	
Saturation	S_o	97.24%	98.85%	96.84%	%
Dry density, lb/cu ft	γ_d	68.31	70.06	67.71	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.36	1.07	2.14	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.54	0.57	0.54	
Time to failure, min	t_f	8.39	7.31	8.45	
Rate of strain, percent/min		0.69	0.68	0.68	
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°; tan φ = 0; c = 0.28 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification So(Gr)CH3;lns&alt lys ML;
LL 62 — PL 23 — PI 39 — G_s 2.6868
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr.Prot. N.O. to Venice, La. Reach "C" GDM
Area 303+05-60'Lt. of C.L.
Boring No 8-CUT — Sample No. 13-B
Depth 48.3 — El -42.3 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 15-C

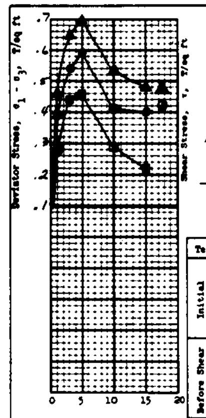


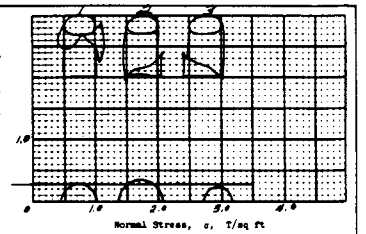


Test No.		1	2	3	
Initial: Water content	w_o	55.16%	55.40%	52.26%	%
Void ratio	e_o	1.565	1.556	1.496	
Saturation	S_o	95.33%	96.49%	94.70%	%
Dry density, lb/cu ft	γ_d	65.92	66.16	67.77	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.43	1.29	2.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.51	0.53	0.51	
Time to failure, min	t_f	7.33	7.29	7.37	
Rate of strain, percent/min		0.68	0.68	0.67	
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°; tan φ = 0; c = 0.26 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification M(Gr&dGr)CH4;lns &few thin lys ML
LL 79 — PL 25 — PI 54 — G_s 2.7086
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr.Prot. N.O. to Venice,La. Reach "C" GDM
Area 303+05-60'Lt. of C.L. Levee
Boring No. 8-CUT — Sample No. 15-C
Depth 57.1 — El -51.1 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 16-C

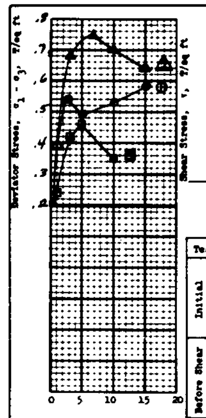


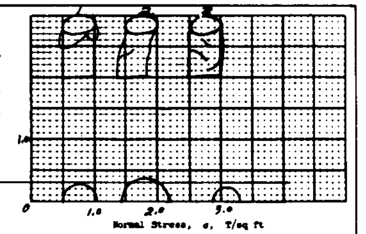


Test No.		1	2	3	
Initial: Water content	w_o	56.51%	59.01%	57.87%	%
Void ratio	e_o	1.610	1.634	1.636	
Saturation	S_o	93.82%	94.75%	94.41%	%
Dry density, lb/cu ft	γ_d	63.82	63.23	63.19	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.43	1.36	2.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.59	0.70	0.46	
Time to failure, min	t_f	7.45	7.44	7.14	
Rate of strain, percent/min		0.68	0.68	0.69	
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°; tan φ = 0; c = 0.28 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns ML;org stks
LL 93 — PL 30 — PI 63 — G_s 2.6724
Remarks NOD Testing Section
Project M.R.L. below N.O. Hurr.Prot. N.O. to Venice,La. Reach "C" GDM
Area 303+05-60" Lt. of C.L. Levee
Boring No. 8-CUT — Sample No. 16-C
Depth 60.9 — El -54.9 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 17-D

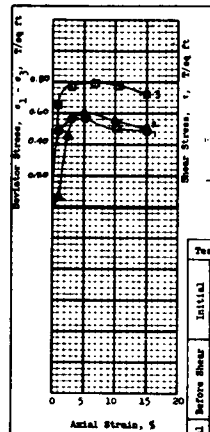


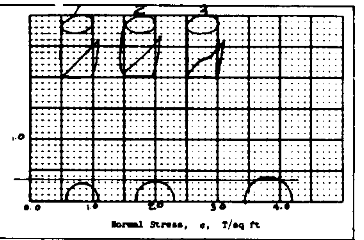


Test No.		1	2	3	
Initial: Water content	w_o	62.18%	59.35%	60.38%	%
Void ratio	e_o	1.714	1.667	1.688	
Saturation	S_o	97.62%	95.80%	96.24%	%
Dry density, lb/cu ft	γ_d	61.86	62.95	62.44	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.50	1.43	2.86	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.54	0.75	0.46	
Time to failure, min	t_f	3.94	25.22	18.30	
Rate of strain, percent/min		0.66	0.26	0.27	
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°; tan φ = 0; c = 0.30 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification So(dGr)CH3;lns & lys ML
LL 91 — PL 28 — PI 63 — G_s 2.6926
Remarks NOD Testing Section
Project M.R.L. below N.O. Hurr.Prot. N.O. to Venice,La.Reach "C" GDM
Area 303+05-60'Lt. of C.L. Levee
Boring No. 8-CUT — Sample No. 17-D
Depth 65.9 — El -59.9 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 21-D

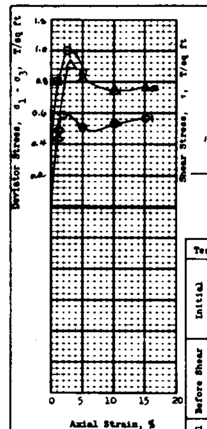


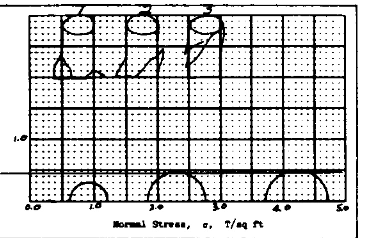


Test No.		1	2	3	
Initial: Water content	w_o	46.22%	49.09%	46.6%	%
Void ratio	e_o	1.311	1.365	1.319	
Saturation	S_o	95.19%	97.10%	95.43%	%
Dry density, lb/cu ft	γ_d	72.90	71.23	72.66	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.57	1.71	3.43	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.56	0.60	0.78	
Time to failure, min	t_f	4.99	7.13	9.79	
Rate of strain, percent/min		0.68	0.69	0.68	
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°; tan φ = 0; c = 0.35 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification M(dGr)CH4; few lns ML
LL 77 — PL 25 — PI 52 — G_s 2.6984
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr.Prot. N.O. to Venice, La. Reach "C" GDM
Area 303+05-60' Lt. of C.L. Levee
Boring No. 8-CUT — Sample No. 21-D
Depth 81.8 — El -75.8 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 23-B

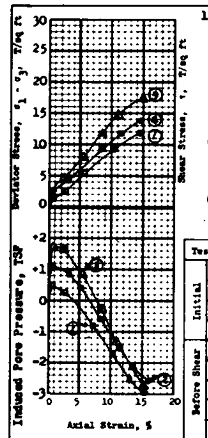


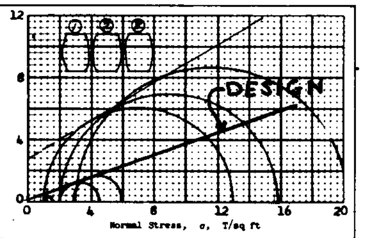


Test No.		1	2	3	
Initial: Water content	w_o	50.54%	49.92%	50.19%	%
Void ratio	e_o	1.386	1.375	1.378	
Saturation	S_o	98.84%	98.43%	98.73%	%
Dry density, lb/cu ft	γ_d	70.88	71.21	71.12	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.64	1.86	3.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.59	0.91	1.00	
Time to failure, min	t_f	2.77	13.28	10.03	
Rate of strain, percent/min		0.66	0.26	0.27	
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°; tan φ = 0; c = 0.45 T/sq ft
Method of saturation ______
☐ Controlled stress ☒ Controlled strain
Type of test "Q" — Type of specimen 5" Undisturbed
Classification M(dGr)CH4;few lns ML
LL 78 — PL 26 — PI 52 — G_s 2.7101
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr.Prot. N.O. to Venice, La. Reach "C" GDM
Area 303+05-60' Lt. of C.L. Levee
Boring No. 8-CUT — Sample No. 23-B
Depth 88.1 — El -82.1 — Date 29 July 69
TRIAXIAL COMPRESSION TEST REPORT 07H

TRIAXIAL COMPRESSION TEST REPORT — Sample 11-C

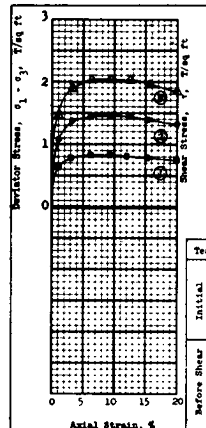


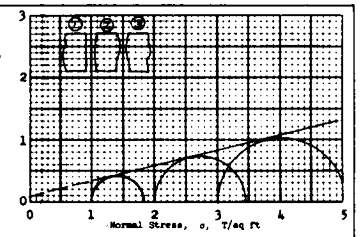


Test No.		1	2	3	
Initial: Water content	w_o	30.3 %	31.0 %	30.5 %	%
Void ratio	e_o	0.836	0.853	0.830	
Saturation	S_o	97.1 %	97.4 %	98.5 %	%
Dry density, lb/cu ft	γ_d	91.1	90.3	91.4	
Before Shear: Water content	w_c	30.5 %	32.3 %	31.7 %	%
Void ratio	e_c	0.853	0.793	0.765	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	38	38	38	
Dry density lb/cu ft	γ_d	92.7	93.3	94.8	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	11.93	13.83	17.25	
Time to failure, min	t_f	115	115	125	
Rate of strain, percent/min		0.13	0.13	0.12	
+ $\sigma_1 - \sigma_3$		1.5	2.5	3	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.39	1.39	1.38	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters *: + φ = 20°; tan φ = 0.364; c = 0.15 T/sq ft
Method of saturation BP
☐ Controlled stress ☒ Controlled strain
Type of test R — Type of specimen UNDISTURBED
Classification SILT (ML), gray, contains layers of CLAY (CL), 3/4" in dia.
LL 30 — PL 25 — PI 5 — G_s 2.68
Remarks * See attached plot for effective values. + Based on Max. Pore Press. Portion of sample allowed to drain before trimming
Project NEW ORLEANS TO VENICE, LA. - 1969 REACH C, GDM
Area
Boring No. 8-CUT — Sample No. 11-C
Depth / El -35.0 — Date 14 July 1969
TES TRIAXIAL COMPRESSION TEST REPORT

TRIAXIAL COMPRESSION TEST REPORT — Sample 14-C

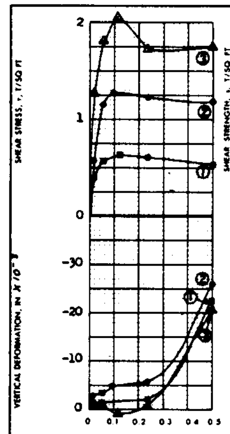


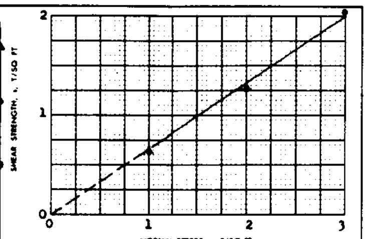


Test No.		1	2	3	
Initial: Water content	w_o	45.0 %	44.7 %	44.8 %	%
Void ratio	e_o	1.20	1.20	1.19	
Saturation	S_o	100+ %	100+ %	100+ %	%
Dry density, lb/cu ft	γ_d	76.3	76.5	76.8	
Before Shear: Water content	w_c	41.3 %	36.2 %	34.1 %	%
Void ratio	e_c	1.09	0.937	0.850	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	50	50	50	
Dry density lb/cu ft	γ_d	80.4	86.7	90.8	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.82	1.45	2.03	
Time to failure, min	t_f	678	1044	700	
Rate of strain, percent/min		0.009	0.009	0.009	
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 = 14°; tan φ = 0.249; c = 0.10 T/sq ft
Method of saturation BP
☐ Controlled stress ☒ Controlled strain
Type of test R — Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, homogeneous
LL 57 — PL 21 — PI 36 — G_s 2.69
Remarks
Project NEW ORLEANS TO VENICE, LA. - 1969 REACH C, GDM
Area
Boring No. 8-CUT — Sample No. 14-C
Depth / El -46.9 — Date 16 July 1969
JL TRIAXIAL COMPRESSION TEST REPORT

DIRECT SHEAR TEST REPORT — Sample 10-B

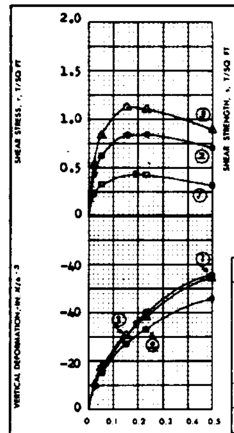


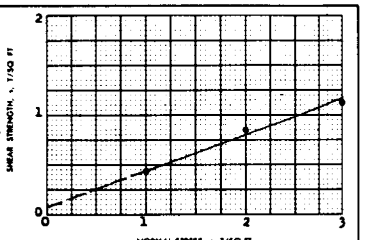


TEST NO		1	2	3	
Initial: WATER CONTENT	w_o	22.0%	22.7%	22.8%	%
VOID RATIO	e_o	0.663	0.680	0.680	
SATURATION	S_o	88.9%	89.5%	89.8%	%
DRY DENSITY, LB/CU FT	γ_d	100.6	99.6	99.6	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
Final: WATER CONTENT	w_f	20.5%	19.7%	22.6%	%
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}	0.63	1.27	2.07	
ACTUAL TIME TO FAILURE, MIN	t_f	720	600	660	
RATE OF STRAIN, IN./MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: φ = 34°; TAN φ = 0.670; 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), gray
LL - — PL - — PI - — G_s 2.68
REMARKS
PROJECT NEW ORLEANS TO VENICE, LA. - 1969 REACH C, GDM
AREA
BORING NO 8-CUT — SAMPLE NO 10-B
DEPTH / EL -30.0 — DATE 14 JULY 1969
WJH&GDA DIRECT SHEAR TEST REPORT

DIRECT SHEAR TEST REPORT — Sample 14-D





TEST NO		1	2	3	
Initial: WATER CONTENT	w_o	63.6%	62.5%	63.6%	%
VOID RATIO	e_o	1.75	1.74	1.76	
SATURATION	S_o	98.5%	97.3%	97.9%	%
DRY DENSITY, LB/CU FT	γ_d	61.5	61.7	61.3	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	2	3	3	
Final: WATER CONTENT	w_f	56.4%	48.7%	45.1%	%
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}	0.43	0.84	1.12	
ACTUAL TIME TO FAILURE, MIN	t_f	1080	900	900	
RATE OF STRAIN, IN./MIN		.00019	.00019	.00019	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

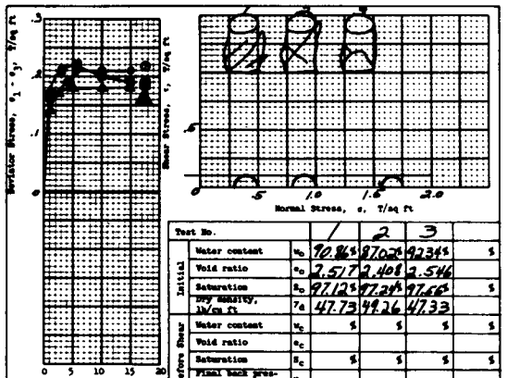
SHEAR STRENGTH PARAMETERS: φ = 20°; TAN φ = 0.364; c = 0.08 T/SQ FT
☐ CONTROLLED STRESS ☒ CONTROLLED STRAIN
TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.550 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), gray, homogeneous
LL - — PL - — PI - — G_s 2.71 Est.
REMARKS
PROJECT NEW ORLEANS TO VENICE, LA. - 1969 REACH D, GDM
AREA
BORING NO 8-CUT — SAMPLE NO 14-D
DEPTH / EL -47.8 — DATE 16 July 1969
WJH DIRECT SHEAR TEST REPORT

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C—PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 8 CUT

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 — FILE NO. H-2-25527

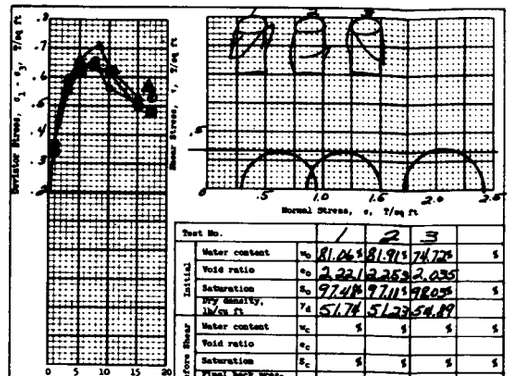
PLATE 29



Test No.			1	2	3	
Initial	Water content	w_o	70.8%	87.0%	92.3%	%
	Void ratio	e_o	2.517	2.408	2.546	
	Saturation	S_o	97.1%	97.2%	97.6%	%
	Dry density, lb/cu ft	γ_d	47.73	49.26	47.33	
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	0.29	0.71	1.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		0.21	0.22	0.18	
Time to failure, min		t_f	8.41	8.51	7.22	
Rate of strain, percent/min			0.67	0.66	0.67	
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°
$\tan\phi$ = 0
c = 0.10 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

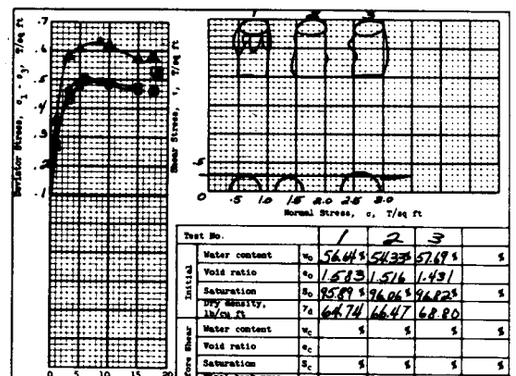
Type of test Q | Type of specimen 5" Undisturbed
Classification vSo(Gr&Br,CH4; lns ML;dw;lg org ars
LL 119 | PI 35 | PI 84 | σ_o 2.6850
Remarks NOD TESTING SECTION
Project M.R.L. Below N.O. Hurr. Prot.N.O. to Venice, La. Reach "C" GDM
Area Sta. 303+05 C/L Levee
Boring No. 8-CU | Sample No. 2-B
Depth 8.6 | Date 2 Jul 69
TRIAXIAL COMPRESSION TEST REPORT QTH



Test No.			1	2	3	
Initial	Water content	w_o	81.0%	81.9%	74.7%	%
	Void ratio	e_o	2.221	2.253	2.035	
	Saturation	S_o	97.4%	97.1%	98.0%	%
	Dry density, lb/cu ft	γ_d	51.74	51.23	54.89	
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	0.29	0.86	1.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		0.66	0.64	0.71	
Time to failure, min		t_f	11.27	11.25	12.51	
Rate of strain, percent/min			0.66	0.66	0.66	
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°
$\tan\phi$ = 0
c = 0.34 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

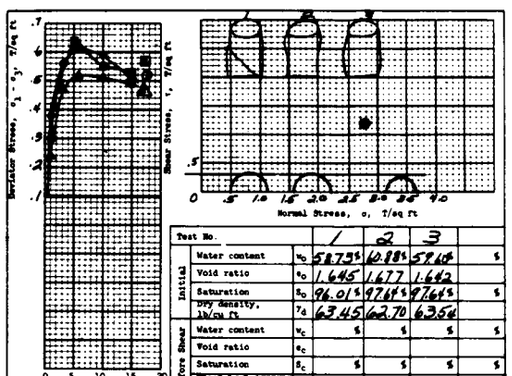
Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(dGr&Br,CH4; lns&ars ML; lg org ars;dw
LL 119 | PI 32 | PI 87 | σ_o 2.6745
Remarks NOD Testing Section
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice,La. Reach "C" GDM
Area Sta. 303+05 C/L Levee
Boring No. 8-CU | Sample No. 7-B
Depth 23.9 | Date 2 Jul 69
EL -10.6
TRIAXIAL COMPRESSION TEST REPORT QTH



Test No.			1	2	3	
Initial	Water content	w_o	56.4%	54.3%	57.6%	%
	Void ratio	e_o	1.583	1.514	1.491	
	Saturation	S_o	95.8%	96.0%	96.8%	%
	Dry density, lb/cu ft	γ_d	64.74	66.47	64.80	
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	0.36	1.14	2.29	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		0.51	0.49	0.63	
Time to failure, min		t_f	8.63	12.48	12.26	
Rate of strain, percent/min			0.67	0.66	0.67	
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°
$\tan\phi$ = 0
c = 0.28 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

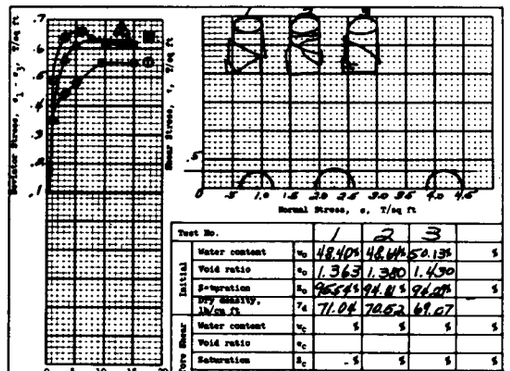
Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(Gr&dGr/CH4;lnsML;dw;slf;org ars
LL 76 | PI 23 | PI 53 | σ_o 2.6823
Remarks NOD Testing Section
Project M.R.L. below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 303 + 05 C/L Levee
Boring No. 8-CU | Sample No. 10-C
Depth 26.9 | Date 2 Jul 69
EL -23.6
TRIAXIAL COMPRESSION TEST REPORT QTH



Test No.			1	2	3	
Initial	Water content	w_o	58.7%	60.8%	58.4%	%
	Void ratio	e_o	1.645	1.677	1.682	
	Saturation	S_o	96.0%	97.4%	97.6%	%
	Dry density, lb/cu ft	γ_d	63.45	62.70	63.56	
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	0.50	1.57	3.14	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		0.62	0.64	0.52	
Time to failure, min		t_f	8.91	7.67	8.52	
Rate of strain, percent/min			0.65	0.66	0.67	
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°
$\tan\phi$ = 0
c = 0.30 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

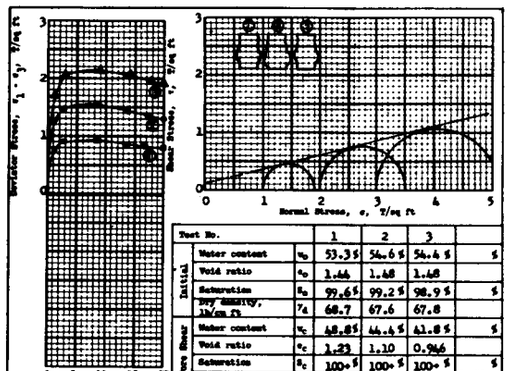
Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns&thin lys ML;
LL 89 | PI 25 | PI 64 | σ_o 2.6922
Remarks NOD Testing Section
Project M.R.L. below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 303+05 C/L Levee
Boring No. 8-CU | Sample No. 16-C
Depth 31.0 | Date 2 Jul 69
EL -47.8
TRIAXIAL COMPRESSION TEST REPORT QTH



Test No.			1	2	3	
Initial	Water content	w_o	48.4%	48.4%	50.1%	%
	Void ratio	e_o	1.363	1.380	1.490	
	Saturation	S_o	96.5%	94.1%	96.0%	%
	Dry density, lb/cu ft	γ_d	71.04	70.52	69.07	
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	0.64	1.93	3.86	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		0.55	0.66	0.63	
Time to failure, min		t_f	13.47	8.63	10.88	
Rate of strain, percent/min			0.67	0.67	0.68	
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°
$\tan\phi$ = 0
c = 0.30 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

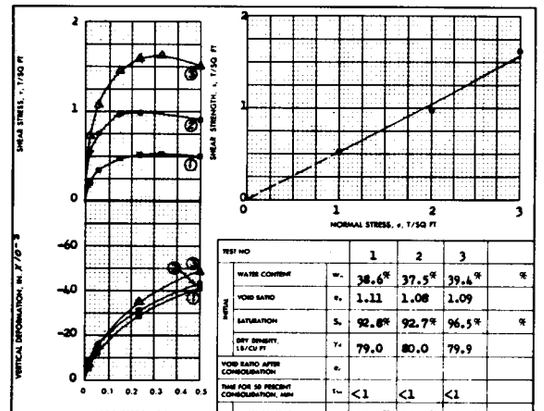
Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(dGr)CH4;few lns ML
LL 84 | PI 25 | PI 59 | σ_o 2.1637
Remarks NOD Testing Section
Project M.R.L. below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 303+05 C/L Levee
Boring No. 8-CU | Sample No. 21-D
Depth 31.0 | Date 2 Jul 69
EL -28.5
TRIAXIAL COMPRESSION TEST REPORT QTH



Test No.			1	2	3	
Initial	Water content	w_o	53.3%	54.6%	54.4%	%
	Void ratio	e_o	1.44	1.48	1.48	
	Saturation	S_o	99.6%	99.2%	98.9%	%
	Dry density, lb/cu ft	γ_d	68.7	67.6	67.8	
Before Shear	Water content	w_c	48.8%	44.4%	41.8%	%
	Void ratio	e_c	1.23	1.10	0.966	
	Saturation	S_c	100+%	100+%	100+%	%
	Final back pressure, PSI	u_b	60	60	60	
Final	Dry Density lb/cu ft	γ_f	75.2	79.9	86.3	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		0.91	1.52	2.12	
Time to failure, min		t_f	105	108	111	
Rate of strain, percent/min			0.08	0.08	0.08	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$					
Initial diameter, in.		D_o	1.40	1.40	3.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 14°
$\tan\phi$ = 0.249
c = 0.13 T/sq ft
Method of saturation MP
☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), grey, contains very thin silt laminations
LL 72 | PI 24 | PI 48 | σ_o 2.69
Remarks
Project NEW ORLEANS TO VENICE, LA. - 1969
REACH C, GDM
Area
Boring No. 8-CU | Sample No. 9-D
Depth -20.5 | Date 10 JULY 1969
EL
TRIAXIAL COMPRESSION TEST REPORT



TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	38.6%	37.5%	39.4%	%
	VOID RATIO	e_o	1.11	1.08	1.09	
	SATURATION	S_o	92.8%	92.7%	96.5%	%
	DRY DENSITY, LB/CU FT	γ_o	79.0	80.0	79.9	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
FINAL	WATER CONTENT	w_f	35.4%	32.8%	29.4%	%
	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}	0.52	0.98	1.62	
ACTUAL TIME TO FAILURE, MIN		t_f	1800	1320	1860	
RATE OF STRAIN, IN / MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

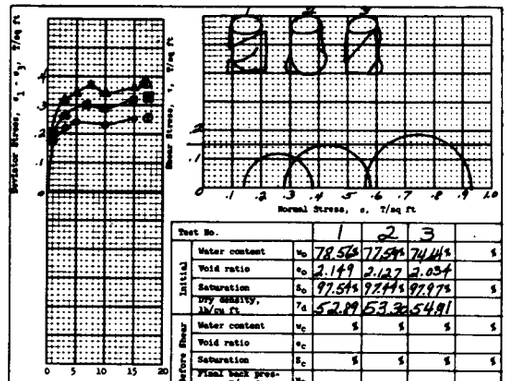
SHEAR STRENGTH PARAMETERS
ϕ = 28°
$\tan\phi$ = 0.532
c = 0 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.550 IN. THICK
CLASSIFICATION LEAN CLAY (CL), grey, contains small pockets of fine silty sand & s
LL 43 | PL 20 | PI 23 | σ_o 2.67
REMARKS * A trace of organic matter
PROJECT NEW ORLEANS TO VENICE,LA. - 1969
REACH C, GDM
AREA
BORING NO 8-CU | SAMPLE NO 13-D
DEPTH -36.3 | DATE 8 JULY 1969
WES DIRECT SHEAR TEST REPORT

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 8 CU

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527



Test No.			1	2	3	
Initial	Water content	w_o	78.5%	77.9%	74.4%	%
	Void ratio	e_o	2.149	2.127	2.034	
	Saturation	S_o	97.5%	97.4%	97.9%	%
	Dry density, lb/cu ft	γ_d	52.89	53.32	54.91	
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	0.28	0.56	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.24	0.30	0.37	
	Time to failure, min	t_f	7.21	9.55	10.58	
	Rate of strain, percent/min		0.67	0.68	0.69	
	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°, $\tan\phi$ = 0, c = 0.15 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(dGr&BrCH4;lns;ML;dw;rt;rts;lg org ars

LL 119 | PL 33 | PI 86 | G_s 2.6738

Remarks NOD TESTING SECTION

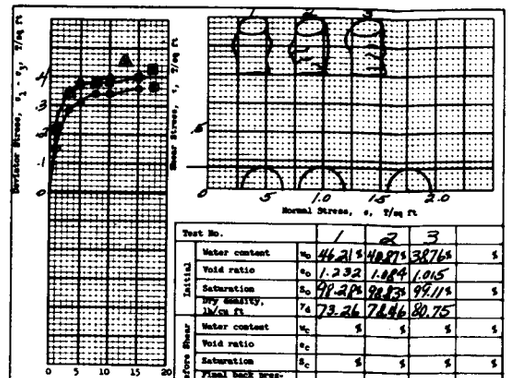
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM

Area Sta. 303+05 - 70'Rt. of Levee C.L.

Boring No. 8-CUTP | Sample No. 2-B

Depth 47.2 to 47.8 | Date 29 July 69

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	46.2%	48.8%	38.7%	%
	Void ratio	e_o	1.232	1.284	1.015	
	Saturation	S_o	98.2%	98.8%	99.1%	%
	Dry density, lb/cu ft	γ_d	73.26	72.86	80.75	
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	0.29	0.79	1.57	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.34	0.38	0.38	
	Time to failure, min	t_f	0.93	10.80	7.15	
	Rate of strain, percent/min		0.67	0.68	0.68	
	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°, $\tan\phi$ = 0, c = 0.19 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr&dGr)CH2;lns&lyrs;ML:org ars

LL 58 | PL 23 | PI 35 | G_s 2.6203

Remarks NOD Testing Section

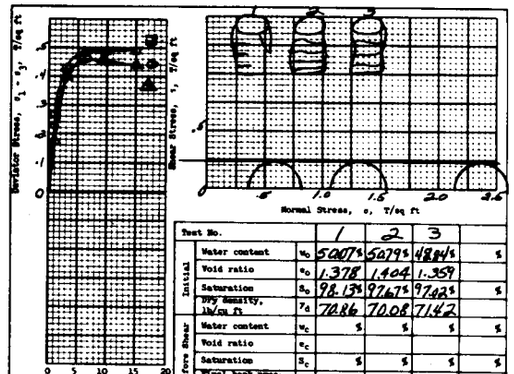
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM

Area 303+05-70' Rt. of Levee C.L.

Boring No. 8-CUTP | Sample No. 8-D

Depth 89.7 to 89.8 | Date 29 July 69

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	50.0%	50.7%	48.4%	%
	Void ratio	e_o	1.378	1.404	1.359	
	Saturation	S_o	98.1%	97.6%	97.0%	%
	Dry density, lb/cu ft	γ_d	70.86	70.08	71.42	
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	0.36	1.07	2.14	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.46	0.49	0.46	
	Time to failure, min	t_f	10.00	8.59	8.58	
	Rate of strain, percent/min		0.66	0.66	0.67	
	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°, $\tan\phi$ = 0, c = 0.23 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr)CH2;lns&lys;ML;org stks

LL 60 | PL 20 | PI 40 | G_s 2.7003

Remarks NOD TESTING SECTION

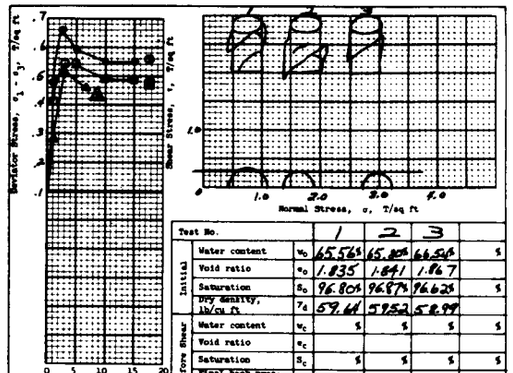
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM

Area 303+05 - 70'Rt of Levee C.L.

Boring No. 8-CUTP | Sample No. 13-B 1

Depth 81.6 | Date 29 July 69

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	65.5%	65.8%	66.5%	%
	Void ratio	e_o	1.835	1.841	1.867	
	Saturation	S_o	96.8%	96.8%	96.6%	%
	Dry density, lb/cu ft	γ_d	59.44	59.52	58.99	
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	0.43	1.36	2.71	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.66	0.54	0.61	
	Time to failure, min	t_f	3.83	12.59	12.19	
	Rate of strain, percent/min		0.69	0.27	0.28	
	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°, $\tan\phi$ = 0, c = 0.28 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

LL 94 | PL 27 | PI 67 | G_s 2.7098

Remarks NOD TESTING SECTION

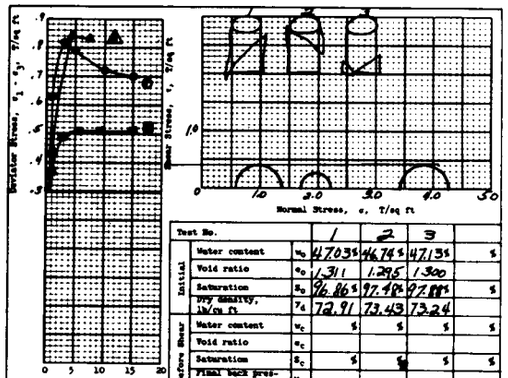
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM

Area Sta. 303+05 - 70' Rt. of Levee C.L.

Boring No. 8-CUTP | Sample No. 16-B

Depth 50.0 to 50.1 | Date 29 July 69

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	47.0%	46.7%	47.1%	%
	Void ratio	e_o	1.311	1.295	1.300	
	Saturation	S_o	96.8%	97.4%	97.8%	%
	Dry density, lb/cu ft	γ_d	72.91	73.43	73.24	
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	0.57	1.71	3.43	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.82	0.61	0.84	
	Time to failure, min	t_f	5.19	21.51	15.82	
	Rate of strain, percent/min		0.66	0.27	0.27	
	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°, $\tan\phi$ = .0087, c = 0.40 T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(dGr)CH3;few lns;ML;few org stks

LL 70 | PL 23 | PI 47 | G_s 2.6481

Remarks NOD Testing Section

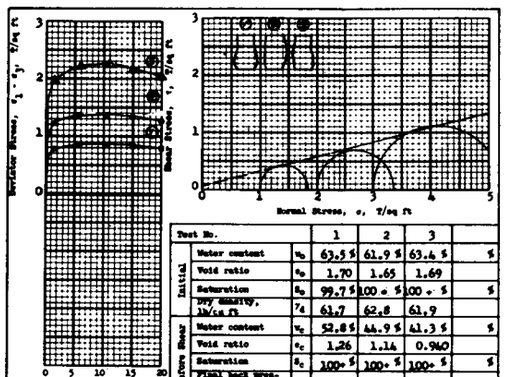
Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM

Area Sta. 303+05 - 70'Rt. of LEVEE C.L.

Boring No. 8-CUTP | Sample No. 21-C

Depth 61.0 to 75.1 | Date 29 July 69

TRIAXIAL COMPRESSION TEST REPORT



Test No.			1	2	3	
Initial	Water content	w_o	63.5%	61.9%	63.4%	%
	Void ratio	e_o	1.70	1.65	1.69	
	Saturation	S_o	99.7%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	61.7	62.8	61.9	
Before Shear	Water content	w_c	52.8%	44.9%	41.3%	%
	Void ratio	e_c	1.26	1.14	0.960	
	Saturation	S_c	100+%	100+%	100+%	%
	Final back pressure, PSI	u_b	60	60	60	
Final	Dry Density lb/cu ft	γ_d	73.7	77.9	85.9	
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.84	1.37	2.22	
	Time to failure, min	t_f	80	132	136	
	Rate of strain, percent/min		0.07	0.08	0.08	
	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	

Shear Strength Parameters: ϕ = 16°, $\tan\phi$ = 0.289, c = 0.08 T/sq ft

Method of saturation BP

☐ Controlled stress ☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains silt lenses & shell fragments

LL 80 | PL 25 | PI 55 | G_s 2.67

Remarks

Project NEW ORLEANS TO VENICE, LA. - 1969

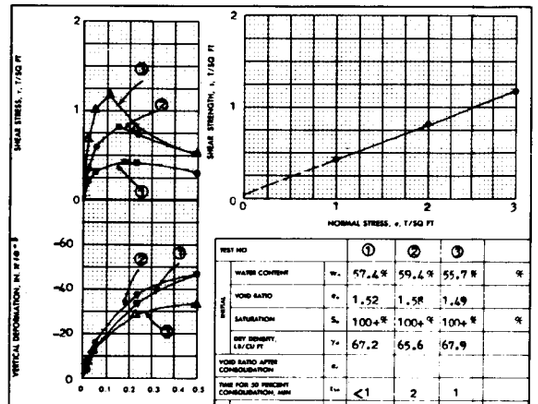
REACH C, GDM

Area

Boring No. 8-CUPT | Sample No. 8-B

Depth -22.0 | Date 10 JULY 1969

RCH TRIAXIAL COMPRESSION TEST REPORT



TEST NO			①	②	③	
INITIAL	WATER CONTENT	w_o	57.4%	59.4%	55.7%	%
	VOID RATIO	e_o	1.52	1.58	1.49	
	SATURATION	S_o	100+%	100+%	100+%	%
	DRY DENSITY LB/CU FT	γ_d	67.2	65.6	67.9	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	<1	2	1	
FINAL	WATER CONTENT	w_f	42.8%	40.1%	32.2%	%
	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}	0.43	0.81	1.18	
	ACTUAL TIME TO FAILURE, MIN	t_f	1020	900	660	
	RATE OF STRAIN, IN / MIN		.00018	.00018	.00018	
	ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: ϕ = 21°, $\tan\phi$ = 0.384, c = 0.05 T/SQ FT

☐ CONSOLIDATED STRESS ☒ CONSOLIDATED STRAIN

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

CLASSIFICATION PLASTIC CLAY (CH), gray

LL 54 | PL 21 | PI 33 | G_s 2.71

REMARKS Specimens 2 and 3 contained seams of fine silty sand

PROJECT NEW ORLEANS TO VENICE, LA.-1969

REACH "C" GDM

AREA

BORING NO 8-CUTP | SAMPLE NO 12-D

DEPTH -40.1 | DATE 9 July, 1969

WJH DIRECT SHEAR TEST REPORT

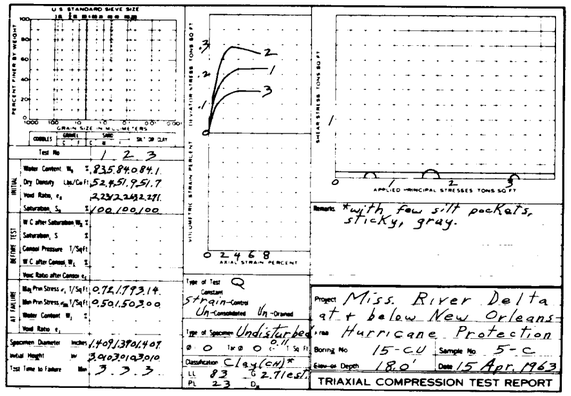
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

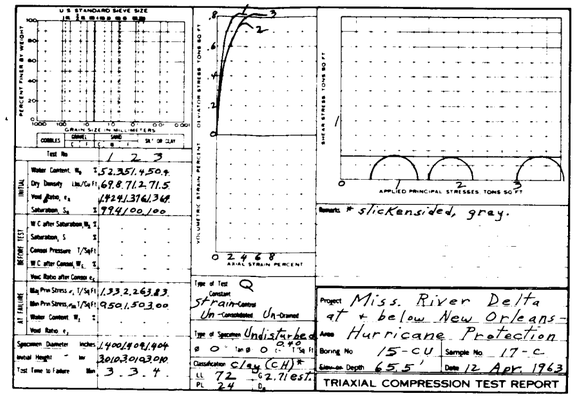
DETAIL SHEAR STRENGTH DATA
BORING 8 CUTP

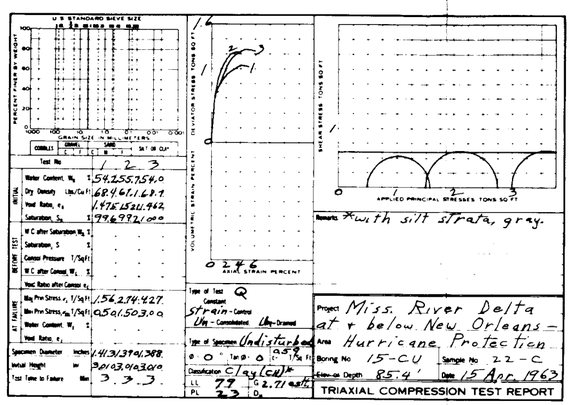
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

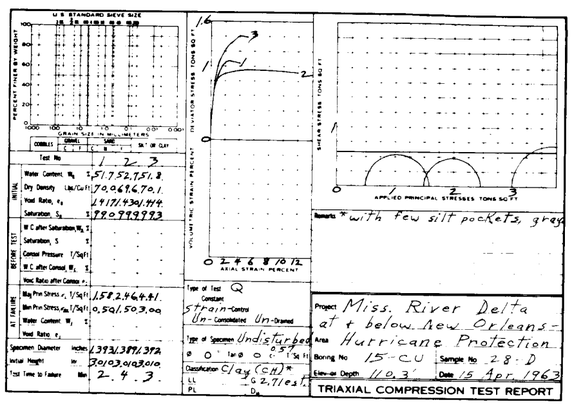
MARCH 1972 | FILE NO. H-2-25527

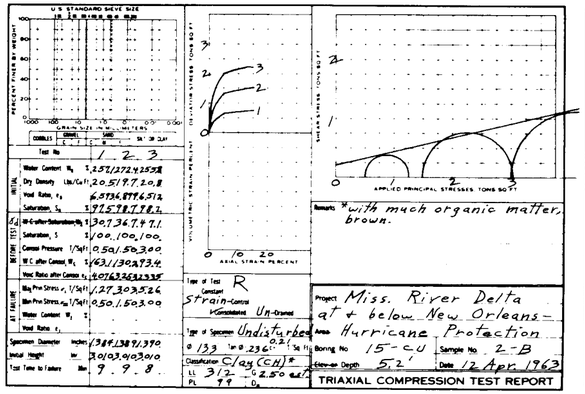
PLATE 31

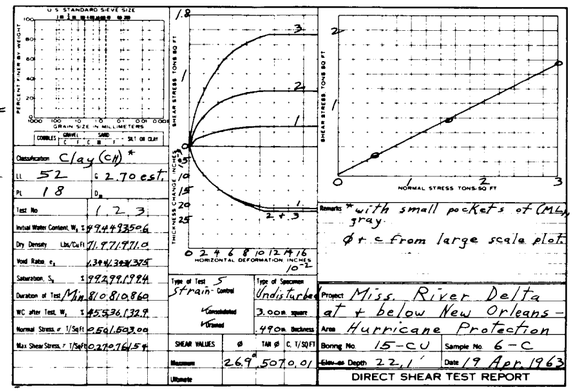


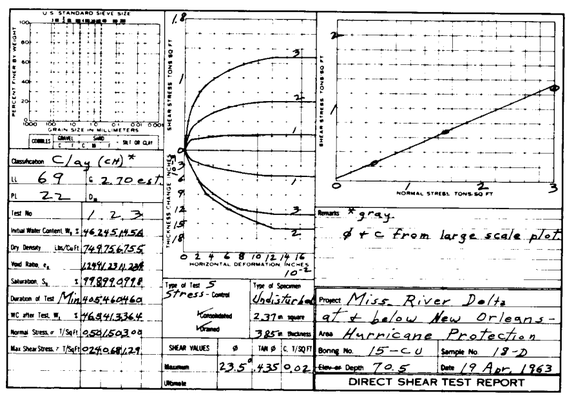


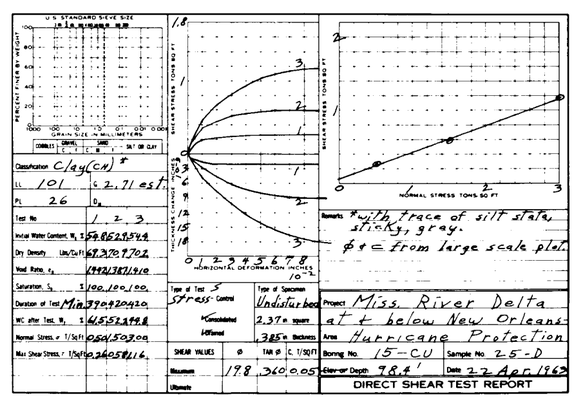










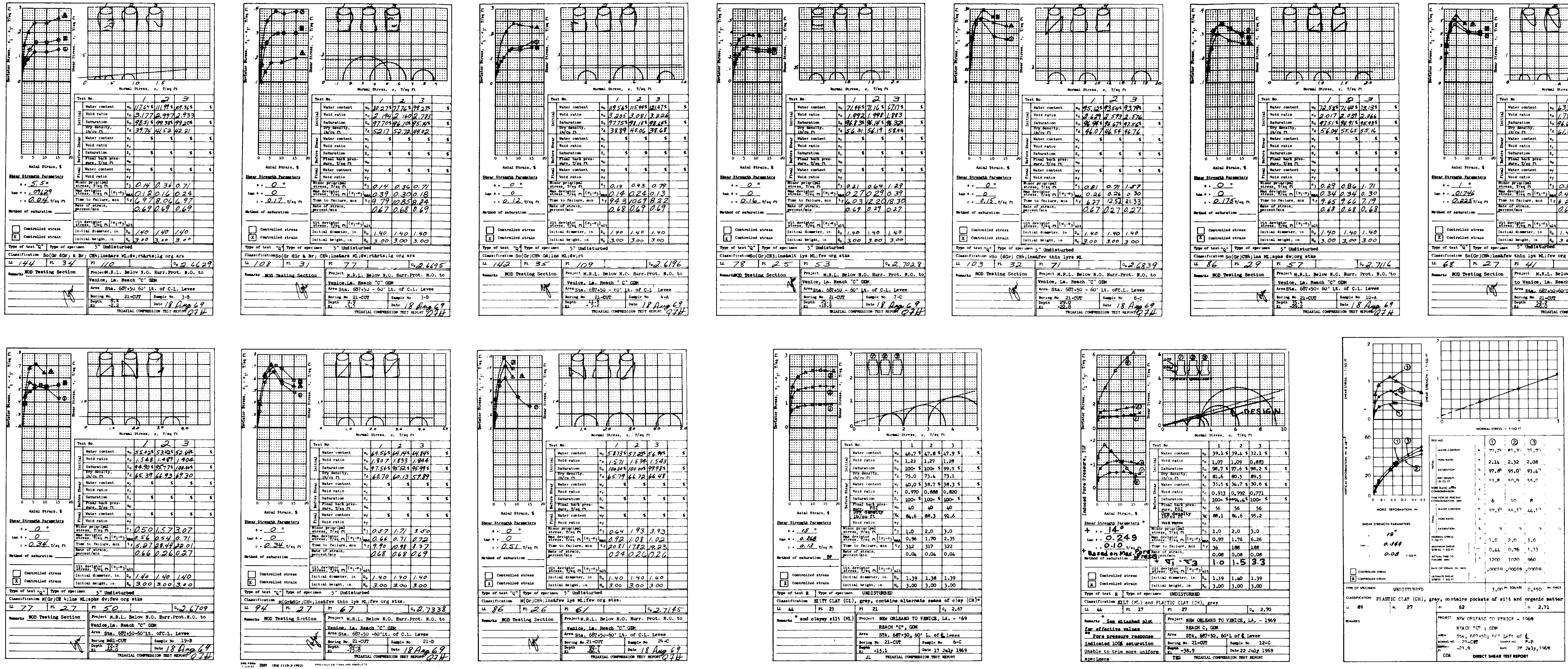


NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 15 CU

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE 32



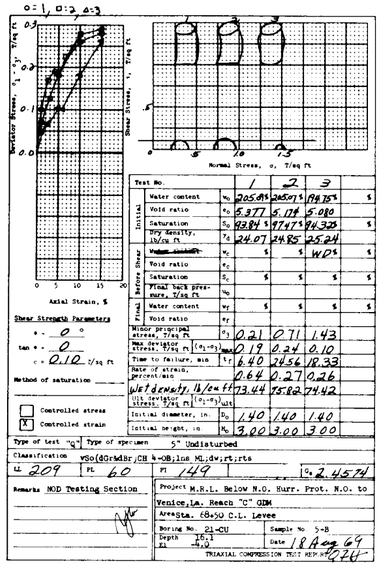
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C—PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 21 CUT

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

MARCH 1972 FILE NO. H-2-25527

PLATE 33

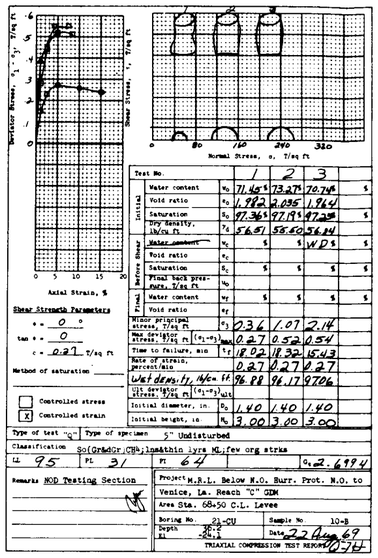


Test No.			1	2	3	
Initial	Water content	w_o	205.4%	205.0%	198.3%	%
	Void ratio	e_o	5.377	5.174	5.080	
	Saturation	S_o	98.84%	97.47%	94.32%	%
	Dry density, lb/cu ft	γ_d	24.07	24.85	25.24	
Before Shear	Water content	w_c	%	%	WD%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.21	0.71	1.43	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.19	0.24	0.10	
	Time to failure, min	t_f	6.40	24.56	18.33	
	Rate of strain, percent/min		0.64	0.27	0.26	
	Wet density, lb/cu ft		73.44	75.82	74.42	
	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 °
tan ϕ = 0
c = 0.10 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification vSo(GR+dSr;CH 4-OB;lns ML,d;wt;rts
LL 209 PL 60 PI 149 G_s 2.4574
Remarks NOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 68+50 C.L. Levee
Boring No. 21-CU Sample No. 5-B
Depth 70.1 Date 18 Aug 69
El. -68.0
TRIAXIAL COMPRESSION TEST REPORT GDA

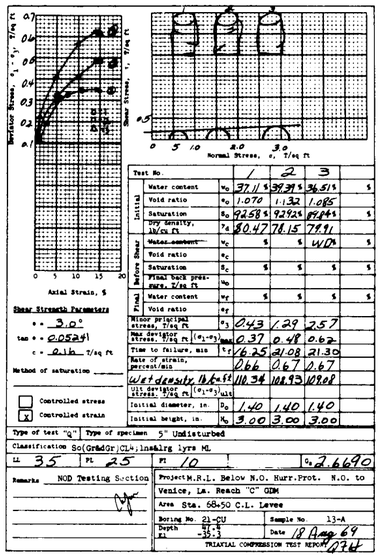


Test No.			1	2	3	
Initial	Water content	w_o	71.4%	73.2%	70.7%	%
	Void ratio	e_o	1.982	2.035	1.944	
	Saturation	S_o	97.36%	97.7%	97.2%	%
	Dry density, lb/cu ft	γ_d	58.61	58.40	58.84	
Before Shear	Water content	w_c	%	%	WD%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.36	1.07	2.14	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.27	0.52	0.54	
	Time to failure, min	t_f	18.02	18.32	15.43	
	Rate of strain, percent/min		0.27	0.27	0.27	
	Wet density, lb/cu ft		96.88	96.17	97.06	
	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 °
tan ϕ = 0
c = 0.27 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification So(GR&Gr;CH&;lns&thin lyrs ML;few org strks
LL 95 PL 31 PI 64 G_s 2.6994
Remarks NOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 68+50 C.L. Levee
Boring No. 21-CU Sample No. 10-B
Depth 26.2 Date 22 Aug 69
El. -93.1
TRIAXIAL COMPRESSION TEST REPORT GDA

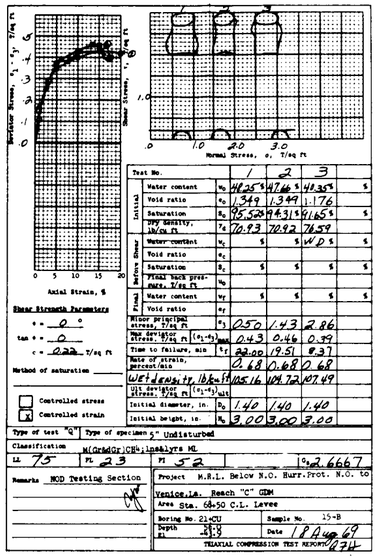


Test No.			1	2	3	
Initial	Water content	w_o	37.1%	39.3%	36.5%	%
	Void ratio	e_o	1.070	1.132	1.085	
	Saturation	S_o	92.58%	92.9%	89.6%	%
	Dry density, lb/cu ft	γ_d	80.47	78.15	79.91	
Before Shear	Water content	w_c	%	%	WD%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.43	1.29	2.57	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.37	0.48	0.62	
	Time to failure, min	t_f	16.25	21.08	21.30	
	Rate of strain, percent/min		0.66	0.67	0.67	
	Wet density, lb/cu ft		118.34	118.93	118.88	
	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 = 3.0°
tan ϕ = 0.0524
c = 0.16 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification So(GR&Gr;CL+;lns&lrg lyrs ML
LL 35 PL 25 PI 10 G_s 2.6690
Remarks NOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 68+50 C.L. Levee
Boring No. 21-CU Sample No. 13-A
Depth 35.5 Date 18 Aug 69
El. -35.3
TRIAXIAL COMPRESSION TEST REPORT GDA

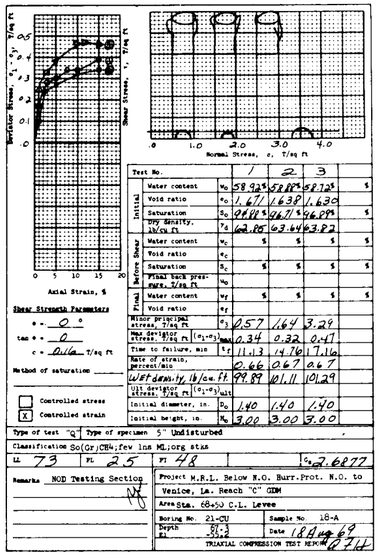


Test No.			1	2	3	
Initial	Water content	w_o	44.2%	47.6%	48.3%	%
	Void ratio	e_o	1.349	1.349	1.176	
	Saturation	S_o	95.52%	94.3%	96.8%	%
	Dry density, lb/cu ft	γ_d	70.93	70.92	76.59	
Before Shear	Water content	w_c	%	%	WD%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.50	1.43	2.86	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.43	0.46	0.39	
	Time to failure, min	t_f	22.00	19.51	8.37	
	Rate of strain, percent/min		0.68	0.68	0.68	
	Wet density, lb/cu ft		105.16	104.72	107.49	
	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 °
tan ϕ = 0
c = 0.22 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification M(GR&Gr;CH&;lns&lyrs ML
LL 75 PL 23 PI 52 G_s 2.6667
Remarks NOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 68+50 C.L. Levee
Boring No. 21-CU Sample No. 15-B
Depth 45.8 Date 18 Aug 69
El. -58.7
TRIAXIAL COMPRESSION TEST REPORT GDA

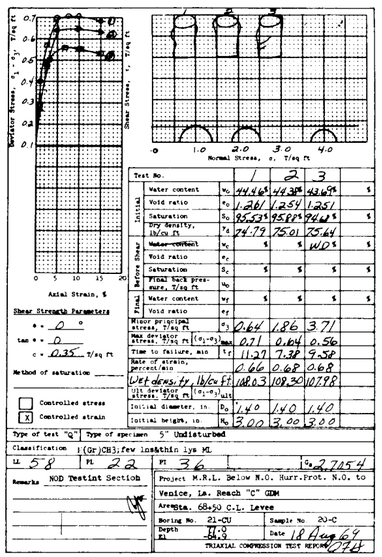


Test No.			1	2	3	
Initial	Water content	w_o	58.9%	58.8%	58.7%	%
	Void ratio	e_o	1.671	1.638	1.630	
	Saturation	S_o	98.8%	96.7%	96.8%	%
	Dry density, lb/cu ft	γ_d	62.86	63.64	63.82	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.57	1.64	3.29	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.34	0.32	0.47	
	Time to failure, min	t_f	11.13	14.76	7.16	
	Rate of strain, percent/min		0.66	0.67	0.67	
	Wet density, lb/cu ft		99.89	101.11	101.29	
	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 °
tan ϕ = 0
c = 0.16 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification So(Gr;CH&;few lns ML;org strks
LL 73 PL 25 PI 48 G_s 2.6877
Remarks NOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 68+50 C.L. Levee
Boring No. 21-CU Sample No. 18-A
Depth 61.3 Date 18 Aug 69
El. -53.2
TRIAXIAL COMPRESSION TEST REPORT GDA

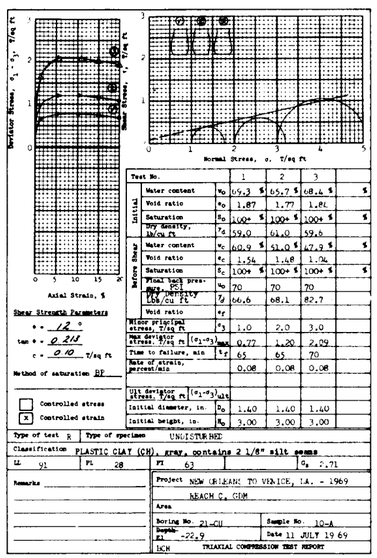


Test No.			1	2	3	
Initial	Water content	w_o	44.4%	44.3%	43.6%	%
	Void ratio	e_o	1.261	1.254	1.251	
	Saturation	S_o	95.53%	95.8%	94.6%	%
	Dry density, lb/cu ft	γ_d	74.79	75.01	75.64	
Before Shear	Water content	w_c	%	%	WD%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	0.64	1.86	3.71	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.71	0.64	0.56	
	Time to failure, min	t_f	11.27	7.38	9.52	
	Rate of strain, percent/min		0.66	0.68	0.68	
	Wet density, lb/cu ft		100.3	100.30	101.98	
	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 °
tan ϕ = 0
c = 0.35 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed
Classification (Gr)CH;few lns&thin lys ML
LL 58 PL 22 PI 36 G_s 2.7454
Remarks NOD Testint Section

Project M.R.L. Below N.O. Hurr. Prot. N.O. to Venice, La. Reach "C" GDM
Area Sta. 68+50 C.L. Levee
Boring No. 21-CU Sample No. 20-C
Depth 77.0 Date 18 Aug 69
El. -84.9
TRIAXIAL COMPRESSION TEST REPORT GDA

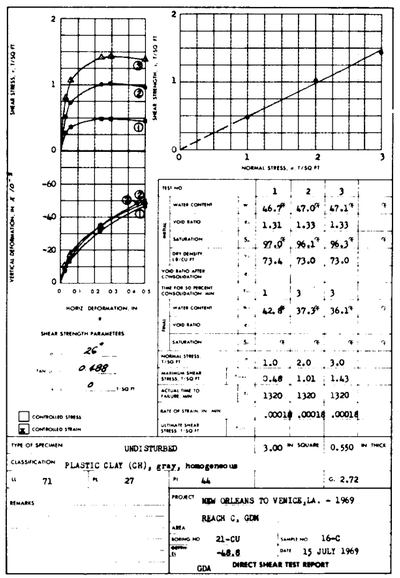


Test No.			1	2	3	
Initial	Water content	w_o	69.3	65.7	68.4	%
	Void ratio	e_o	1.87	1.77	1.81	
	Saturation	S_o	100+	100+	100+	%
	Dry density, lb/cu ft	γ_d	59.0	61.0	59.6	
Before Shear	Water content	w_c	60.9	51.0	47.9	%
	Void ratio	e_c	1.54	1.48	1.34	
	Saturation	S_c	100+	100+	100+	%
	Final back pressure, T/sq ft	u_b	70	70	70	
Final	Wet density lbs/cu ft	γ	66.6	68.1	82.7	
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.77	1.20	2.09	
	Time to failure, min	t_f	65	65	70	
	Rate of strain, percent/min		0.08	0.08	0.08	
	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 = 12 °
tan ϕ = 0.213
c = 0.0 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Type of test R Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains 2 1/8" silt seams
LL 91 PL 28 PI 63 G_s 2.71
Remarks

Project NEW ORLEANS TO VENICE, LA. - 1969
REACH C, GDM
Area
Boring No. 21-CU Sample No. 10-A
Depth -222.9 Date 11 JULY 1969
El.
LCH TRIAXIAL COMPRESSION TEST REPORT



TEST NO		1	2	3	
INITIAL	WATER CONTENT	% 46.7	47.0	47.1	%
	VOID RATIO	1.31	1.33	1.33	
	SATURATION	% 97.0	96.1	96.3	%
	DRY DENSITY LB/CU FT	73.4	73.0	73.0	
	VOID RATIO AFTER CONSOLIDATION				
	TIME FOR 50 PERCENT CONSOLIDATION MIN	1	3	3	
FINAL	WATER CONTENT	% 42.8	37.5	36.1	%
	VOID RATIO				
	SATURATION	%	%	%	%
	NORMAL STRESS T/SQ FT	1.0	2.0	3.0	
	MAXIMUM SHEAR STRESS T/SQ FT	0.48	1.01	1.43	
	ACTUAL TIME TO FAILURE MIN	1320	1320	1320	
	RATE OF STRAIN IN. MIN	.00018	.00018	.00018	
	ULTIMATE SHEAR STRESS T/SQ FT				

TYPE OF SPECIMEN UNDISTURBED 3.00 IN. SQUARE 0.550 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), gray, homogeneous
LL 71 PL 27 PI 44 G_s 2.72
REMARKS

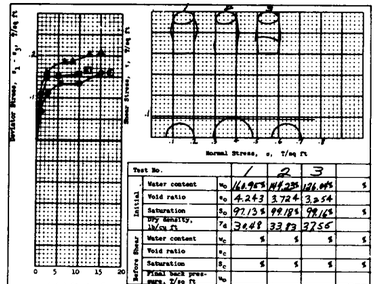
PROJECT NEW ORLEANS TO VENICE, LA. - 1969
REACH C, GDM
AREA
BORING NO 21-CU SAMPLE NO 16-C
DEPTH -48.8 DATE 15 JULY 1969
EL
GDA DIRECT SHEAR TEST REPORT

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 21 CU

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE 34



Test No.		1	2	3	
Initial	Water content	w_o	16.78%	17.23%	16.04%
	Void ratio	e_o	4.243	3.724	3.954
	Saturation	S_o	97.13%	99.18%	98.16%
	Dry density, lb/cu ft	γ_d	3648	3283	3456
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	0.07	0.29	0.57
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.13	0.19	0.14
	Time to failure, min	t_f	8.21	9.42	3.67
	Rate of strain, percent/min		0.68	0.69	0.67
	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: $\phi = 0°$, $\tan\phi = 0$, $c = 0.09$ T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr&Br)CH& OB lnsa&lyre ML;spks dw;rts &rt

LL 162 | PL 39 | PI 123 | G_s 2.5597

Remarks MOD TESTING SECTION

Project M.R.L. Below N.O. Hurr.Prot. H.O. to Venice,La. Reach "C" GDM

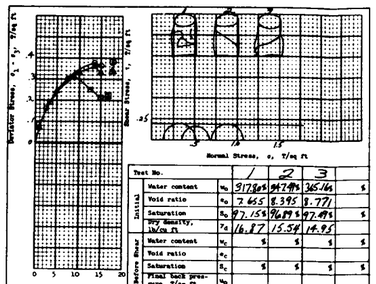
Area Sta. 687+50 70' Rt. of Levee C.L.

Boring No. 21-CUTP | Sample No. 3-B

Depth 25.9 to 26.9 | Date 18 Aug 69

El -25.9

TRIAXIAL COMPRESSION TEST REPORT DTH



Test No.		1	2	3	
Initial	Water content	w_o	31.78%	34.78%	36.46	$
	Void ratio	e_o	2.665	2.953	3.077	
	Saturation	S_o	97.15%	96.89%	97.49%	$
	Dry density, lb/cu ft	γ_d	16.87	15.94	14.95	
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	0.36	0.71	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.37	0.31	0.36	
	Time to failure, min	t_f	19.64	13.30	19.41	
	Rate of strain, percent/min		0.68	0.68	0.69	
	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: $\phi = 0°$, $\tan\phi = 0$, $c = 0.18$ T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr&Br)CH$; OC;lns ML;dw;rt

LL 227 | PL 66 | PI 161 | G_s 2.3470

Remarks MOD Testing Section

Project M.R.L. Below N.O. Hurr.Prot.H.O. to Venice,La. Reach "C" GDM

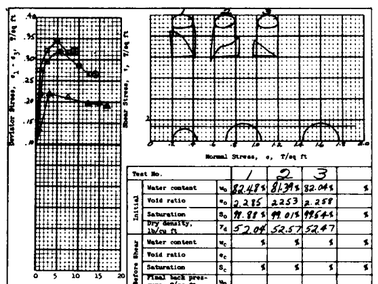
Area Sta. 687+50 70' Rt. of Levee C.L.

Boring No. 21-CUTP | Sample No. 4-B

Depth 26.2 to 27.0 | Date 18 Aug 69

El -27.0

TRIAXIAL COMPRESSION TEST REPORT DTH



Test No.		1	2	3	
Initial	Water content	w_o	32.48%	31.39%	32.04%	$
	Void ratio	e_o	2.235	2.253	2.258	
	Saturation	S_o	99.88%	99.01%	99.64%	$
	Dry density, lb/cu ft	γ_d	5.206	52.57	52.47	
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	0.71	1.43	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.28	0.32	0.36	
	Time to failure, min	t_f	4.73	12.10	18.37	
	Rate of strain, percent/min		0.68	0.26	0.27	
	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: $\phi = 0°$, $\tan\phi = 0$, $c = 0.14$ T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification vSo(Gr)CH$;lns & ars ML;spks;dw; few org stks

LL 90 | PL 31 | PI 59 | G_s 2.7438

Remarks MOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. H.O. to Venice,La. Reach "C" GDM

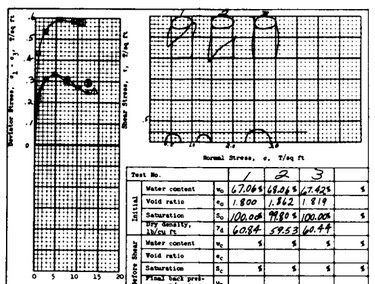
Area Sta. 687+50 70' Rt. of Levee C.L.

Boring No. 21-CUTP | Sample No. 8-B

Depth 27.9 to 28.7 | Date 18 Aug 69

El -28.7

TRIAXIAL COMPRESSION TEST REPORT DTH



Test No.		1	2	3	
Initial	Water content	w_o	67.06%	68.06%	67.42%	$
	Void ratio	e_o	1.800	1.862	1.819	
	Saturation	S_o	100.00%	99.80%	100.00%	$
	Dry density, lb/cu ft	γ_d	6084	59.53	60.44	
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	0.36	1.14	2.29	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.34	4.33	0.59	
	Time to failure, min	t_f	7.26	15.60	22.03	
	Rate of strain, percent/min		0.67	0.26	0.26	
	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: $\phi = 0°$, $\tan\phi = 0$, $c = 0.22$ T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr)CH$;lns&lyre ML org stks

LL 95 | PL 28 | PI 67 | G_s 2.7279

Remarks MOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. H.O. to Venice,La. Reach "C" GDM

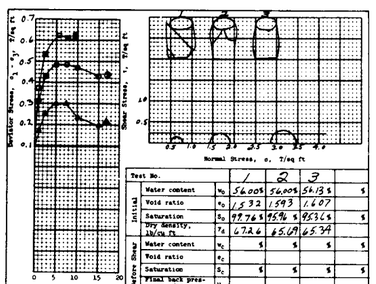
Area Sta. 687+50 70' Rt. of Levee C.L.

Boring No. 21-CUTP | Sample No. 14-C

Depth 27.5 to 28.5 | Date 18 Aug 69

El -28.5

TRIAXIAL COMPRESSION TEST REPORT DTH



Test No.		1	2	3	
Initial	Water content	w_o	56.00%	56.00%	54.13%	$
	Void ratio	e_o	1.532	1.593	1.607	
	Saturation	S_o	97.76%	95.7%	95.36%	$
	Dry density, lb/cu ft	γ_d	6.726	65.69	65.39	
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	0.50	1.43	2.86	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.30	0.49	0.62	
	Time to failure, min	t_f	7.45	18.46	21.55	
	Rate of strain, percent/min		0.66	0.27	0.27	
	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: $\phi = 0°$, $\tan\phi = 0$, $c = 0.23$ T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr)CH$;few thin lys ML

LL 79 | PL 33 | PI 46 | G_s 2.7303

Remarks MOD Testing Section

Project M.R.L. Below N.O. HURR. PROT. H.O. to Venice,La. Reach "C" GDM

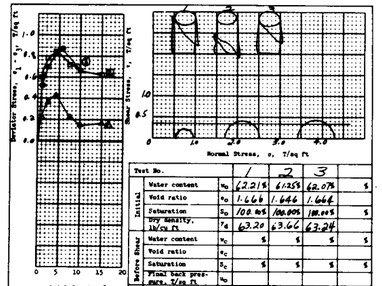
Area Sta. 687+50 70' Rt. of Levee C.L.

Boring No. 21-CUTP | Sample No. 17-D

Depth 28.9 to 29.7 | Date 18 Aug 69

El -29.7

TRIAXIAL COMPRESSION TEST REPORT DTH



Test No.		1	2	3	
Initial	Water content	w_o	22.1%	61.5%	62.0%	$
	Void ratio	e_o	1.466	1.666	1.664	
	Saturation	S_o	100.00%	100.00%	100.00%	$
	Dry density, lb/cu ft	γ_d	63.20	53.66	53.24	
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	0.57	1.71	3.43	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.42	0.84	0.87	
	Time to failure, min	t_f	6.08	16.41	21.85	
	Rate of strain, percent/min		0.68	0.26	0.27	
	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: $\phi = 0°$, $\tan\phi = 0$, $c = 0.35$ T/sq ft

Method of saturation ____

☐ Controlled stress ☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification (Gr &Br) CH$;lns&few thin lys ML;few org stks

LL 90 | PL 31 | PI 59 | G_s 2.6969

Remarks MOD Testing Section

Project M.R.L. Below N.O. Hurr. Prot. H.O. to Venice,La. Reach "C" GDM

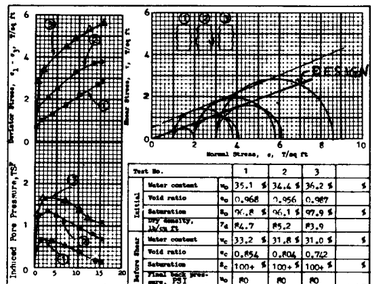
Area Sta. 687+50 70' Rt. of Levee C.L.

Boring No. 21-CUTP | Sample No. 21-D

Depth 28.4 to 29.2 | Date 18 Aug 69

El -29.2

TRIAXIAL COMPRESSION TEST REPORT DTH



Test No.		1	2	3	
Initial	Water content	w_o	35.1 %	34.4 %	36.2 %	$
	Void ratio	e_o	0.968	0.956	0.987	
	Saturation	S_o	96.8 %	96.1 %	99.9 %	$
	Dry density, lb/cu ft	γ_d	84.7	85.2	83.9	
Before Shear	Water content	w_c	33.2 %	31.8 %	31.0 %	$
	Void ratio	e_c	0.854	0.806	0.742	
	Saturation	S_c	100+ %	100+ %	100+ %	$
	Final back pressure, T/sq ft	u_b	PO	PO	PO	
Final	Dry density, lb/cu ft	γ_d	89.9	92.4	94.7	
	Void ratio	e_f				
	Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
	Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	2.90	3.77	5.55	
	Time to failure, min	t_f	214	171	150	
	Rate of strain, percent/min		0.07	0.09	0.10	
	Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$	1.0	2.1	3.3	
	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: $\phi = 20°$, $\tan\phi = 0.364$, $c = 0.05$ T/sq ft

Method of saturation BP

☐ Controlled stress ☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification SANDY SILT (ML), gray, contains two 1/32" lenses of silty clay

LL 34 | PL 24 | PI 10 | G_s 2.67

Remarks See attached plot for effective values. Based on Max. Pore Pr. of 0.65 * (CL)

Portion of sample allowed to drain before trimming

Project NEW ORLEANS TO VENICE - 1969

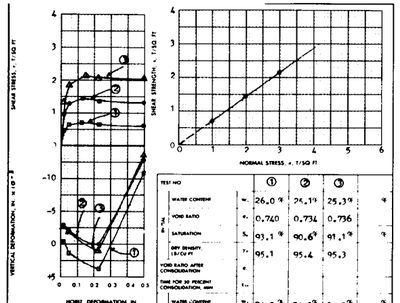
Area REACH "C" ; GDM

Boring No. 21-CWFP | Sample No. 6-B

Depth -15.1 | Date 14 July,1969

El

WTR & GDA DIRECT SHEAR TEST REPORT



TEST NO		①	②	③	
INITIAL	WATER CONTENT %	w_o	26.0 %	24.1 %	25.3 %	%
	VOID RATIO	e_o	0.740	0.734	0.736	
	SATURATION %	S_o	93.1 %	90.6 %	91.1 %	%
	DRY DENSITY LB/CU FT	γ_d	95.1	95.4	95.3	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL	WATER CONTENT %	w_f	24.2 %	24.1 %	24.3 %	%
	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}	0.70	1.44	2.15	
ACTUAL TIME TO FAILURE, MIN		t_f	780	780	900	
RATE OF STRAIN, IN / MIN			.0001R	.0001R	.0001R	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS: $\phi = 36°$, $\tan\phi = 0.726$, $c = 0$ T/SQ FT

CONTROLLED STRESS ☐ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 0.557 IN THICK

CLASSIFICATION SAND (SP), gray

LL – | PL – | PI – | G_s 2.65

REMARKS

PROJECT NEW ORLEANS TO VENICE - 1969

REACH "C" ; GDM

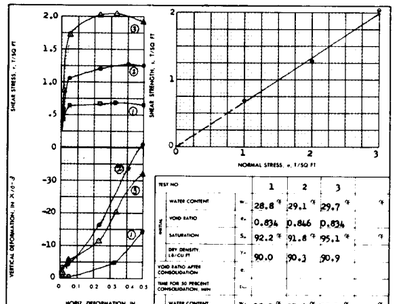
AREA

BORING NO 21-CWFP | SAMPLE NO 2-C

DEPTH -0.2 | DATE 17 July,1969

EL

WTR & GDA DIRECT SHEAR TEST REPORT



TEST NO		1	2	3	
INITIAL	WATER CONTENT %	w_o	28.8 %	29.1 %	29.7 %	%
	VOID RATIO	e_o	0.834	0.846	0.834	
	SATURATION %	S_o	92.2 %	91.8 %	95.1 %	%
	DRY DENSITY LB/CU FT	γ_d	90.0	90.1	90.9	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}				
FINAL	WATER CONTENT %	w_f	28.9 %	27.6 %	28.1 %	%
	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	1.27	2.06	
ACTUAL TIME TO FAILURE, MIN		t_f	1800	2220	1860	
RATE OF STRAIN, IN / MIN			.0001R	.0001R	.0001R	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS: $\phi = 34°$, $\tan\phi = 0.674$, $c = 0$ T/SQ FT

CONTROLLED STRESS ☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 0.557 IN THICK

CLASSIFICATION SILTY SAND (SM), gray

LL – | PL – | PI – | G_s 2.67

REMARKS

PROJECT NEW ORLEANS TO VENICE - 1969

REACH C, GDM

AREA

BORING NO 21-CUTP | SAMPLE NO 5-D

DEPTH -11.6 | DATE 22 July 1969

EL

WN DIRECT SHEAR TEST REPORT

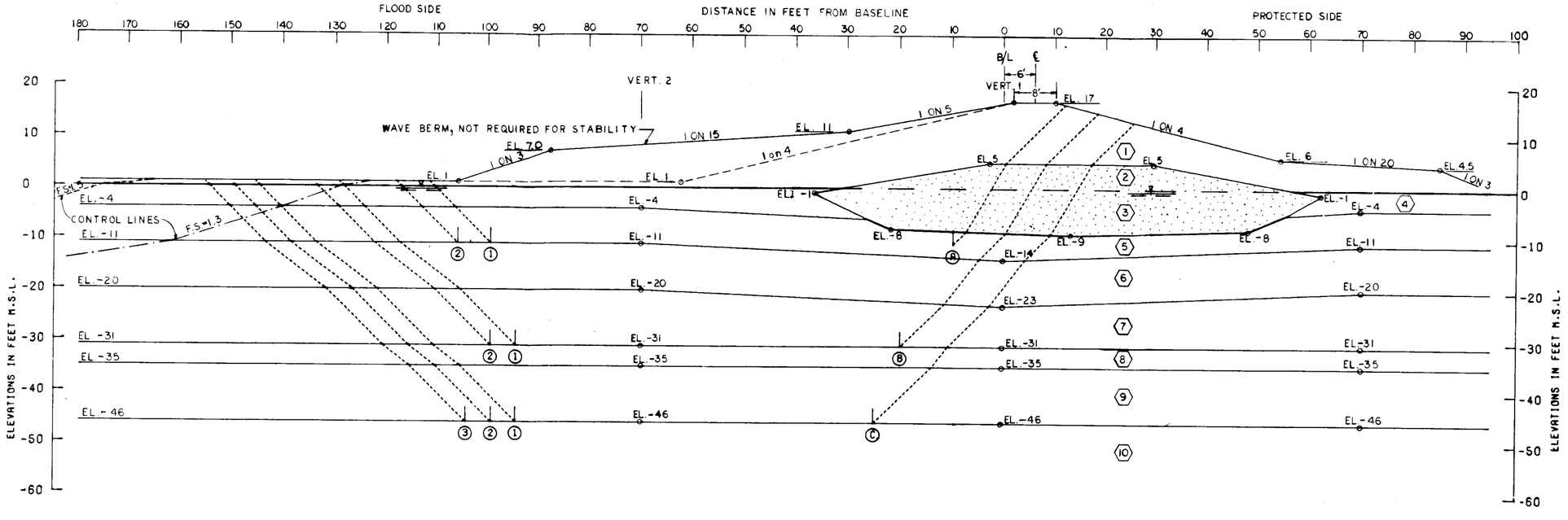
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

DETAIL SHEAR STRENGTH DATA
BORING 21 CUTP

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

MARCH 1972 | FILE NO. H-2-25527

PLATE 35



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.

VERT. 1 = BORING 30-CU
VERT. 2 = BORING 30-CUT

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	95.0	95.0	300.0	300.0	300.0	300.0	0.0
⟨2⟩	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
⟨3⟩	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
⟨4⟩	CH	33.0	33.0	200.0	200.0	200.0	200.0	0.0
⟨5⟩	CHO	20.0	20.0	600.0	200.0	600.0	200.0	0.0
⟨6⟩	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⟨7⟩	CH	40.0	40.0	600.0	400.0	600.0	400.0	0.0
⟨8⟩	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⟨9⟩	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
⟨10⟩	CH	40.0	40.0	730.0	730.0	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	
Ⓐ ①	-11.00	24885	30211	5000	34777	3433	60096	31344	1.917
Ⓐ ②	-11.00	24885	31511	5000	34777	2769	61396	32008	1.918
Ⓑ ①	-31.00	49098	34588	22355	85285	22278	106041	63007	1.683
Ⓑ ②	-31.00	49098	36588	22353	85285	20862	108039	64423	1.677
Ⓒ ①	-46.00	63340	28000	37184	132886	47086	128525	85800	1.498
Ⓒ ②	-46.00	63340	30000	37182	132886	45670	130522	87216	1.497
Ⓒ ③	-46.00	63340	32000	37182	132886	45041	132522	87845	1.509

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

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

② WEDGE NUMBER
⟨3⟩ STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

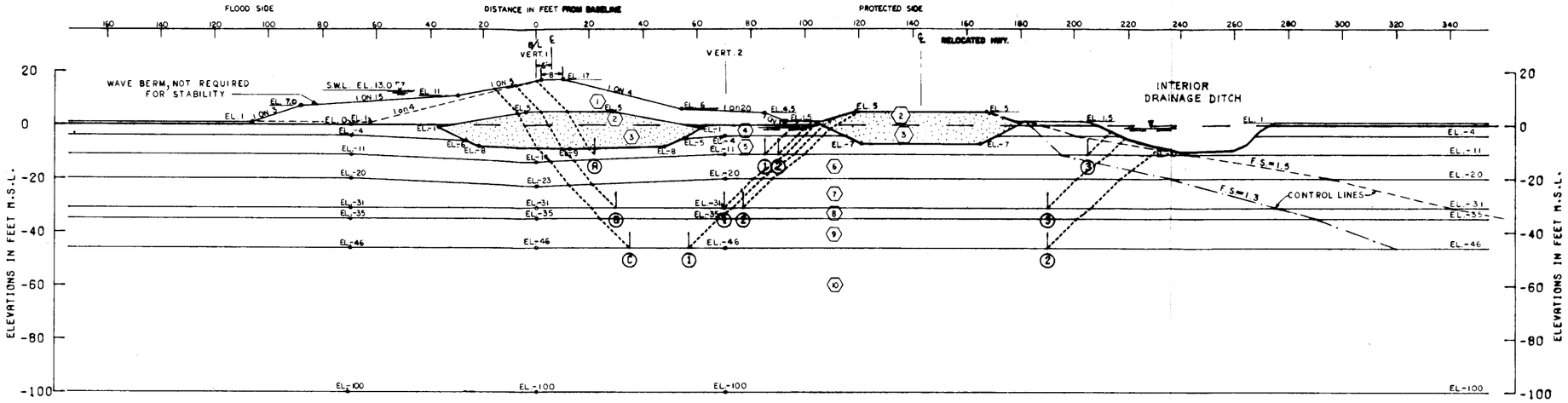
REACH C - PHOENIX TO BOHEMIA
LEVEE - FLOOD SIDE
(Q) STABILITY ANALYSIS
STA. 0+00 TO STA. 159+00

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

MARCH 1972

FILE NO. 6-3-30007

PLATE 36



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.

VERT. 1 = BORING 30-CU
VERT. 2 = BORING 30-CUTP

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	95.0	95.0	300.0	300.0	300.0	300.0	0.0
2	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
3	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
4	CH	33.0	33.0	200.0	200.0	200.0	200.0	0.0
5	CHO	20.0	20.0	600.0	200.0	600.0	200.0	0.0
6	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
7	CH	40.0	40.0	600.0	400.0	600.0	400.0	0.0
8	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
9	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
10	CH	40.0	40.0	730.0	730.0	1000.0	1000.0	0.0

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	24478	19869	5300	34307	4418	49646	29889	1.661
A	2	-11.00	24478	20869	5300	34307	3469	50646	30838	1.642
A	3	-11.00	24478	43869	3493	34307	1641	71839	32666	2.199
B	1	-31.00	48383	18463	24154	86082	27067	91000	59016	1.542
B	2	-31.00	48383	21381	24840	86082	26688	94605	59394	1.593
B	3	-31.00	48383	66629	19606	86082	18228	134617	67855	1.984
C	1	-46.00	63027	8800	39378	133770	67980	111205	75790	1.467
C	2	-46.00	63027	62000	31714	133770	39105	156741	94665	1.656

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

F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

(2) WEDGE NUMBER
(3) STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

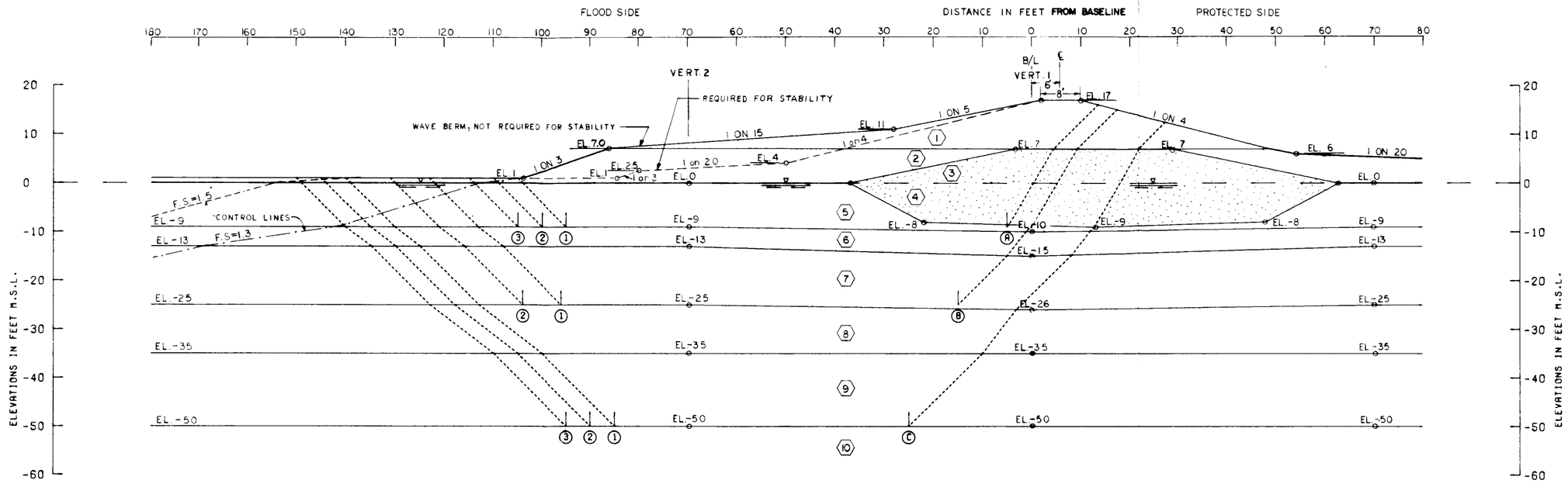
REACH C - PHOENIX TO BOHEMIA
LEVEE - PROTECTED SIDE
(Q) STABILITY ANALYSIS

STA. 0+00 TO STA. 159+00

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

MARCH 1972 FILE NO. H-2-25527

PLATE 37



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.

VERT. 1 = BORING 8-CU

VERT. 2 = BORING 8-CUT

THE WAVE BERM INDICATED ABOVE APPLIES FROM STA. 159+00 TO STA. 400+56.8 & FROM STA. 400+56.8 TO STA. 495+00, THE WAVE BERM CHANGES TO THE SECTION INDICATED ON PLATE 40

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F. CENTER OF STRATUM		BOTTOM OF STRATUM		FRICTION ANGLE
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	DEGREES
1	CH	95.0	95.0	200.0	200.0	200.0	200.0	0.0
2	CH	95.0	95.0	300.0	300.0	300.0	300.0	0.0
3	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
4	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
5	CHO	20.0	20.0	300.0	300.0	300.0	300.0	0.0
6	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
7	CH	40.0	40.0	500.0	350.0	500.0	350.0	0.0
8	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
9	CH	40.0	40.0	500.0	500.0	500.0	500.0	0.0
10	CH	40.0	40.0	750.0	750.0	750.0	750.0	0.0

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)	-9.00	21567	27000	6000	32097	3014	54567	29084	1.876
(A) (2)	-9.00	21567	28500	6000	32097	1968	56067	30129	1.861
(A) (3)	-9.00	21567	29934	6000	32097	1711	57500	30386	1.892
(B) (1)	-25.00	38313	32287	17560	71857	13098	88160	58759	1.500
(B) (2)	-25.00	38313	35087	17560	71857	12069	90960	59788	1.521
(C) (1)	-50.00	66672	30000	46640	152022	57675	143311	94347	1.519
(C) (2)	-50.00	66672	32500	48502	152022	55093	145674	96930	1.503
(C) (3)	-50.00	66672	35000	46502	152022	53242	148174	98780	1.500

NOTES

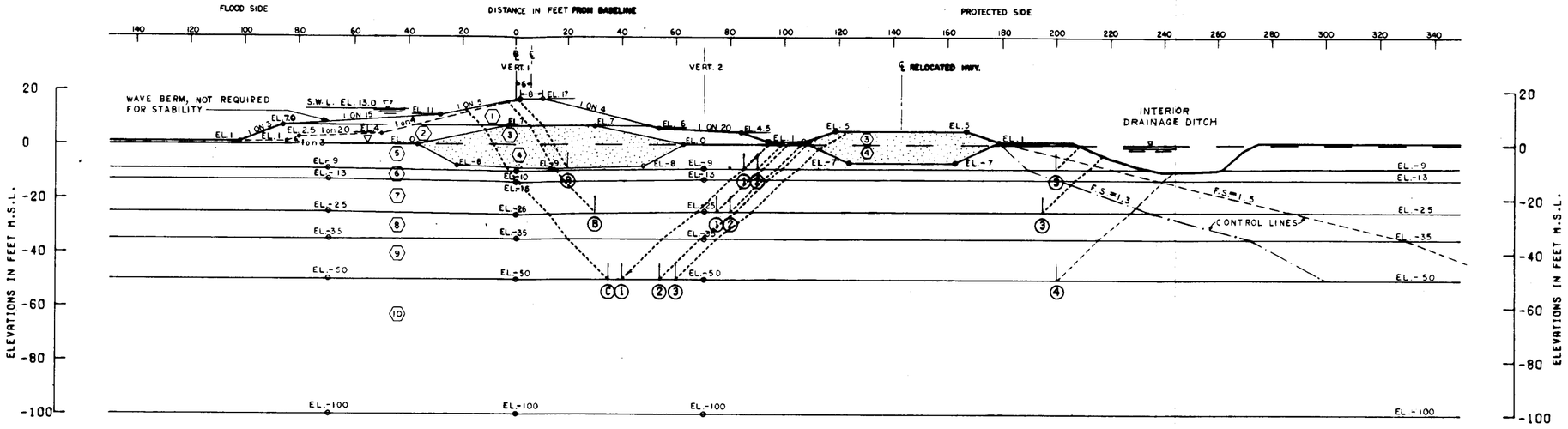
Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

(2) WEDGE NUMBER
(3) STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
LEVEE - FLOOD SIDE
(Q) STABILITY ANALYSIS
STA. 159+00 TO STA. 400+56.8
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25327

PLATE 38



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.

VERT. 1 = BORING 8-CU
VERT. 2 = BORING 8-CUTP

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	95.0	95.0	200.0	200.0	200.0	200.0	0.0
②	CH	95.0	95.0	300.0	300.0	300.0	300.0	0.0
③	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
④	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
⑤	CHO	20.0	20.0	300.0	300.0	300.0	300.0	0.0
⑥	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑦	CH	40.0	40.0	500.0	350.0	500.0	350.0	0.0
⑧	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑨	CH	40.0	40.0	500.0	600.0	500.0	500.0	0.0
⑩	CH	40.0	40.0	750.0	750.0	750.0	750.0	0.0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_B	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
Ⓐ	①	-9.00	21290	19500	6000	31035	3057	46790	27978	1.672
Ⓐ	②	-9.00	21290	21000	6000	31035	1977	48290	29058	1.662
Ⓐ	③	-9.00	21290	52954	5224	31035	1471	79468	29564	2.688
Ⓑ	①	-25.00	37580	17658	17968	70676	16737	73206	53938	1.357
Ⓑ	②	-25.00	37580	19445	18052	70676	15063	75077	55612	1.350
Ⓑ	③	-25.00	37580	59704	14336	70676	10284	111620	60391	1.848
Ⓒ	①	-50.00	65729	2500	50913	152466	79007	119142	73459	1.622
Ⓒ	②	-50.00	65729	9500	49105	152466	85760	124333	86706	1.434
Ⓒ	③	-50.00	65729	12500	51457	152466	84723	129685	87743	1.478
Ⓒ	④	-50.00	65729	82500	37739	152466	42624	185968	109842	1.693

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

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

(2) WEDGE NUMBER
(3) STRATUM NUMBER

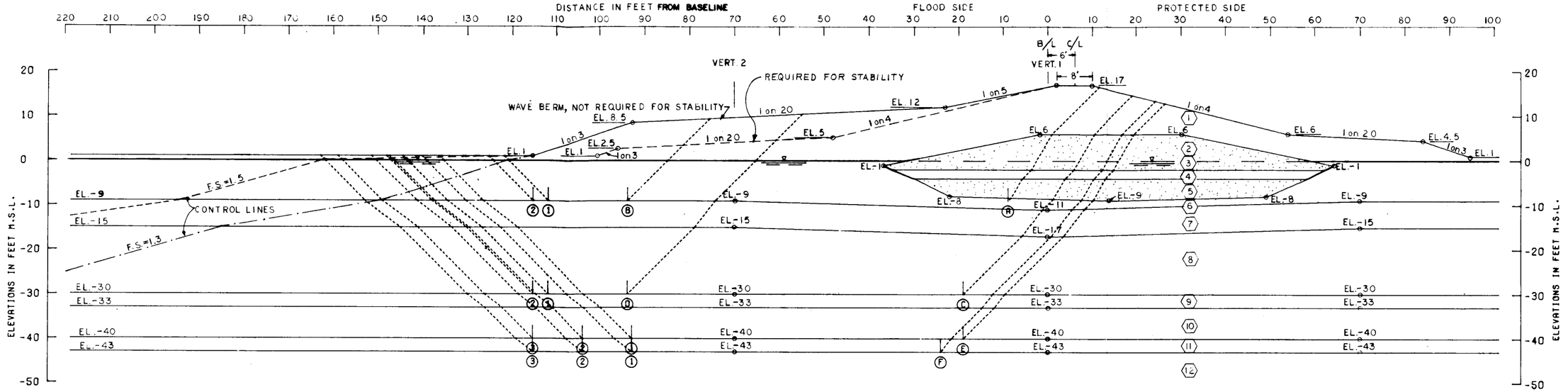
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA
LEVEE - PROTECTED SIDE
(Q) STABILITY ANALYSIS
STA. 159+00 TO STA. 495+00

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

MARCH 1972 FILE NO. H-2-28887

PLATE 39

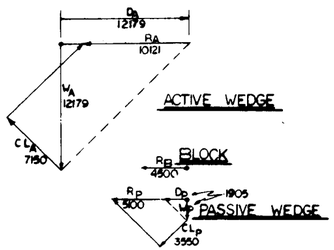


GENERAL NOTES

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.

VERT. 1=BORING 21-CU
VERT. 2=BORING 21-CUT



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	CENTER OF STRATUM VERT. 2	BOTTOM OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 2	FRICTION ANGLE, DEGREES
1	CH	95.0	95.0	300.0	300.0	300.0	300.0	0.0
2	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
3	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
4	CHO	21.0	21.0	300.0	300.0	300.0	300.0	0.0
5	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
6	CHO	20.0	20.0	600.0	250.0	600.0	250.0	0.0
7	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
8	CH	40.0	40.0	500.0	300.0	500.0	300.0	0.0
9	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
10	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
11	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
12	CH	40.0	40.0	715.0	715.0	*430.0	*430.0	0.0

* STRENGTH USED FOR TOP OF STRATUM AT EL.-43

$$FS = \frac{10121 + 4500 + 5100}{12179 - 1905}$$

$$FS = \frac{19721}{10274} = 1.920$$

ASSUMED FAILURE SURFACE Ⓑ①

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
Ⓐ ①	-9.00	21460	37677	5100	30260	1905	64236	28355	2.265
Ⓐ ②	-9.00	21460	38552	5100	30260	1711	65111	28548	2.281
Ⓑ ①	-9.00	10121	4500	5100	12179	1905	19721	10274	1.920
Ⓑ ②	-9.00	10121	5375	5100	12179	1711	20596	10467	1.968
Ⓒ ①	-30.00	43326	33156	19071	81861	18116	95553	63745	1.499
Ⓒ ②	-30.00	43326	34206	19071	81861	17923	96603	63938	1.511
Ⓓ ①	-30.00	24626	5400	19071	46047	18116	49097	27931	1.758
Ⓓ ②	-30.00	24626	6450	19071	46047	17923	50147	28124	1.783
Ⓔ ①	-40.00	52243	29600	29830	111998	39976	111673	72022	1.551
Ⓔ ②	-40.00	52243	34000	29100	111998	34373	115343	77625	1.486
Ⓔ ③	-40.00	52243	38600	28932	111998	32354	119775	79644	1.504
Ⓕ ①	-43.00	57415	29670	36127	120809	44694	123212	76115	1.619
Ⓕ ②	-43.00	57415	34400	34761	120809	39367	126576	81442	1.554
Ⓕ ③	-43.00	57415	39345	34125	120809	37551	130885	83258	1.572

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

F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

(2) -- WEDGE NUMBER
(3) -- STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA LEVEE - FLOOD SIDE

(Q) STABILITY ANALYSIS

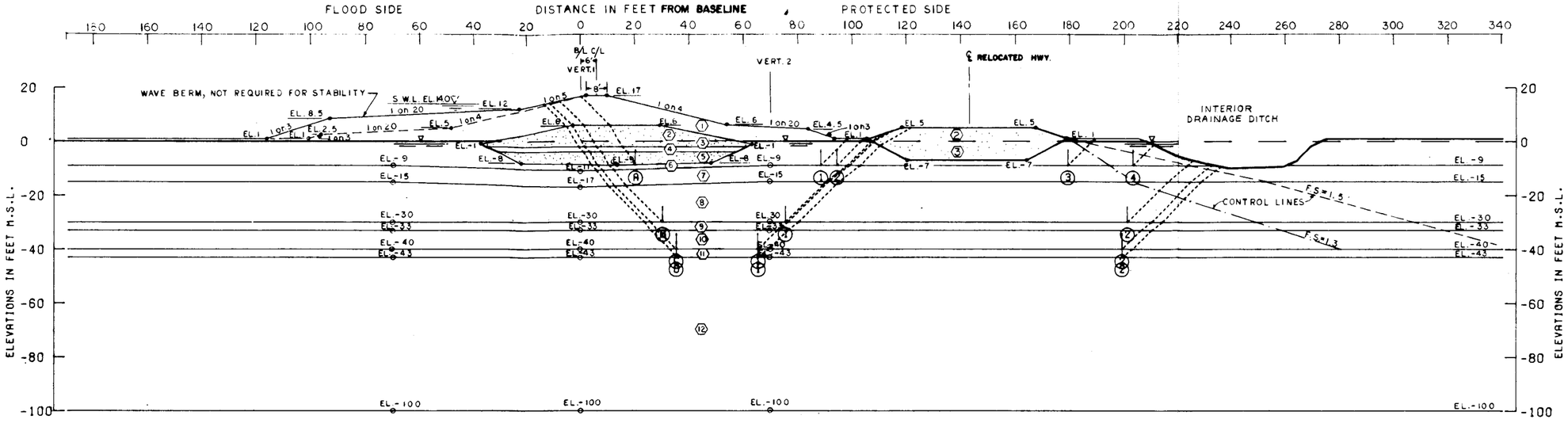
STA 400+56.8 TO STA 801+09.5

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

MARCH 1972

FILE NO. H-2-23827

PLATE 40



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.

VERT. 1 = BORING 21-CU
VERT. 2 = BORING 21-CUTP

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F. CENTER OF STRATUM		BOTTOM OF STRATUM		FRICTION ANGLE
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	DEGREES
①	CH	95.0	95.0	300.0	300.0	300.0	300.0	0.0
②	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
③	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
④	CHO	21.0	21.0	300.0	300.0	300.0	300.0	0.0
⑤	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
⑥	CHO	20.0	20.0	600.0	250.0	600.0	250.0	0.0
⑦	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑧	CH	40.0	40.0	500.0	300.0	500.0	300.0	0.0
⑨	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑩	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
⑪	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑫	CH	40.0	40.0	715.0	715.0	430.0*	430.0*	0.0

* STRENGTH USED FOR TOP OF STRATUM AT EL. -43

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
Ⓐ	①	-9.00	21397	23563	5100	29981	2126	50059	27855	1.797
Ⓐ	②	-9.00	21397	25063	5100	29981	1711	51559	28270	1.824
Ⓐ	③	-9.00	21397	46313	5123	29981	1743	72832	28238	2.579
Ⓐ	④	-9.00	21397	52313	3878	29981	1122	77587	28860	2.688
Ⓑ	①	-30.00	42407	15944	19018	62264	22597	77369	59687	1.296
Ⓑ	②	-30.00	42407	53793	14138	62264	13902	110338	68381	1.614
Ⓒ	①	-40.00	52338	12000	29905	111789	40672	94243	70917	1.329
Ⓒ	②	-40.00	52338	65600	22771	111789	26263	140709	85525	1.645
Ⓓ	①	-43.00	56827	12900	38006	121542	47432	107733	74110	1.454
Ⓓ	②	-43.00	56827	70520	27447	121542	30441	154794	91102	1.699
Ⓑ	①'	-30.00	43805	15944	20577	88981	32639	80326	56342	1.426
Ⓑ	②	-30.00	43805	53793	14246	88991	16652	111844	72329	1.546
Ⓒ	②	-40.00	54024	65600	22638	120966	28832	142262	92134	1.544

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

F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

(2) -- WEDGE NUMBER

(3) -- STRATUM NUMBER

FAILURE SURFACES B1', B2' & C2'
WATER TABLE AT EL. -6.0

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

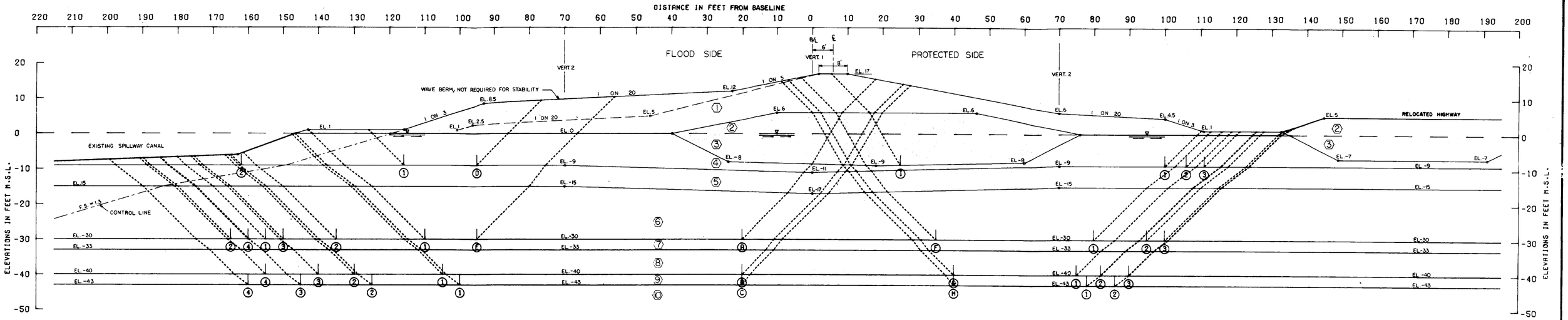
REACH C - PHOENIX TO BOHEMIA LEVEE - PROTECTED SIDE (Q) STABILITY ANALYSIS

STA. 495+00 TO STA. 834+85

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

MARCH 1978 FILE NO. H-2-25387

PLATE 41



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.

VERT. 1 = BORING 21-CU
VERT. 2 = BORINGS 21-CUT & 21-CUTP

ASSUMED FAILURE NO.	ASSUMED SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY
(A) (1)	-30.00	45479	30569	19071	84614	18480	95119	66134	1.438
(A) (2)	-30.00	45479	38069	15137	84614	14949	98685	69665	1.417
(A) (3)	-30.00	45479	42569	14313	84614	12348	102361	72266	1.416
(A) (4)	-30.00	45479	45569	14096	84614	11648	105144	72966	1.441
(B) (1)	-40.00	55320	34000	28300	116707	33834	117620	82872	1.419
(B) (2)	-40.00	55320	44000	24460	116707	28194	123779	88512	1.398
(B) (3)	-40.00	55320	48000	23918	116707	26134	127238	90572	1.405
(B) (4)	-40.00	55320	54000	23378	116707	24024	132698	92682	1.432
(C) (1)	-43.00	59888	34400	34621	126721	40803	128909	85918	1.500
(C) (2)	-43.00	59888	45150	29706	126721	33614	134743	93106	1.447
(C) (3)	-43.00	59888	53750	26588	126721	29506	142226	97215	1.463
(C) (4)	-43.00	59888	60200	27929	126721	28189	148016	98551	1.502
(D) (1)	-9.00	10112	5250	5100	12080	1711	20462	10369	1.973
(D) (2)	-9.00	10112	16488	1463	12080	92	28063	11988	2.341
(E) (1)	-30.00	24604	18000	14205	45932	11916	56808	34015	1.670
(E) (2)	-30.00	24604	21000	13987	45932	11530	59591	34401	1.732

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	95.0	95.0	300.0	300.0	300.0	300.0	0.0
(2)	SP(f)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
(3)	SP(f)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
(4)	CH	20.0	20.0	600.0	250.0	600.0	250.0	0.0
(5)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
(6)	CH	40.0	40.0	500.0	300.0	500.0	300.0	0.0
(7)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
(8)	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
(9)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
(10)	CH	40.0	40.0	715.0	715.0	430.0*	430.0*	0.0

*STRENGTH AT TOP OF STRATUM (EL.-43)

ASSUMED FAILURE NO.	ASSUMED 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
(F) (1)	-30.00	44058	15250	20431	84803	26759	79739	58044	1.374
(F) (2)	-30.00	44058	19750	19079	84803	21468	82887	63335	1.309
(F) (3)	-30.00	44058	21250	19071	84803	19750	84379	65053	1.297
(G) (1)	-40.00	54568	14000	30571	116304	43278	99139	73026	1.358
(G) (2)	-40.00	54568	16800	29796	116304	40560	101164	75744	1.336
(G) (3)	-40.00	54568	20000	29272	116304	37518	103840	78786	1.318
(H) (1)	-43.00	59561	16340	35891	126770	47075	111792	79695	1.403
(H) (2)	-43.00	59561	19780	35269	126770	43909	114610	82861	1.383
(I) (1)	-9.00	22618	23813	5245	29537	3527	51675	26010	1.987
(I) (2)	-9.00	22618	25313	5100	29537	2088	53030	27449	1.932
(I) (3)	-9.00	22618	26563	5100	29537	1711	54280	27826	1.951

NOTES

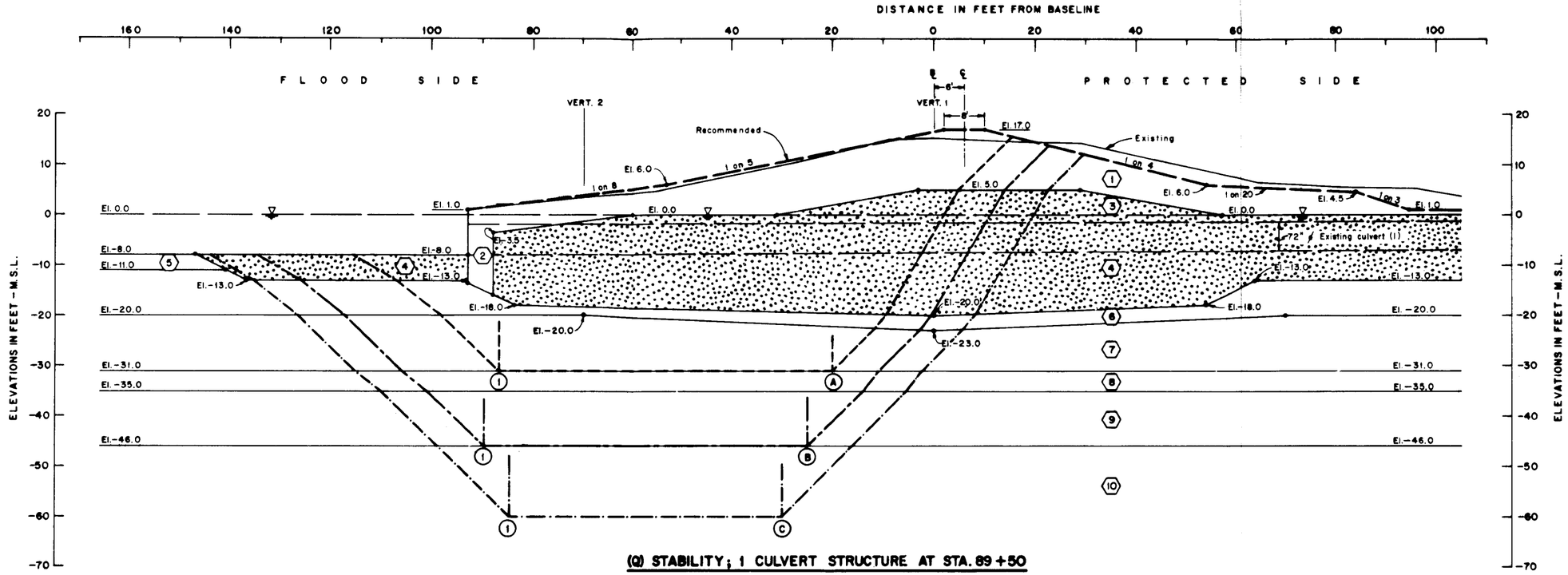
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

(2) STRATUM NUMBER
(3) WEDGE NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA
LEVEE-FLOOD SIDE
(Q) STABILITY ANALYSIS
STA. 801+09.5 TO STA. 834+85
U.S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25587

PLATE 42



(Q) STABILITY; 1 CULVERT STRUCTURE AT STA. 89+50

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	95.0	95.0	300.0	300.0	300.0	300.0	0
2	CH	33.0	33.0	300.0	300.0	300.0	300.0	0
3	SP (F)	122.0	122.0	0	0	0	0	30
4	SP (F)	60.0	60.0	0	0	0	0	30
5	CH	33.0	33.0	300.0	300.0	300.0	300.0	0
6	ML	55.0	55.0	200.0	200.0	200.0	200.0	15
7	CH	40.0	40.0	600.0	400.0	600.0	400.0	0
8	ML	55.0	55.0	200.0	200.0	200.0	200.0	15
9	CH	40.0	40.0	400.0	400.0	400.0	400.0	0
10	CH	40.0	40.0	530.0	530.0	600.0	600.0	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	- 31.0	53,268	30,258	16,354	89,370	15,604	99,880	73,766	1.354
B 1	- 46.0	69,367	26,000	33,240	141,603	42,298	128,607	99,305	1.295
C 1	- 60.0	81,603	33,000	46,821	194,563	72,640	161,424	121,923	1.324

NOTES

Surcharge was added to passive wedge equal to the total weight of concrete and sacked riprap above the soil divided by an assumed failure width.

VERT. 1 = Boring 30-CU

VERT. 2 = Boring 30-CUT

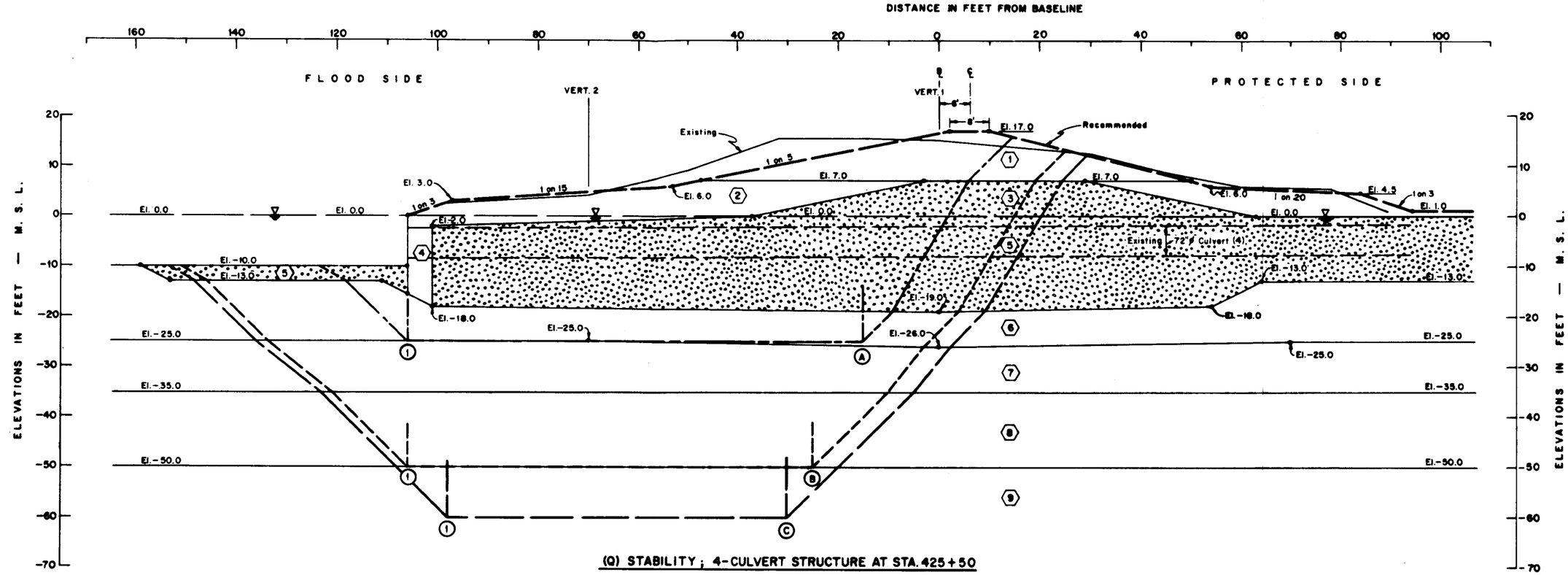
(1) Wedge number

(2) Stratum number

See plate 53 for design plan and section

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA
(Q) STABILITY-1 CULVERT STRUCTURE
STA. 89+50
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE 43



(Q) STABILITY ; 4-CULVERT STRUCTURE AT STA. 425+50

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	95.0	95.0	200.0	200.0	200.0	200.0	0
⟨2⟩	CH	95.0	95.0	300.0	300.0	300.0	300.0	0
⟨3⟩	SP (F)	122.0	122.0	0	0	0	0	30
⟨4⟩	CH	33.0	33.0	300.0	300.0	300.0	300.0	0
⟨5⟩	SP (F)	60.0	60.0	0	0	0	0	30
⟨6⟩	CH	40.0	40.0	500.0	350.0	500.0	350.0	0
⟨7⟩	ML	55.0	55.0	200.0	200.0	200.0	200.0	15
⟨8⟩	CH	40.0	40.0	500.0	500.0	500.0	500.0	0
⟨9⟩	CH	40.0	40.0	550.0	550.0	600.0	600.0	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)	-25.0	43,526	35,033	9,853	73,482	7,759	88,412	65,723	1.345
(B)(1)	-50.0	80,224	37,500	37,449	163,741	45,287	155,173	118,454	1.310
(C)(1)	-60.0	89,736	40,800	47,910	203,948	66,633	178,446	137,315	1.300

NOTES:

Surcharge was added to passive wedges equal to the total weight of concrete and sacked riprap above the soil, divided by an assumed failure width.

(1) Wedge number

⟨2⟩ Stratum number

VERT. 1 = BORING 8-CU

VERT. 2 = BORING 8-CUT

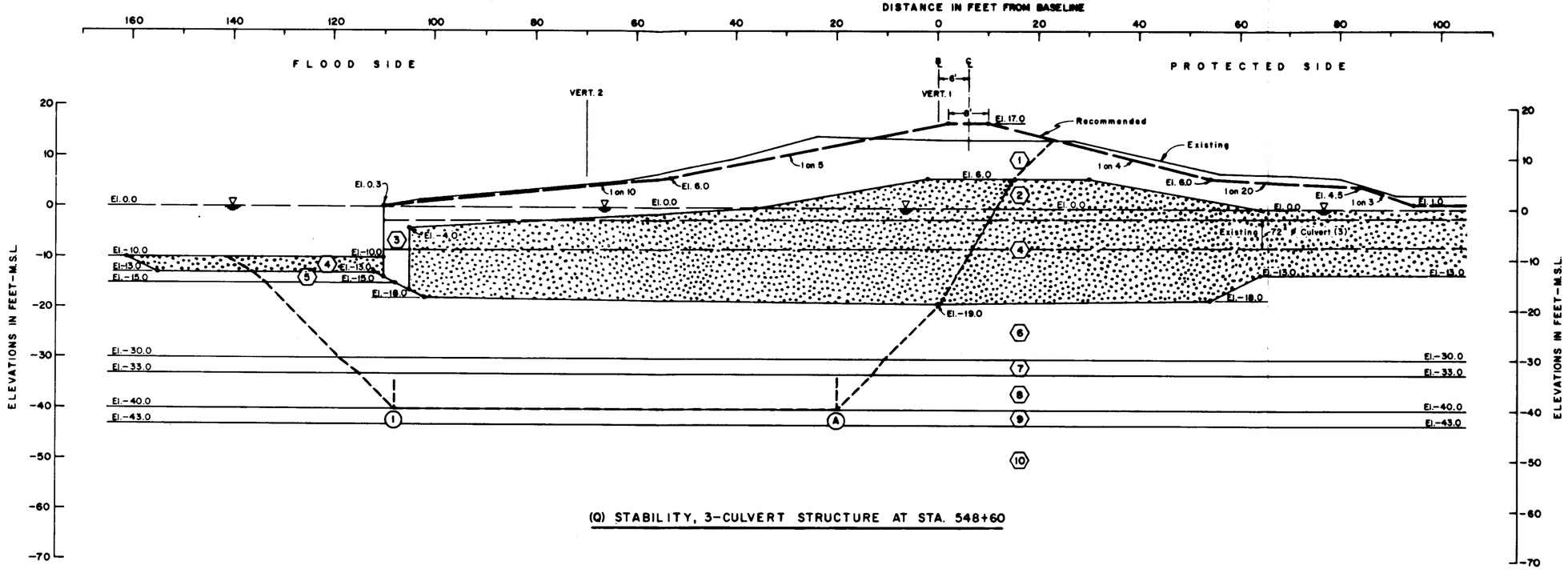
See plate 53 for design plan and section.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

(Q) STABILITY-4 CULVERT STRUCTURE STA. 425+50

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

MARCH 1972 FILE NO. H-2-25527



(Q) STABILITY, 3-CULVERT STRUCTURE AT STA. 548+60

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)	CH	95.0	95.0	300.0	300.0	300.0	300.0	0
(2)	SP (F)	122.0	122.0	0	0	0	0	30
(3)	CH	33.0	33.0	300.0	300.0	300.0	300.0	0
(4)	SP (F)	60.0	60.0	0	0	0	0	30
(5)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15
(6)	CH	40.0	40.0	500.0	300.0	500.0	300.0	0
(7)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15
(8)	CH	40.0	40.0	400.0	400.0	400.0	400.0	0
(9)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15
(10)	CH	40.0	40.0	715.0	715.0	430.0	430.0	0

INFINITE WIDTH STABILITY ANALYSIS

Assumed Failure Surface (A)(1)

R_A = 59,777 lbs.

D_A = 120,449 lbs.

R_B = 35,200 lbs.

R_P = 21,454 lbs.

D_P = 25,286 lbs.

$F.S. = \frac{\Sigma R}{\Sigma D} = \frac{116,431}{95,163}$

F.S. = 1.223

MASS STABILITY ANALYSIS

Assumed Failure Surface (A)(1)

R_A = 5,021,184 lbs.

D_A = 10,117,716 lbs.

R_B = 1,577,600 lbs.

R_P = 1,246,882 lbs.

D_P = 1,321,964 lbs.

SIDE EFFECTS = 4,421,940

$F.S. = \frac{\Sigma R + \text{SIDE EFFECTS}}{\Sigma D}$

$F.S. = \frac{12,267,606}{8,795,782}$

F.S. = 1.395

NOTES:

In the infinite width stability analysis, a surcharge was added to the passive wedge equal to the total weight of concrete and sacked riprap above the soil, divided by an assumed failure width.

In the mass stability analysis, the factor of safety does not include the surcharge described above.

(1) Wedge number

(2) Stratum numbers

VERT. 1 = BORING 21-CU

VERT. 2 = BORING 21-CUT

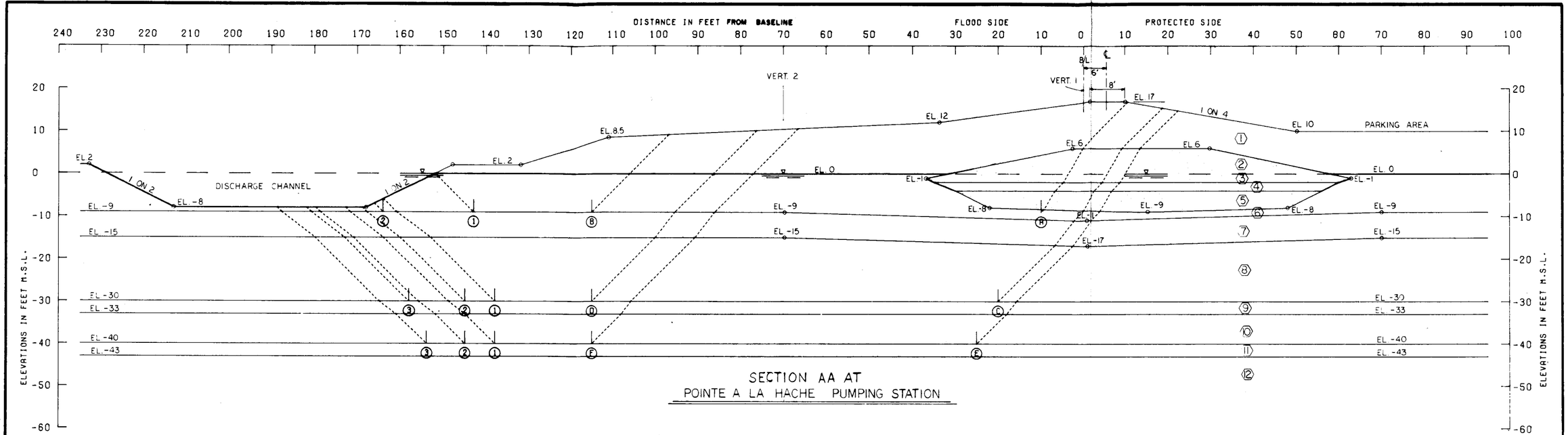
See plate 53 for design plan and section.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
(Q) STABILITY-3 CULVERT STRUCTURE
STA. 548+60

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

MARCH 1972 FILE NO. H-2-25527

PLATE 45



SECTION AA AT
POINTE A LA HACHE PUMPING STATION

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.

(2) WEDGE NUMBER
(3) STRATUM NUMBER

SEE PLATE 55 FOR LOCATION OF SECTION AA

VERT. 1 = BORING 21-CU
VERT. 2 = BORING 21-CUT

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	95.0	95.0	300.0	300.0	300.0	300.0	0.0
(2)	SP (F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
(3)	SP (F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
(4)	CHO	21.0	21.0	300.0	300.0	300.0	300.0	0.0
(5)	SP (F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
(6)	CHO	20.0	20.0	600.0	250.0	600.0	250.0	0.0
(7)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
(8)	CH	40.0	40.0	500.0	300.0	500.0	300.0	0.0
(9)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
(10)	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
(11)	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
(12)	CH	40.0	40.0	715.0	715.0	430.0	430.0	0.0

ASSUMED FAILURE SURFACE NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	FACTOR OF SAFETY
(A) (1)	-9.00	21739	42090	4500	30549	2138	68329	28410	2.405
(A) (2)	-9.00	21739	47126	1000	30549	60	69864	30489	2.291
(B) (1)	-9.00	9994	7000	4500	11699	2138	21494	9560	2.248
(B) (2)	-9.00	9994	12036	1000	11699	60	23029	11639	1.979
(C) (1)	-30.00	43698	38940	14897	83305	16336	97535	66970	1.456
(C) (2)	-30.00	43698	41040	13573	83305	14140	98311	69165	1.421
(C) (3)	-30.00	43698	44940	13402	83305	11366	102040	71939	1.418
(D) (1)	-30.00	24396	6900	14897	45072	16336	46192	28736	1.607
(D) (2)	-30.00	24396	9000	13573	45072	14140	46969	30931	1.518
(D) (3)	-30.00	24396	12900	13402	45072	11366	50698	33706	1.504
(E) (1)	-40.00	53807	45200	23496	113582	28212	122503	85369	1.435
(E) (2)	-40.00	53807	48000	23023	113582	25968	124830	87614	1.425
(E) (3)	-40.00	53807	51600	22835	113582	23681	128242	89901	1.426
(F) (1)	-40.00	33775	9200	23496	68322	28212	66471	40109	1.657
(F) (2)	-40.00	33775	12000	23023	68322	25968	68798	42354	1.624
(F) (3)	-40.00	33775	15600	22835	68322	23681	72209	44641	1.618

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

F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

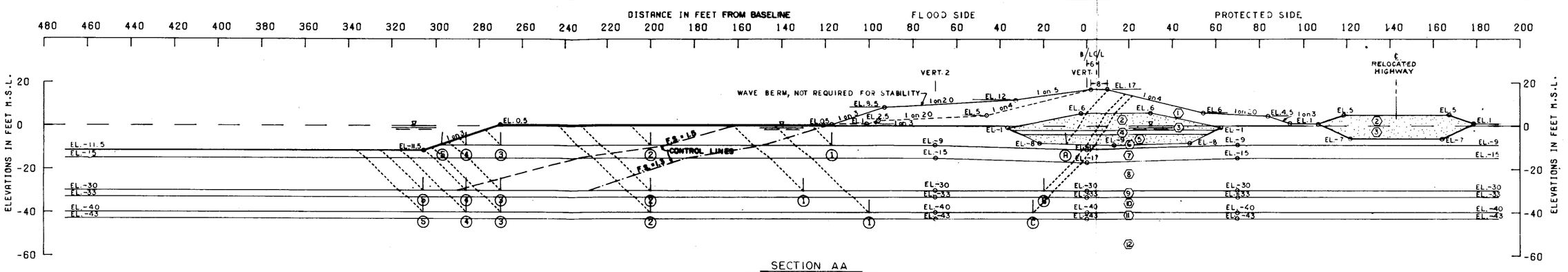
POINTE A LA HACHE PUMPING STATION (Q) STABILITY ANALYSIS

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

MARCH 1972

FILE NO. N-E-28887

PLATE 46



SECTION AA

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
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	DEGREES
①	CH	95.0	95.0	300.0	300.0	300.0	300.0	0.0
②	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
③	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
④	CHO	21.0	21.0	300.0	300.0	300.0	300.0	0.0
⑤	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
⑥	CHO	20.0	20.0	600.0	250.0	600.0	250.0	0.0
⑦	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑧	CH	40.0	40.0	500.0	300.0	500.0	300.0	0.0
⑨	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑩	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
⑪	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑫	CH	40.0	40.0	715.0	715.0	430.0	430.0	0.0

VERT. 1 = BORING 21-CU
VERT. 2 = BORING 21-CUT

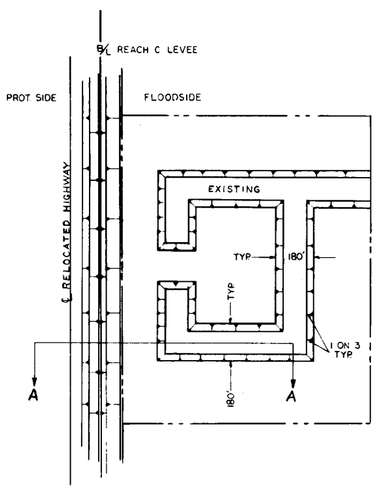
ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
Ⓐ	①	-9.00	21695	35599	4800	30507	1248	62094	29259	2.122
Ⓐ	②	-9.00	21695	56349	4800	30507	1248	82844	29259	2.831
Ⓐ	③	-9.00	21695	73849	3563	30507	704	99106	29803	3.325
Ⓐ	④	-9.00	21695	77635	1563	30507	130	100892	30377	3.321
Ⓐ	⑤	-9.00	21695	79973	187	30507	2	101855	30505	3.339
Ⓑ	①	-30.00	43375	36544	18572	82953	16462	98491	66491	1.481
Ⓑ	②	-30.00	43375	57544	18572	82953	16462	119491	66491	1.797
Ⓑ	③	-30.00	43375	78544	13796	82953	12974	135715	69979	1.939
Ⓑ	④	-30.00	43375	83344	11234	82953	10421	137953	72532	1.902
Ⓑ	⑤	-30.00	43375	89344	11059	82953	7721	143779	75232	1.911
Ⓒ	①	-40.00	53300	30000	28867	112894	34760	112167	78134	1.436
Ⓒ	②	-40.00	53300	70000	28333	112894	30418	151633	82476	1.839
Ⓒ	③	-40.00	53300	98000	21661	112894	24594	172961	88300	1.958
Ⓒ	④	-40.00	53300	104400	20394	112894	20635	178094	92260	1.930
Ⓒ	⑤	-40.00	53300	112400	20056	112894	18027	185756	94867	1.958

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

F.S.= FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

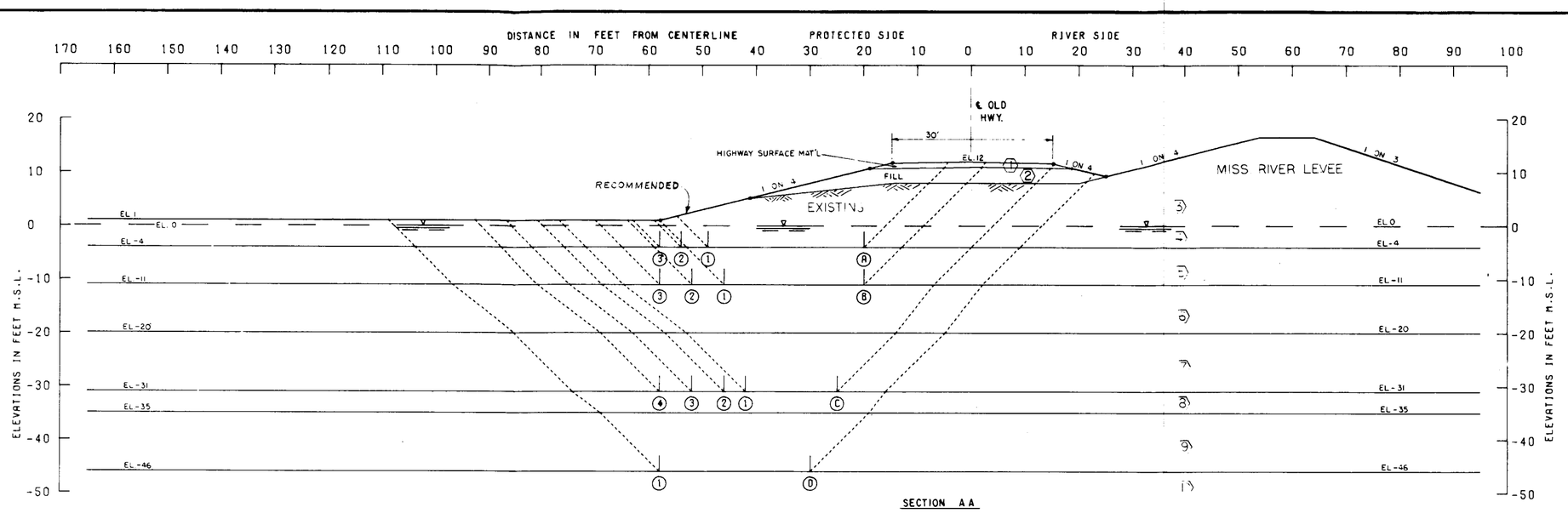
(2)--WEDGE NUMBER
⟨3⟩--STRATUM NUMBER



EXISTING
POINTE A LA HACHE
BOAT HARBOR
SCALE IN FEET
100 0 100 200 300 400 500

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
POINTE A LA HACHE BOAT HARBOR
(Q) STABILITY ANALYSIS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1978 FILE NO. H-2-[illegible]

PLATE 47



SECTION A A

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.

SEE PLATE 50 FOR LOCATION OF SECTION A-A.

VERT. 1 = VERT. 2 = BORING 30-CUT BELOW EL.-4 BORING 25-MHULT USED ABOVE EL.-4

25 MHULT data, refer to "Mississippi River Levees and Banks, Mile 66 to Mile 10, Soils Report-Part I, Soils Data, Volume I-East Bank.

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
⑴		120.0	120.0	0.0	0.0	0.0	0.0	30.0
⑵	CH	110.0	110.0	400.0	400.0	400.0	400.0	0.0
⑶	CH	110.0	110.0	400.0	400.0	400.0	400.0	0.0
⑷	CH	48.0	48.0	400.0	400.0	400.0	400.0	0.0
⑸	CH	20.0	20.0	200.0	200.0	200.0	200.0	0.0
⑹	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑺	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
8	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑼	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
⑽	CH	40.0	40.0	730.0	730.0	460.0	460.0	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	
Ⓐ ①	-4.00	11975	11600	4640	12971	1814	28215	11156	2.529
Ⓐ ②	-4.00	11975	13600	4000	12971	1097	29575	11873	2.491
Ⓐ ③	-4.00	11975	15200	4000	12971	878	31175	12093	2.578
Ⓑ ①	-11.00	14815	5200	6800	24088	5460	26815	18629	1.439
Ⓑ ②	-11.00	14815	6400	6800	24088	3975	28015	20113	1.393
Ⓑ ③	-11.00	14815	7600	6800	24088	3481	29215	20607	1.418
Ⓒ ①	-31.00	33192	6800	24808	65863	25848	64801	40014	1.619
Ⓒ ②	-31.00	33192	8400	24632	65863	24386	66224	41477	1.597
Ⓒ ③	-31.00	33192	10800	24625	65863	22904	68617	42958	1.597
Ⓒ ④	-31.00	33192	13200	24624	65863	22410	71017	43452	1.634
Ⓓ ①	-46.00	46770	11200	39663	106728	48343	97634	58385	1.672

NOTES

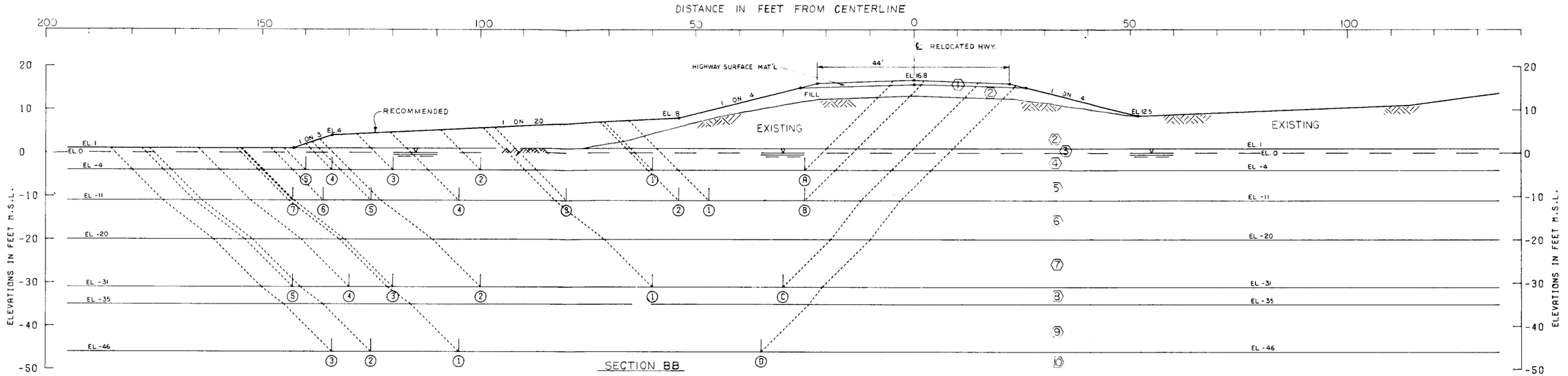
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

Ⓔ -- WEDGE NUMBER
③ -- STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA
OLD LOUISIANA STATE HIGHWAY 39 CROSSING (Q) STABILITY
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1978
FILE NO. H-2-25527

PLATE 48



SECTION BB

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.

VERT. 1 = VERT 2 = BORING 30-CUT
FOR LOCATION OF SECTION BB,
SEE PLATE 50

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		120.0	120.0	0.0	0.0	0.0	0.0	30.0
②	CH	110.0	110.0	400.0	400.0	400.0	400.0	0.0
③	CH	95.0	95.0	200.0	200.0	200.0	200.0	0.0
④	CH	33.0	33.0	200.0	200.0	200.0	200.0	0.0
⑤	CH	20.0	20.0	200.0	200.0	200.0	200.0	0.0
⑥	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑦	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
⑧	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑨	CH	40.0	40.0	400.0	400.0	400.0	400.0	0.0
⑩	CH	40.0	40.0	730.0	730.0	460.0	460.0	0.0

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
Ⓐ	①	-4.00	13747	7000	6914	21975	6483	27661	15493	1.785
Ⓐ	②	-4.00	13747	15000	5391	21975	4242	34138	17724	1.925
Ⓐ	③	-4.00	13747	19000	4629	21975	3278	37376	18697	1.999
Ⓐ	④	-4.00	13747	21800	2800	21975	1954	38347	20021	1.915
Ⓐ	⑤	-4.00	13747	23000	2000	21975	855	38747	21120	1.835
Ⓑ	①	-11.00	16636	4400	9943	36241	14996	30979	21245	1.458
Ⓑ	②	-11.00	16636	5800	9676	36241	13755	32112	22486	1.428
Ⓑ	③	-11.00	16636	11000	8686	36241	11257	36322	24985	1.454
Ⓑ	④	-11.00	16636	16000	7733	36241	9021	40369	27220	1.483
Ⓑ	⑤	-11.00	16636	20000	6000	36241	6950	42636	29291	1.456
Ⓑ	⑥	-11.00	16636	22200	4800	36241	3666	43636	32575	1.340
Ⓑ	⑦	-11.00	16636	23600	4800	36241	2769	45036	33472	1.345
Ⓒ	①	-31.00	36396	12000	29984	86790	42006	78380	44784	1.750
Ⓒ	②	-31.00	36396	28000	26474	86790	33981	90870	52808	1.721
Ⓒ	③	-31.00	36396	36000	23491	86790	26259	95887	60531	1.584
Ⓒ	④	-31.00	36396	40000	22192	86790	23028	98588	63761	1.546
Ⓒ	⑤	-31.00	36396	45200	22153	86790	20198	103749	66592	1.558
Ⓓ	①	-46.00	51345	28000	39256	135107	57384	118602	77723	1.526
Ⓓ	②	-46.00	51345	36000	37432	135107	49487	124777	85620	1.457
Ⓓ	③	-46.00	51345	39600	36982	135107	46489	127928	88618	1.444

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

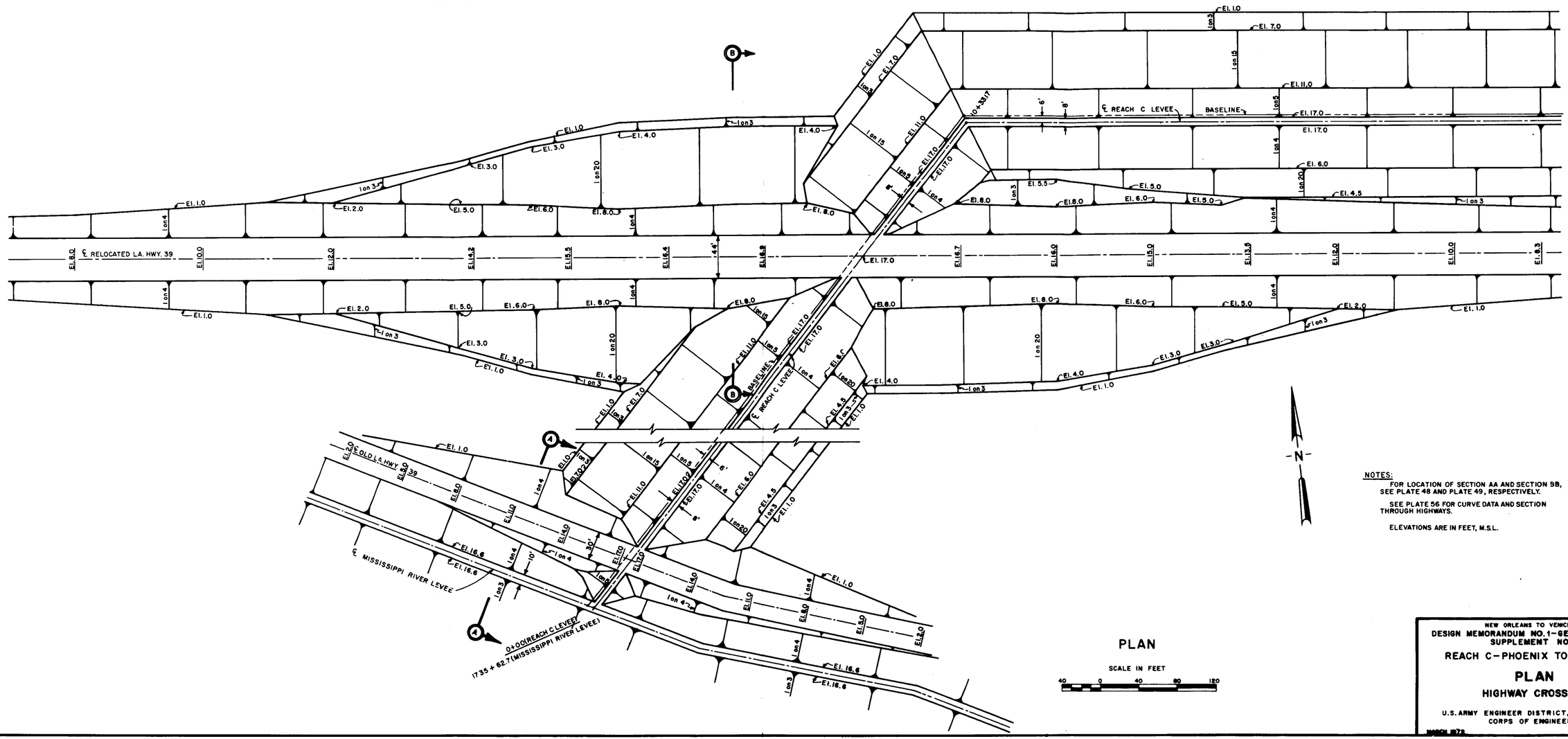
F.S. = FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$

② — WEDGE NUMBER

③ — STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
RELOCATED LOUISIANA STATE HWY 39 CROSSING
(Q) STABILITY
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DRAWN 1973 FILE NO. H-2-25587

PLATE 49



NOTES:

FOR LOCATION OF SECTION AA AND SECTION BB, SEE PLATE 48 AND PLATE 49, RESPECTIVELY.

SEE PLATE 56 FOR CURVE DATA AND SECTION THROUGH HIGHWAYS.

ELEVATIONS ARE IN FEET, M.S.L.

PLAN

SCALE IN FEET

40 0 40 80 120

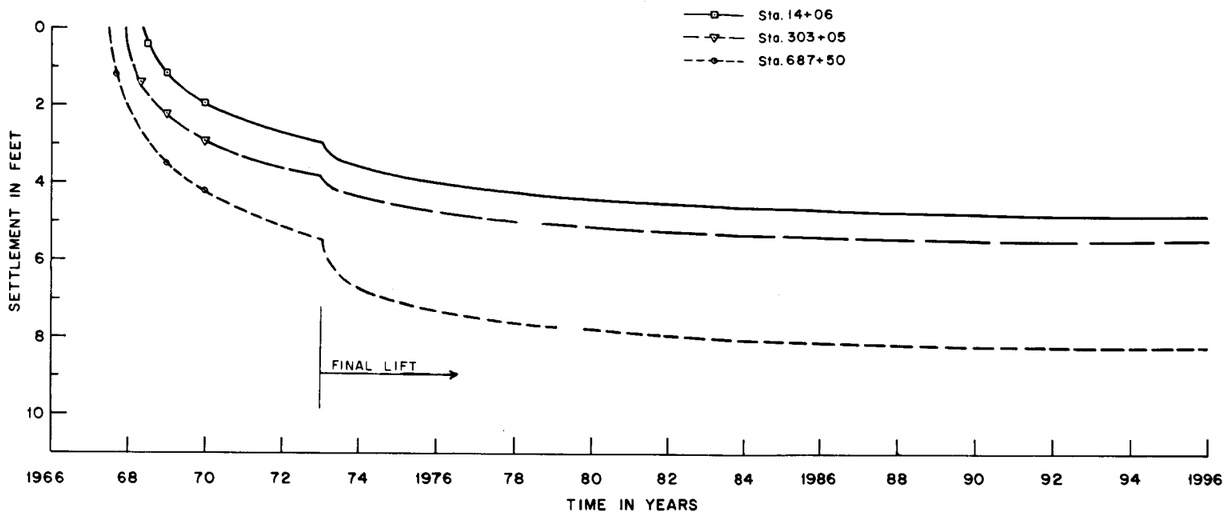
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

PLAN
HIGHWAY CROSSINGS

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

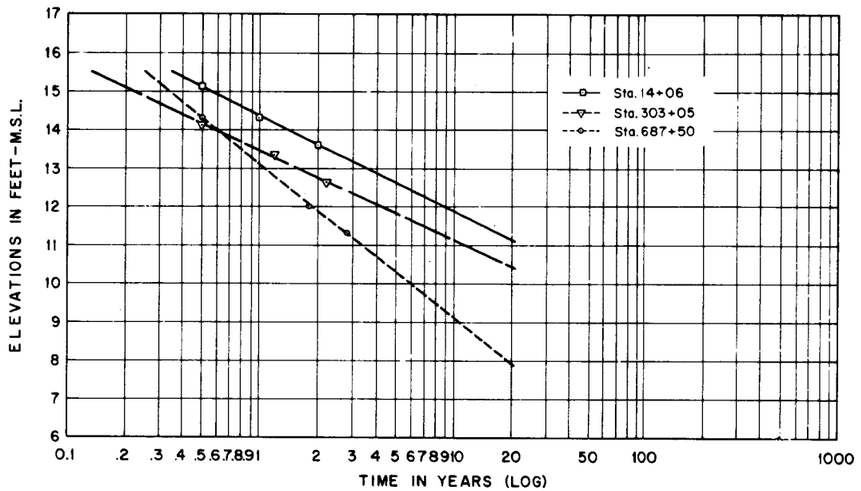
MARCH 1972 FILE NO. H-2-25527

PLATE 50



SETTLEMENT — TIME RELATIONSHIP (3 BORING LOCATIONS)
FINAL LIFT ASSUMED TO OCCUR IN 1973

NOTE:
All plotted points are readings taken in the field at the times indicated. These readings were taken on the levee baseline at the three undisturbed boring locations listed on the curves.



SETTLEMENT — TIME (LOG) RELATIONSHIP
EXCLUDING FINAL LIFT

ESTIMATED 1970*-1973 SETTLEMENT		ESTIMATED SETTLEMENT AFTER FINAL LIFT (1973)
STA. 14+06	1.0 FT.	1.9 FT.
STA. 303+05	1.0 FT.	1.8 FT.
STA. 687+50	1.4 FT.	2.6 FT.

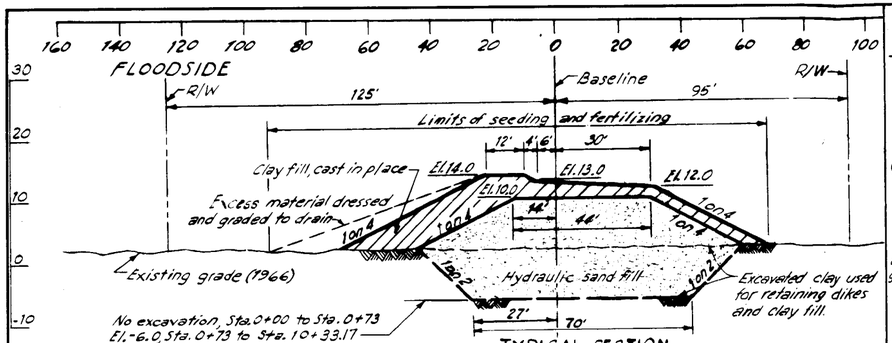
*Date of last field readings.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C—PHOENIX TO BOHEMIA

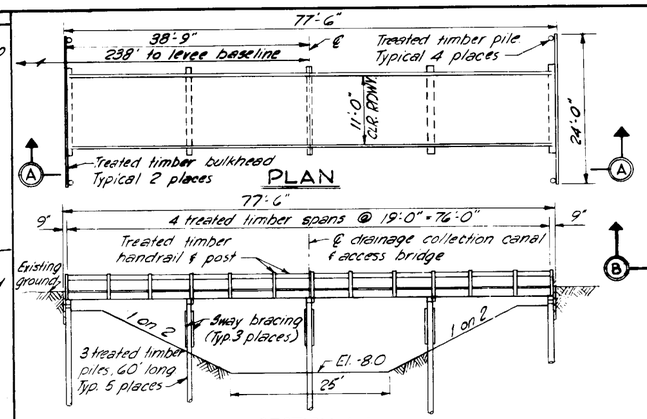
ESTIMATE OF SETTLEMENT

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

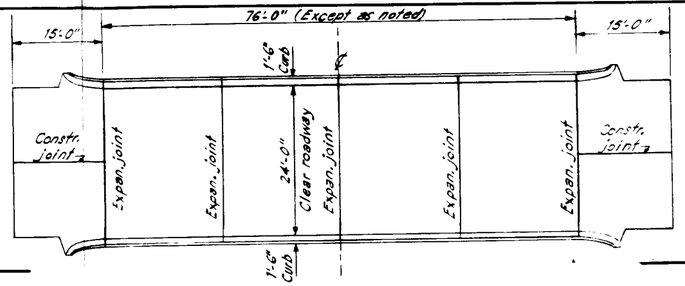
PLATE 51

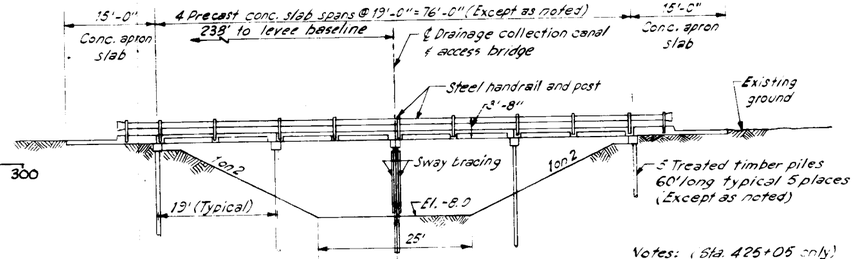


TYPICAL SECTION
STA. 0+00 TO 10+33.17



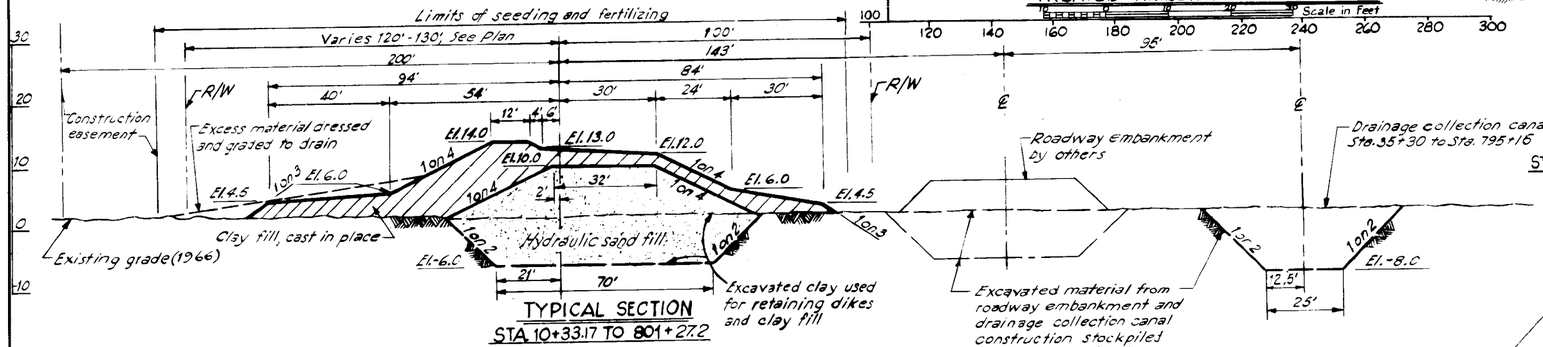
SECTION A-A
STA. 145+68 & 352+75
TREATED TIMBER ACCESS BRIDGES
Scale in Feet



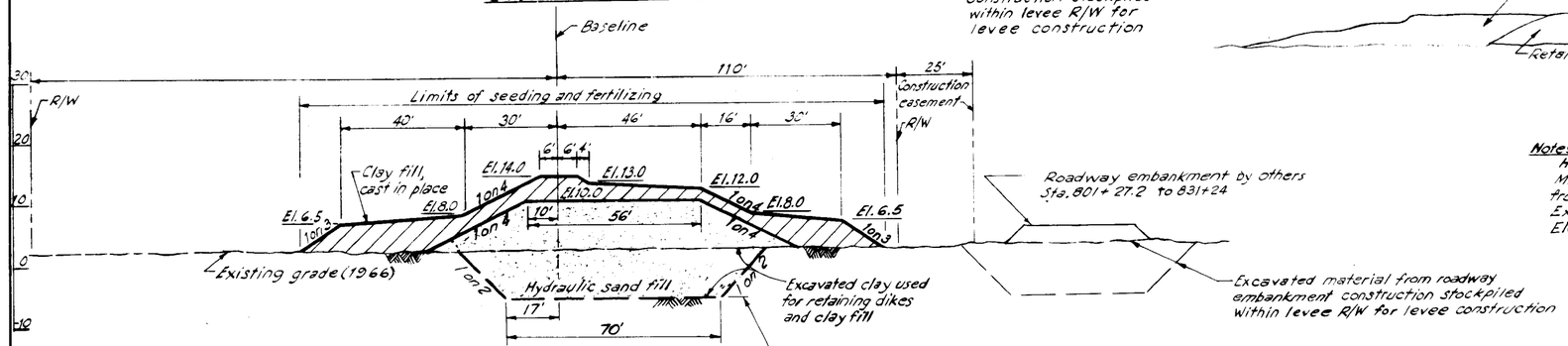


SECTION B-B
STA. 220+90, 257+70, 399+08, 425+05, 515+72, 536+50, 548+00, 674-71
PRECAST CONCRETE ACCESS BRIDGES
Scale in Feet

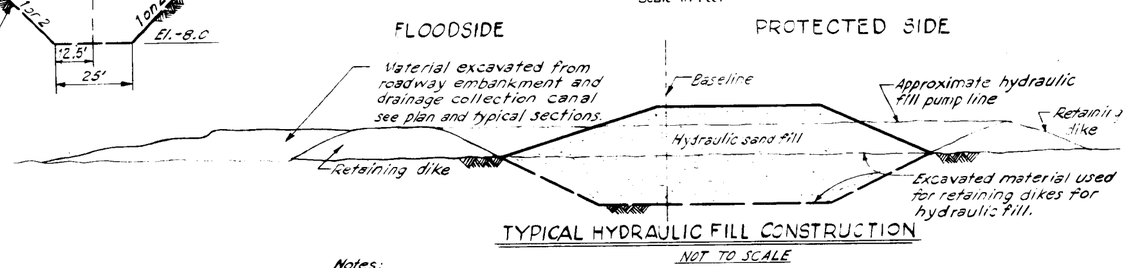
Notes: (Sta. 425+05 only)
1. 5 Precast concrete slabs @ 19'-0" = 95'-0"
2. 5 Treated timber piles, 60' long, typical 6 places



TYPICAL SECTION
STA. 10+33.17 TO 801+27.2



TYPICAL SECTION
STA 801+27.2 TO 834+85.0



TYPICAL HYDRAULIC FILL CONSTRUCTION
NOT TO SCALE

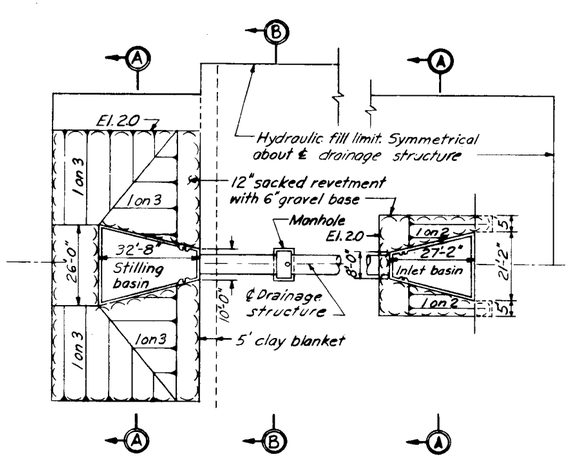
Notes:
Hydraulic sand fill borrowed from Mississippi River. 500' Min. distance from ℄ Mississippi River Levee.
Excavation to El. -90 Max.
Elevations are in feet, M.S.L.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

INTERIM LEVEE DESIGN SECTIONS AND ACCESS BRIDGE DETAILS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

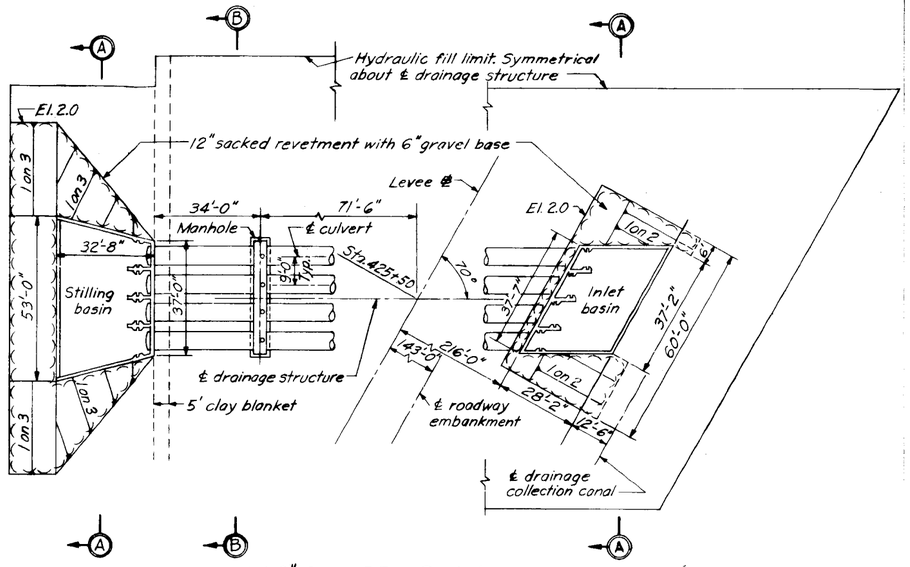
PLATE 52



1-72" CULVERT PLAN

STA. 89+50, 236+70, 486+30

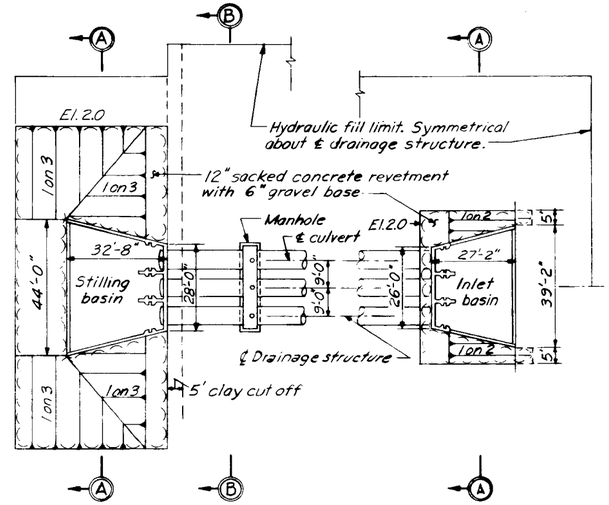
Scale in Feet



4-72" CULVERT PLAN

STA. 425+50

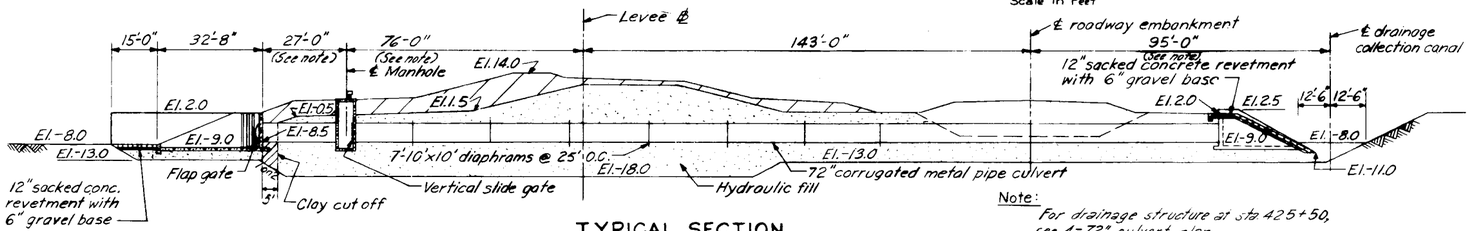
Scale in Feet



3-72" CULVERT PLAN

STA. 548+60

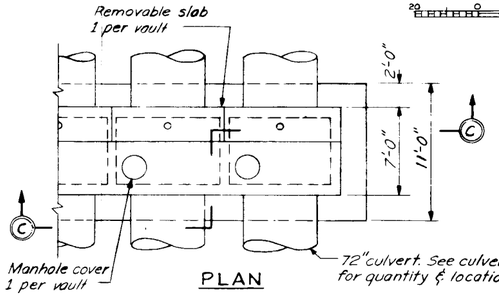
Scale in Feet



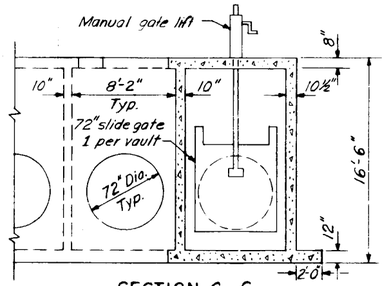
TYPICAL SECTION

Scale in Feet

Note:
For drainage structure at sta 425+50, see 4-72" culvert plan.



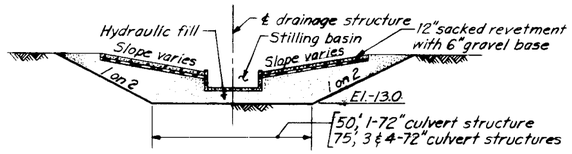
PLAN



SECTION C - C

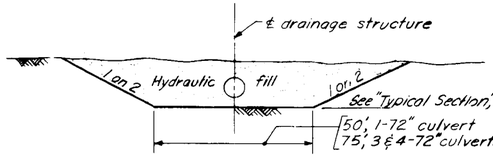
MANHOLE DETAILS

Scale in Feet



SECTION A-A

Not to scale



SECTION B-B

Not to scale

Notes:
See Plate 54 for Drainage Structure Modifications.
Elevations are in feet, M.S.L.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

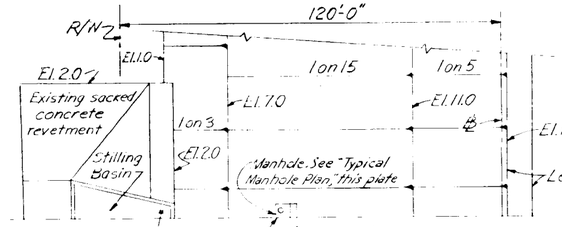
DRAINAGE STRUCTURES PLANS AND SECTIONS

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

MARCH 1972

FILE NO. H-2-25527

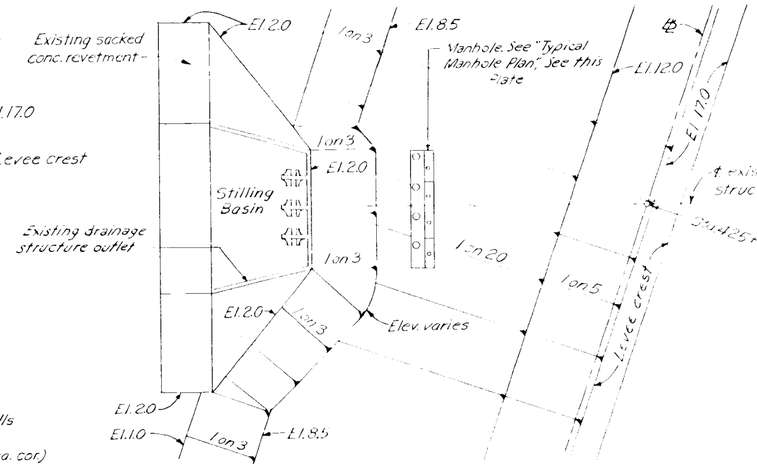
PLATE 53



STA. 89+50 & 236+70

LEVEE PLAN

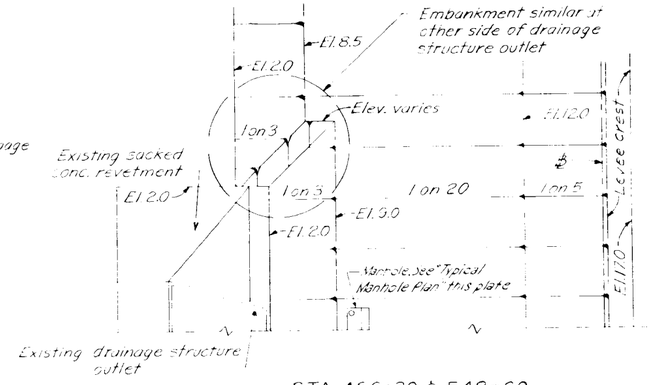
Scale in Feet



STA. 425+50

LEVEE PLAN

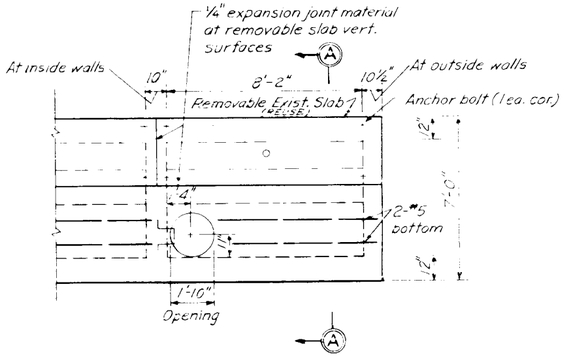
Scale in Feet



STA. 486+30 & 548+60

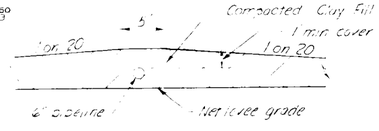
LEVEE PLAN

Scale in Feet



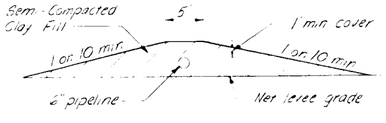
TYPICAL MANHOLE PLAN

Scale in Feet



SECTION A-A

Not to scale



SECTION B-B

Not to scale

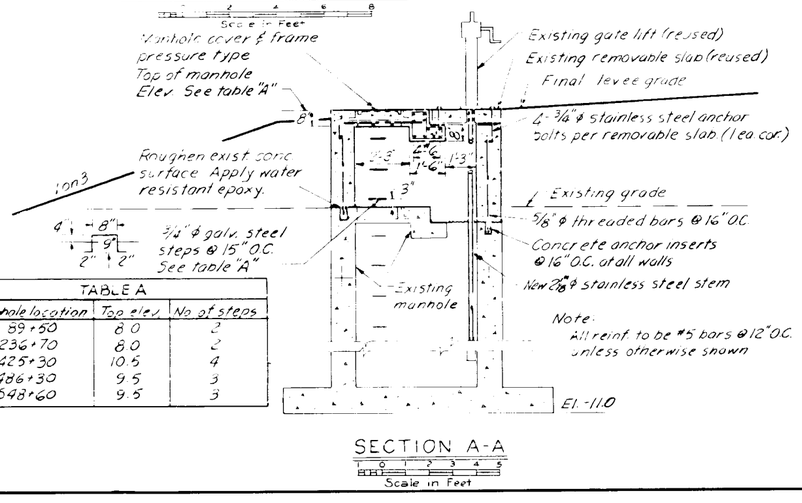
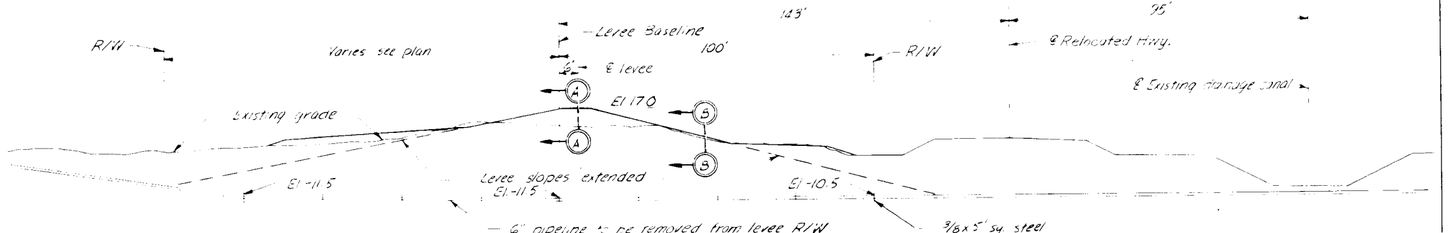


TABLE A		
Manhole location	Top elev.	No. of steps
Sta. 89+50	8.0	2
236+70	8.0	2
425+30	10.5	4
486+30	9.5	3
548+60	9.5	3

SECTION A-A

Scale in Feet



Note:
Elevations are in feet, M.S.L.

STA. 398+75

TEXAS PIPELINE RELOCATION

Scale in Feet

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

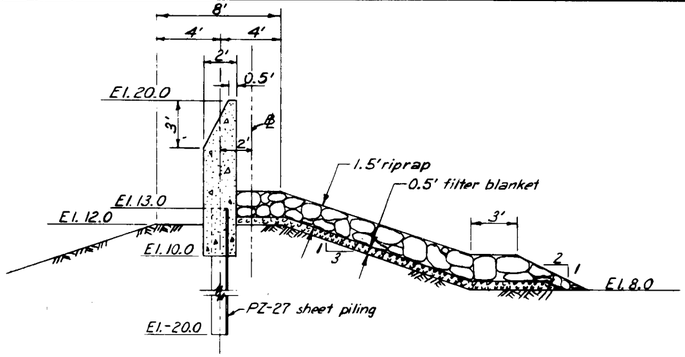
DRAINAGE STRUCTURES & MISCELLANEOUS MODIFICATIONS

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

MARCH 1972

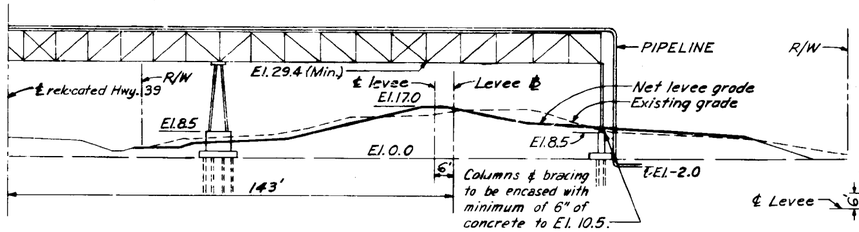
FILE NO. H-2-25527

PLATE 54



TYPICAL FLOODWALL SECTION

Not to scale

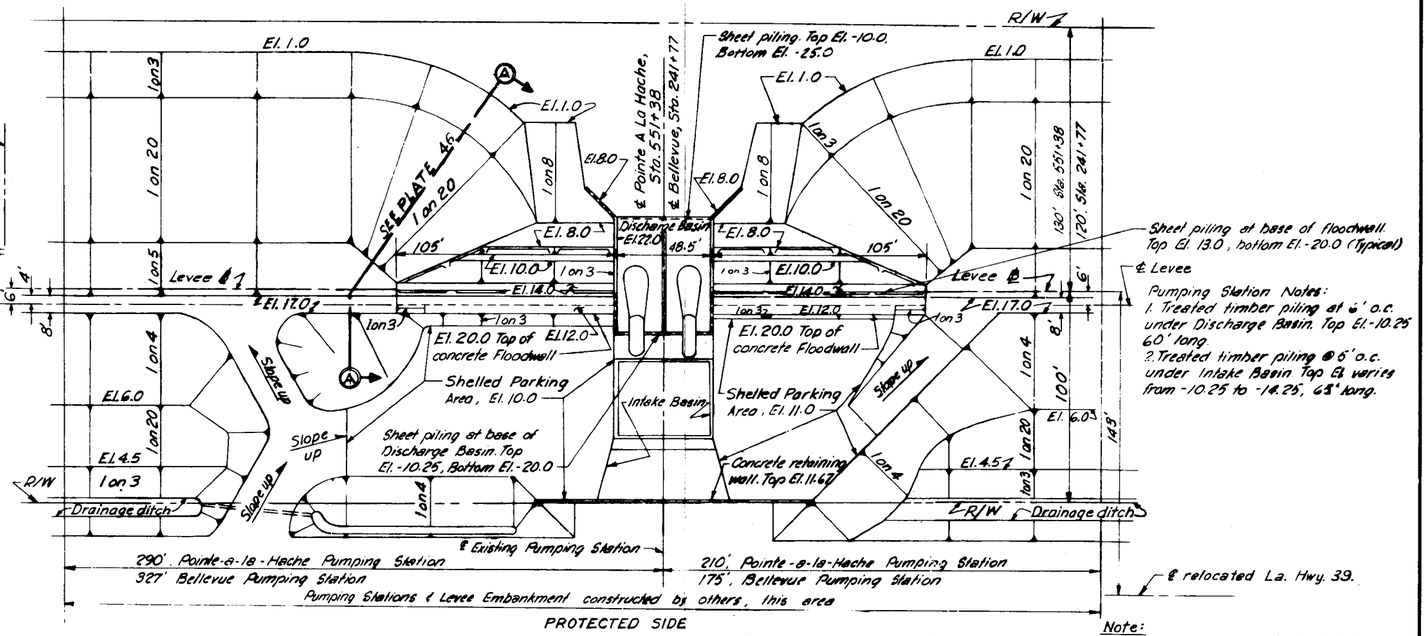


TYPICAL EXISTING PIPELINE BRIDGES

Not to scale

UNITED GAS PIPELINE CO. - STA. 517+00
PERRY R. BASS CO. - STA. 538+00
PERRY R. BASS CO. - STA. 578+43
SOUTHERN NATURAL GAS PIPELINE CO. - STA. 601+85

FLOOD SIDE



Note:
Elevations are in feet, M.S.L.

LEVEE PLAN IN VICINITY OF PUMPING STATIONS

Not to scale

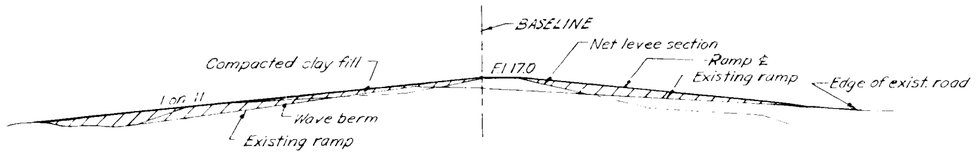
BELLEVUE PUMPING STATION - STA. 241+77
POINTE A LA HACHE PUMPING STATION - STA. 551+38
NOTE:
See Plate 46 for Stability Analysis

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

TYPICAL PIPELINE BRIDGE AND PUMPING STATION DETAILS

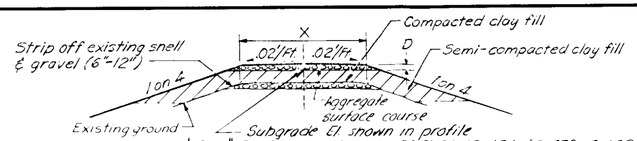
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

PLATE 55



RAMP PROFILE

Scale in Feet



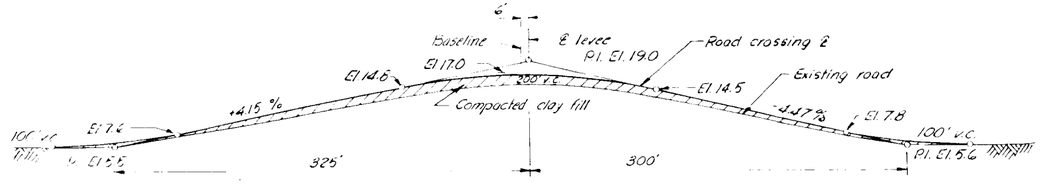
X=20', D=6", Sta.(vicinity of Sta 10+33.2), 86+45, 454+50, 579+15, 602+17, 657+25

X=30', D=12", Sta 36+45, 145+68, 220+90, 257+70, 352+75, 399+08, 424+20, 484+50, 489+60, 515+30, 536+50, 547+60, 674+71, 831+24

X=40', D=12", Sta. 18+45

RAMP SECTION

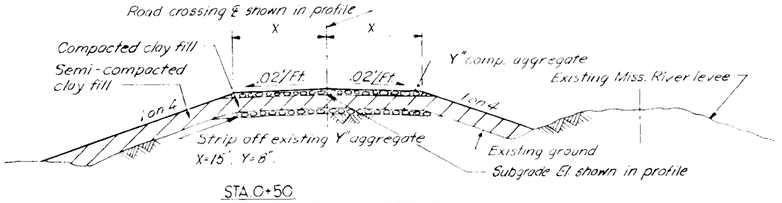
Scale in Feet



STA 0+50

HIGHWAY CROSSING PROFILE

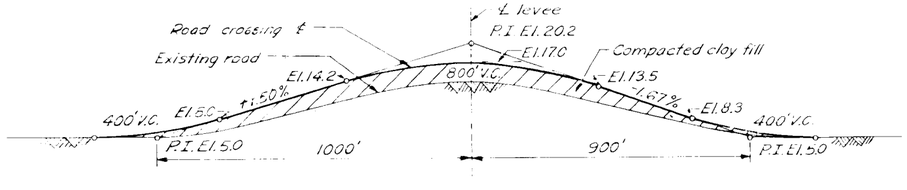
Scales in Feet: Horiz. Vert.



STA 0+50

HIGHWAY CROSSING SECTION

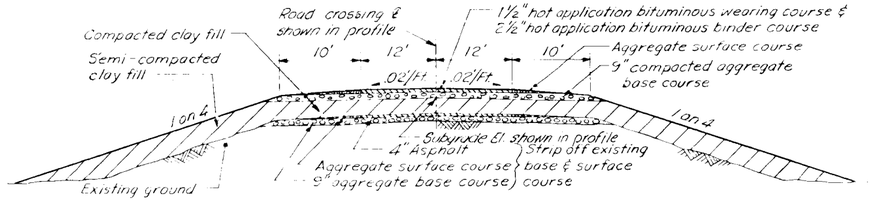
Scale in Feet



STA 6+54

HIGHWAY CROSSING SECTION

Scales in Feet: Horiz. Vert.



STA 8+54

HIGHWAY CROSSING SECTION

Scale in Feet

Notes:

Elevations are in feet, M.S.L.

See Plate 50 for Plan At Highway Crossings.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C-PHOENIX TO BOHEMIA

RAMP AND HIGHWAY PROFILES AND SECTIONS

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

MARCH 1972

FILE NO. H-2-25527

PLATE 56

CORPS OF ENGINEERS

U.S. ARMY

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					

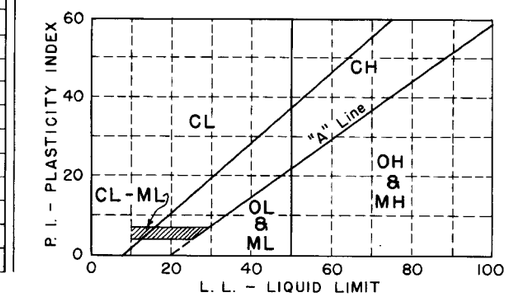
NOTE: Soils possessing characteristics of two groups are designated by combinations of group symbols

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

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



PLASTICITY CHART

For classification of fine - grained soils

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 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.D.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

PLATE A

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

APPENDIX A

HYDROLOGY AND HYDRAULIC ANALYSIS

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

APPENDIX A
HYDROLOGY AND HYDRAULIC ANALYSIS

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GLOSSARY

ASTRONOMICAL TIDE - See PREDICTED NORMAL TIDE

ATMOSPHERIC PRESSURE ANOMALY - The difference between atmospheric pressure at any point within the hurricane and normal pressure at the periphery of the hurricane.

BUILDUP - The increase, in feet, over that from other causes, of water surface elevation in a body of water resulting from:

a. Convergence in depth or width
b. Construction of a barrier
c. Ponding

CENTRAL PRESSURE INDEX - A parameter of hurricane intensity which reflects the minimum atmospheric pressure within the eye of a particular hurricane.

FETCH - The continuous area of water over which the wind blows in essentially a constant direction. Often used with FETCH LENGTH.

FETCH LENGTH - The horizontal distance over which the wind from a fixed direction may have unobstructed contact with the water surface.

HURRICANE - A cyclonic storm, usually of tropical origin, containing winds of 75 miles per hour or more.

a. DESIGN HURRICANE - That hurricane selected by the reporting office as a basis for design of the proposed plan of improvement.

b. STANDARD PROJECT HURRICANE - A hypothetical hurricane intended to represent the most severe combination of meteorological conditions that are reasonably characteristic of the region involved, excluding extremely rare combinations.

c. PROBABLE MAXIMUM HURRICANE - A hypothetical hurricane that might result from the most severe combination of meteorological conditions that are considered reasonably possible in the region involved. This hurricane is substantially more severe than the standard project hurricane and is seldom, if ever, used as the controlling consideration in design.

d. MODERATE HURRICANE - A hurricane that may be expected from a combination of meteorological conditions that are frequently experienced in the region.

e. TRANSPOSED HURRICANE - A storm transferred from actually observed location to another location for the purpose of study, with appropriate changes in storm characteristics.

HURRICANE TRACK - The line connecting successive locations of central pressure of the hurricane.

HURRICANE SPEED - The rate of forward movement of the hurricane eye in knots or miles per hour.

HURRICANE SURGE - The mass of water causing an increase in elevation of the water surface above normal tide at the time of a hurricane.

HURRICANE SURGE HEIGHT - The elevation of the stillwater level at a given point resulting from predicted normal tide and from hurricane surge action. It may be the result of one or more of the following components:

a. Predicted normal tide
b. Pressure setup
c. Setup due to winds over the continental shelf
d. Buildup

In inland lakes, hurricane surge height is the average lake level and does not include local wind setup.

HURRICANE TIDE - The elevation of the stillwater level at a given point during a hurricane. In inland lakes it is the sum of hurricane surge height and additional local wind setup.

ISOVEL - Line connecting points of simultaneous equal wind velocities and in this appendix represents a 5-minute average, 30 feet above ground level.

KNOT - A velocity equal to 1 nautical mile (6,080 feet) per hour, or about 1.15 statute miles per hour.

LANDFALL - The arrival of a hurricane center at the coastline.

OVERTOPPING - The amount of water passing over the top of a structure as a result of wave runup or surge action.

PONDING - The storage, behind a water-retaining structure, of water from interior runoff or from overtopping of a structure.

PREDICTED NORMAL TIDE - The periodic rising and falling of the water that results from gravitational attraction of the moon and sun acting upon the rotating earth.

PRESSURE SETUP - A rise in the surface of a large body of water caused by a measurable reduction in local atmospheric pressure at sea level.

RANGE - An imaginary line representing the centerline of a narrow fetch over which the hurricane surge height is computed.

RUNUP - The vertical elevation above stillwater level to which water rises on the face of a structure as a result of wave action.

SETUP - The vertical rise in the stillwater level, above that which would occur without wind action, caused by wind stresses on the surface of the water.

SIGNIFICANT WAVE - A statistical term denoting waves having the average height and period of the highest one-third waves of a given wave train.

STILLWATER LEVEL - The elevation of the water surface if all wave action were to cease.

STORM SURGE - Same as HURRICANE SURGE, except that it may be caused by storms not of hurricane characteristics as well as by hurricanes.

SURGE REFERENCE LINE - The locus of points where the maximum surge height would be observed along fetches normal to the general coast.

WAVE HEIGHT - The vertical distance between the crest and the preceding trough. (Referenced to significant waves in this report.)

WAVE SETUP - The superelevation of the water surface above the hurricane surge height due to wave action alone.

WAVE TRAIN - A series of waves from the same direction.

WIND SETUP - Same as SETUP

WIND TIDE LEVEL - Same as STILLWATER LEVEL

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

APPENDIX A
HYDROLOGY AND HYDRAULIC ANALYSIS

SECTION I - CLIMATOLOGY AND HYDROLOGY

1. Climatology.

a. Climate. The climate of the project area is related to a subtropical latitude in proximity to the Gulf of Mexico. The climate may be characterized as marine, especially in summer when southerly winds prevail and produce conditions favorable for the generation of convective thundershowers. In colder seasons the area is subjected to frontal movements which produce squalls and sudden temperature drops. Fogs on the Mississippi River are prevalent during the winter and spring when the temperature of the river is generally colder than the air temperature. Normally, the river flood season occurs from December to early June, and the hurricane season occurs during the period from June to October. Climatological data for this area are contained in monthly and annual publications by the U. S. Department of Commerce, Weather Bureau (now the National Oceanic and Atmospheric Administration, National Weather Service), titled "Climatological Data for Louisiana," and "Local Climatological Data, New Orleans, Louisiana." The temperature and precipitation data are available for several National Weather Service stations. The data for New Orleans, with 98 years of record, and Burrwood, with 56 years of record, were used to compute normals and averages of temperature and precipitation for the project area.

b. Temperature. The average annual temperature in the project area is 70° Fahrenheit, with monthly means ranging from 57° in January to 83° in July and August. The maximum temperature of 102° was recorded at Belle Chasse on 7 August 1935, at New Orleans on 30 June 1954 and earlier dates, and at Port Sulphur on 31 August 1951. Minimum temperatures of 6° were recorded at Diamond on 12 February 1899 and 7° at New Orleans on 13 February 1899. Normal temperatures by months, determined by averaging Weather Service normals for Burrwood and New Orleans, are as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
56.8	58.2	62.2	68.8	76.0	81.7	83.1	83.2	80.4	73.5	63.6	58.4

c. Rainfall. Precipitation is generally heavy during two fairly well defined periods. Summer showers occur from about mid-June to mid-September and winter rains from mid-December to mid-March. Precipitation is greatest in the warm months due to summer thundershowers, and February has a greater average than the other winter months. The average annual rainfall is 60.8 inches. At New Orleans, a maximum annual rainfall accumulation of 85.73 inches was recorded in 1875 and a minimum of 31.04 inches was recorded in 1899. Normal monthly rainfall ranges from 7.3 inches in July to 3.3 inches in October. Monthly normals based on averaging records for Burrwood and New Orleans are as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
4.25	4.50	5.22	4.71	4.60	4.87	7.31	6.93	6.83	3.31	3.94	4.34

The maximum monthly rainfall is 29.0 inches, recorded at Belle Chasse in October 1937. Several stations have experienced periods in which no rainfall was recorded in a calendar month. Snow occurs infrequently in the area. New Orleans had an 8.2-inch snowfall on 14-15 February 1895. The last appreciable snowfall in the project area occurred on 12 February 1958 when stations reported snowfalls ranging from 1.3 to 4.0 inches.

2. Hydrology.

a. Tides. The tide along the coast is diurnal and has a mean range of approximately 1 foot under normal conditions. During periods of low flow of the Mississippi River, tidal effects are observed in the river as far as 200 miles upstream from the Gulf of Mexico. Water surface elevations are observed regularly at four locations along the Mississippi River within and in the general vicinity of the project limits. These elevations reflect headwater flows and tidal fluctuations. Stage recording gages are located and have been observed at West Pointe a la Hache from 1926 to date; Empire, 1960 to date; and Venice, 1944 to date. Staff gage records are available at Port Sulphur for the period 1934 to date. In addition, daily river stages were obtained at Fort Jackson during the period 1891-1960. Crest stage recorders are maintained at two points--one at Davant on the landside of the Mississippi River east levee and the other at Magnolia on the landside of the west levee. These recorders show the maximum tides reached during tropical storms. River water surface elevations are available in "Stages and Discharges of the Mississippi River and its Outlets and Tributaries," published annually by the Mississippi River Commission, and in "Stages and Discharges of the Mississippi River and Tributaries and Other Streams and Waterways in the New Orleans District," published biennially by the U. S. Army Engineer District, New Orleans.

b. River floods of record. Headwater flooding of the natural banks of the Mississippi River occurs almost annually, but the area flooded is small and confined by the river levees. The higher stages usually occur during the period from February to May. The 1950 high water which produced stages of 10.7 and 7.5 feet m.s.l.[1] at Pointe a la Hache and Fort Jackson, respectively, is the maximum of record in the project area. The coincidence of a hurricane occurring with a major river flood is considered to be possible but highly improbable.

c. Storm tides. Many severe storms have been experienced in and near the project area. Flooding to various depths occurred in these areas during the storms of 1856, 1860, 1886, 1887, 1893, 1901, 1906, 1909, 1915, 1916, 1917, 1926, 1940, 1947, 1948, 1956, 1961, 1964, 1965, and 1969. Hurricane Betsy, in September 1965, passed west of the project area and produced tides of 14.8 feet at Bohemia; 14.4 feet at West Pointe a la Hache; 12.6 feet at Ostrica Lock; 9.7 feet at Empire; and 7.9 feet at Venice. Hurricane Camille, occurring in August 1969, passed east of the project area and inundated the protected area on the west side of the Mississippi River from Port Sulphur to Venice and caused almost total destruction to facilities located south of the latitude of Port Sulphur. The Phoenix-Pointe a la Hache-Bohemia area escaped severe flood damage as a result of the interim levee constructed by local interests as well as the fact that Hurricane Camille passed a relatively safe distance east of the project area. Some of the flood stages caused by Hurricane Camille at and near the project area were: Ostrica Lock, 15.1 feet; Mississippi River mile 48.7 AHP (Above Head of Passes), 10.9 feet; Mississippi River mile 35.5 AHP, 10.6 feet; interim Reach C levee in the vicinity of Bohemia, 10.1 feet; interim Reach C levee in the vicinity of Pointe a la Hache, 6.0 feet. Had the path of Hurricane Camille been closer to the project area, damage would have equaled or exceeded that which was experienced from Hurricane Betsy.

SECTION II - TIDAL HYDRAULICS

3. Description and verification of procedures.

a. Hurricane memorandums. The Hydrometeorological Branch (HMB), National Weather Service, cooperated in the development of hurricane criteria for historical and potential hurricanes in the project area. Memorandums prepared by the HMB provided isovel patterns, hurricane tracks, pressure profiles, rainfall estimates, frequency data, and various other parameters required

[1] Mean sea level, the datum to which all elevations in this appendix are referenced unless otherwise indicated.

for the hydraulic computations. A reevaluation of historical meteorologic and hydrologic data was the basis for memorandums relative to historical hurricanes. Those relative to potential hurricanes were developed through the use of generalized estimates of hurricane parameters based on the latest research and theory. Memorandums applicable to the project area are listed in Section IV - Bibliography of this appendix.

b. Historical storms used for verification. Three observed storms, with known parameters and effects, were used to establish and verify procedures and relationships for determining hurricane surge heights. These three storms occurred in September of 1915, 1947, and 1956. Isovel patterns for the hurricanes of September 1915(1)[2], September 1947(2), and September 1956(3) are shown on plates A-1, A-2, and A-3, respectively. Isovel patterns are also shown for the two recent devastating hurricanes, Betsy(4) and Camille(5), on plates A-4 and A-5, respectively.

(1) The hurricane of 29 September 1915 had a CPI (central pressure index) of 27.87 inches, an average forward speed of 10 knots, and a maximum windspeed of 99 m.p.h. at a radius of 27 nautical miles. This hurricane approached the mainland from the south. A surge height of 12 feet was experienced at Pointe a la Hache, and Buras had a surge height of 7.9 feet.

(2) The 19 September 1947 hurricane had a CPI of 28.57 inches, an average forward speed of 16 knots, and a maximum windspeed of 100 m.p.h. at a radius of 33 nautical miles. The direction of approach of this hurricane was approximately from the southeast. Surge heights of 11.2 feet at Shell Beach, 8.2 feet at Bohemia, and 11.5 feet at Ostrica lock were experienced during this hurricane.

(3) Hurricane Flossy, 24 September 1956, had a CPI of 28.76 inches, an average forward speed of 10 knots, and a maximum windspeed of 80 m.p.h. at a radius of 30 nautical miles. Flossy approached the mainland from the southwest. Surge heights of 12.1 feet and 8 feet occurred at Ostrica lock and Grand Isle, respectively.

(4) The hurricane of 9 September 1965, Betsy, had a CPI of 27.79 inches, an average forward speed of about 17 knots, and a maximum windspeed of 122 m.p.h. at a radius of 30 nautical miles. The storm approached land from a southeasterly direction. Surge heights experienced in and near the project area are listed in paragraph 2c of this appendix.

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[2]Superscript numbers in parentheses indicate references in Section IV - Bibliography of this appendix.

(5) Hurricane Camille, 17 August 1969, had a CPI of 26.61 inches, an average forward speed of about 13 knots, and a maximum windspeed of 146 m.p.h. at a radius of 15 nautical miles. Refer to paragraph 2c of this appendix for maximum surge heights experienced in and near the project area.

c. Synthetic storms. Computed hurricane surge heights, resulting from synthetic storms, are necessary for frequency and design computations. Parameters for certain synthetic storms and methods for derivation of other parameters were furnished by the National Weather Service. The SPH (Standard Project Hurricane) for the Louisiana coast was used as the base hurricane since other hurricanes could be derived from it. The PMH (Probable Maximum Hurricane) and Mod H (Moderate Hurricane) were derived from the SPH and differ from it only in wind velocities and CPI's.

(1) The SPH used in the "Interim Survey Report, Mississippi River Delta at and below New Orleans, Louisiana," was derived by the National Weather Service from a study of 48 hurricanes that occurred in the region over a period of 69 years. Based on subsequent studies of recent hurricanes, the Weather Service revised the original SPH wind field patterns.(6)(7) However, the other characteristics of the SPH were not changed. The hurricane track and isovel pattern at the critical hour for the design hurricane critical to the Reach C levee are shown on plate A-6.

(a) The SPH has a frequency of once in 100 years for the Louisiana coastal region. The CPI that corresponds to this frequency is 27.5 inches. CPI probabilities are based on the following relationship(8)(9):

$$P = \frac{100\ (M-0.5)}{Y}$$

where P = percent chance of occurrence per year
M = number of the event (rank)
Y = number of years of record

(b) The radius of maximum winds is an index of hurricane size. The average radius of 12 hurricanes occurring in the vicinity of the project area is 36 nautical miles. From relationships of CPI and radius of maximum winds of gulf coast hurricanes(8)(9), a radius of 30 nautical miles is considered representative for an SPH having a CPI of 27.5 inches.

(c) An average forward speed of 11 knots was used for hurricanes critical to the project area. The average forward speeds of hurricanes experienced in the Gulf of Mexico ranged from 5 to 30 miles per hour.

(d) Maximum theoretical gradient wind[8] is expressed as follows:

$$V_{gx} = 73 \sqrt{P_n - P_o} - R\,(0.575\,f)$$

where V_{gx} = maximum gradient windspeed in miles per hour
P_n = asymptotic pressure in inches
P_o = central pressure in inches
R = radius of maximum winds in nautical miles
f = Coriolis parameter in units of hour $^{-1}$

The estimated windspeed[3] (V_x)[10] in the region of the highest speeds is obtained as follows:

$$V_x = 0.885\,V_{gx} + 0.5T$$

where T is equal to the forward speed of translation in miles per hour. From these relationships, a windspeed of approximately 100 m.p.h. was obtained for the SPH.

(2) Synthetic storms with various frequencies and corresponding CPI's are derived from the SPH. The CPI for any frequency except the PMH is obtained from the graph shown on plate A-7. For the PMH, the National Weather Service recommends a CPI of 26.9 inches[9][10][11][12]. The computation of V_{gx} for all synthetic and historical storms is identical to that for the SPH. However, for the PMH, P_n is increased to 31.22 inches.[9] Similarly, the computation of V_x for any storm is identical to that for the SPH. Various isovels are adjusted from the SPH pattern using the ratio V_x of any hurricane to V_x of the SPH. Characteristics of some Zone B, large radius, synthetic storms with moderate speeds of translation, along with the characteristics of five historical storms, are listed in table A-1.

TABLE A-1
HURRICANE CHARACTERISTICS

Hurricane[1]	CPI	Radius to max. winds	Forward speed	V_x
	inches	nautical miles	knots	m.p.h.
Sept 1915	27.87	29	10	99
Sept 1947	28.57	33	16	100
Sept 1956	28.76	30	10	80
Sept 1965	27.79	32	17	122
Aug 1969	26.61	15	13	146(@ 25° lat.)
PMH	26.9	30	11	143(@ 30° lat.)
SPH	27.5	30	11	100
Mod H	28.3	30	11	83

[1]Tracks are shown on plate A-8.

[3]Windspeeds represent a 5-minute average, 30 feet above ground level.

d. Surges.

(1) Maximum hurricane surge heights along the gulf shore were determined by use of a general wind tide formula that is based on the steady state theory of water superelevation[13][14][15]. The computations were made for ranges extending from the shore to the continental shelf. In order to reach agreement between computed maximum surge heights and observed high-water marks, it was necessary to introduce a calibration coefficient or surge adjustment factor (Z) into the general equation which, in its modified form, is:

$$S = 1.165 \times 10^{-3} \frac{V^2 F}{D} NZ \cos \theta$$

where S = wind setup in feet
V = windspeed in statute miles per hour
F = fetch length in statute miles
D = average depth of fetch in feet
N = planform factor, generally equal to unity
Z = surge adjustment factor
θ = angle between direction of wind and the fetch

(2) Water surface elevations along a range were determined by incremental summation of wind setup above the water elevation at the gulf end of the range. The initial elevation at the beginning of each range was determined from the predicted normal tide and the setup due to atmospheric pressure anomaly. Typical tidal cycles for the project area are shown on plate A-9. An adjustment was made at the shoreward end of the range to compensate for the difference in pressure setup between the ends of the range. This procedure for the determination of surge height at the coastline was developed for an area along the Mississippi gulf coast where reliable data were available at several locations for more than one severe hurricane. The procedure was then used for the entire Louisiana coastal region. Due to dissimilar shoreline configurations, different surge adjustment factors were required at each location, but identical factors were used at a particular location for all storms. The value of the factor is apparently a function of the distance between the shoreline and deep water and varies inversely with this distance. Computed maximum elevations and observed high-water elevations for the 1915 and 1947 hurricanes at the locations that were used in the development of the procedure are shown in table A-2.

TABLE A-2
HURRICANE SURGE HEIGHTS

Location	Surge Adjustment factor(Z)	1915 Observed feet m.s.l.	1915 Computed feet m.s.l.	1947 Observed feet m.s.l.	1947 Computed feet m.s.l.
Bay St.Louis,Miss.	0.46	11.8	11.8	15.2	15.1
Gulfport, Miss.	0.60	10.2[1]	9.9	14.1	14.3
Biloxi, Miss.	0.65	10.1[1]	9.8	12.2[1]	12.6

[1]Average of several high-water marks.

(3) The incremental step computation was used to check maximum hurricane surge heights experienced at several locations within the project area. Verification of these surge heights and the surge adjustment factors used in the computations are shown in table A-3.

TABLE A-3
VERIFICATION OF HURRICANE SURGE HEIGHTS

Location	Surge Adjustment factor(Z)	Sept 1915 Observed feet m.s.l.	Sept 1915 Computed feet m.s.l.	Sept 1956 Observed feet m.s.l.	Sept 1956 Computed feet m.s.l.
Belair	0.52	-	-	5.3	6.2
Phoenix	0.52	-	-	8.5	7.8
Pointe a la Hache	0.52	12.0	12.4	10.3	10.2
Ostrica Lock	0.64	-	-	12.1	12.2

(4) Surge heights were computed for Hurricane Betsy, September 1965, at locations within the project area where reliable observed surge heights were available. Using the same Z factors as shown in table A-3, the computed surge heights averaged about 2.9 feet higher than the observed surge heights. This apparently was caused by the higher forward speed of Betsy. A fast-moving hurricane does not allow enough time for the surge heights to approach the steady state of water superelevation(13)(14)(15). However, it was determined that the Z factors derived from slow-moving hurricanes should be used for design purposes because this type hurricane is more nearly representative of hurricanes in the project area, and the resulting design elevations are conservative (high).

(5) For each surge computation, the average windspeed was determined from isovel charts supplied by the National Weather Service,(6) and average depth values were derived from standard hydrographic charts prepared by the U. S. Coast and Geodetic Survey (now the National Oceanic and Atmospheric Administration, National Ocean Survey).

(6) Marshlands fringe the coastline and are inundated for considerable distances inland by hurricane surges. The limit of overland surge penetration is dependent upon the height of the surge and the duration of high stages at the coast. The surge height at the coastline depends primarily on the direction and intensity of winds and the hurricane velocity of translation. Bays are prevalent in the project area and influence surge heights at inland locations. The routing of these surges overland by conventional methods was complicated by the undefinable effect of high windspeeds on flow, such that the procedures yielded questionable results when applied to different hurricanes experienced in a given location. Attempts to correlate hurricane translation speeds, surge hydrographs at the coastline, and surge heights at inland locations also yielded inconsistent relationships. A study of available observed inland and coastline high-water marks indicates a consistent simple relationship between the maximum surge height and the distance inland from the coast, as shown on plate A-10. This relationship exists independently of the speed of hurricane translation, windspeed, or direction. The data indicate that the weighted mean decrease in surge heights inland is at the rate of 1.0 foot per 2.75 miles. This relationship remains true even in the western portion of Louisiana where relatively high wooded ridges parallel the coast. Efforts to establish time lags between the crest surge heights at the coast and at inland locations were unsuccessful because of inadequate basic data.

(7) For the purpose of surge routing procedures, the coastline is defined as the locus of points where the maximum surge heights would be observed along fetches normal to the general coast. This synthetic coastline has been designated the surge reference line (SRL) and is shown on plate A-11. In order to determine maximum surge heights at inland locations, it was necessary to compute maximum surge heights at the SRL, and then reduce these computed elevations at the rate of 1.0 foot per 2.75 miles to the location of interest. The procedure has given satisfactory results in the project area, and has verified the observed data in other study areas.

e. Wave runup.

(1) Wave runup on a protective structure depends on the characteristics of the structure (i.e., shape and surface roughness), the wave characteristics, and the depth of water at the structure. The vertical height to which water from a breaking wave will run up on a given protective structure determines the

top elevation to which the structure must be built to prevent wave overtopping.

(2) Computations were made to determine wave runup for protective structures along the project alinement. The configurations of the structures are shown on plate A-12.

(3) In order to compute wave runup on a protective structure, the significant wave height (H_S) and wave period (T) in the vicinity of the structure must be known. These parameters were determined according to Bretschneider[16] and as described in paragraph 1.25 of bibliographic reference (13). The windspeed and depth used in determining H_S and T were average values over a 5-mile fetch. Data used to determine wave characteristics in the vicinity of the protective structures are shown in table A-4.

TABLE A-4
DATA USED TO DETERMINE WAVE CHARACTERISTICS
DESIGN HURRICANE

Pertinent factors	Phoenix to Davant	Davant to Bohemia
F - Length of fetch, miles	5	5
U - Windspeed, m.p.h.	96	96
s.w.l. - Stillwater elevation, feet	13.0	14.0
d - Average depth of fetch, feet	11.5	12.5
d_t - Depth at toe of structure, feet	11.5	12.5

(4) Wave runup was calculated by use of model study data developed by Saville[17][18][19][20] which relate relative runup (R/H_0'), wave steepness (H_0'/T^2), and relative depth (d/H_0'). The average depth (d) of the 5-mile fetch is shown in table A-4 and the significant wave height (H_S) and wave period (T) can be determined from the data in table A-4. The equivalent deepwater wave height (H_0') can be determined from table D-1 of bibliographic reference (13) which relates d/L_0 to H/H_0'. The deepwater wave length (L_0) is determined from the equation:

$$L_0 = 5.12\ T^2$$

When determining runup based on the significant wave, H in the term H/H_0' is equal to H_S. Wave characteristics used in computing runup based on the significant wave are shown in table A-5.

TABLE A-5
WAVE CHARACTERISTICS
DESIGN HURRICANE

Characteristics	Phoenix to Davant	Davant to Bohemia
H_S - Significant wave height, feet	5.45	5.45
T - Wave period, seconds	5.35	5.65
L_o - Deepwater wave length, feet	146.53	163.43
d/L_o - Relative depth	0.07848	0.07649
H_S/H'_o - Shoaling coefficient	0.9569	0.9599
H'_o - Deepwater wave height, feet	5.70	5.68
H'_o/T^2 - Wave steepness	0.199	0.178

(5) With the terms d/H'_o and H'_o/T^2 known, runup on a protective structure can be computed if the slope of the structure is known. The levee configurations used in these computations have berms on the flood side. Since berms break the continuity of the levee slope, Saville's[20] method of determining wave runup on composite slopes was used (see plate A-13). In using this method, the actual composite slope is replaced by a hypothetical single constant slope. This hypothetical slope is computed by estimating a value of wave runup and then determining the slope of a line from the point where the wave breaks to the estimated point of runup. The breaking depth is determined from the equation:

$$d_b = \frac{0.67\ H'_o}{(H'_o/T^2)^{1/3}}$$

Using the slope of this line, which is the hypothetical slope, a value of runup is determined. If the value of runup determined is different from the estimated runup, the process is then repeated using the new value of runup to obtain a new hypothetical slope which, in turn, determines a new value of runup. This process is repeated until the estimated value of runup agrees with the computed value of runup.

(6) Protective structures exposed to wave runup will be constructed to an elevation that is sufficient to prevent all overflow from the significant wave and all lesser waves accompanying the design hurricane. Waves larger than the significant wave may overtop the protective structures, but such overtopping will not endanger the security of the structures or cause significant interior flooding. During the time of maximum hurricane surge height, the berms on the flood side of the levees become submerged and waves of lesser height than the significant wave, but of the

same period, break farther up the levee slope. Sometimes runup from these smaller waves reach an elevation higher than that from the significant wave; therefore, runup resulting from these smaller waves must also be computed. The equivalent deepwater wave heights for the smaller waves breaking on the berms were computed by use of the equation:

$$H_o' = \frac{1.84}{T} \quad (d_b)^{3/2}$$

Runup was computed for the significant wave and for smaller waves breaking on each berm and the required levee height was determined by adding the highest computed runup value to the maximum stillwater elevation. Design runup values and proposed elevations for the project protective structures are shown in table A-6.

TABLE A-6
DESIGN WAVE RUNUP AND DESIGN ELEVATIONS
FOR PROTECTIVE STRUCTURES
DESIGN HURRICANE

Location	Avg. depth	Surge height	Design runup	Design elevations for protective structures
	ft.	ft. m.s.l.	ft.	ft. m.s.l.
Phoenix to Davant				
Levee	11.5	13.0	4.0	17.0
Floodwall	11.5	13.0	7.0	20.0
Davant to Bohemia				
Levee	12.5	14.0	3.0	17.0
Floodwall	12.5	14.0	6.0	20.0

f. Residual flooding. Protective structures were designed to prevent wave overtopping from the significant or any lesser wave that would be experienced during an occurrence of the design hurricane. However, 14 percent of the waves in a spectrum are higher than the significant wave and the maximum wave height to be expected is about 1.87 times the significant wave height. Thus, the protective structures described herein will be overtopped by those waves of the spectrum which exceed the significant wave. Studies indicate that no significant flooding will result from such overtopping.

4. Frequency estimates.

a. Procedure.

(1) Prior to 1900, information of record deals primarily with loss of life and damage in the more densely populated

areas, with practically no reference to water surface elevations caused by hurricanes. Only since 1900 has detailed information been available on flooding in coastal Louisiana and adjacent areas. Subsequent to the widely destructive September 1915 hurricane, Charles W. Okey, Senior Drainage Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, made a thorough survey of the coastal areas between Biloxi, Mississippi, and Palacios, Texas. The 1915 investigation was the only known area-wide study containing reliable stages until the investigation of Hurricane Flossy (September 1956) was completed. The data indicate that all localities along the Louisiana coast are about equally prone to hurricane attack.

(2) Pointe a la Hache is the only location within the project area where a sufficient number of observed hurricane surge elevations are available to compute a dependable observed stage-frequency curve for comparison with the results of a synthetic method of computing frequencies. Probabilities for the historical data shown on plate A-14 were calculated by means of the formula:

$$P = \frac{100\ (M-0.5)}{Y}$$

(3) The first requirement in the development of synthetic frequency relationships for localities within the project area was to select representative critical hurricane tracks for the particular locale in question. Although hurricanes from any direction within a 50-mile midgulf coastal subzone (refer to paragraph 4a(5) below) are critical to Pointe a la Hache, a track for the design hurricane was selected as the track critical for Reach C - Phoenix to Bohemia and is shown on plate A-6. In the process of formulating synthetic frequency relationships, it was necessary to correlate the following hurricane parameters: central pressure indexes, tracks of approach, wind velocities, radii to maximum winds, and forward speeds of translation.

(4) Surge heights were developed for at least three storms of different CPI values. Each hurricane selected for the representative track was assumed to have the same radius of maximum winds, the same forward speed of translation, and the same adjustment for any land effects. Conversion of wind fields for hurricanes of different CPI's requisite to computing surge heights is covered in paragraph 3c of this appendix. Surge heights for storms with other CPI values were obtained graphically by plotting the above data and reading from the resulting curves.

(5) Hurricane characteristics of area-representative storms were developed in cooperation with the National Weather Service. The Weather Service has made a generalized study of hurricane frequencies for a 400-mile zone along the central gulf coast, Zone B, from Cameron, La., to Pensacola, Fla., and has

presented the results in a memorandum[8]. Frequencies for hurricane central pressure indexes that were presented in the report, as shown on plate A-7, reflect the probability of hurricane recurrence from any direction in the midgulf coastal area. In order to establish frequencies for the localities under study, it was assumed that a hurricane whose track is perpendicular to the coast will ordinarily cause high tides and inundation for a distance of about 50 miles along the coast. Thus, the number of occurrences in the 50-mile subzone would be 12.5 percent of the number of occurrences in the 400-mile zone, provided that all hurricanes traveled in a direction normal to the coast. However, the usual hurricane track is oblique to the shoreline as shown in table 2 of the HMB memorandums.[8][9] The average projection along the coast of this 50-mile swath for the azimuths of 48 Zone B hurricanes is 80 miles. Since this is 1.6 times the width of the normal 50-mile strip affected by a hurricane, the probability of occurrence of any hurricane in the 50-mile subzone would be 1.6 times the 12.5 percent, or 20 percent of the probability for the entire midgulf Zone B. Thus, 20 percent of the Zone B frequencies shown on plate A-7[9] were used to represent the CPI frequencies in the 50-mile subzone that is critical for the study area.

(6) The location and physical features of Reach C are conducive to critical stages for a hurricane approaching from any direction within the 50-mile subzone previously described. Therefore, the full 20 percent of the probabilities for midgulf Zone B was used for computing synthetic frequencies for Reach C. Table A-7 illustrates the computation for Pointe a la Hache.

TABLE A-7
SYNTHETIC STAGE-FREQUENCY
POINTE A LA HACHE

CPI	Surge height	Frequency[1] Zone B (400 miles)	Frequency[1] Pointe a la Hache (50-mile subzone)
in.	ft. m.s.l.	occ/100 years	occ/100 years
(1)	(2)	(3)	(4)[2]
27.5	14.7	1	0.2
27.8	14.1	2	0.4
28.3	11.8	10	2.0
29.0	7.5	40	8.0

[1] $\text{Frequency} = \frac{100}{\text{Return period in years}}$

[2] Col. (4) = 20 percent of Col. (3)

(7) The synthetic frequency curve for Pointe a la Hache was shifted to the experienced frequency plot, maintaining as nearly as possible its general shape. Plate A-14 is a graphical presentation of the shift. The shifted curve was then used in determining frequencies for the Reach C location.

(8) The SRL, shown on plate A-11, parallels the protective levee from Bohemia to about the latitude of the town of Davant. Therefore, the hurricane surge frequency for this area would be the same as that for Pointe a la Hache. Above Davant, where the SRL breaks away from the protective levee, the hurricane surge heights would be lower. Accordingly, computations were made to reflect the difference in surge elevations, and separate computations were made to determine frequencies for the areas above and below Davant.

b. Relationships. Based on procedures described above, stage-frequency relationships were established for the areas identified as Phoenix-Davant and Davant-Bohemia. The stage-frequency curves are shown on plate A-15.

5. Design hurricane.

a. Selection of the design hurricane. A hurricane that would produce the 100-year stage was selected as the design hurricane. A hurricane of lesser intensity which would indicate a lower levee grade and an increased frequency would expose the protected areas to hazards to life and property that would be disastrous in the event a hurricane occurred with the intensity and destructive capability of the design hurricane.

b. Characteristics. The design hurricane for the project area has a CPI of 28.00 inches and a maximum windspeed of 96 m.p.h. at a radius of 30 nautical miles. The forward speed of the hurricane is 11 knots.

c. Predicted normal tide. The range of predicted normal tides in the project area is 1 foot and the mean tide elevation varies from 0.4 to 1.0. The difference, therefore, in hurricane surge heights for an occurrence of the design hurricane at high or low tides is only a few tenths of a foot. In determining the elevations of design surge heights, it was assumed that the mean predicted normal tide occurs at the initial period of surges.

d. Design hurricane surge heights. The hurricane surge height is the maximum stillwater surface elevation experienced at a given location during the passage of a hurricane. The design hurricane surge heights for the project area are shown in table A-6.

SECTION III - INTERIOR DRAINAGE

6. General. The project area consists of approximately 7.4 square miles of land extending along the left descending bank of the Mississippi River between river miles 44 and 60 AHP. On the alluvial ridges, the elevation of natural ground is about 5, decreasing to approximate elevation 0.5 in the adjacent back swamplands. The minimum elevation of the natural ground is about -0.5. The lands at and above elevation 2 are devoted primarily to industrial and residential development. Except for the sites which have been protected against runoff from local rainfall, the floor elevations of residential and industrial buildings are at least 1 foot above the elevations of the adjacent natural ground.

7. Improvements by local interests.

a. Levee. Along an alinement generally east of and parallel to the Mississippi River, local interests have constructed an interim hurricane protection levee which provides protection against moderate hurricane tides. At both the northern and southern termini, the project levee is connected to the Mississippi River east levee.

b. Gravity drainage system. To accommodate drainage intercepted by the Reach C levee, local interests have constructed a gravity drainage system. A landside collector ditch has been excavated with a bottom width of 25 feet, bottom elevation of -8, and side slopes of 1 vertical on 2 horizontal. Five gravity drainage structures have been constructed along the levee alinement, and discharge from the collector canal into outlet channels tributary to adjacent bays and lakes on the flood side of the levee (structure locations are shown on plates 2 and 7). Each of these drainage structures contains one or more 72-inch diameter, asbestos bonded, corrugated, metal culverts with asphalt paved inverts; reinforced concrete inlet and outlet basins; and the appropriate number of flap gates and vertical sliding gates. Since discharges from the structures are affected by tidal action, the flap gates permit normal, automatic operation; the vertical sliding gates have been installed to provide positive closure. Data pertinent to these drainage structures are shown in table A-8; structural details are shown on plate 53. Each of the structures has been installed so that its operation will not be adversely affected when the existing levee embankment is modified to the grade (elevation 17.0) and cross section required for protection against the design hurricane.

c. Pumping stations. Local interests have recently constructed two pumping stations (one at station 241+77 and the other at station 551+38) with a combined capacity of 880 c.f.s. The operation of these stations will permit the development of additional lands which could not be developed with gravity drainage alone.

8. Hydraulic computations. The Manning formula with a roughness coefficient of 0.021 was used for determining friction losses in the corrugated metal pipes. In computing the discharges for the drainage structures, an entrance loss of 20 percent of the difference in the velocity heads was used. These culverts will normally operate with inlet and outlet ends submerged. The composite rating curve for the ten 72-inch diameter conduits operating under this condition is shown on plate A-16.

9. Infiltration and runoff. Data from which runoff factors or infiltration rates for the area could be determined are not available. The derivations of synthetic inflows for all storms were made assuming an infiltration rate of 0.10 inch per hour for the entire area.

10. Synthetic inflow hydrographs. The inflow hydrographs for the hydraulic analyses of the drainage structures and stilling basins were synthesized with the use of values contained in U. S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States," published in 1961. Curves showing the rainfall-duration-frequencies and distribution of rainfalls are presented on plate A-17.

11. Analysis of existing gravity drainage system.

a. The hydraulic analysis indicated that the existing gravity drainage system provides sufficient capacity to meet the general criteria used by the Corps of Engineers, New Orleans District, for the design of drainage facilities to accommodate drainage intercepted by Federal hurricane protection projects in the vicinity of the project area. Specifically, the system provides sufficient capacity to dispose of inflows from the 25-year 24-hour storm (assumed to occur coincident with an average stage of 0.5 on the gulfside of the structures) such that both of the following requirements are satisfied:

(1) The sump pool elevation will not exceed 2.0.

(2) Storage equivalent to about 3 inches of runoff below elevation 2.0 will be available within 24 hours after cessation of runoff from the design storm.

b. An average water surface elevation of 0.5 on the protected side of the structures represents the stage at which sump storage is required with only the gravity drainage system in operation. The curve which shows the relationship between stage and storage above this elevation is presented on plate A-17. Inflow, outflow, and sump pool hydrographs are shown on plate A-16. Additional pertinent data are provided in table A-8.

c. With respect to the stilling basin analysis, the storm with a frequency of 100 years and a duration of 24 hours was assumed to occur with the gulfside at elevation 0.5. Inflow, outflow, and sump pool hydrographs are shown on plate A-18. Additional pertinent data are provided in table A-8.

12. Pumping station analyses.

a. Additional analyses were made to determine the effectiveness of the pumping stations operating alone and in combination with the existing gravity drainage system. In these analyses, the synthetic inflows from the 25-year 24-hour storm were assumed to occur with a gulfside stage of 0.5. The average water surface elevation on the landside at the inception of inflow was assumed to be -0.5, since operation of the pumping stations will reduce the sump to this elevation. The curve which shows the relationship between stage and storage above elevation -0.5 is shown on plate A-17.

b. Peak sump stages produced by the 25-year 24-hour storm were 1.86 for the pumping stations operating alone and 1.46 for the stations operating in combination with the existing gravity drainage system.

13. Ponding area. The responsibility of the Federal Government, as it concerns provisions for drainage in this project, extends only to the installation of gravity drainage structures to provide for drainage intercepted by the construction of the project levee. Generally, responsible local interests are required to give assurances that they will permit no encroachment on ponding areas and, if ponding areas and capacities are impaired, provide substitute storage capacity or equivalent pumping capacity promptly without cost to the United States. In the instant case, pumping stations which can dispose of 4.5 inches of runoff in 24 hours have been constructed by local interests. Accordingly, assurances by local interests that encroachment on ponding areas will be prevented are not required.

TABLE A-8
EXISTING GRAVITY DRAINAGE SYSTEM
PERTINENT DATA

	Levee stations 89+50, 236+70, & 486+30	Levee station 425+50	Levee station 548+60
Number of 72-inch diameter corrugated metal pipes	1	4	3
Length of corrugated metal pipe, feet	300	326	300
Length of reinforced concrete stilling basin, feet	31	31	31
Width of reinforced concrete stilling basin at downstream end, feet	27	54	45
Length of sacked concrete riprap, feet	15	15	15
Width of sacked concrete riprap at downstream end, feet	87	114	105
Maximum outflow, 100-year 24-hour storm, c.f.s.	157	628	471
Maximum average velocities, 100-year 24-hour storm:			
a. In conduit, f.p.s.	5.6	5.6	5.6
b. At downstream end of concrete stilling basin, f.p.s.	0.3	0.9	0.7
c. At downstream end of sacked concrete riprap, f.p.s.	0.3	0.9	0.7

SECTION IV - BIBLIOGRAPHY

(1) U. S. Weather Bureau, "Revised Wind Fields, Vicinity of Lake Pontchartrain, Hurricane of September 9, 1915," Memorandum HUR 7-39, August 16, 1957.

(2) U. S. Weather Bureau, "Wind Speed and Direction Charts for the Lake Pontchartrain, Chandeleur, and Breton Sounds and Mississippi Delta Regions, September 19, 1947," Memorandum HUR 7-37, June 12, 1957.

(3) U. S. Weather Bureau, "Pressure and Winds over the Gulf of Mexico in Hurricane Flossy, September 23-24, 1956," Memorandum HUR 7-53, June 19, 1958.

(4) U. S. Weather Bureau, "Surface Winds (30 ft.) over Gulf of Mexico in Hurricane Betsy, September 9 and 10, 1965," Memorandum HUR 7-87, December 20, 1965.

(5) U. S. Weather Bureau, "Preliminary Analysis of Surface Wind Field and Sea-Level Pressures of Hurricane Camille (August 1969)," Memorandum HUR 7-113, November 26, 1969, and subsequent correspondence.

(6) U. S. Weather Bureau, "Standard Project Hurricane Wind Field Patterns Revised to Replace Existing Patterns in NHRP Report No. 33, for Zones B and C," Memorandum HUR 7-84, August 17, 1965.

(7) U. S. Weather Bureau, "Adjustments to SPH isovel patterns in Memoranda HUR 7-62, 7-62A, 7-63, 7-64, and 7-65," Memorandum HUR 7-85, November 3, 1965.

(8) U. S. Weather Bureau, "Hurricane Frequency and Correlations of Hurricane Characteristics for the Gulf of Mexico Area, P.L. 71," Memorandum HUR 2-4, August 30, 1957.

(9) U. S. Weather Bureau, "Interim Report-Meteorological Characteristics of the Probable Maximum Hurricane, Atlantic and Gulf Coasts of the United States," Memorandum HUR 7-97, October 18, 1969.

(10) U. S. Weather Bureau, "SPH Parameters and Isovels, Mid-Gulf Coast U. S. Zone B, and SPH Lake Pontchartrain, La.," Memorandum HUR 7-42, October 11, 1957.

(11) U. S. Weather Bureau, "Relationships Between SPH Isovel Patterns and Probable Maximum Events for the New Orleans Area," Memorandum HUR 7-61, August 21, 1959.

(12) U. S. Weather Bureau, "Relationships Between SPH Isovel Patterns and Probable Maximum Events for the New Orleans Area, continued," Memorandum No. 7-61a, November 15, 1961.

(13) Coastal Engineering Research Center, "Shore Protection, Planning and Design," Technical Report No. 4, June 1966.

(14) Saville, Thorndike, Jr., "Wind Set-up and Waves in Shallow Water," Beach Erosion Board, Technical Memorandum No. 27, June 1952.

(15) U. S. Army Engineer District, Jacksonville, "Design Memorandum Wind Tides Produced by Hurricanes," Partial Definite Project Report, Central and Southern Florida Project, for Flood Control and Other Purposes, Part IV, Supplement 2, Section 3, July 26, 1956.

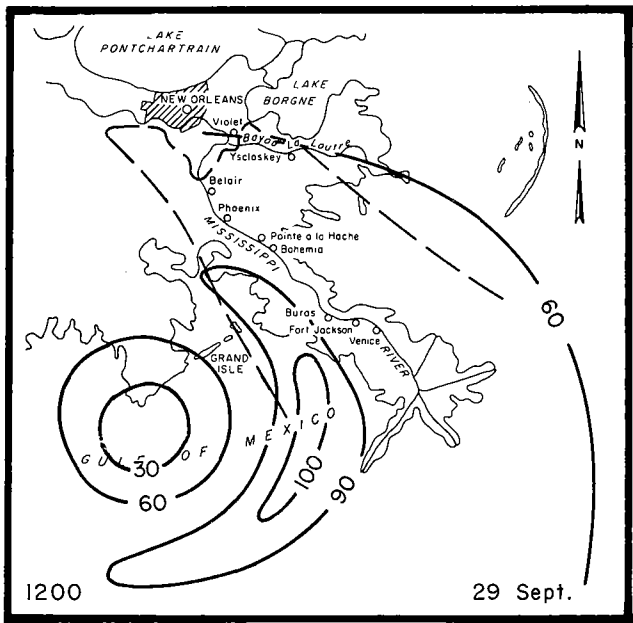
(16) Bretschneider, C. L., "Prediction of Wind Waves and Setup in Shallow Water, with Special Application to Lake Okeechobee, Florida," Unpublished Paper, Texas A&M College, August 1954.

(17) Saville, Thorndike, Jr., "Wave Run-Up on Shore Structures," Journal of the Waterways Division of the American Society of Civil Engineers, Vol. 82, No. WW 2, April 1956.

(18) Saville, Thorndike, Jr., "Laboratory Data on Wave Run-Up and Overtopping on Shore Structures, "Beach Erosion Board, Technical Memorandum No. 64, October 1955.

(19) Saville, Thorndike, Jr., Inclosure to letter from Beach Erosion Board to U. S. Army Engineer District, New Orleans, 1 July 1958.

(20) Saville, Thorndike, Jr., "Wave Run-Up on Composite Slopes," Proc. of the 6th Conference on Coastal Engineering, Council on Wave Research University of California 1958.



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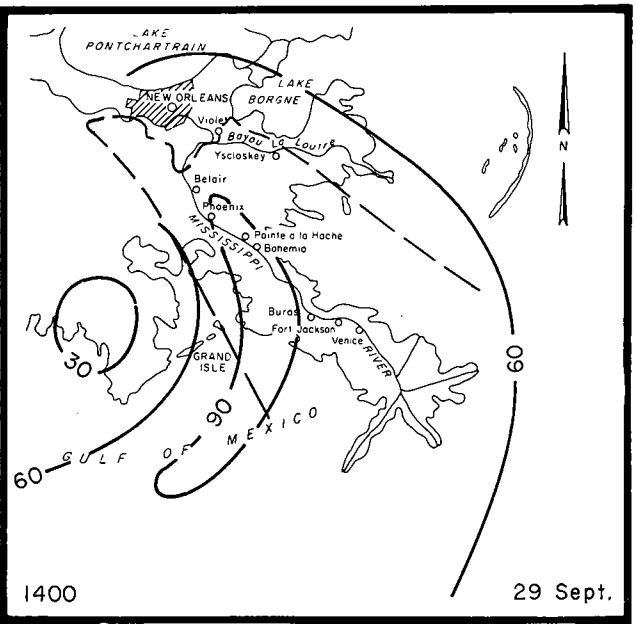

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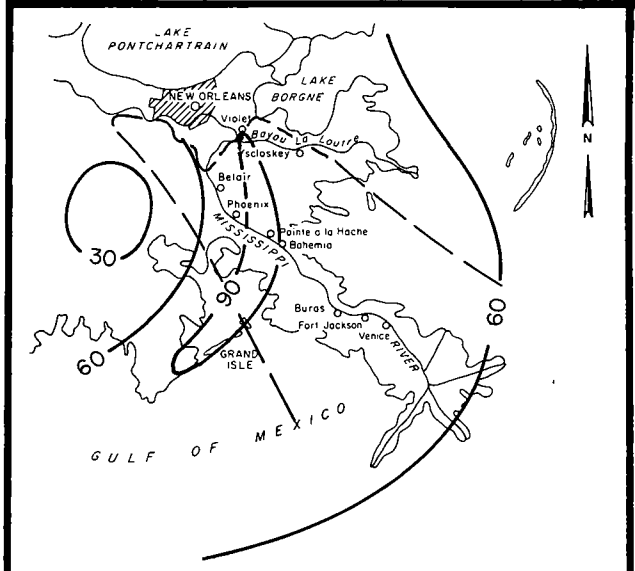

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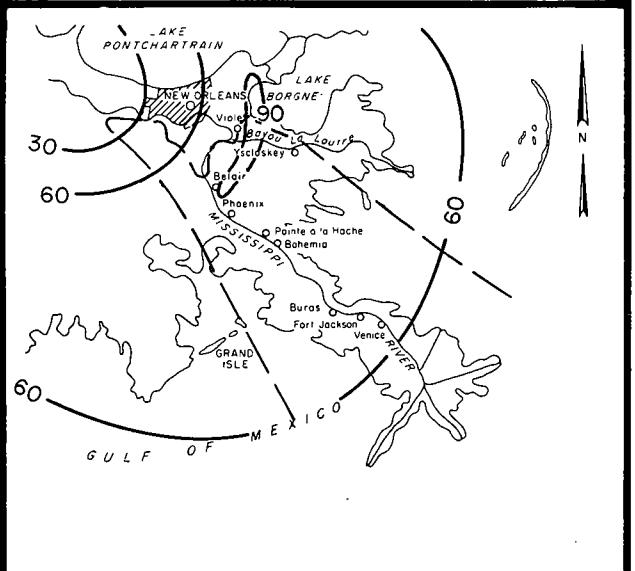
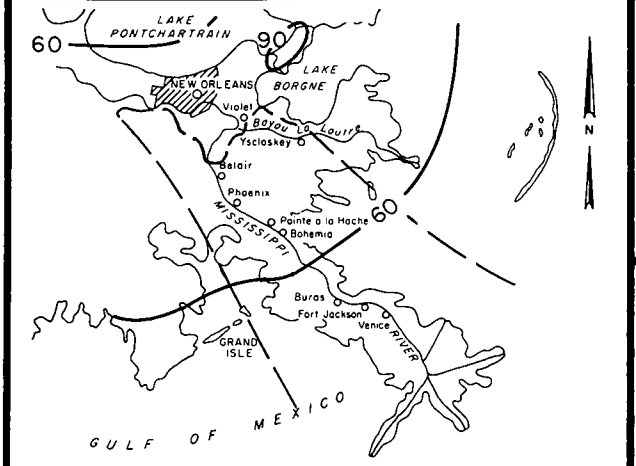


1800 29 Sept.



2000 29 Sept.

LEGEND

70 Average Wind Velocity in M.P.H.

Project Area

SCALE IN MILES

25 0 25 50

NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3

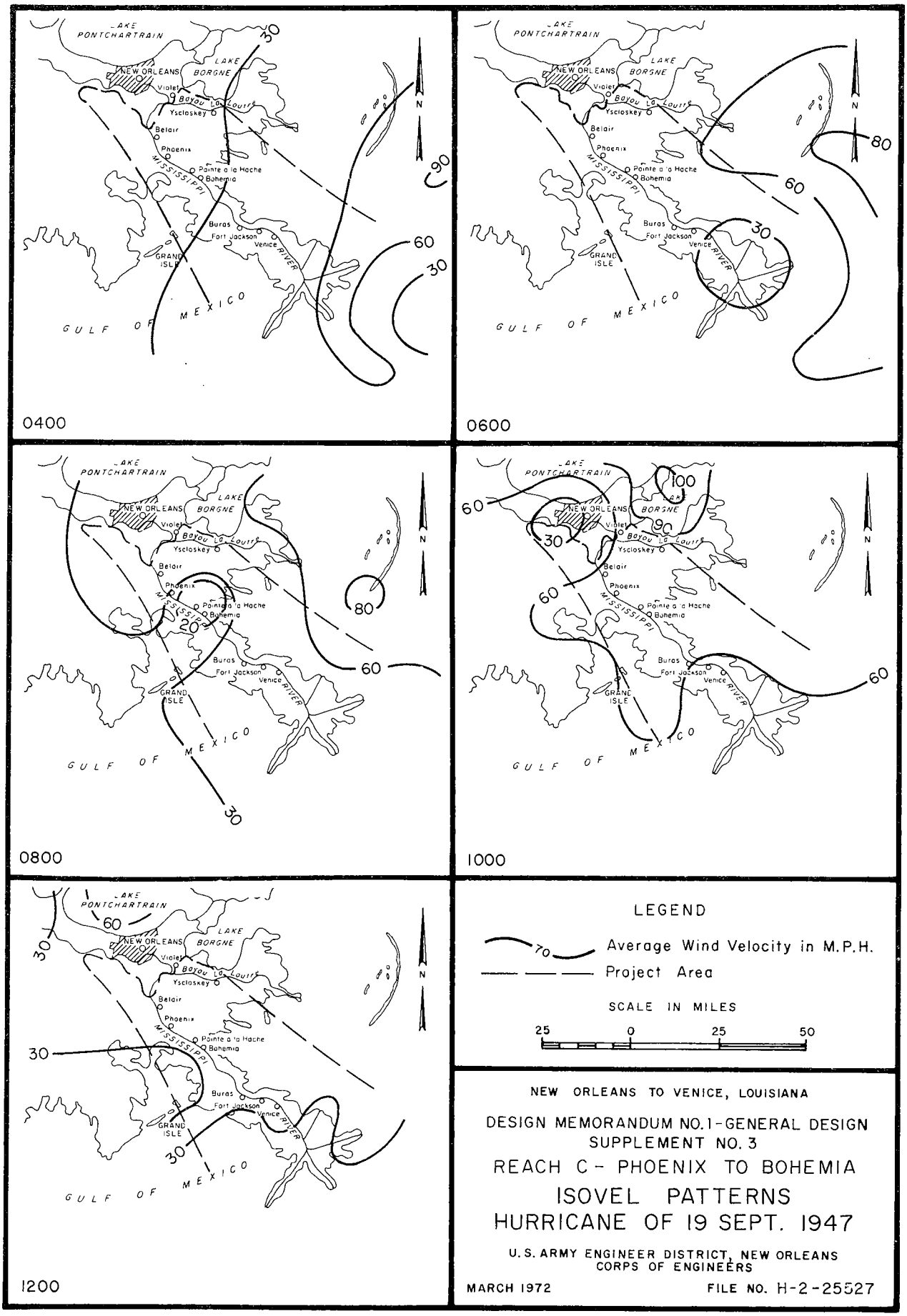
REACH C - PHOENIX TO BOHEMIA

ISOVEL PATTERNS
HURRICANE OF 28 SEPT.-1 OCT. 1915

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-1



NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

ISOVEL PATTERNS
HURRICANE OF 19 SEPT. 1947

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-2

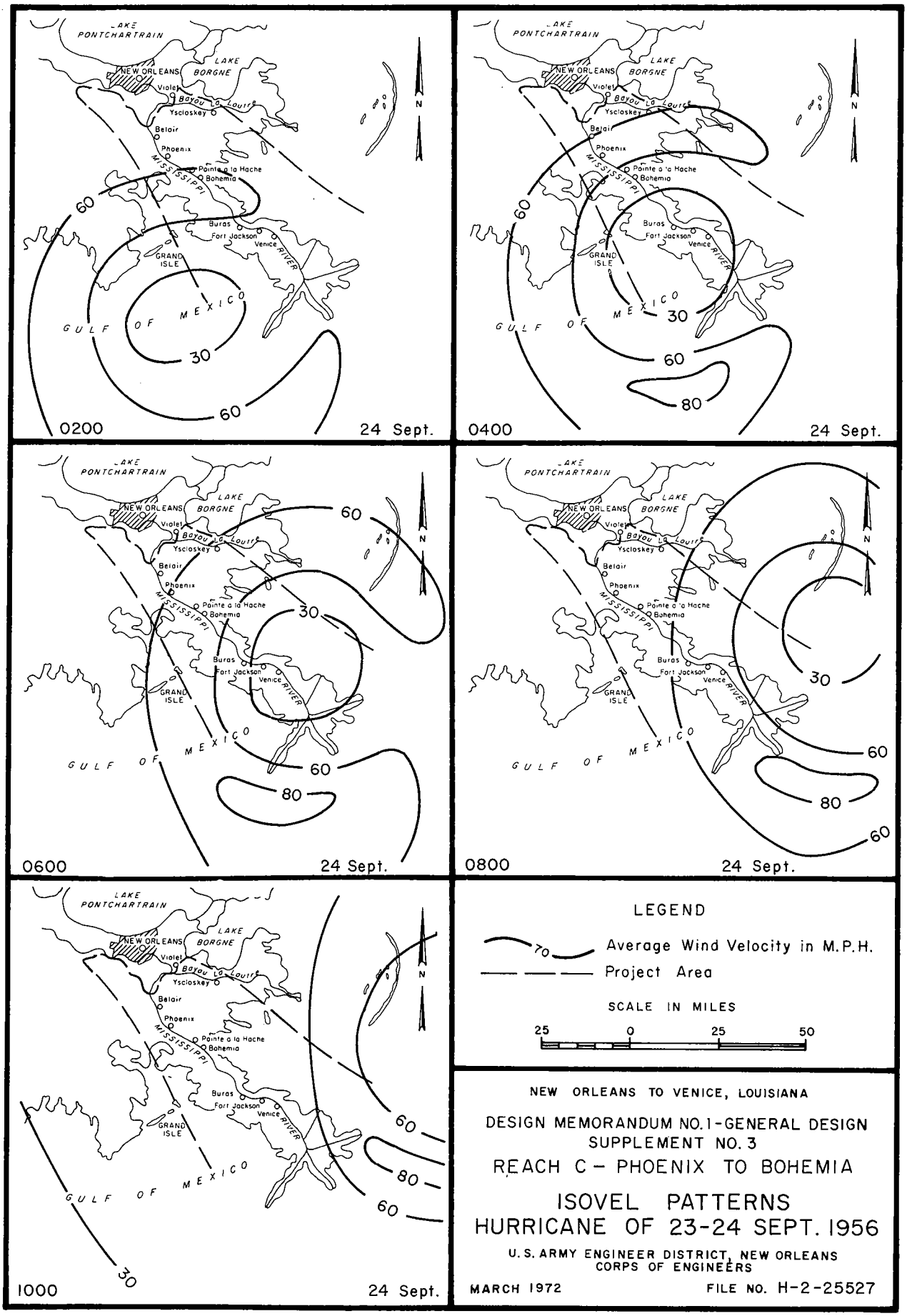

LAKE PONTCHARTRAIN
LAKE BORGNE
NEW ORLEANS
Violet
Bayou La Loutre
Ycloskey
Belair
Phoenix
MISSISSIPPI
Pointe a la Hache
Bohemia
Buras
Fort Jackson
Venice
RIVER
GRAND ISLE
GULF OF MEXICO
N
0200
24 Sept.
0400
24 Sept.
0600
24 Sept.
0800
24 Sept.
1000
24 Sept.
30
60
80
LEGEND
70
Average Wind Velocity in M.P.H.
Project Area
SCALE IN MILES
25 0 25 50
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
ISOVEL PATTERNS
HURRICANE OF 23-24 SEPT. 1956
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

PLATE A-3

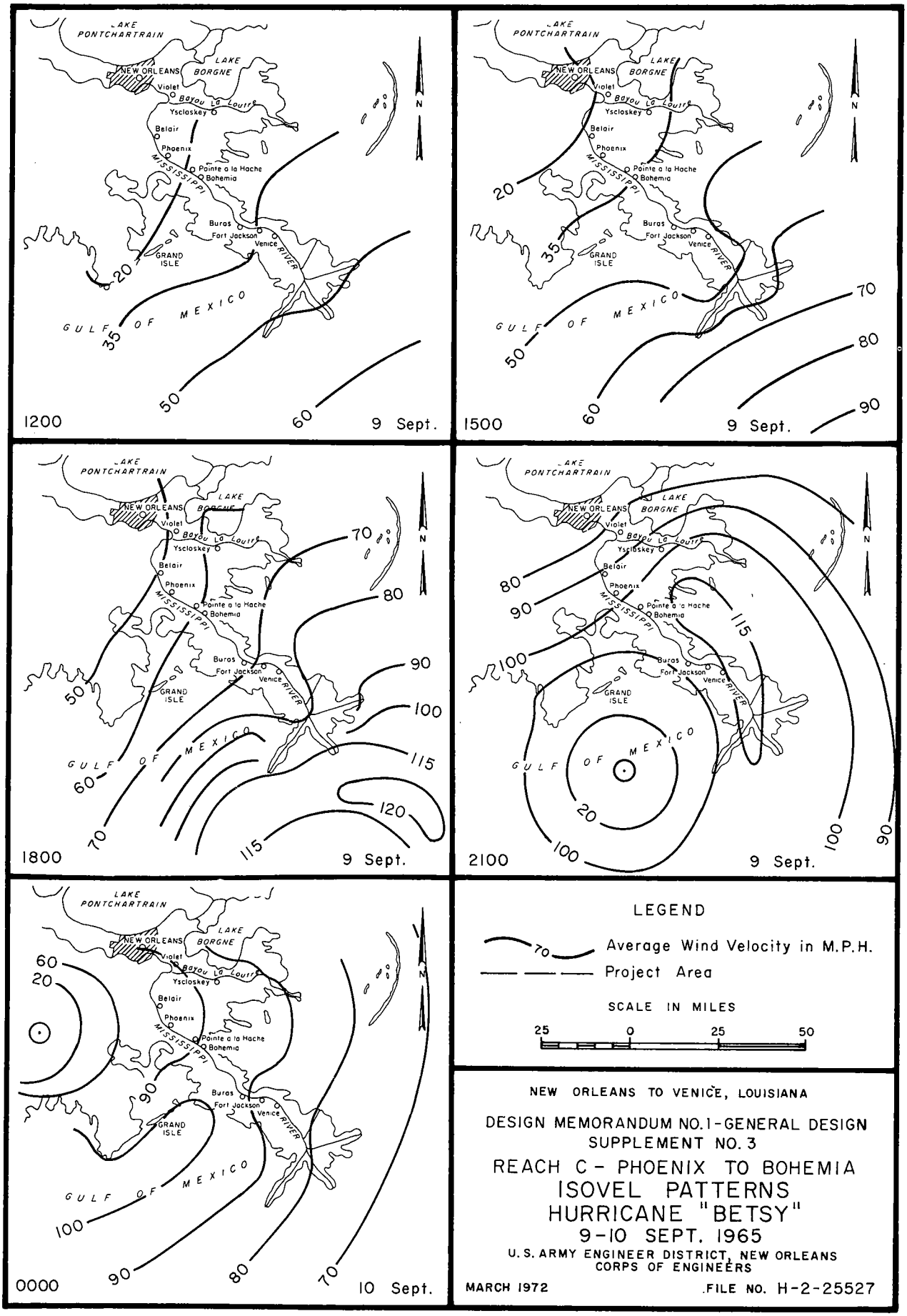
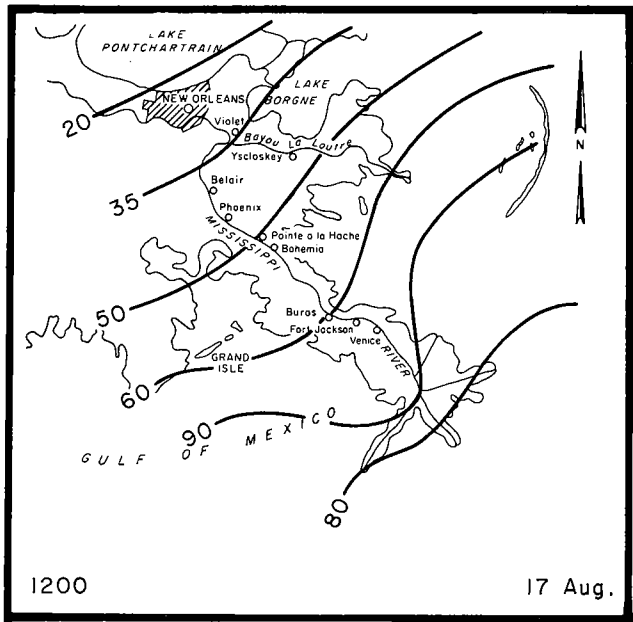
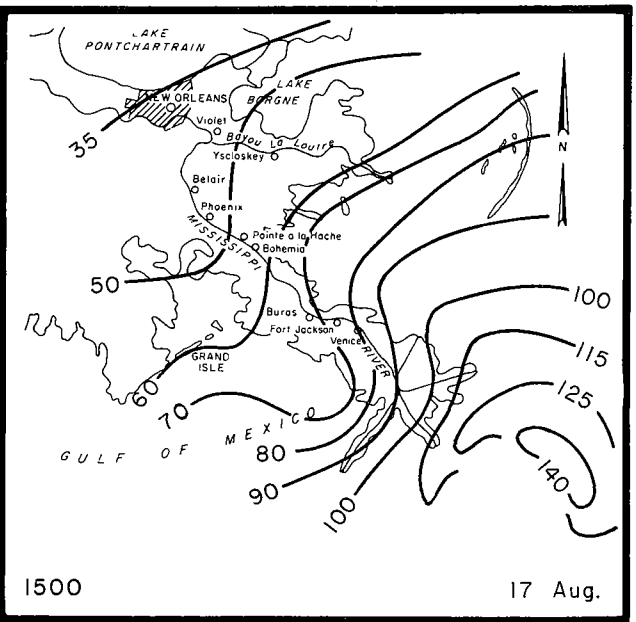

LAKE PONTCHARTRAIN
LAKE BORGNE
NEW ORLEANS
Violet
Bayou La Loutre
Ysclosky
Belair
Phoenix
MISSISSIPPI
Pointe a la Hache
Bohemia
Buras
Fort Jackson
Venice
RIVER
GRAND ISLE
GULF OF MEXICO
N
1200
9 Sept.
1500
9 Sept.
1800
9 Sept.
2100
9 Sept.
0000
10 Sept.
LEGEND
Average Wind Velocity in M.P.H.
Project Area
SCALE IN MILES
25 0 25 50
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
ISOVEL PATTERNS
HURRICANE "BETSY"
9-10 SEPT. 1965
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

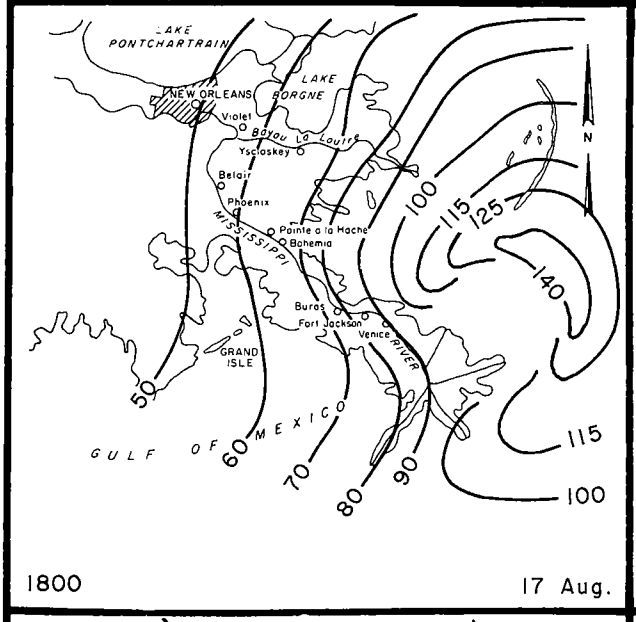
PLATE A-4



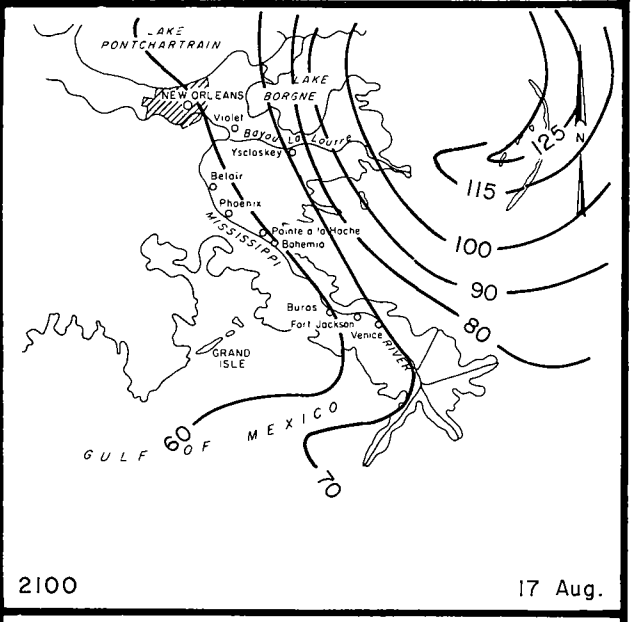
1200 17 Aug.



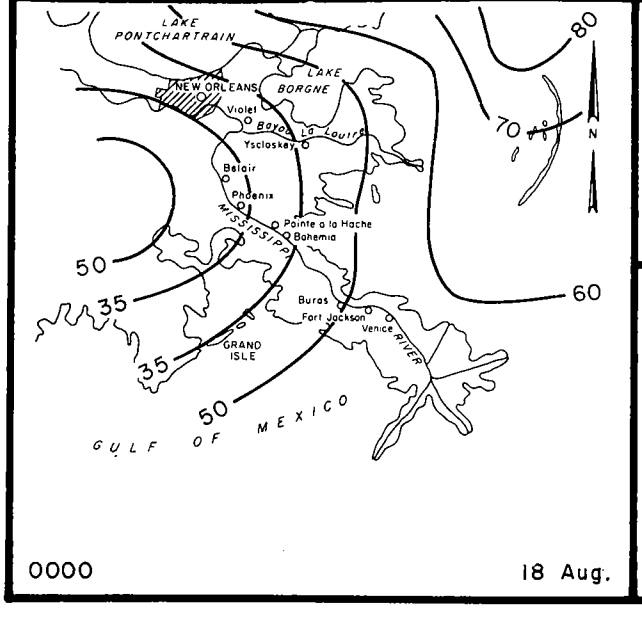
1500 17 Aug.



1800 17 Aug.



2100 17 Aug.



0000 18 Aug.

LEGEND

70 Average Wind Velocity in M.P.H.

Project Area

SCALE IN MILES

25 0 25 50

NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3

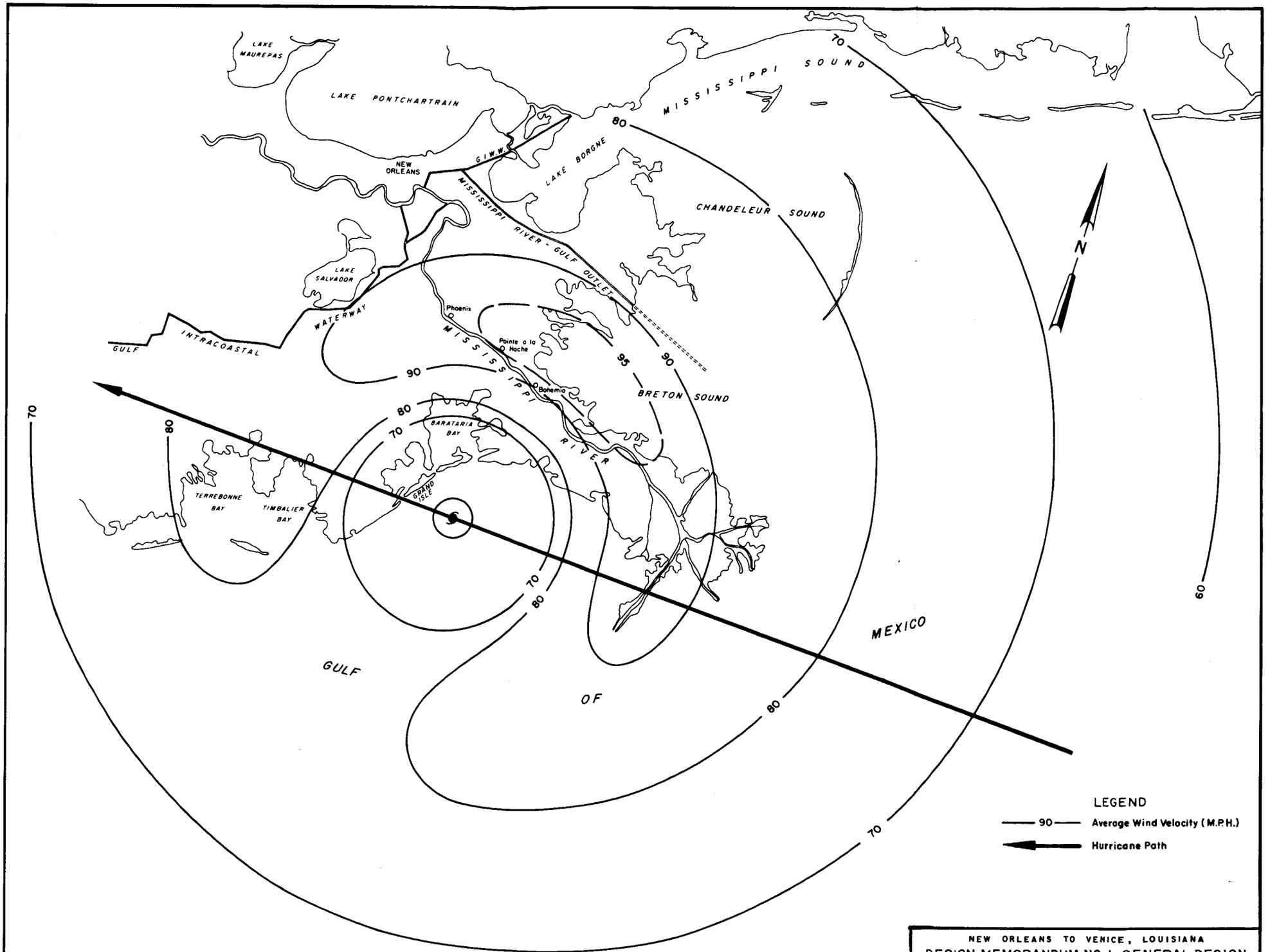
REACH C - PHOENIX TO BOHEMIA

ISOVEL PATTERNS
HURRICANE "CAMILLE"
17-18 AUG. 1969

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

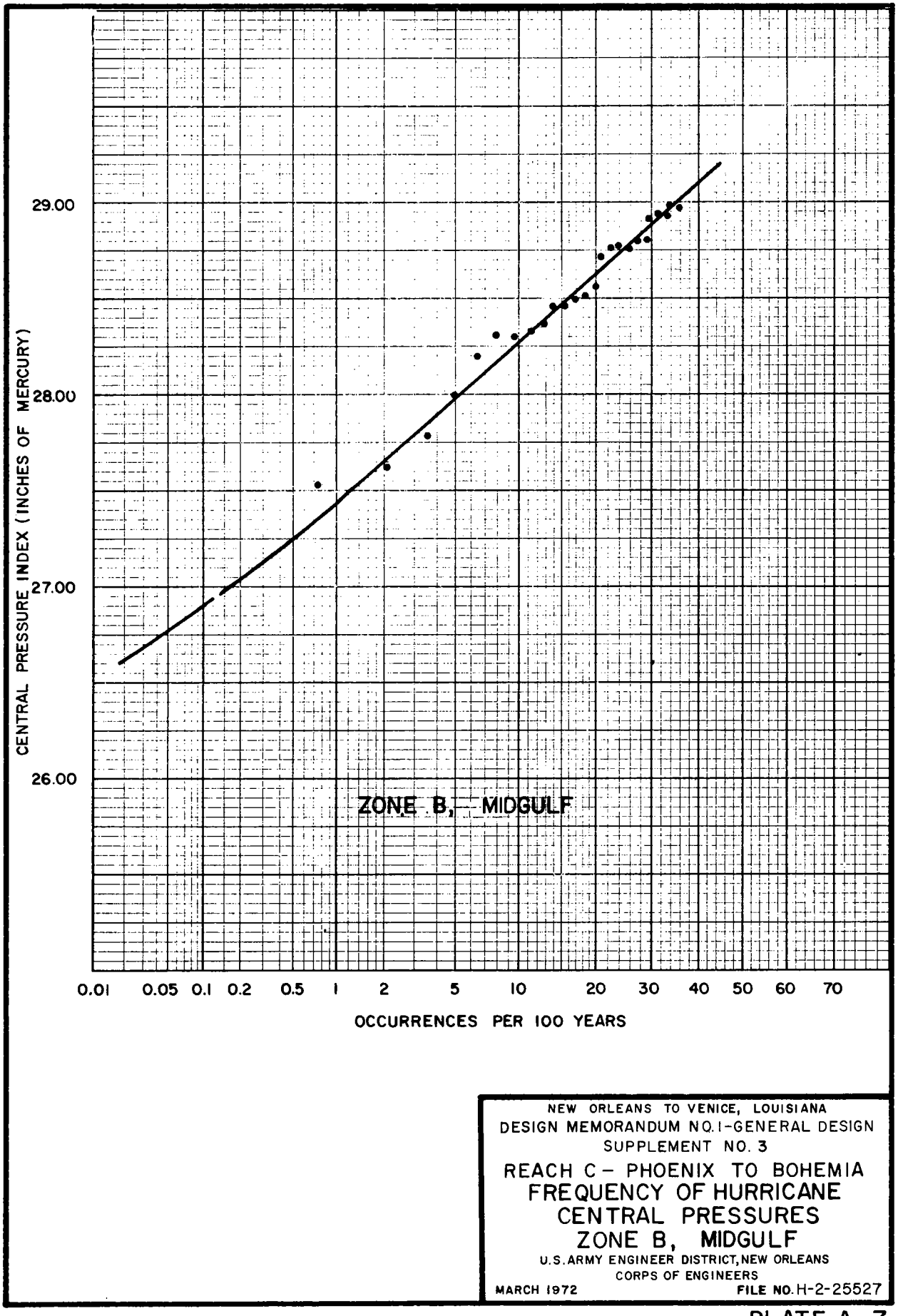
MARCH 1972 FILE NO. H-2-25527

PLATE A-5



NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C- PHOENIX TO BOHEMIA
DESIGN HURRICANE
TRACK AND ISOVEL PATTERN
CRITICAL TO PHOENIX-BOHEMIA
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25528

PLATE A-6



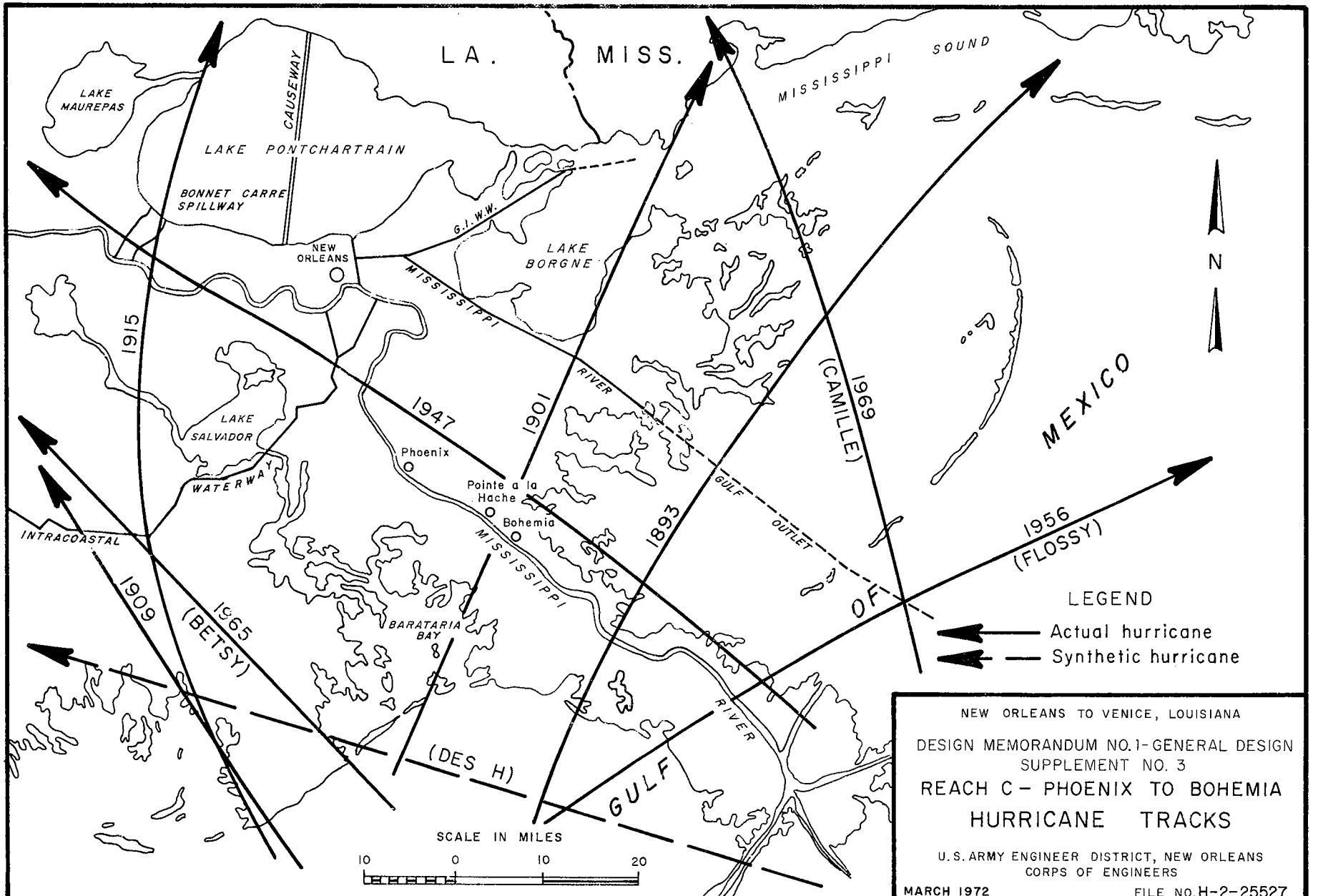
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA
FREQUENCY OF HURRICANE
CENTRAL PRESSURES
ZONE B, MIDGULF

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-7



NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C – PHOENIX TO BOHEMIA

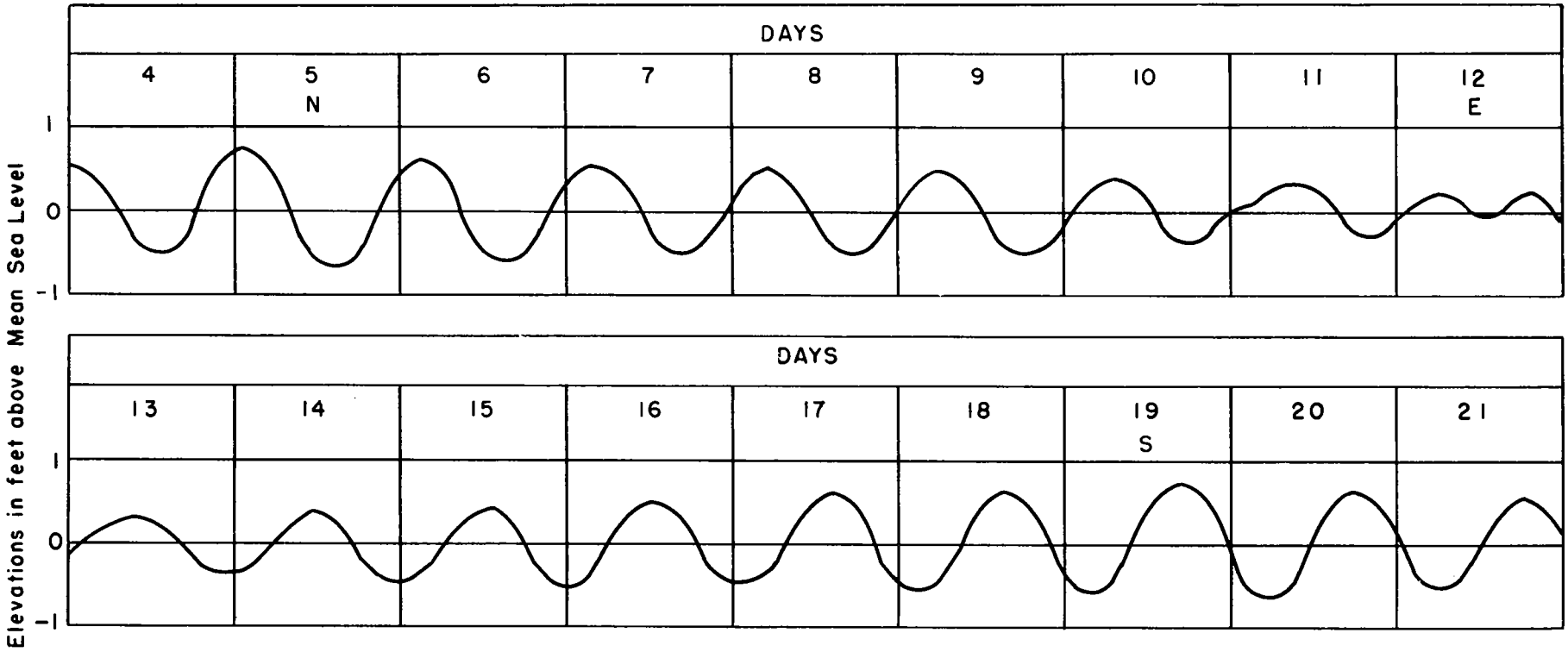
HURRICANE TRACKS

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-8

PLATE A-8



LEGEND

E, moon on the equator
N, S, moon farthest north or south of the equator

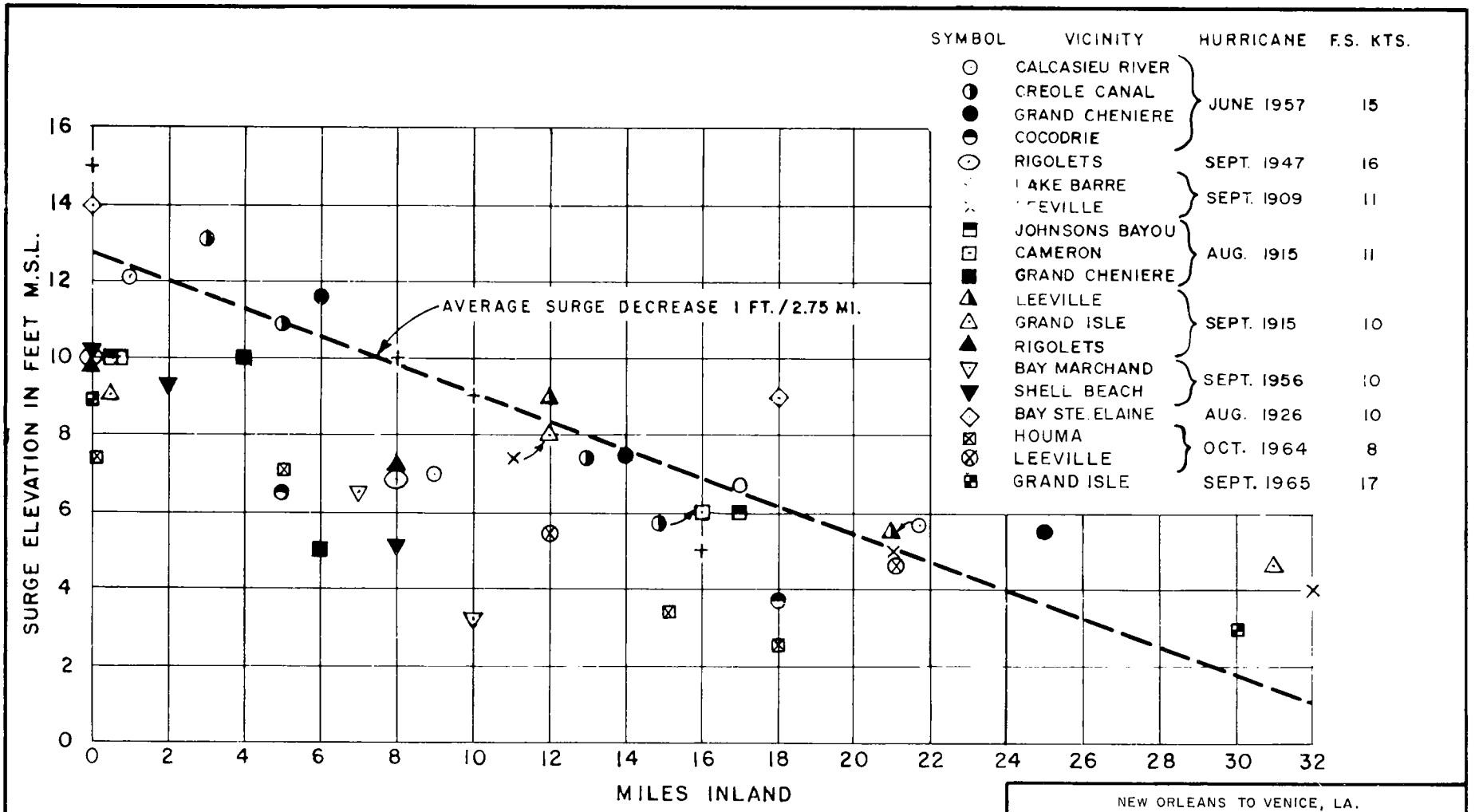
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C – PHOENIX TO BOHEMIA

TYPICAL TIDAL CYCLES

U.S.ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE A-9

PLATE A-9



NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 3

REACH C – PHOENIX TO BOHEMIA

OVERLAND SURGE ELEVATIONS
COASTAL LOUISIANA

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-10

PLATE A-10

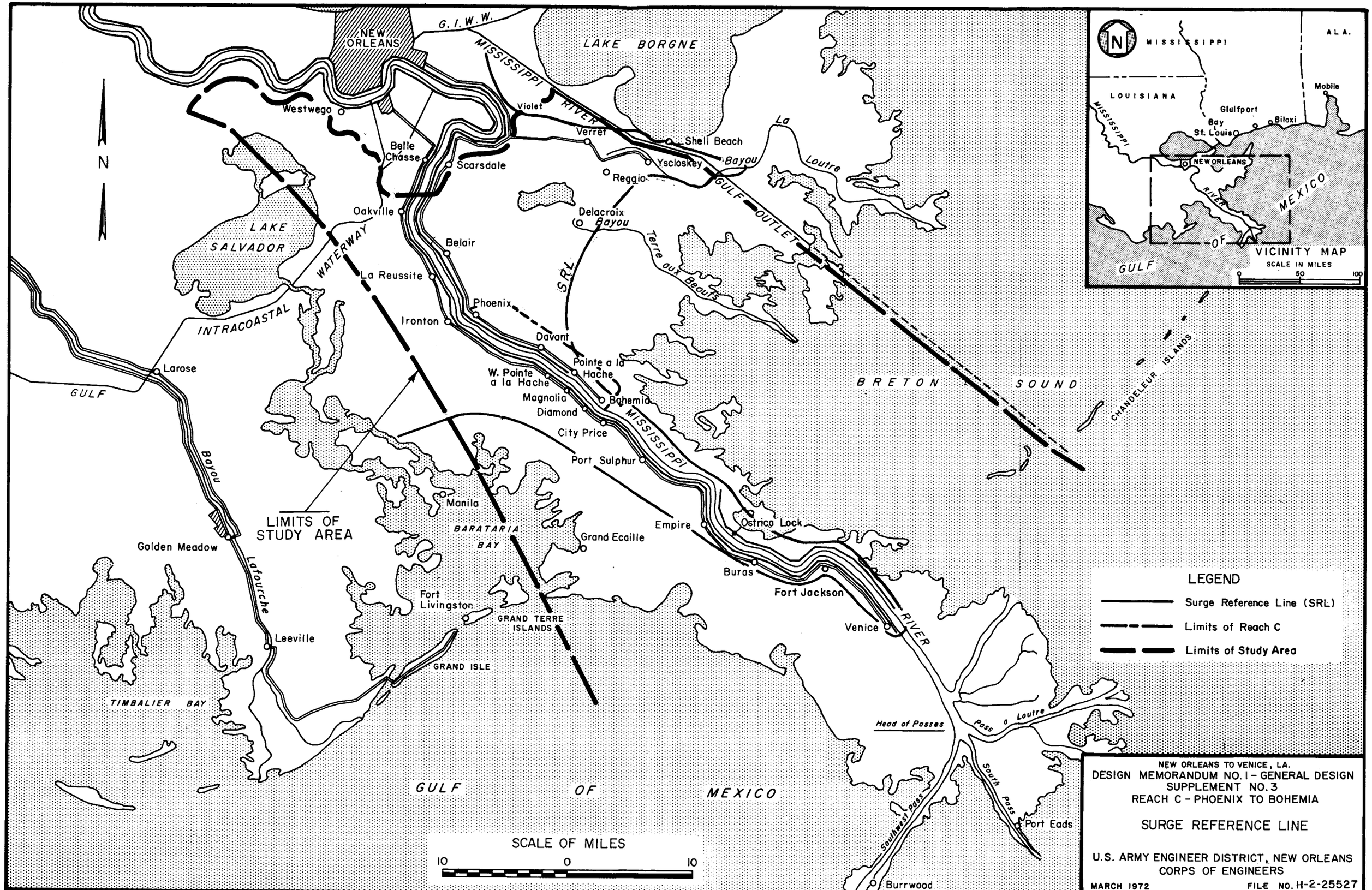
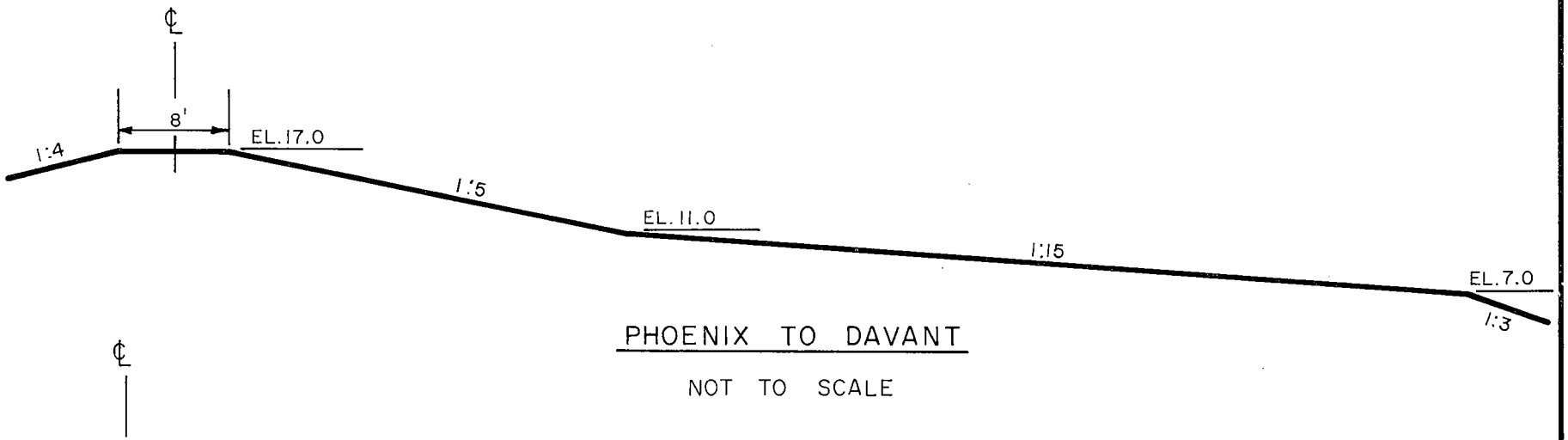
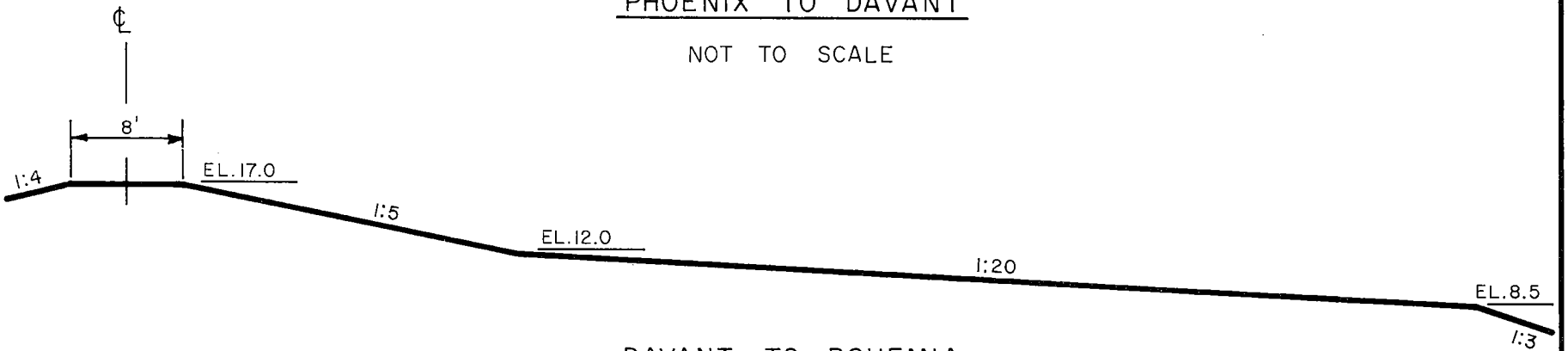

NEW ORLEANS
G.I.W.W.
MISSISSIPPI RIVER
LAKE BORGNE
Westwego
Violet
Belle Chasse
Scarsdale
Verret
Shell Beach
Yscloskey
Reggio
La Loutre Bayou
GULF OUTLET
Delacroix Bayou
Terre aux Boeufs
SRL
Oakville
LAKE SALVADOR
WATERWAY
Belair
La Reussite
Phoenix
Ironton
Davant
Pointe a la Hache
W. Pointe a la Hache
Magnolia
Bohemia
Diamond
City Price
Port Sulphur
Empire
Ostrica Lock
Buras
Fort Jackson
Venice
INTRACOASTAL
Larose
GULF
Bayou Lafourche
Golden Meadow
LIMITS OF STUDY AREA
Manila
BARATARIA BAY
Grand Ecaille
Fort Livingston
GRAND TERRE ISLANDS
Leeville
GRAND ISLE
TIMBALIER BAY
BRETON SOUND
CHANDELEUR ISLANDS
Head of Passes
Pass a Loutre
South Pass
Southwest Pass
Port Eads
Burrwood
GULF OF MEXICO
SCALE OF MILES
10 0 10
N
MISSISSIPPI
ALA.
LOUISIANA
Mobile
Gulfport
Bay St. Louis
Biloxi
NEW ORLEANS
MEXICO
GULF
VICINITY MAP
SCALE IN MILES
50 100
LEGEND
Surge Reference Line (SRL)
Limits of Reach C
Limits of Study Area
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
SURGE REFERENCE LINE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

PLATE A-II



PHOENIX TO DAVANT

NOT TO SCALE



DAVANT TO BOHEMIA

NOT TO SCALE

NOTE: Elevations are in feet and refer to mean sea level

NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1-GENERAL DESIGN SUPPLEMENT NO. 3

REACH C - PHOENIX TO BOHEMIA

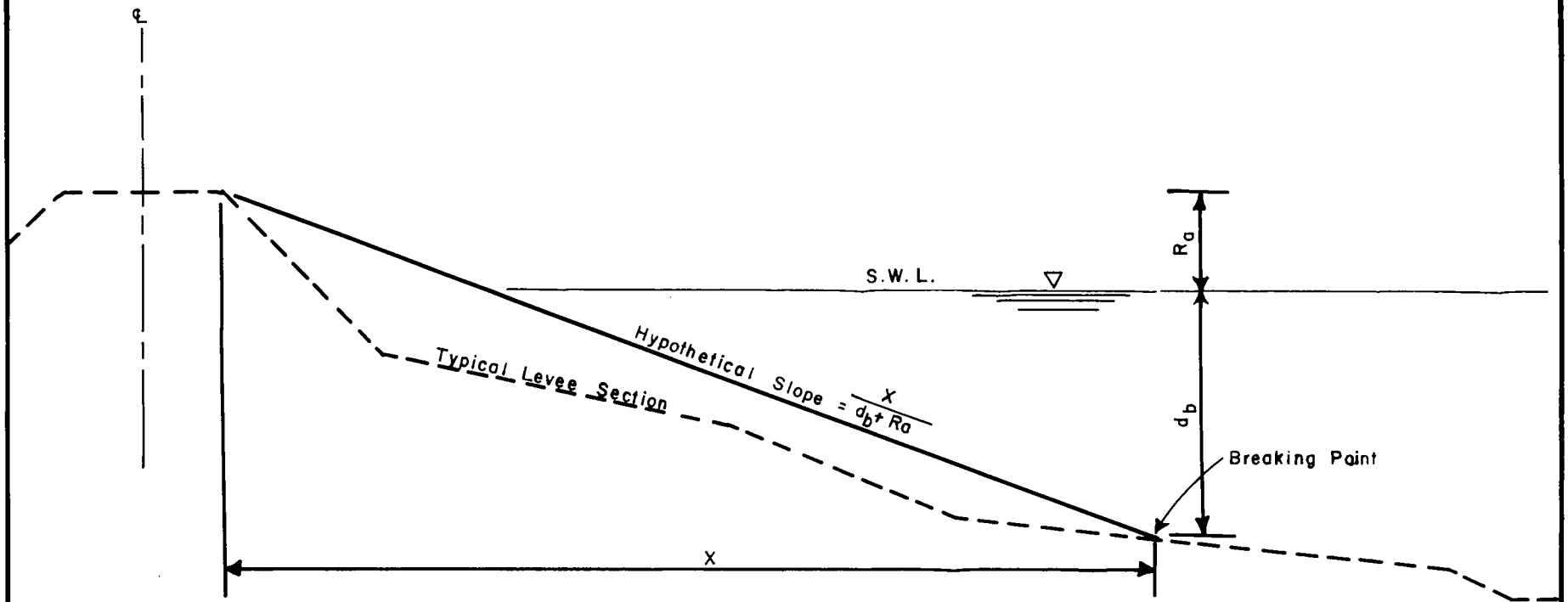
TYPICAL LEVEE CROSS SECTIONS

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-12

PLATE A-12



LEGEND

R_a = assumed runup

d_b = breaking depth of wave

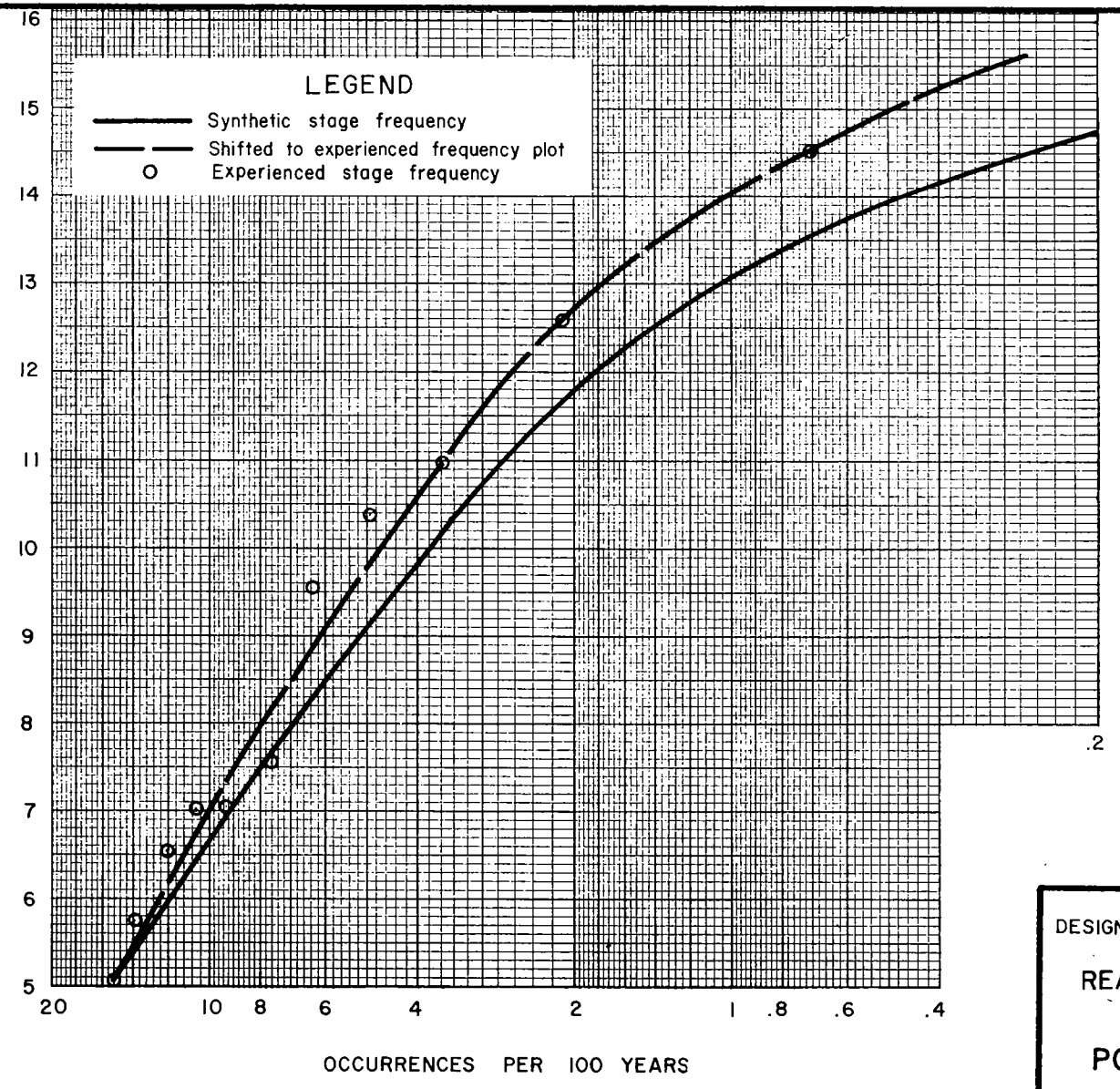
X = horizontal distance from breaking point to elevation of runup

S.W.L.= stillwater level

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C – PHOENIX TO BOHEMIA
DETERMINATION OF
HYPOTHETICAL SLOPE
U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

PLATE A-13

PLATE A-13



FREQUENCY ANALYSIS			
M	YEARS	WIND TIDE LEVEL (FT.)	P
1	1965	14.4	0.72
2	1915	12.5	2.17
3	1969	10.9	3.62
4	1956	10.3	5.07
5	1901	9.5	6.52
6	1909	7.5	7.97
7	1940	7.0	9.42
8	1947	7.0	10.87
9	1906	6.5	12.32
10	1917	5.7	13.77
11	1961	5.0	15.22

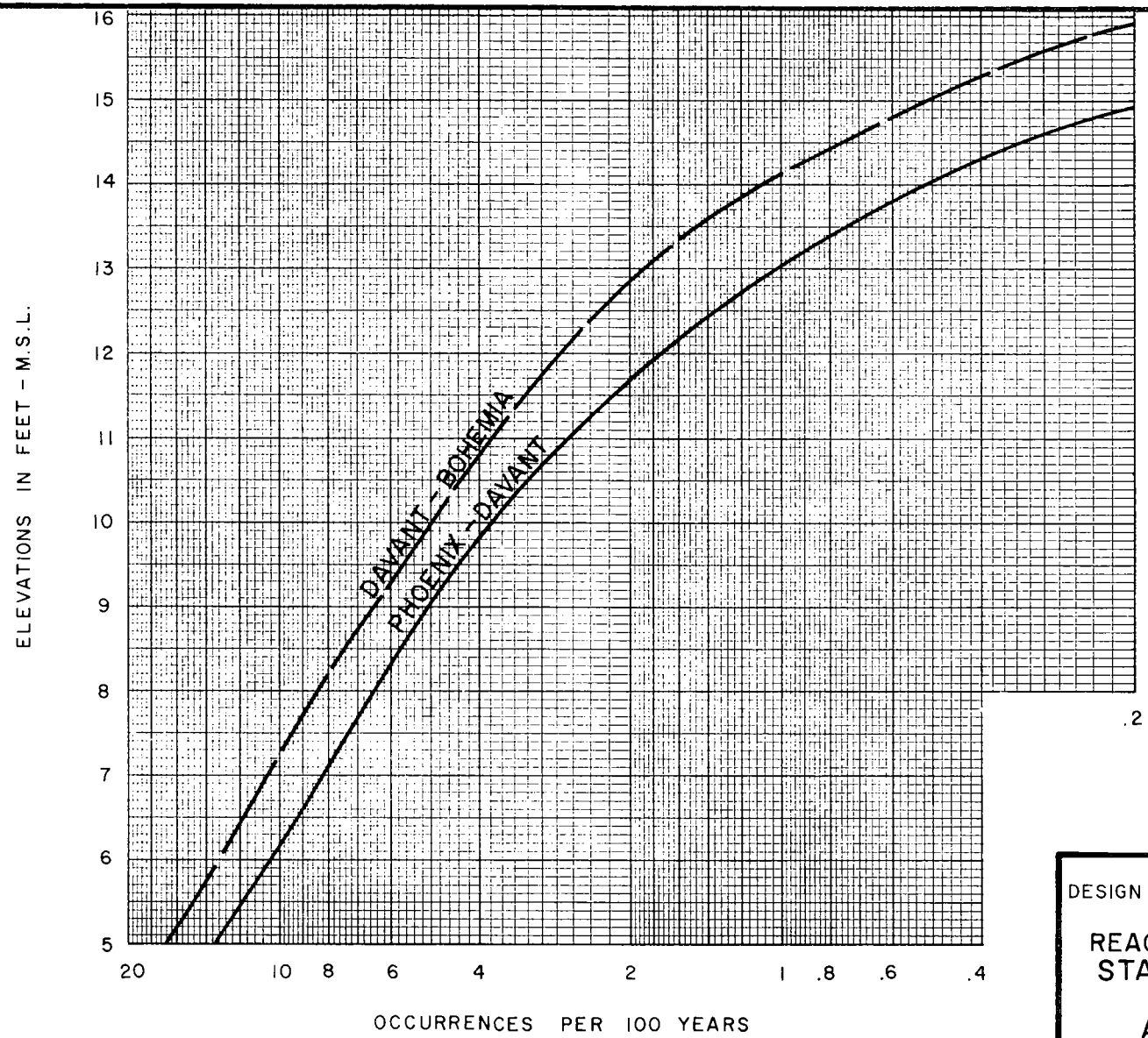
$$P = \frac{100\,(M-0.5)}{Y}$$

P = Probability
M = Number of the event (rank)
Y = Number of years of record (69)

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
STAGE - FREQUENCY
POINTE A LA HACHE, LA.
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE A-14

PLATE A-14



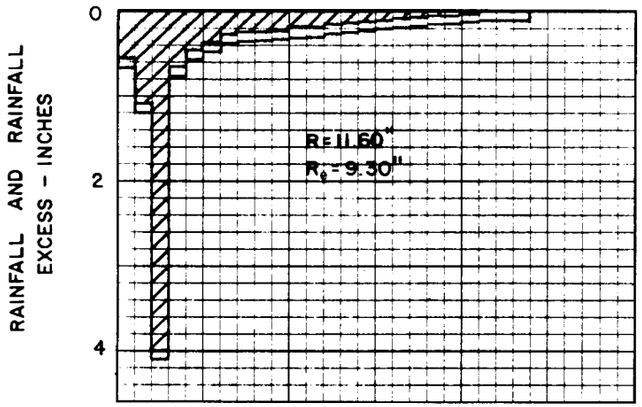
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3

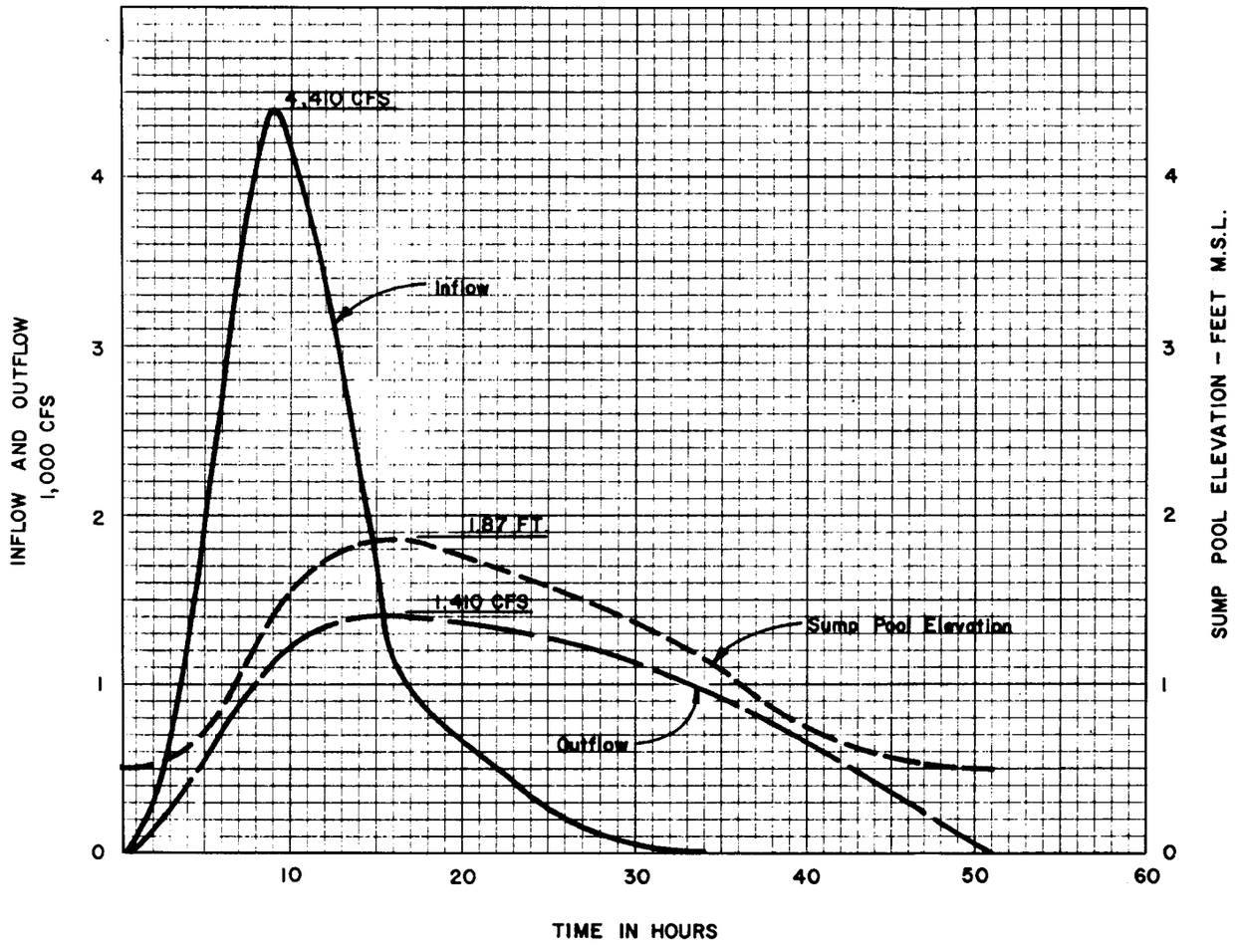
REACH C - PHOENIX TO BOHEMIA STAGE FREQUENCY CURVES DAVANT - BOHEMIA AND PHOENIX - DAVANT

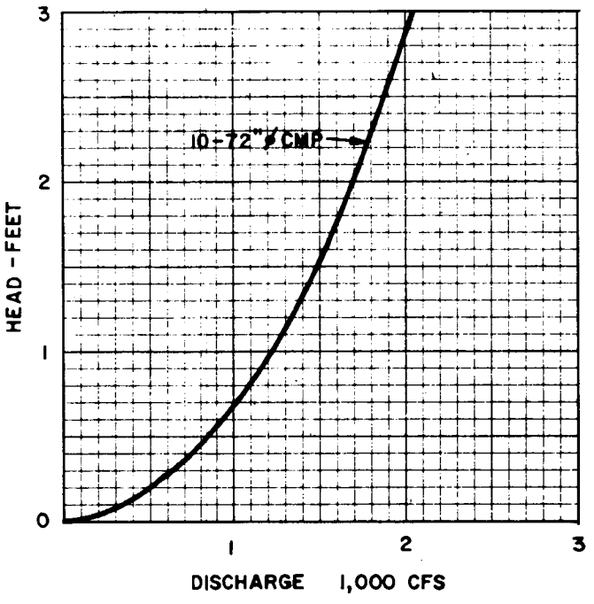
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25527

PLATE A-15

PLATE A-15



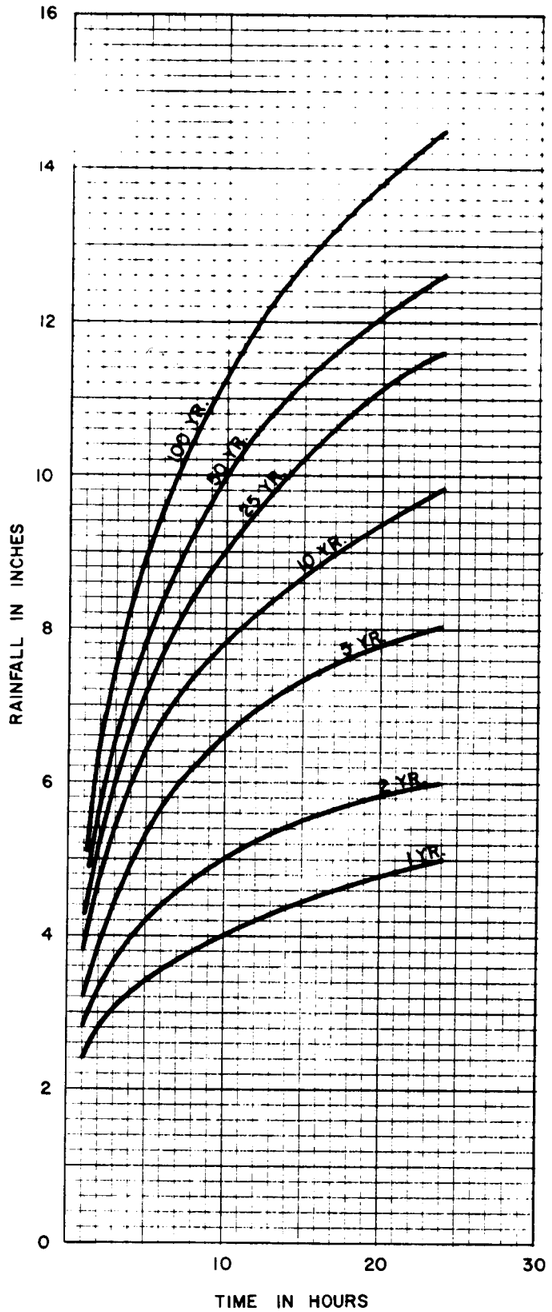




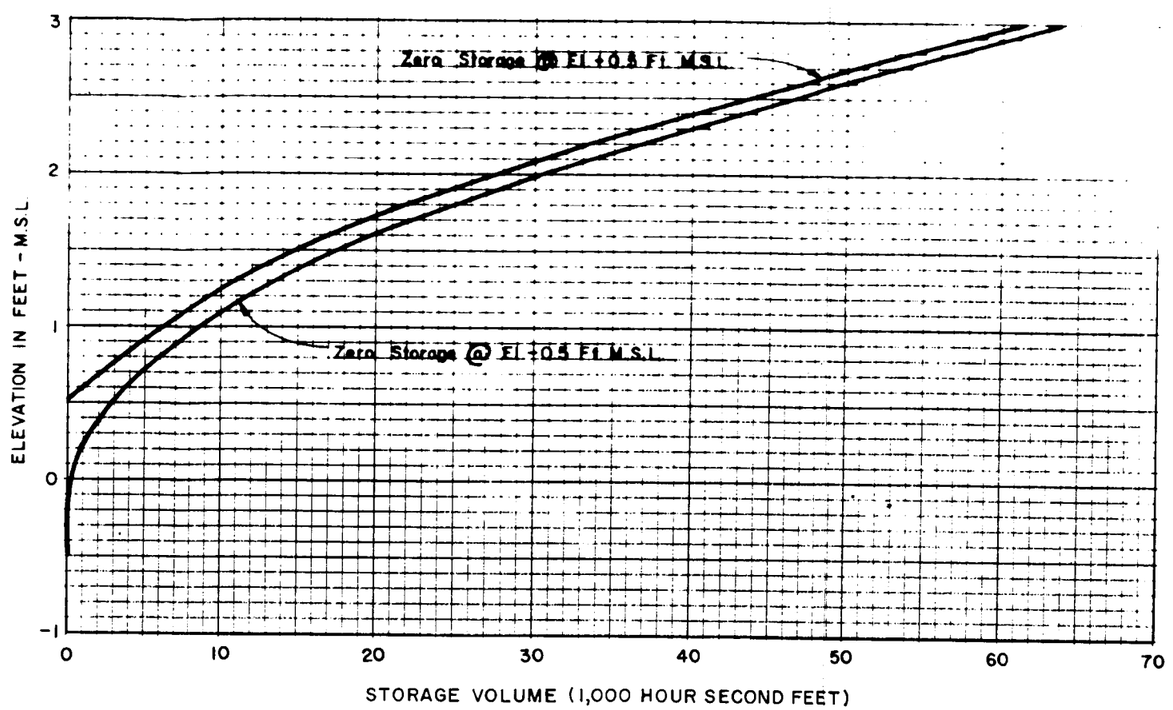
SUBMERGED OUTLET

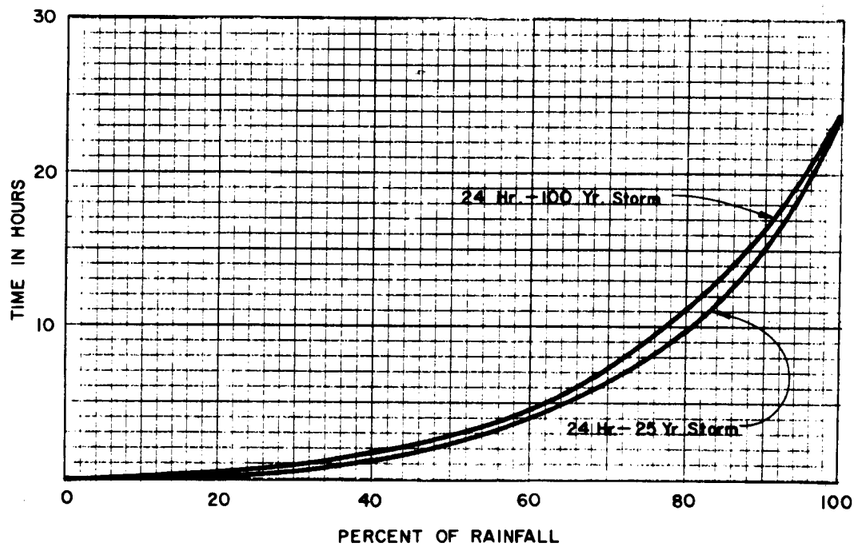
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1- GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
HYDRAULIC ANALYSIS
25 YEAR 24 HOUR STORM
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE A-16



RAINFALL - DURATION - FREQUENCY



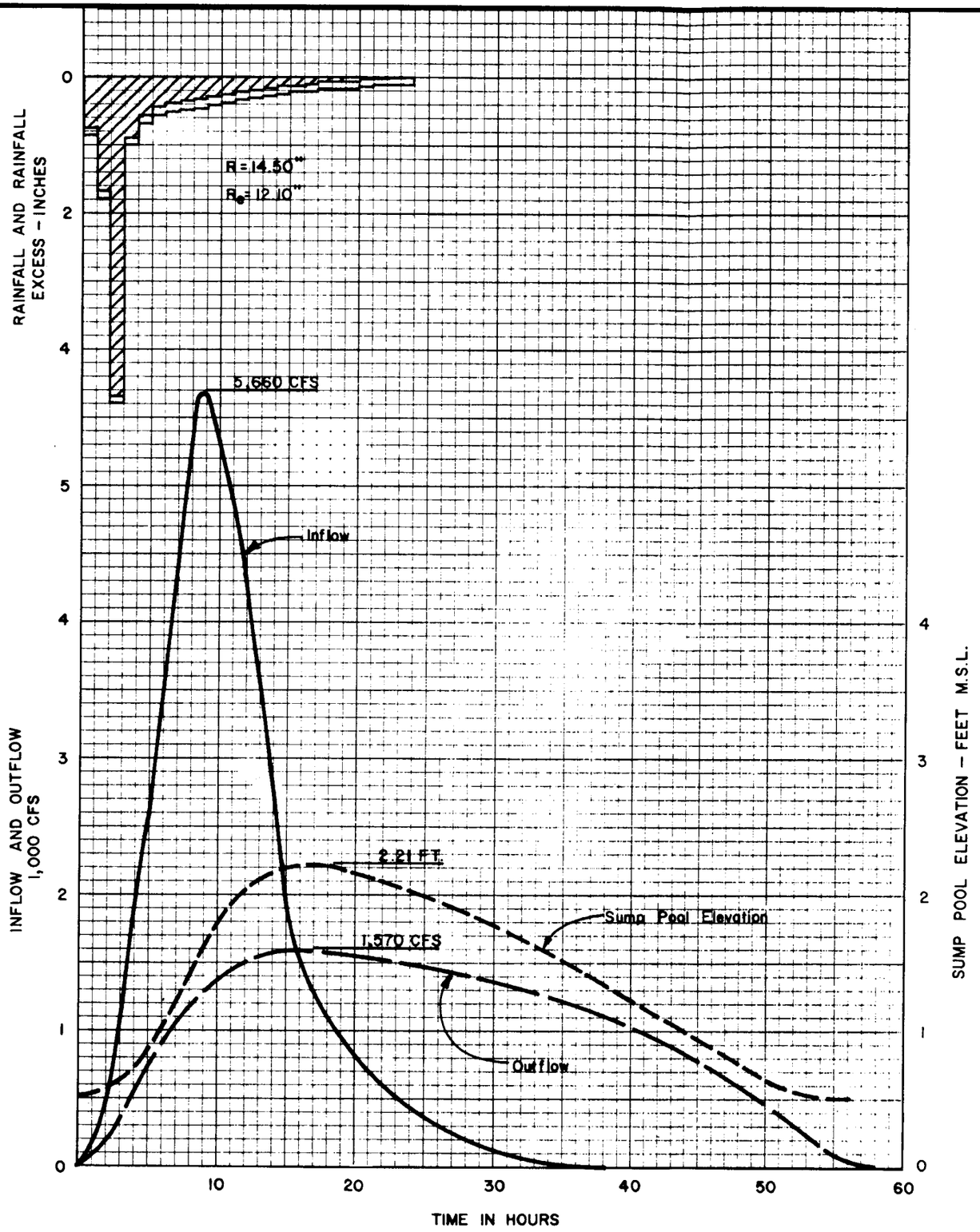


DISTRIBUTION OF RAINFALL

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
HYDRAULIC DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972 FILE NO. H-2-25527

PLATE A-17



NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1- GENERAL DESIGN
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA
HYDRAULIC ANALYSIS
100 YEAR 24 HOUR STORM

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

MARCH 1972 FILE NO. H-2-25527

PLATE A-18

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SUPPLEMENT NO. 3
REACH C - PHOENIX TO BOHEMIA

APPENDIX B

CORRESPONDENCE RELATIVE TO COORDINATION WITH OTHER AGENCIES

C O P Y

STATE OF LOUISIANA
WILD LIFE AND FISHERIES COMMISSION
400 Royal Street
New Orleans 16

March 27, 1963

District Engineer
U. S. Army Corps of Engineers
P. O. Box 60267
New Orleans 60, Louisiana

Dear Sir:

In response to your letter of February 18, 1963, the Louisiana Wild Life and Fisheries Commission submits the following comments relative to the protection plan recommended for Reach C, Phoenix to Bohemia segment of the Hurricane Protection Project for the Mississippi River Delta at and below New Orleans, Louisiana.

The plan for Reach C has been slightly modified to conform to the alignment of a highway-levee planned by the Louisiana Highway Department, in cooperation with local interests. This planned highway-levee alignment will result in the closure of four access waterways: Suburban Canal (Davant Canal), Gravolet Canal, Richardson and Bass Canal, and Parish Canal (Adema Canal).

With the construction of the highway-levee and associated waterway closures fish and wildlife utilization could be adversely effected. There is a large amount of hunting, fishing, crabbing, shrimping and related forms of commercial and sport activities carried on in the marshes to the east of the proposed project. If access into these areas is adversely effected there would be losses to both sport and commercial interests.

I am sure you recognize the potential problem of fish and wildlife utilization that may be caused by reduced access; therefore, we request that full consideration be given to the need for access equal to present existing conditions and that provisions be made in the project to allow all camp owners, local residents, and other recreational and commercial interests access over the highway-levee into the waterways and roads currently providing access into this area.

March 27, 1963

In the event our recommendations are not in sufficient detail we request additional time in which to establish specific locations of the access points which may be effected by the proposed project.

If our considerations or recommendations are accepted we do not have any opposition to the proposed highway-levee improvements or alignment.

Should additional planning be necessary on this project segment, we would like to be informed and make additional review for comment on this public works project.

Sincerely yours,

/s/ L. D. Young, Jr.
L. D. Young, Jr.
Director

LDYJr:mj

cc: Plaquemines Parish Council
La. Department of Highways
U. S. Fish and Wildlife Service,
Branch of River Basin Studies

C O P Y

May 16, 1963

Mr. George H. Hudson, Chief,
Engineering Division,
U. S. Army Corps of Engineers,
P. O. Box 60267
New Orleans 60, Louisiana

Dear Mr. Hudson:

In response to your letter of April 16, 1963, the Louisiana Wild Life and Fisheries Commission submits the following comments and recommendations in addition to the general considerations stated in our letter of March 27, 1963 relative to the hurricane protection plan recommended for Reach C, Phoenix to Bohemia segment of the Hurricane Protection Project for the Mississippi River Delta at and below New Orleans, Louisiana.

In order to provide access equivalent to that presently existing in this area for fish, wildlife and recreational utilization, we wish to recommend the following access points be provided and maintained as part of the continued highway protection-levee project.

The following access points are located by station numbers as taken from the Proposed State Highway plans (State Project No. 46-06-18) for the Poverty Point - Bohemia Highway, Plaquemines Parish, Louisiana, and are as follows:

(1) Permanent automobile access to be continued at Station 800+05, the Joe Gravolet Canal, to allow all camp owners passage to and from their hunting and fishing camps. Automobile access should be maintained from new highway to the road now providing access to these camps.

(2) Same as above should apply for the camp owners on the Albert Schayots Canal located at approximately Station 1099.

(3) Access corresponding to provisions indicated in Louisiana Highway Department plans should be provided at the Lopez Canal at approximately Station 1149.

(4) Continued automobile access to the twelve camps adjacent to the back levee canal at the Horse Power Canal should be maintained. There is a road which now services this area located near Station 1207+63 and this present form of access should not in any way be adversely affected.

(5) It is further requested that access be provided at Station 1634+75 corresponding to the type that has been planned and is indicated by the highway-levee project plans as adopted by the Louisiana Highway Department in cooperation with local interests.

(6) Continued automobile access should be maintained from the existing old highway across the new highway and embankment on property in Section 48 belonging to Mr. T. N. Miller at the presently existing road near Station 180/-65. Further provisions should be made to allow crossing of the drainage ditch on the riverside of the new highway and also the borrow canal marshward of the new highway embankment and the proposed plug in the borrow canal in the vicinity should be aligned to coincide with the presently existing access road.

(7) Continued automobile access to the road now allowing car passage to the boat house facility located at approximately Station 275/-60 should be maintained and correspond to the provisions outlined in number 6 above.

(8) The Suburban Canal will be closed due to construction of the highway-levee project. The Suburban Rod and Gun Club which presently has approximately 60 members maintains club house and boat house facilities at the southern most end of this canal. This project will isolate the club's boat house and deprive the members of access to the marshes where they hunt and fish. Special provisions must be provided to allow this large hunting and fishing interest continued access and use of this canal for travel from this club facilities to their hunting and fishing areas. The desired access location is near Station 347/-40.

(9) There is a road near Davant which now provides access from the old highway to the back levee and back levee canal. This road is located near Station 377. We recommend this road be allowed to cross the new highway, embankment and borrow area so as to continue to provide access to the back levee canal.

(10) The closure of the G. W. Gravolet Canal will also be a result of this project. This canal currently provides water access to an oyster processing establishment which is economically important to this area. Oyster fishermen use this canal to gain access to the oyster plant for unloading. Road access to the north of the new high-levee alignment should be made a project requirement. This access road could be located on either side of the canal, depending upon the relocation site of the oyster plant. The corresponding map location is near Station 411/-50.

(11) The Highway Department plans call for an access road from the new highway into United Gas Company property at Station 430/-73. We wish to have this access point included in the hurricane protection project plans.

(12) The Richardson Bass Canal will also be closed due to the highway-levee project. Access to the proposed relocation of this Company's plant should be provided as indicated in the highway plans at Station 459/-50.

(13) The Parish (Adema) Canal is another waterway which will be closed as a result of highway-levee construction. The Parish Canal is currently a harbor for some 60 to 70 small and intermediate size shrimp and oyster boats. A public boat livery is now in service on the north bank of this canal. Also private interests maintain boat houses on the south bank of this area. It is requested these interests be given due consideration when providing access to an area suitable for relocation of their present facilities marshward of the highway-levee alignment.

(14) The William A. Beshel Industries have a road which provides access to boat houses on a canal leading to the back levee canal. This access should be continued and provisions made to include this access at Station 579/40 in the proposed highway-levee project.

(15) A road described as Tabony Lane currently provides access to the back levee canal from the presently existing highway. There is a hunting and fishing camp located at the end of this road, adjacent to the back levee canal. Access provisions are indicated in the highway-levee plans at Station 596/92. This should be continued as an access point and be included in project plans.

The above access points are currently in existence in this area and it is requested these specified locations be continued as access sites regardless of any construction or project installations that may be performed in connection with the Poverty Point-Bohemia Highway-Levee Project.

Other project features included and described in the plans developed by the Louisiana Highway Department are acceptable to fish and wildlife interests and we do not have further comment or recommendations relative to these provisions.

With respect to the additional hurricane protection planned for this area by the Corps, if allowable under project standards, we request consideration be given to developing a public boat launching area for added recreational benefits which could be attributed to the value of this project. The location of such a facility could be at the discretion of the Corps and should be included in the planning details of this project.

We appreciate the opportunity to offer comments relative to the fish, wildlife and recreational aspects of this project and request to be included in all planning phases as this public works project continues. Should there be any change or modification in the present project plans, we request the opportunity to review these plans and submit additional comments or recommendations pursuant to fish and wildlife interests.

Sincerely,

/s/ L. D. Young, Jr.

L. D. Young, Jr.
Director

LDYJr/sl.
cc: La. Highway Department
Plaquemines Parish Council
U. S. Fish and Wildlife Service
(Branch of River Basin,
Vicksburg)

LOUISIANA WILD LIFE AND FISHERIES COMMISSION

WILD LIFE AND FISHERIES BUILDING
400 ROYAL STREET
NEW ORLEANS, LOUISIANA 70130

October 7, 1971

Colonel Richard L. Hunt
District Engineer
US Army Corps of Engineers
P. O. Box 60267
New Orleans, LA 70160

Dear Colonel Hunt:

This is in reply to your letter of October 1, 1971, requesting that we review the authorized "New Orleans to Venice, Louisiana Hurricane Protection Project".

We have at your suggestion reviewed the previous correspondence detailing our interest, recommendations, and considerations regarding the various fish and wildlife resources and values associated with the project area. Because there have been no appreciable modifications or changes in the plan for reaches A, B, and C. We feel our original letter reports would be sufficient in establishing our interest and recommendations regarding the proposed work.

However, because of the absence of sufficient discharges of waters from the Mississippi River into the marshes on either side possibly at some later date some consideration could be given to establishing fresh water introduction features in the levee system of the hurricane protection project. With reduced flood peaks by upstream works and the improvement and extention of the Mississippi River levees, fresh water flows into the marshes have been drastically reduced. This has resulted in increased salinities in the prime oyster producing areas east and west of the river below New Orleans. The increased salinities have reduced the amount of area which now can produce oysters on a reoccuring or annual basis. In order to maintain the oyster industry as we know it today, provisions for the introduction of fresh water into these areas should be included where ever possible and made a part of existing projects in this area. This would improve the quality of the environment and help maintain or reestablish valuable natural renewable resources. In the event additional planning is possible and other features could be considered, we would appreciate a review of the above request in order to take every opportunity to maintain or improve existing environmental conditions in this valuable marsh land area.

We appreciate the opportunity to offer comments relative to fish and wildlife aspects of this project. Should you have any questions concerning our interest in this area or should the project as presently proposed be altered or modified in any way, we request the opportunity to review these changes and submit additional comments concerning wildlife interest.

Sincerely yours,

Clark M. Hoffpauer
Director
Louisiana Wild Life & Fisheries
Commission

MWS/cgl

cc Oyster Division
Robert E. Murry

Plaquemines Parish Commission Council

POINTE-A-LA-HACHE, LA. 70082

CHALIN O. PEREZ, PRESIDENT
CLARENCE T. KIMBLE, VICE-PRESIDENT
MRS. E. LAFRANCE, SECRETARY

COMMISSIONERS:
LUKE A. PETROVICH
HOWARD H. WILCOX, JR.
CHESTER A. WOOTON

January 18, 1972

Re: LMNED-PP

Department of the Army
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Attention: Mr. William E. Lee, Jr.
Lieutenant Colonel, CE
Acting District Engineer

Gentlemen:

Thank you for your letters of 15 October 1971 and 11 January 1972, concerning proposed public boat-launching facility in the Reach C - Phoenix to Bohemia feature of the New Orleans to Venice Hurricane Protection Project.

The Plaquemines Parish Commission Council has under construction a large Marina at Lower Pointe a la Hache which should be in operation within the next two months, and which will accommodate our fishing industries and provide boat launching facilities for commercial and recreational purposes on the east bank.

We assure you that your kind offer is appreciated, but additional facilities in this area would serve no purpose.

Sincerely,

Plaquemines Parish Commission Council

President

COP:sb

United States Department of the Interior
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

November 8, 1971

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 October 1, 1971, requesting our review of the New Orleans to Venice, Louisiana, hurricane protection project.

Based on the information contained in your letter that no appreciable modifications are being contemplated for Reaches A, B-2, and C of the authorized New Orleans to Venice, Louisiana project, our previous reports with respect to these reaches will suffice in establishing the fish and wildlife implications of the hurricane protection plan.

However, with respect to Reach A we would recommend that consideration be given to establishing the necessary features for the freshwater introduction control structure No. 3 which is a part of the authorized plan for Freshwater Introduction Into the Sub-Delta Marshes Below New Orleans, Louisiana. Incorporation of this structure which is to be located in the vicinity of Homeplace, Louisiana, with Reach A of the hurricane protection plan would provide for the timely implementation of one of the four freshwater introduction structures needed to rectify, in part, the adverse conditions to fish and wildlife resources brought about by the existing levees along the Mississippi River below New Orleans.

The opportunity to provide these additional comments with respect to the fish and wildlife aspects of the proposed project is appreciated. Should questions arise concerning our recommendations, or should project plans be further modified, we will be happy to assist in any manner possible in the interest of fish and wildlife conservation.

Sincerely yours,

C. Edward Carlson

C. Edward Carlson
Regional Director

1871
1971

ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1600 Patterson, Suite 1100
Dallas, Texas 75201

November 26, 1971

Colonel Richard L. Hunt
District Engineer
Departments of the Army
New Orleans District, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Colonel Hunt:

We have reviewed the maps showing the New Orleans to Venice, Louisiana Hurricane Protection Levees. The project consists of the enlargement of existing levees and extensive construction of new levees.

The enlargement and construction of new levees will involve the excavation of large quantities of sand from the Mississippi River and clay fill from adjacent marsh areas.

Obviously, the project potentially could have significant adverse effects on the environment even if construction methods are of the highest quality.

We would like to know more about the construction methods and methods that will be used to protect environmental values during and after construction of the project.

Perhaps your office plans to prepare an Environmental Statement on this project and/or associated projects. An Environmental Statement that would include this project would permit our agency to evaluate more fully the potential adverse effects on environmental values within our area of responsibility.

We appreciate the opportunity to give you our preliminary views on this project.

Sincerely,

Mac A. Weaver

Mac A. Weaver, P. E.
Air and Water Programs Division

STATE OF LOUISIANA
STREAM CONTROL COMMISSION
P. O. DRAWER FC
UNIVERSITY STATION
BATON ROUGE, LOUISIANA 70803

January 19, 1972

Colonel Richard L. Hunt, C.E.
District Engineer
Department of the Army
Corps of Engineers, New Orleans District
Post Office Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter dated October 15, 1971, requesting our comments on the New Orleans to Venice, Louisiana, Hurricane Protection Project.

We reiterate our previous position:

1. Spoil bank control to prevent water pollution from turbid conditions is recommended.

Areas adjacent to reaches A and B2 are oyster growing areas; therefore, siltation of these water bottoms could be most harmful.

2. State and federal water pollution control and health laws, rules, and regulations should be complied with by the contractor.

Very truly yours,

Robert A. Lafleur
Executive Secretary

fbr

LOUISIANA AIR CONTROL COMMISSION

Louisiana State Office Building
P.O. Box 60630
NEW ORLEANS 70160

October 28, 1971

Department of the Army
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, La. 70160

Attention: Colonel Richard L. Hunt, CE
District Engineer

Gentlemen:

Thank you for your letter of October 15, 1971 in regard to various authorized projects including the "New Orleans to Venice, Louisiana" hurricane protection project.

We have no further comment except that in the period since 1967 greater emphasis is being placed on air pollution control.

There is no information as to whether or not there will be combustible materials from the work involved. If there will be such materials, we believe that any contract could provide for compliance with the Louisiana Air Control Commission's standards and regulations.

At the direction of Andrew Hedmeg, M.D., M.P.H.

Very truly yours,

John E. Trygg

John E. Trygg
Technical Secretary

JET:ls