

U. S. ARMY ENGINEER DISTRICT, BUFFALO
Corps of Engineers
Foot of Bridge Street
Buffalo 7, New York

NCBED

8 March 1963

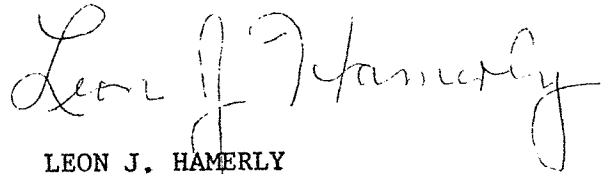
SUBJECT: Design Memorandum on Pier Repair Project at
Olcott Harbor, New York

THRU: Division Engineer
U. S. Army Engineer Division, North Central
Chicago, Illinois

TO: Chief of Engineers
Department of the Army
Washington, D. C.

1. In accordance with EM 1110-2-1152, there are inclosed 5 copies of subject memorandum. There are also inclosed 3 copies for retention by the Division Engineer.

2. It is recommended that the design memorandum be approved.



1 Incl
Subj Design Memo (8 cys)
(OCE - Ser. Nos. 1-5)
(NCD - Ser. Nos. 6-8)

LEON J. HAMERLY
Col., Corps of Engineers
District Engineer

NCDED-T (8 Mar '63-NCBED) 1st Ind
SUBJECT: Design Memorandum on Pier Repair Project at Olcott
Harbor, New York

U. S. Army Engr Div, North Central, Chicago, Illinois 19 March 1963

TO: Chief of Engineers, Attn: ENG CW-E, DA, Washington, D. C.

1. Reference is made to North Central Division letter dated 12 March 1963 on the above subject.

2. Five copies of the subject design memorandum were forwarded for concurrent review in the above reference.

3. It is recommended the subject design memorandum be approved subject to the following comment: Page 5, Paragraph 19. This office has no objection to the use of high strength steel for the sheet piling as outlined. However, due to the amount of piling involved, the irregularity of the lengths and the separate handling required, it may be more economical and practical to use either all Z-27 piling or the high strength steel sheet pile for all the MA-22 piling. The Buffalo District will be requested to include option, covering the above in the specifications.

FOR THE DIVISION ENGINEER:



EDWIN W. NELSON
Chief, Engineering Division

Incls
w/d

ENGCW-EZ (8 Mar 63)

2nd Ind

SUBJECT: Design Memorandum on Pier Repair Project at Olcott Harbor, New York

Office, Chief of Engineers, Washington 25, D. C., 5 April 1963

TO: Division Engineer, U. S. Army Engineer Division, North Central

1. The design memorandum is approved subject to the following comments:

a. Referring to Plate 3.

(1) Inasmuch as the descriptions, especially those for the rock, on the logs for borings made in 1940 and in 1948 do not agree with those shown on the logs for the more recent borings, some indication of the reliability of the descriptions or an explanation for the disagreement should be given if this drawing is to be included in the contract drawings.

(2) Also, it is the understanding of persons in this office that cores and samples from the 1940 and the 1948 explorations are not now available for inspection. If this is true and if the drawing is to be one of the contract drawings, the lack of availability of these cores and samples should be indicated.

(3) In note 4, this office questions the description of the shale as "hard" inasmuch as a hard rock is one that cannot be scratched with one's fingernail (Plate 2, EM 1110-1-1806). Maybe definitions of hardness terms should be included in the drawing.

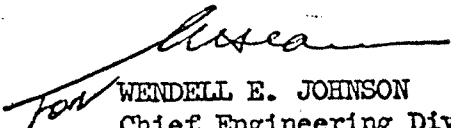
b. If on-site work is initiated prior to 30 June 1963 a completion date of 1 October 1964 would allow a contractor to drag out the work over a long period of time. A completion date of 30 June 1964 should be more than sufficient for even a small business firm to complete the work.

c. Consideration should be given to locating the wales on the outside surface of the piles rather than on the inside as shown on the Plate 1 cross-sections.

2. The above confirms telephone information given to Mr. Amrein this date.

FOR THE CHIEF OF ENGINEERS:

Incl w/d


WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

TCZ02
E804

59008827

NCDED-T (8 Mar 63-NCBED)

3rd Ind

SUBJECT: Design Memorandum on Pier Repair Project at Olcott Harbor, New York

U. S. Army Engr Div, North Central, Chicago, Illinois

8- APR 1963

TO: District Engineer, U. S. Army Engineer District, Buffalo, New York

1. Forwarded for continuance of action.
2. Reference is made to paragraph 1c of the 2nd Indorsement. In telephone conversation mentioned in paragraph 2 of 2nd Indorsement, OCE was informed that comment would not receive favorable consideration in view of past experience wherein wales on outside of piling were damaged by wave action. Example cited was Presque Isle Peninsula, Erie, Pa. in the 1940's.
3. Foregoing confirms telephone conversation Mr. Amrein to Mr. Hunt on 5 April 1963.
4. The tentative approval of the plans and specifications set forth in NCD 1st Indorsement dated 4 April 1963 on Buffalo District letter dated 8 March 1963 is hereby revised to final subject to comments in the 4 April NCD Indorsement and those set forth in the preceding 2nd Indorsement.

FOR THE DIVISION ENGINEER:

Edwin W. Nelson

EDWIN W. NELSON
Chief, Engineering Division

U. S. ARMY ENGINEER DISTRICT, BUFFALO
Corps of Engineers
Foot of Bridge Street
Buffalo 7, New York

DESIGN MEMORANDUM

ON

PIER REPAIR PROJECT

AT

OLCOTT HARBOR, NEW YORK

PERTINENT DATA

STRUCTURE REQUIRING REPAIR: West pier

LENGTH TO BE REPAIRED: 620 feet

TYPE OF CONSTRUCTION:

Two parallel walls of steel sheet piling - one wall driven on each side of the existing structure - tied together near the top with tie rods. The spaces between the sheet pile walls and the existing structure will be filled with granular material and a new concrete deck placed over the existing cap, from wall to wall.

QUANTITIES OF PRINCIPAL MATERIALS:

Steel sheet piling, pounds	782,000
Granular fill, cubic yards	2,700
Concrete, cubic yards	810

ESTIMATED COST: \$270,000

CONSTRUCTION SCHEDULE:

Start - June 1963
Latest allowable completion date - October 1964

U. S. ARMY ENGINEER DISTRICT, BUFFALO
Corps of Engineers
Foot of Bridge Street
Buffalo 7, New York

DESIGN MEMORANDUM

ON

PIER REPAIR PROJECT

AT

OLCOTT HARBOR, NEW YORK

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APPENDIX - TYPICAL DESIGN COMPUTATIONS

U. S. ARMY ENGINEER DISTRICT, BUFFALO
Corps of Engineers
Foot of Bridge Street
Buffalo 7, New York

DESIGN MEMORANDUM

ON

PIER REPAIR PROJECT

AT

OLCOTT HARBOR, NEW YORK

AUTHORITY, PURPOSE AND SCOPE

1. The purpose of this design memorandum is to present data relevant to the contemplated pier repair project at Olcott Harbor, New York. This work was originally programmed as a minor rehabilitation project for accomplishment with Construction General funds. However, the necessary funds have been provided under the Public Works Acceleration Act, 1963 (by transfer from the Department of Commerce).

2. Authorization and description of the Olcott Harbor project, history of the structure requiring repair, the basic data, design criteria, assumptions and procedures used in design of the repair work, and other pertinent data, are outlined herein.

PROJECT AUTHORIZATION AND DESCRIPTION

3. PREVIOUS PROJECT

The original project for Olcott Harbor, New York, was adopted by the River and Harbor Act of 2 March 1867.

4. EXISTING PROJECT

Works of improvement completed under the previous project were made part of the existing project, which was authorized by the River and Harbor Act of 4 March 1913. The project provides for:

a. Parallel timber-crib piers about 200 feet apart, the west pier 873 feet long and the east pier 850 feet long.

b. A channel 12 feet deep and 140 feet wide from deep water in Lake Ontario to the shoreward end of the piers.

5. STATUS AND CONDITION OF EXISTING PROJECT

The existing project was completed in 1918. The general arrangement of piers and channel are shown on plate 1. About 28 feet at the outer end of the east pier was never maintained and is completely gone. The remaining 822 feet of the structure were repaired in 1949: the old stone-filled timber crib structure, some of which was concrete capped, was encased with steel sheet piling and topped with a new concrete cap for its entire length. It is in excellent condition. The west pier is in such critical condition that extensive repairs are needed. A detailed description of its condition is given in paragraph 12. The entrance channel is maintained to project depth. Dredging to restore that depth was last performed in 1962.

LAKE LEVELS

6. Project depths at Olcott Harbor are referred to low-water datum for Lake Ontario, which is 242.8 feet above mean water level at Father Point, Quebec - International Great Lakes Datum (1955). Ordinary fluctuations of water surface are from low-water datum to 4 feet above that plane, and extreme fluctuations produced by wind and other causes are from 5 feet above to about 0.5 foot below low-water datum.

HISTORY OF WEST PIER

7. ORIGINAL CONSTRUCTION

The original west pier was constructed 1867-1874. It was 881 feet long, of stone-filled timber cribs founded on natural bottom materials. Some dredging at the inner end was done to obtain greater foundation depths. Actual depth of cribs at the inner end is not recorded. For the shoreward 305 feet, the cribs were 15 feet wide by 30 feet long. For the balance they were 20 feet wide by 30 feet long. Recorded depths of these cribs range from 9 to 10.5 feet, but some may have been less. Throughout, top of the timber superstructure was 4 feet above "ordinary low water."

8. PREVIOUS REPAIRS

The superstructure of the inner 305 feet was completely rebuilt 1881-82. Between 1887 and 1892 the superstructure of the outer 368 feet was rebuilt and miscellaneous repairs made to other sections. On conclusion of this work the length of the pier was reported as 873 feet, and this was subsequently adopted as the project length.

9. From 1896 through 1902 the project was dropped from the Federal rolls. From 1903, when the project was reactivated, to 1928, the west pier required repeated repairs. Most of the work was concentrated at the inner end, where the structure was breached on several occasions. Details of the work, some of which was of an emergency nature, are lost, but at various times new timber, stone, brush, wooden and steel piling, and concrete were used in the work. Most of the work was done by the Government, but some was also done by local interests.

10. By 1928 only the outer 54½ feet of the structure still retained its original identity. In the next 29 feet, where the landmost section of the original 20-foot wide cribs had stood, a timber structure only about 9 feet wide had been installed. In the next succeeding 41 feet a structure only 5 feet wide had replaced the original 15-foot wide cribs. This section tied into a single line of steel piling, about 65 feet long, which had been driven in 1914 to close a breach. Landward of the inner end of this piling the balance of the structure was so built over by local repairs and developments as to be unidentifiable. By this time, however, as a result of natural accretion, fills, and other local developments, the adjacent shore had been built out to the point that this portion of the structure was no longer needed to preserve and protect the channel.

11. In 1928-30, over the outer 61½ feet of the structure lakeward of the 1914 piling, the timber superstructure was removed and replaced with a concrete cap; the crest of the new cap was about 6.5 feet above low water datum. Only minor repairs, to this same section of the structure, have been made since.

12. PRESENT CONDITION OF STRUCTURE

A typical section of the outer portion of the west pier as rebuilt in 1930 is shown on plate 1. All but a few short sections give evidence of advanced deterioration. Near the outer end, one section of the crib substructure has collapsed and the cap has tilted downward. Near the middle another has been undermined and its section of cap obtains most of its support from the adjacent sections with daylight visible beneath it. The 5-foot wide portion of the structure at the inner end is verging on collapse due to loss of filling stone near its middle. The adjacent yacht club has driven a second line of piling behind the narrow capped sections and the 1914 piling to retain its fill and buildings. Large cracks are visible in the concrete cap of the pier throughout. Differential lateral movement, tilting and settlement of the substructure cribbing are also evident. As a result, crest of the cap is now below 6 feet above low-water datum for the entire length of the structure. Existing conditions are illustrated by the accompanying photographs.

SUITABILITY OF DESIGN AS CONSTRUCTED

13. In view of its history, it is apparent that the landward portion of the original pier, constructed of 15-foot wide cribs, was not substantial enough to adequately resist Lake Ontario storms. On the other hand, the balance of the structure, of the same type of construction but made up of 20-foot wide cribs, is for the most part still standing after 90 years, and has served to preserve and protect the harbor entrance throughout its life. The suitability of the timber cribs, in view of the materials available at the time of construction, is attested to by this service life. The concrete cap installed in 1930 was also a suitable type of construction. Nearly all faults discernible in the cap today are directly attributable to the great age and deterioration of the underlying timber cribs.

RECOMMENDED PLAN FOR REPAIR

14. To determine the extent of the repair needed, and the physical conditions which would influence the design of repairs, a detailed survey of the west pier was made in 1962. It was concluded that repair work should be confined to the outer portion of the structure rebuilt 1928-30. Cross sections of the structure and adjacent lake bottom were obtained at frequent intervals along this section of the pier. Several of these are shown within the typical repair sections on plate 1. Probing was made along both sides to locate top of rock. Seven core holes were also drilled adjacent to the structure. Locations of probings and cores are shown on plate 1; probing data on plate 2; logs of borings on plate 3; and the approximate profile of subsurface materials on plate 4.

15. Some useful data were also available from borings made along the east pier prior to repair of that structure in 1949. Locations of these holes are also shown on plate 1; logs on plate 3.

16. It is contemplated that the repairs to the west pier be generally similar to the 1949 repairs to the east pier: two parallel walls of steel sheet piling tied together near the top with tie rods; the spaces between the steel sheet pile walls and the existing structures filled with granular material; and a new concrete deck placed over the existing cap, between the new walls. Top of the walls and deck will be 7 feet above low-water datum. At the outer and inner ends, steel sheet pile cross walls will be driven to completely encase the existing structures. At the inner end, the cross wall will be tied into the existing line of piling driven by the yacht club.

17. Typical sections of the contemplated repairs are shown on plate 1. The plan is shown on plate 2.

DESIGN FOR REPAIR

18. The elevations of lake and channel bottom assumed for design of the repairs were based upon an examination of soundings adjacent to the structure over a period of years and also took into account possible excessive overdredging in the maintained portion of the channel. There are no plans for deepening or widening the existing channel in the foreseeable future.

19. Because of the presence of clay in the bottom material, the design of the steel sheet pile walls was based on the assumption of "free earth support," and no reduction in bending moment was taken. Basic allowable working stresses of 24,000 and 20,000 pounds per square inch were used for the steel sheet piling and structural steel, respectively, except in the reach lakeward of station 3+50 (approximately), where it was found economical to use a high strength steel with an allowable unit working stress of 30,000 pounds per square inch for the steel sheet piling. The higher working stress is based on use of piling similar to Bethlehem V50 or U. S. Steel Ex-Ten 50.

20. Active and passive earth pressures were computed in accordance with Coulomb's theory. Because of the poor condition of the cribs, it was assumed that the full pressure of the crib filling stone would bear against the sheet pile wall.

21. Design of the wales took into account the fact that wales, on some existing structures which were designed for theoretical loads only, have sometimes been stressed beyond the yield point by the action of pulling the steel sheet pile wall against the existing structure when tightening the tie rods to obtain alignment during construction. To avoid this possibility of deforming the wale, it has been so proportioned that when the tie rods have been stressed to 29,000 pounds per square inch, the stress in the wale will not exceed 24,000 pounds per square inch.

22. Theoretical tie rod loads have been increased by 20%, as recommended by Karl Terzaghi in his "Theoretical Soil Mechanics." Penetration requirements have also been increased by 20%, as recommended by Terzaghi in Proceedings of A.S.C.E., Vol. 79, Separate No. 262, dated 5 September 1953.

23. Where rock is encountered, a minimum penetration of 4 feet into the rock was assumed to insure that the bottom of piling would be in sound rock. Direct shear tests performed

by O.R.D. Lab, Mariemont, Ohio, in 1951, on samples of Queenston shale, which is geologically similar to that encountered at Olcott, produced values varying from 485 to 679 pounds per square inch. In the design calculations, the location of the resultant rock reaction was placed 2 feet below the surface of rock.

24. At the landward end of the pier, where natural ground is approximately level with the top of the pier, the wall on the landward side of the pier was designed as a cantilever anchor wall. Since this side of the pier is in the zone of natural accretion, it is believed extremely unlikely that this wall would ever be exposed by erosion.

25. Criteria, assumptions, and typical designs of portions of the steel sheet pile walls are contained in the appendix to this memorandum.

COMPARISON WITH EXISTING CONSTRUCTION

26. The proposed method of repair will confine the existing materials and increase the stability of the pier. Replacement of parts of the existing structure with a type of construction similar to that now existing is not feasible because of the age and deterioration of the substructure cribs. Experience has shown that the general method of repair considered requires little if any maintenance. It is also the most economical type of construction from the point of view of first cost.

NECESSITY FOR REPAIRS

27. The proposed repairs to the west pier are necessary to prevent further damage to the timber cribs and concrete cap. Lacking repairs at this time, progressive deterioration of the structure will rapidly increase costs for any possible repairs. Maintenance of the piers at Olcott Harbor in good repair is essential to preservation and protection of the entrance channel. The harbor is an important base and harbor of refuge for recreational craft.

ESTIMATES OF COST

28. ESTIMATE OF REPAIR COST

A detailed estimate of cost for the proposed work is given in the following table. It provides for complete repair of the presently useful length of the west pier. There are no deferred items. The estimate is considered to be on current, March 1963, price levels.

Item	Quantity	Unit	Unit cost	Amount	Total
			\$	\$	\$
BREAKWATERS					
Steel sheet pile	782,000	Lbs.	0.15	117,300	
Metalwork	84,000	Lbs.	0.40	33,600	
Breaking existing cap	620	L.F.	6.00	3,720	
Granular fill	2,700	C.Y.	6.00	16,200	
Welded wire mesh	1,830	S.Y.	1.00	1,830	
Expansion joint	235	L.F.	2.00	470	
Portland cement	1,100	Bbl.	6.00	6,600	
Concrete	810	C.Y.	35.00	28,350	
Ladders	7	Ea.	100.00	700	
Cleats	12	Ea.	50.00	600	
Contingencies, 10%±				20,630	
TOTAL BREAKWATERS					230,000
ENGINEERING AND DESIGN					
					20,000
SUPERVISION AND ADMINISTRATION					
					23,000
GRAND TOTAL					
					273,000

29. COMPARISON WITH PREVIOUS ESTIMATE

The Project Information Sheet for a proposed minor rehabilitation project at Olcott Harbor, dated 2 July 1962, reported a reconnaissance estimate of \$200,000. The difference between that estimate, which was considered to be on July 1962 price levels, and the current estimate of \$273,000 is due to the following:

Increase in length of proposed repairs from about 600' to about 620', due to details of method of repair	+6,700
Price level changes	+ 1,600
Final design details and related requirements for engineering and design and supervision and administration	+64,700
	<hr/>
Total difference	73,000

30. FUNDING

Public Works Acceleration Act funds in an amount of \$200,000 have been made available for the repair work at Olcott Harbor. The design memorandum estimate given in paragraph 28 exceeds this amount by \$73,000. Authority will be requested to advertise the work on the basis that additional funds, if actually needed, will be requested after receipt of bids.

SOURCES OF CONSTRUCTION MATERIALS

31. Sheet piling and other steel items required for the repairs to the west pier at Olcott Harbor are standard items available from most suppliers or steel manufacturers. Suitable granular fill material can be obtained locally: from Frontier Stone Products, Lockport, New York; and Royalton Stone Company (Ex Colorado Fuel and Iron), Gasport, New York. It is anticipated that the contractor will purchase transit-mix concrete for capping the repair work.

CONSTRUCTION SCHEDULE

32. Submission of plans and specifications for the repair work is scheduled for about 8 March 1963, concurrent with submission of the design memorandum, with a view to securing approval thereof in time to advertise the work on about 8 April 1963. Bid opening and contract award are scheduled for 7 and 21 May, respectively. This schedule is designed to insure that on-site work will be initiated prior to 30 June 1963, as required by the Department of Commerce (ARA) in furnishing funds for the repairs under the Public Work Acceleration Act, 1963. It is estimated that construction could be completed within about 200 calendar days. However, this work has been set aside for small business only, and a more liberal amount of time will be allowed to encourage the widest possible competition. A contract completion date of as late as 1 October 1964 will be permitted.

RECOMMENDATION

33. It is recommended that the plan for repair of the west pier at Olcott Harbor, New York, as presented in this design memorandum, be approved.

OLCOTT HARBOR - WEST PIER

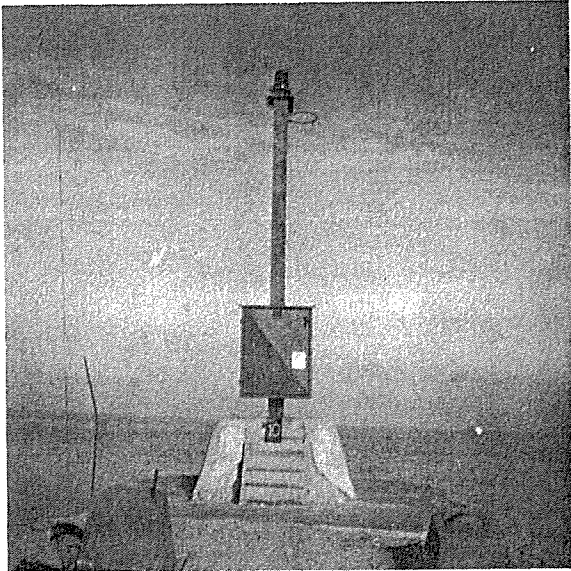


Photo No. 1 - View of light at outer end of pier.



Photo No. 2 - View from channel of section of pier from sta. 2+35 to 3+15.



Photo No. 3 - View along pier crest toward shore from steps shown in Photo No. 1. Shoreward sections of crest show evidence of differential tilting of timber crib substructure.



Photo No. 4 - View from lake side of section of pier from sta. 4+00 to 4+30.

OLCOTT HARBOR - WEST PIER



Photo No. 5 - View from lake side of section of pier from Sta. 4+50 to 4+90. Note east pier, repaired in 1949, in background of this and Photo No. 4.

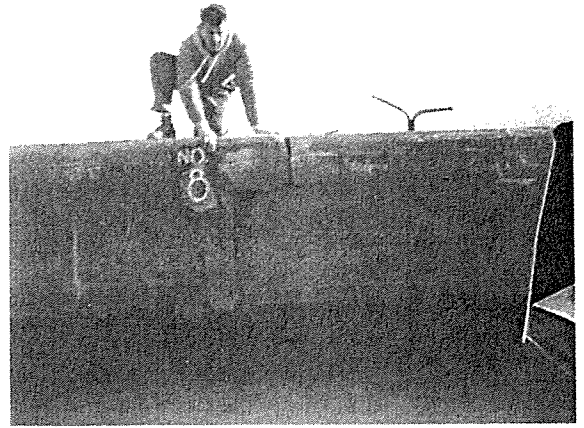


Photo No. 6 - View from lake side of section of pier from Sta. 5+00 to 5+20. Here, only superficial signs of deterioration are evident.

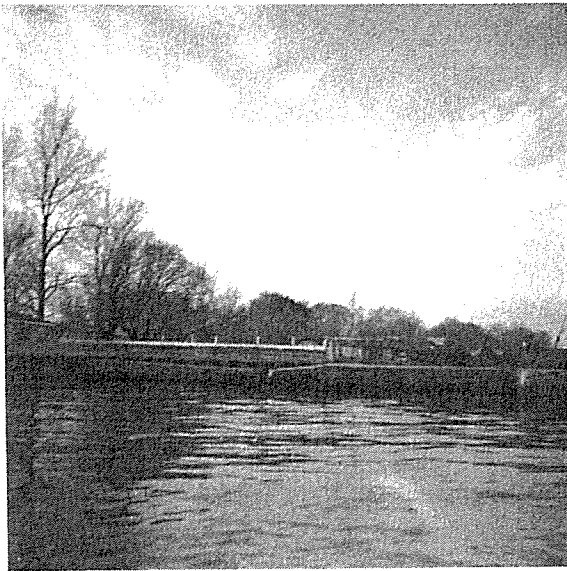


Photo No. 7 - View from channel of section of pier from Sta. 7+90 to 8+90, showing the inner end of the 20-foot wide portion, the 9-foot wide portion, and the 5-foot wide portion.

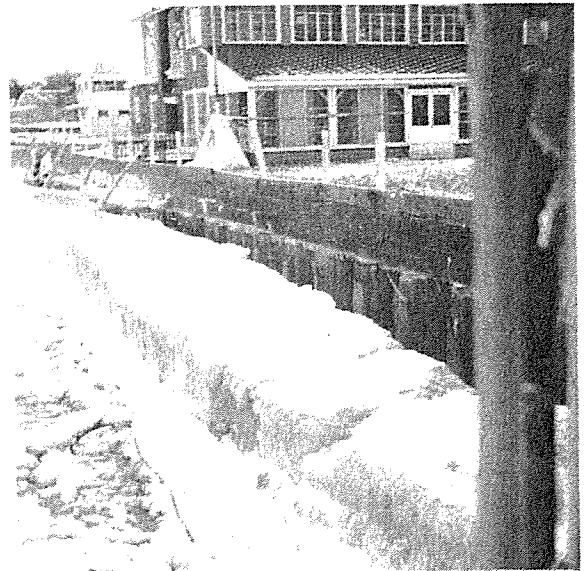
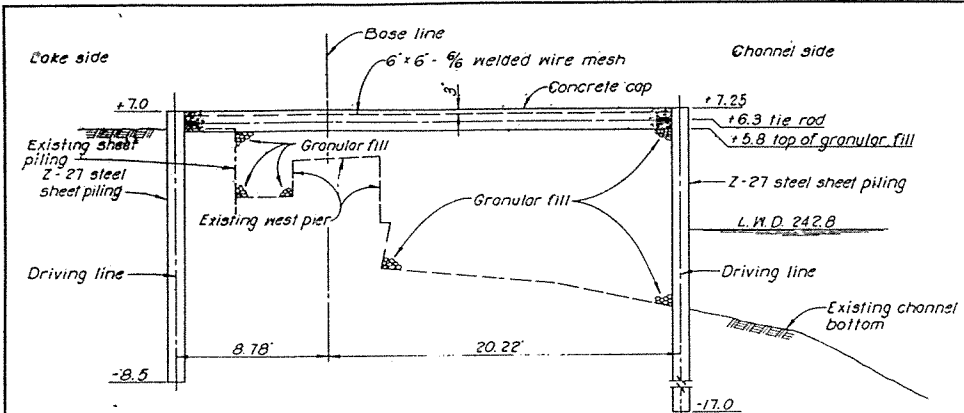
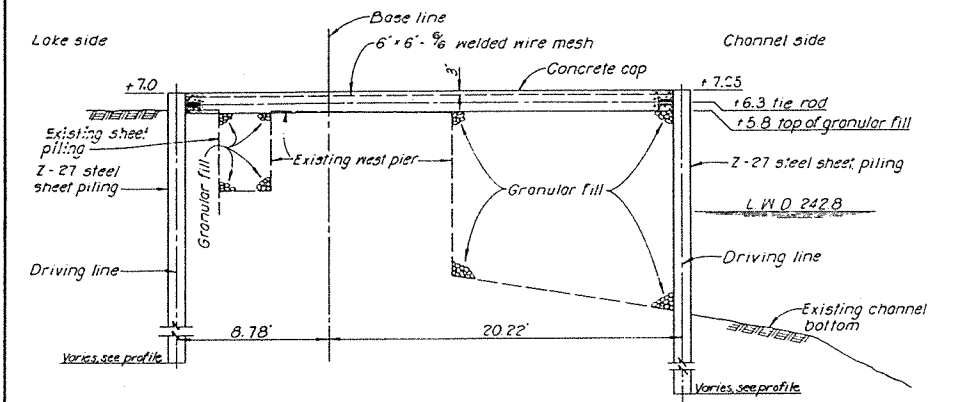


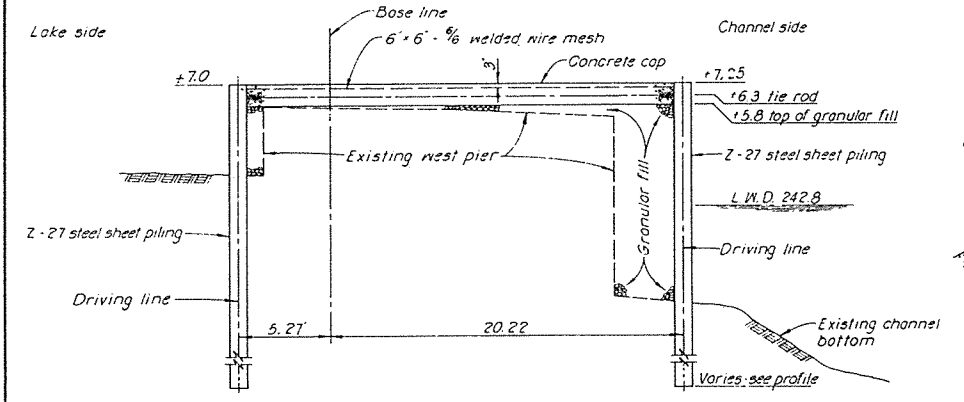
Photo No. 8 - View of the 5-foot wide portion of the structure, showing piling driven in 1914 in left background. Note line of piling driven by Yacht Club behind pier and old piling. (Structure in right foreground in part of core drill rig).



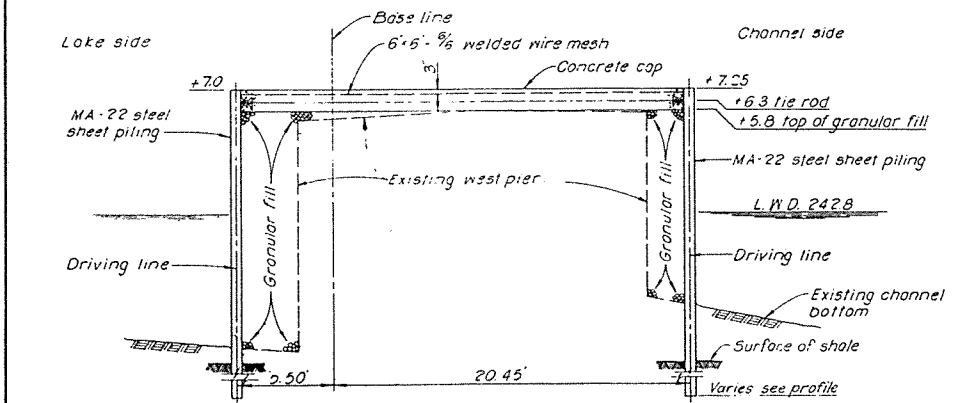
STA. 8+29 TO STA. 8+75.35



STA. 7+06.35 TO STA. 8+29

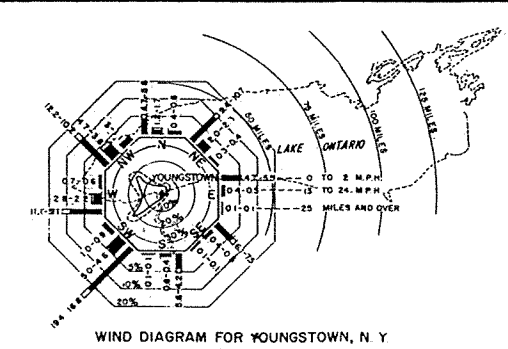


STA. 4+94.85 TO STA. 7+06.35



STA. 2+55.5 TO STA. 4+94.85

TYPICAL CROSS SECTIONS OF REPAIR TO WEST PIER
SCALE: 1" = 4'



WIND DIAGRAM FOR YOUNGSTOWN, N. Y. NOTES

■ INDICATES DURATION FOR ICE-FREE PERIOD (MAR. TO DEC. INCL.) IN PERCENT OF TOTAL DURATION.

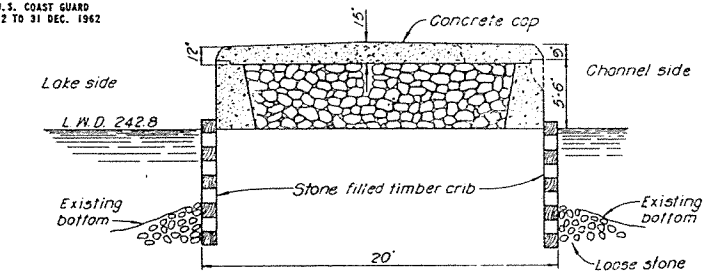
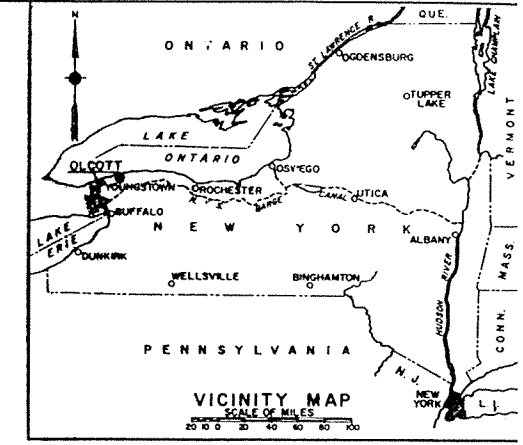
□ INDICATES DURATION FOR ICE PERIOD (JAN. TO FEB. INCL.) IN PERCENT OF TOTAL DURATION.

— INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING ICE-FREE PERIOD.

— INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING COMBINED ICE AND ICE-FREE PERIODS.

FIGURES AT ENDS OF BARS INDICATE PERCENT OF TOTAL WIND DURATION FOR ICE-FREE PERIOD AND COMBINED ICE-FREE AND ICE PERIODS, RESPECTIVELY.

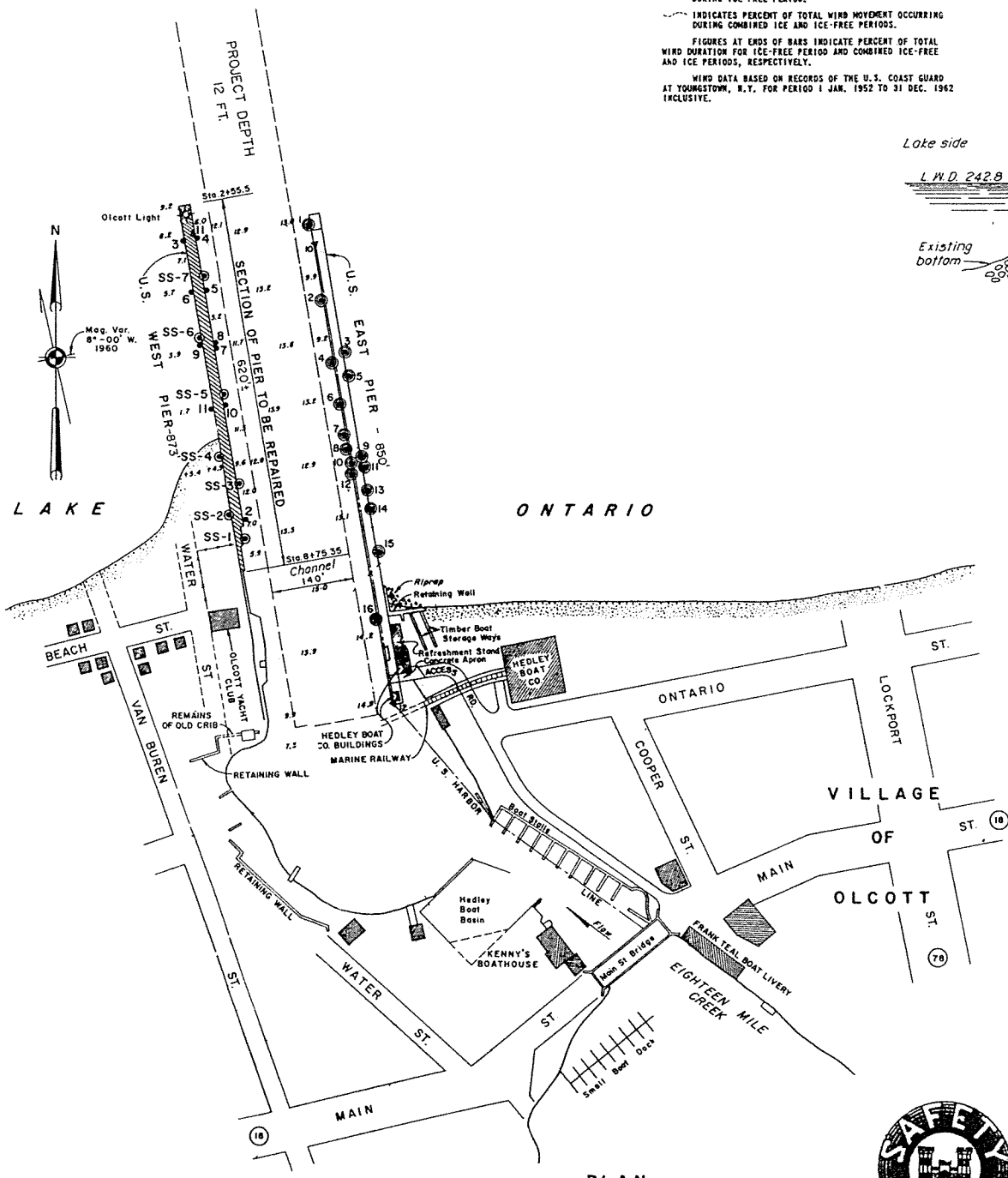
WIND DATA BASED ON RECORDS OF THE U.S. COAST GUARD AT YOUNGSTOWN, N.Y. FOR PERIOD 1 JAN. 1952 TO 31 DEC. 1962 INCLUSIVE.



CROSS-SECTION OF ORIGINAL WEST PIER

Dimensions shown are based on construction drawings and records (Dimensions are approximate)

SCALE: 1" = 4'



PLAN
SCALE 1" = 100'

GENERAL NOTES:

- All elevations are in feet and are referred to low water datum, elevation 242.8 feet above Mean Water Level of Father Point, Quebec. (I.G.L.D. 1955) (International Great Lakes Datum 1955).
- Depths below L.W.D. are preceded by a minus sign or are without any sign, thus: -17.0 or 13.9.
- Elevations above L.W.D. are preceded by a plus sign, thus: +7.0.
- Soundings taken in October 1961 and December 1962.
- Location of borings taken in 1940 and 1948 are shown thus: 5.
- Location of borings taken in 1962 are shown thus: 55-7.
- Location of borings are shown thus: 11.
- Field notes filed in 4-OLC-24.
- Existing concrete cap to be broken to eliminate all bridging before placing new cap, except as noted.

TO ACCOMPANY DESIGN MEMORANDUM DATED: 8 MARCH 1963...

REVISION	DATE	DESCRIPTION	BY

**U.S. ARMY ENGINEER DISTRICT, BUFFALO
CORPS OF ENGINEERS
BUFFALO 7, NEW YORK**

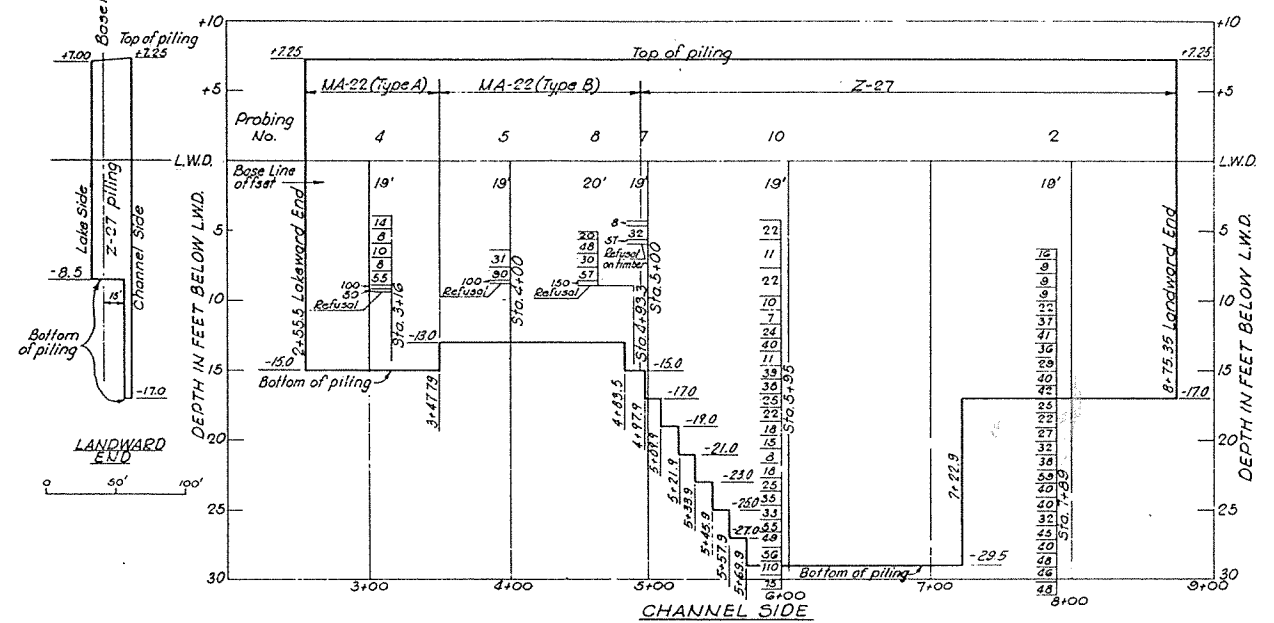
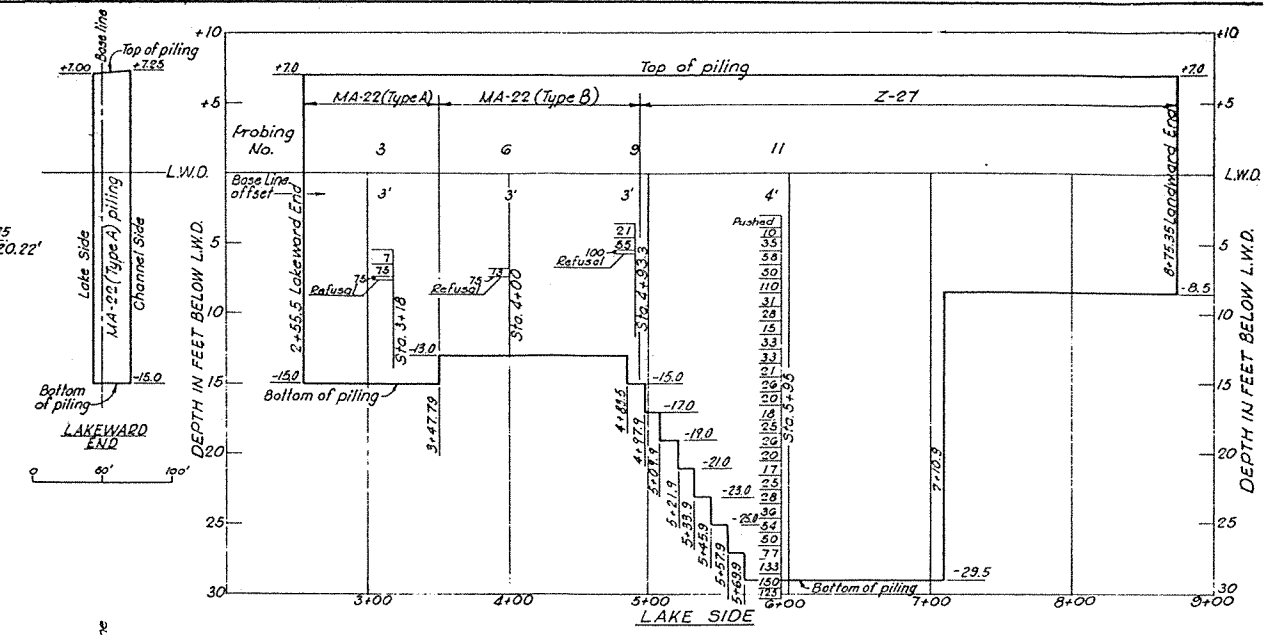
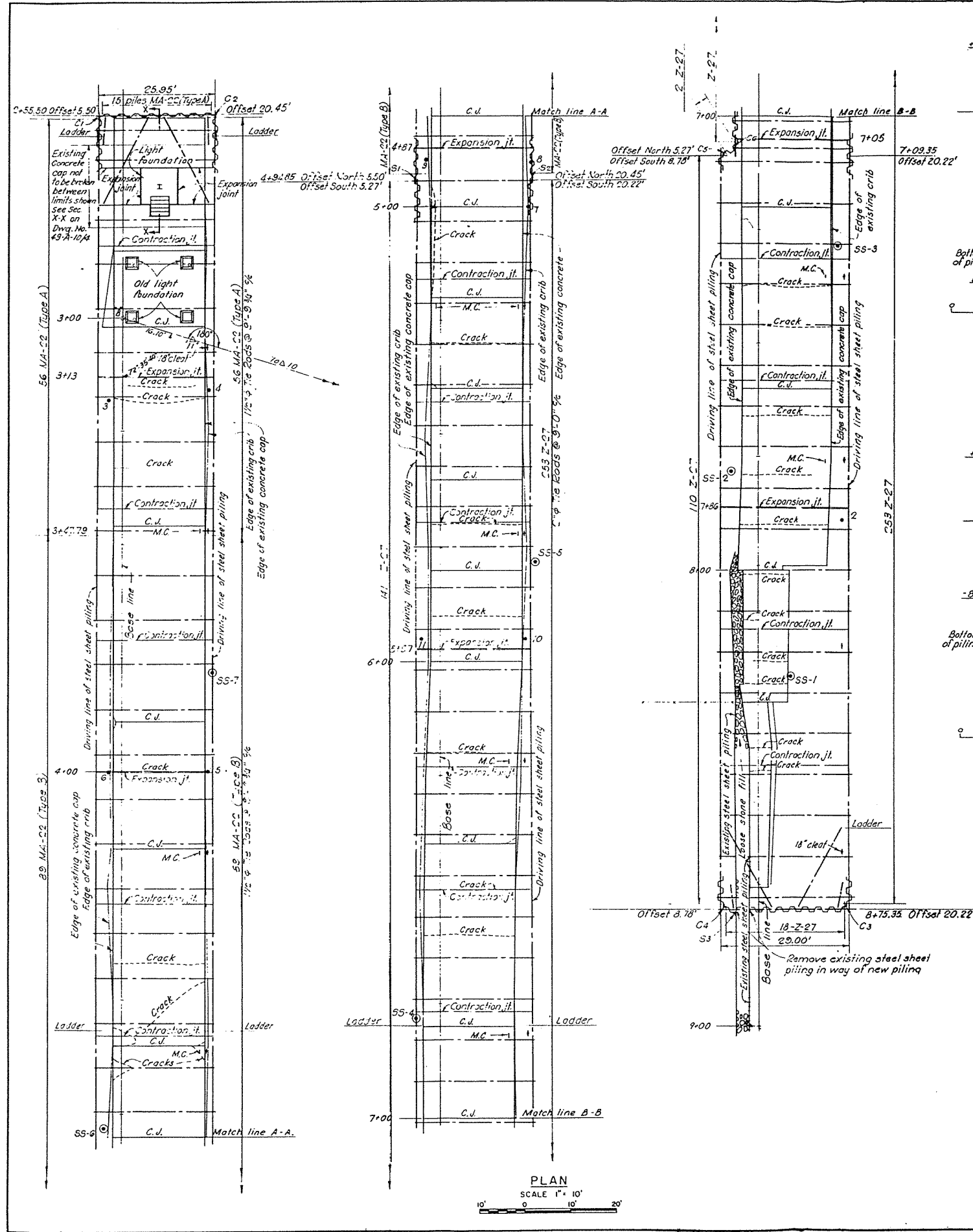
**OLCOTT HARBOR, N.Y.
REPAIRS TO WEST PIER
GENERAL PLAN**

DRAWN BY: T.E.T.
DESIGNED BY: D.M.L.
CHECKED BY: [Signature]
APPROVED BY: [Signature]

APPROVED: [Signature] DATE: 6 FEB 1963

TO ACCOMPANY SPECIFICATIONS SERIAL NO. CIVENG-30-023-63-27
DRAWING NUMBER: 49-A-10/1
SHEET 1 OF 7





NOTES:

- All lengths and stationing of sheet pile walls are based on theoretical dimensions of piles.
- Driving lines of steel sheet piling are straight lines between offsets shown on plan.
- Plan shows location of steel before placing concrete cap.
- Tie rod locations shown thus: $\text{---} \times \text{---}$. One standard turnbuckle to be located near midpoint of each tie rod except as indicated.
- 1/2" expansion joints in new concrete cap to be located as indicated. Contraction joints to be located at approximately equal intervals between expansion joints as shown.
- For typical sections of pier see plate 1.
- Existing mooring cleats, shown thus: M.C., shall be removed. New 18" cleats shown thus: \times shall be provided where shown on the plan and placed 1'-6" from channel face of piling.
- Ladders shall be located approximately as indicated on the plan.
- For general notes see plate 1.
- Mesh not to extend thru contraction joints.
- Existing construction joints shown thus: C.J.

PROBING NOTES:

- Probing taken during period 28 Nov. - 2 Dec. 1962.
- Probing accomplished with a 1 1/8 in. "E" rod driven by a 160 lb. hammer falling approximately 30 inches, mechanically operated.
- Number of blows required to drive probing rod footage as indicated.
- Refusal indicates excessive blow counts or maximum possible penetration of rod.

TO ACCOMPANY DESIGN MEMORANDUM DATED: 8 MARCH 1963

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DISTRICT, BUFFALO
CORPS OF ENGINEERS
BUFFALO 7, NEW YORK

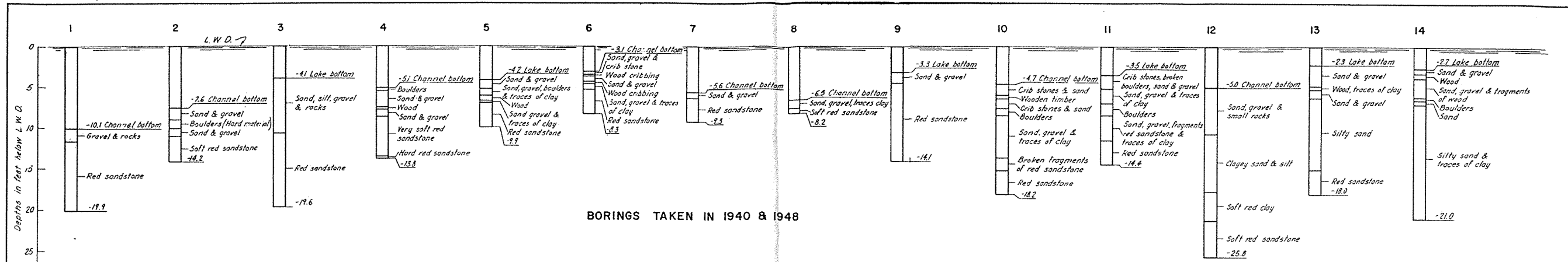
DRAWN BY: C.R.C.
DESIGNED BY: H.A.J.
CHECKED BY: [Signature]
SUBMITTED BY: [Signature]

OLCOTT HARBOR, N.Y.
REPAIRS TO WEST PIER
PLAN AND PROFILE

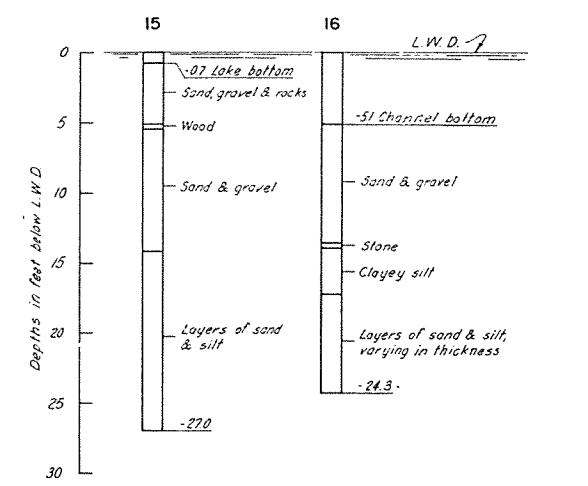
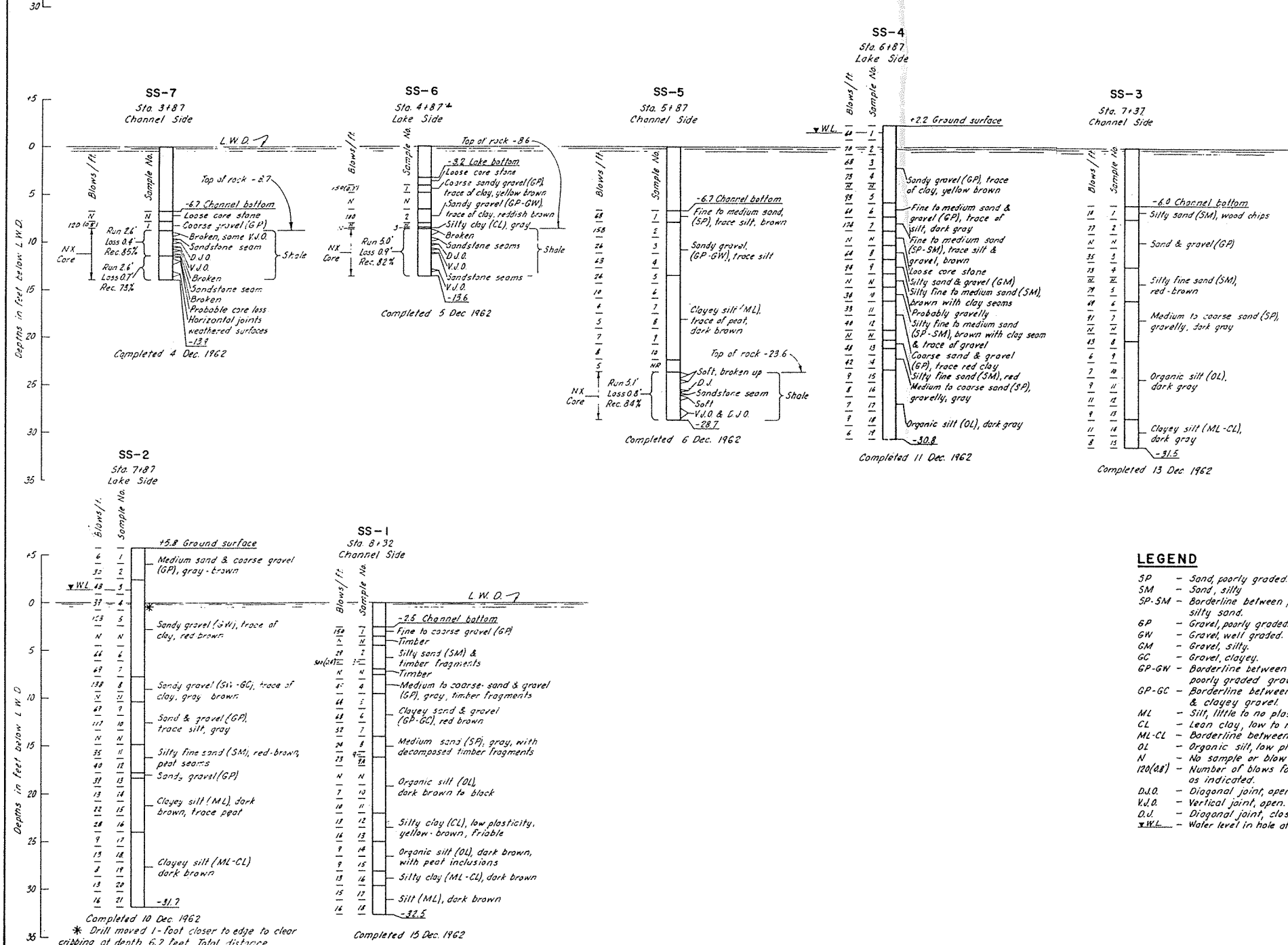
APPROVED: [Signature] DATE: 6 FEB. 1963

SCALE: AS SHOWN SPEC. NO. 49-A-10/2
DRAWING NUMBER 49-A-10/2
SHEET 2 OF 7





BORINGS TAKEN IN 1940 & 1948



NOTES

- Blows per foot indicate resistance to penetration of a 1 1/4 - inch I.D. split spoon sampler advanced by a 140-lb. hammer falling 30 inches.
- Soil and rock descriptions on borings drilled in Dec. 1962 are based on visual and manual examination of the samples.
- The descriptions of materials and format of the logs of borings taken prior to 1962 are shown as originally plotted.
- The rock in general is a moderately hard, reddish brown calcareous shale, with occasional thin seams of a greenish-gray sandstone and numerous closely spaced open horizontal fractures.
- For general notes see plate 1.
- The meanings of the soil group symbols shown in the legend are given in more detail in the Corps of Engineers Technical Memorandum No. 3-357 "The Unified Soil Classification System," Tables 1 and 2 Vol. 1, March 1953.
- Soil samples in jars and rock cores in boxes are available for inspection at the office of the District Engineer, Buffalo, N.Y.

LEGEND

- SP - Sand, poorly graded.
- SM - Sand, silty
- SP-SM - Borderline between poorly graded & silty sand.
- GP - Gravel, poorly graded.
- GW - Gravel, well graded.
- GM - Gravel, silty.
- GC - Gravel, clayey.
- GP-GW - Borderline between well graded & poorly graded gravel.
- GP-GC - Borderline between poorly graded & clayey gravel.
- ML - Silt, little to no plasticity.
- CL - Lean clay, low to medium plasticity.
- ML-CL - Borderline between silt & clay.
- OL - Organic silt, low plasticity.
- N - No sample or blow count taken.
- 120(28) - Number of blows for fraction of foot as indicated.
- D.J.O. - Diagonal joint, open
- V.J.O. - Vertical joint, open.
- D.J. - Diagonal joint, closed or healed.
- W.L. - Water level in hole at completion date

TO ACCOMPANY DESIGN MEMORANDUM DATED: 8 MARCH 1963

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DISTRICT, BUFFALO
CORPS OF ENGINEERS
BUFFALO 7, NEW YORK

DRAWN BY: C.R.C.
DESIGNED BY: D.W.L.
CHECKED BY: [Signature]
SUBMITTED BY: [Signature]

APPROVED: [Signature] DATE: 6 FEB. 1963

TO ACCOMPANY SPECIFICATIONS
SERIAL NO. CIVENG - 30-023-63-27

SCALE: AS SHOWN SPEC. NO.
DRAWING NUMBER
49-A-1075
SHEET 5 OF 7



U. S. ARMY ENGINEER DISTRICT, BUFFALO
Corps of Engineers
Foot of Bridge Street
Buffalo 7, New York

DESIGN MEMORANDUM

ON

PIER REPAIR PROJECT

AT

OLCOTT HARBOR, NEW YORK

APPENDIX - TYPICAL DESIGN COMPUTATIONS

Subject OLCOTT HARBOR, N.Y.
 Computation of WEST PIER REPAIR
 Computed by DWL Checked by H.A.J. Date FEB 63

DESIGN CRITERIA AND ASSUMPTIONS

ELEVATIONS

Top of pier	+7.0
Tie rod	+6.3
Top of granular fill	+5.8
Still water level	-1.0
Bottom of crib	-7.5
Channel bottom - Sta. 2+55 (rock)	-11.0
Channel bottom - Sta. 3+77 (rock)	-8.5
Channel bottom - Sta. 8+40	-8.0
Ground elevation - land side - Sta. 8+40	+6.3

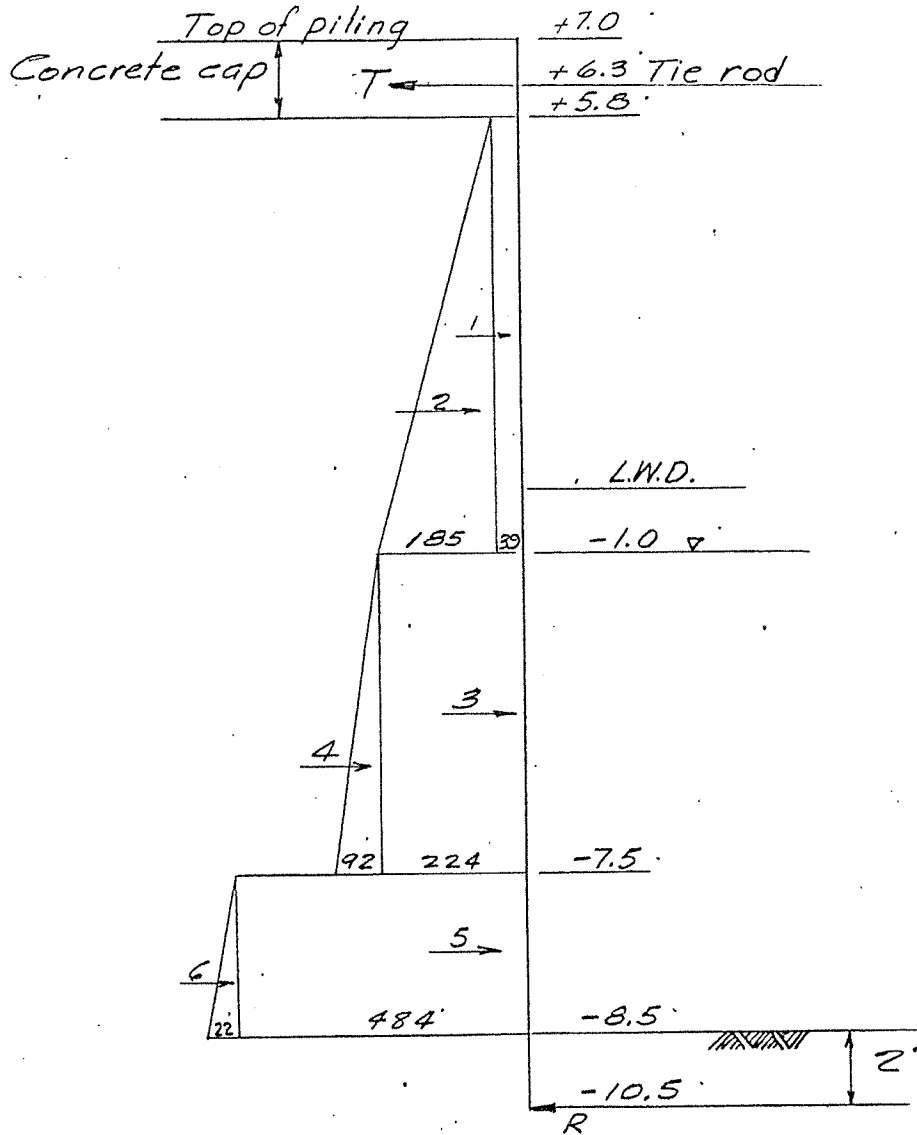
WEIGHTS

Concrete cap	150#/cf
Granular fill (moist)	125#/cf
Granular fill (submerged)	65#/cf
Bottom material (sand and gravel)	65#/cf
Bottom material (silt and clay)	55#/cf

ANGLES OF INTERNAL FRICTION

Granular fill	$\phi = 40^\circ$
Bottom material (sand and gravel)	$\phi = 30^\circ$
Bottom material (silt and clay)	$\phi = 10^\circ$

Subject OLCOTT HARBOR, N. Y.
 Computation of WEST PIER REPAIR - STA. 3+77
 Computed by DWL Checked by H.A.J. Date FEB 63



Y	φ	K _A
125	40	0.217
65	40	0.217
65	30	0.333

Subject OLCOTT HARBOR, N. Y.
 Computation of WEST PIER REPAIR - STA 3+77
 Computed by DWL Checked by H.A.J. Date FEB 63

Moments about tie rod

		Load	Lever	Moment
1	$39(6.8) =$	265	3.9	1034
2	$0.5(185)6.8 =$	629	4.8	3019
3	$224(6.5) =$	1456	10.55	15,360
4	$0.5(92)6.5 =$	299	11.6	3,468
5	$484(1) =$	484	14.3	6,921
6	$0.5(22)1 =$	11	14.6	161
		$\Sigma F = 3144 \#$		$\Sigma M = 29,963 \#'$

$$R = \frac{29,963 \#'}{16.8} = 1784 \#$$

$$T = 3144 - 1784 = 1360 \#$$

Point of zero shear

$$1360 - 265 - 629 - 224x - 7.1x^2 = 0$$

$$x^2 + 31.5x = 66$$

$$x = 2.0' \text{ below } -1.0 = \text{El. } -3.0$$

Subject OLCOTT HARBOR, N. Y.Computation of WEST PIER REPAIR - STA 3+77Computed by DWL Checked by H.A.J.Date FEB '63Maximum bending moment

$$T \quad 1360(9.3) = +12,648$$

$$1 \quad - 265(5.4) = - 1431$$

$$2 \quad - 629(4.3) = - 2705$$

$$3 \quad - 224(2.0)(1.0) = - 448$$

$$4 \quad - 7.1(2.0)^2(0.67) = - 19$$

$$\Sigma M = +8045$$

Required section modulus

$$S = \frac{8045(12)}{24,000} = 4.02 \text{ in}^3$$

MA-22 furnishes 5.4 in³

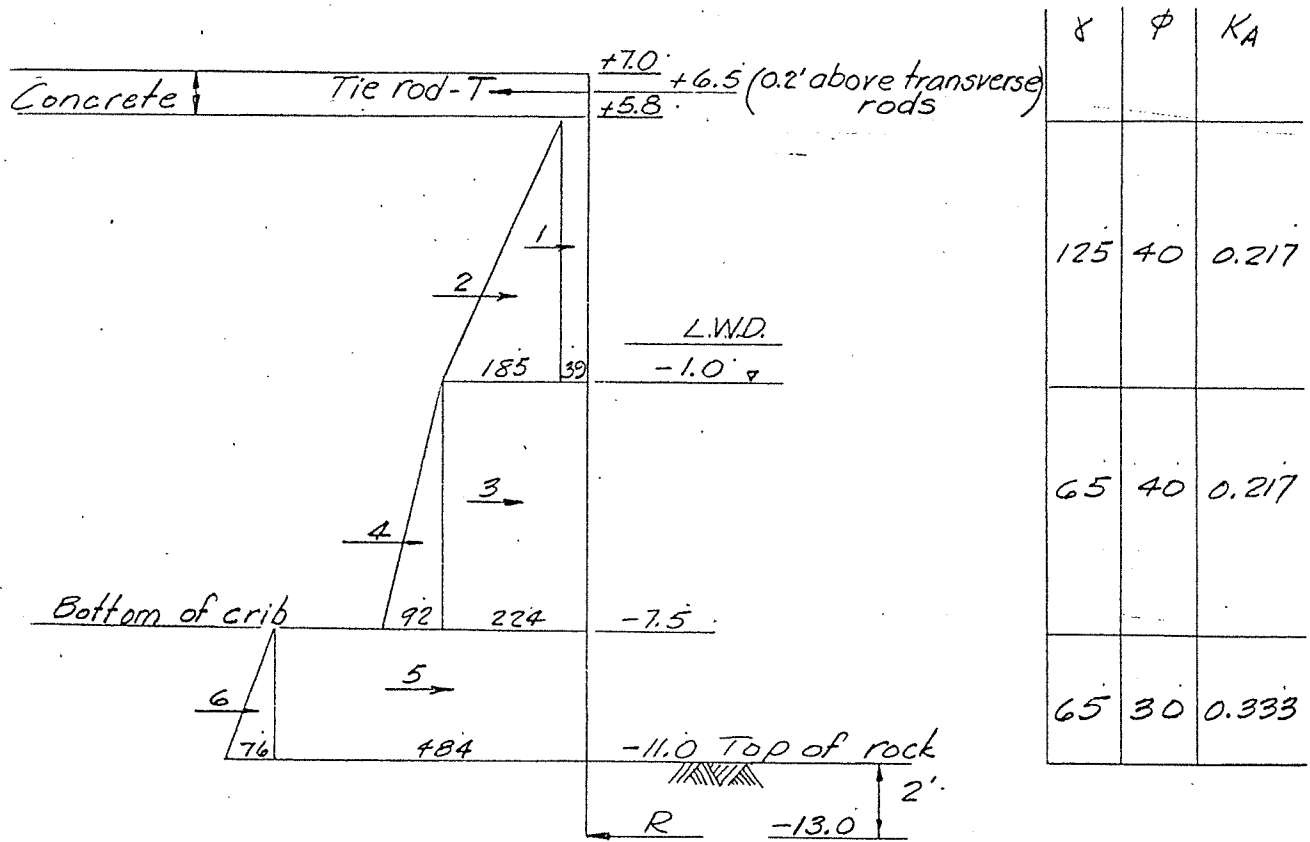
Subject OLCOTT HARBOR, N.Y.

Computation of WEST PIER REPAIR - LAKEWARD END - STA 2+55

Computed by HAJ

Checked by DWL

Date FEB 63



Moments @ tie rod:

	Load	Lever	Moment
1 $39(6.8) =$	265	3.9	1034
2 $0.5(185)(6.8)$	629	5.2	3271
3 $224(6.5)$	1456	10.75	15,652
4 $0.5(92)6.5$	299	11.8	3,528
5 $484(3.5)$	1694	15.75	26,681
6 $0.5(76)3.5$	133	16.33	2172

$\Sigma F = 4476 \#$

$\Sigma M = 52,248 \text{ \#ft}$

$R = \frac{52,248}{19.5} = 2679 \#$

$T = 4476 - 2679 = 1797 \#$

Subject OLCOTT HARBOR N.Y.
 Computation of WEST PIER REPAIR - LAKEWARD END - STA 2+55
 Computed by H AJ Checked by DWL Date FEB '63

Point of zero shear

$$1797 - 265 - 629 - 224X - 7.1X^2 = 0$$

$$X^2 + 31.5X = 127 \quad X = 3.6 \text{ below } -1.0 = \text{El.} - 4.6$$

Maximum bending moment

$$T \quad 1797(11.1) = +19,948$$

$$1 \quad -265(7.0) = -1855$$

$$2 \quad -629(5.8) = -3648$$

$$3 \quad -224(3.6)(1.8) = -1452$$

$$4 \quad -7.1(3.6)^2(1.2) = -110$$

$$\Sigma M = +12,883 \text{ \#}$$

Required section modulus

$$S = \frac{12,883(12)}{24,000} = 6.44 \text{ in}^3$$

Z-27 furnishes 30.2 in

MA-22 furnishes 5.4 in

Using extra grade steel with min. yield point of 50,000 p.s.i.

$$S = \frac{12,883(12)}{30,000} = 5.15 \text{ in}^3$$

MA-22 (S=5.4 in³) is acceptable.

Subject OLCOTT HARBOR, N.Y.
 Computation of WEST PIER REPAIR - STA. 2+55
 Computed by DWL Checked by HAI Date FEB '63

Design of tie rod (MA-22 piling)

Tie rod load increased by 20% (Terzaghi)

$$T = 1797(1.2) = 2156 \text{ \# per foot of wall}$$

With rods at 9.8124' c/c

$$A_s = \frac{2156(9.8124)}{20,000} = 1.058 \text{ in}^2$$

1 1/2" ϕ rods provide 1.294 in²

Design of wale

Wale is considered continuous over 3 tie rod sp.

Tie rod load for design of wale:

$$1.294 \text{ in}^2 (29,000) = 37,526 \text{ \#}$$

$$S = KT \quad \text{where} \quad K = \frac{0.1332 L^2}{f_s}$$

$$= \frac{0.1332 (3 \times 9.8124)^2}{24,000}$$

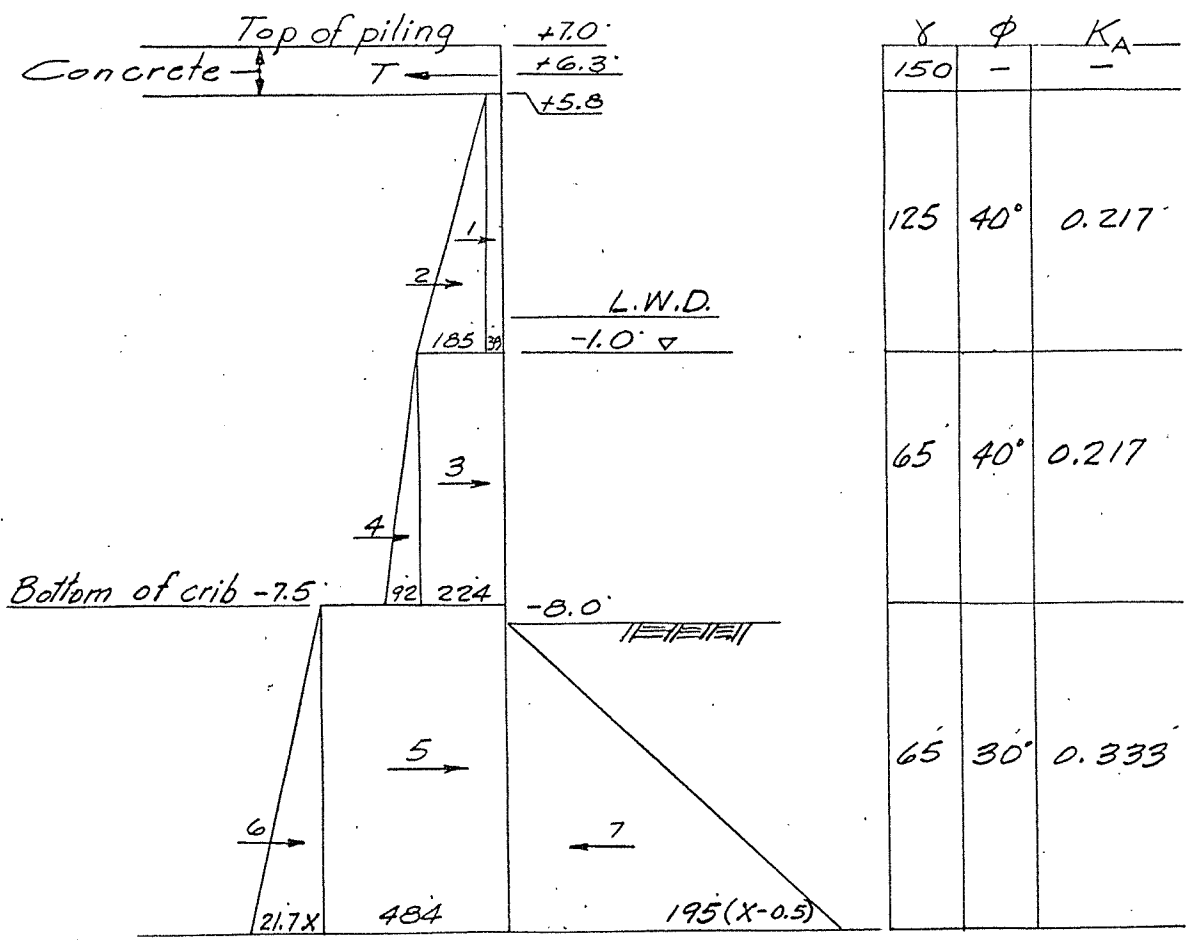
$$K = 0.00481$$

$$S = 0.00481 \left(\frac{37,526}{9.8124} \right)$$

$$S = 18.40 \text{ in}^3$$

2 channels - 8 C 18.75 furnish 21.8 in³

Subject OLCOTT HARBOR, N. Y.
 Computation of WEST PIER REPAIR - STA. 8+40
 Computed by DWL Checked by HAI Date FEB 63



Subject OLCOTT HARBOR, N. Y.
 Computation of WEST PIER REPAIR - STA 8+40
 Computed by DWL Checked by H.A.J. Date FEB '63

Moments about tie rod

	Load	Lever	Moment
1	$39(6.8) = 265$	3.9	1034
2	$0.5(185)6.8 = 629$	5.0	3145
3	$224(6.5) = 1456$	10.6	15,434
4	$0.5(92)6.5 = 299$	11.6	3,468
5	$484X$	$13.8 + 0.5X$	$+6679X + 242X^2$
6	$0.5(21.7)X^2$	$13.8 + 0.67X$	$+150X^2 + 7X^3$
7	$-[97.5X^2 - 97.5X + 24.4]$	$13.7 + 0.67X$	$-334 + 1320X - 1271X^2 - 65X^3$
$\Sigma F =$	$-86.7X^2 + 582X - 2625$		$\Sigma M = 22,747 + 7999X - 879X^2 - 58X^3 = 0$

$X^3 + 15.2X^2 - 138X - 392 = 0$

$X = 8.0' \text{ below } -7.5'$

Use penetration of $7.5(1.2) = 9.0'$

$9.0' \text{ below } -8.0 = -17.0'$

Tie rod pull

$\Sigma F = T - 86.7X^2 + 582X - 2625 = 0$

$T = 3518 \#$

Point of zero shear

$3518 - 265 - 629 - 1456 - 299 - 484X - 10.9X^2 + [-97.5X^2 + 97.5X - 24.4] = 0$

$X = 1.6' \text{ below } -7.5'$

Subject OLCOTT HARBOR, N.Y.Computation of WEST PIER REPAIR - STA 8+40Computed by DWL Checked by H.A.J.Date FEB '63Maximum bending moment

	$+3518(15.4)$	=	$+ 54,177$
1	$-265(11.5)$	=	$- 3,048$
2	$-629(10.4)$	=	$- 6,542$
3	$-1456(4.9)$	=	$- 7,134$
4	$-299(3.8)$	=	$- 1,136$
5	$-774(0.8)$	=	$- 619$
6	$-28(0.5)$	=	$- 14$
7	$+118(0.4)$	=	$+ 47$

$$\Sigma M = 35,731 \text{ \#}$$

Required section modulus:

$$S = \frac{35,731(12)}{24,000} = 17.87 \text{ in}^3$$

Z-27 furnishes 30.2 in^3

Subject OLCOTT HARBOR, N. Y.Computation of WEST PIER REPAIR - STA 8+40Computed by DWL Checked by HAI Date FEB '63Design of tie rod (Z-27 piling)

Tie rod load increased by 20% (Terzaghi)

$$T = 3518(1.2) = 4222 \# \text{ per foot of wall}$$

$$\text{With rods at 9' c/c } A_s = \frac{4222(9)}{20,000} = 1.899 \text{ in}^2$$

2" ϕ rod provides 2.300 in²Design of wale

Wale is considered continuous over 3 tie rod spans

Tie rod load for design of wale:

$$2.300 \text{ in}^2 (29,000) = 66,700 \#$$

$$S = KT \text{ where } K = \frac{0.1332 L^2}{f_s}$$

$$K = \frac{0.1332 (3 \times 9)^2}{24,000}$$

$$K = 0.004046$$

$$S = 0.004046 \left(\frac{66,700}{9} \right)$$

$$S = 29.98 \text{ in}^2$$

2 channels - 10 E 20 furnish 31.4 in²

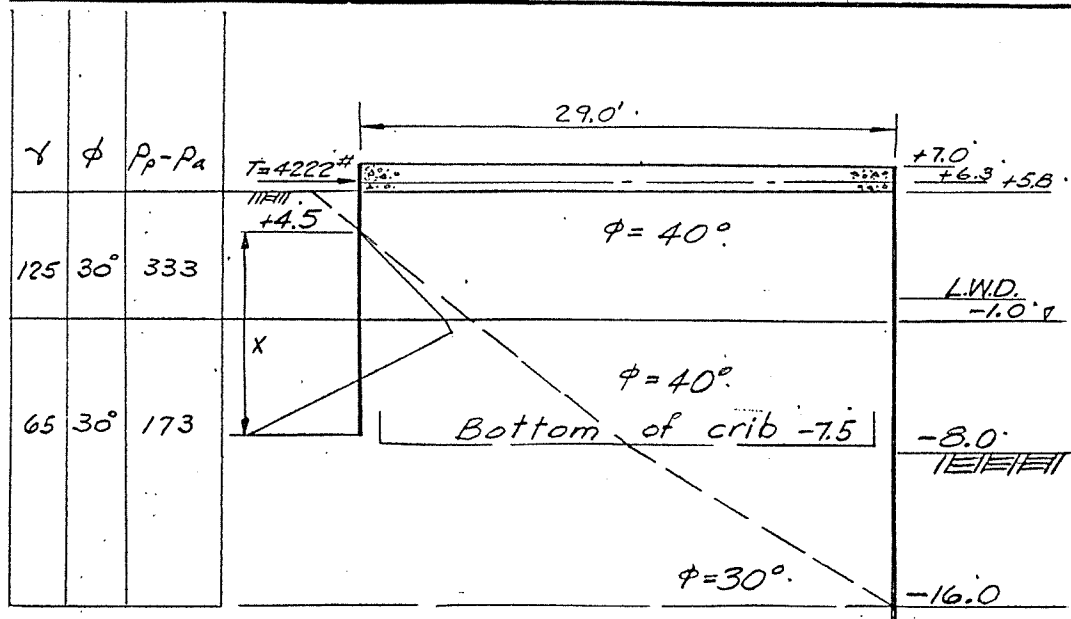
Subject OLCOTT HARBOR, N. Y.

Computation of WEST PIER REPAIR - STA. 8+40

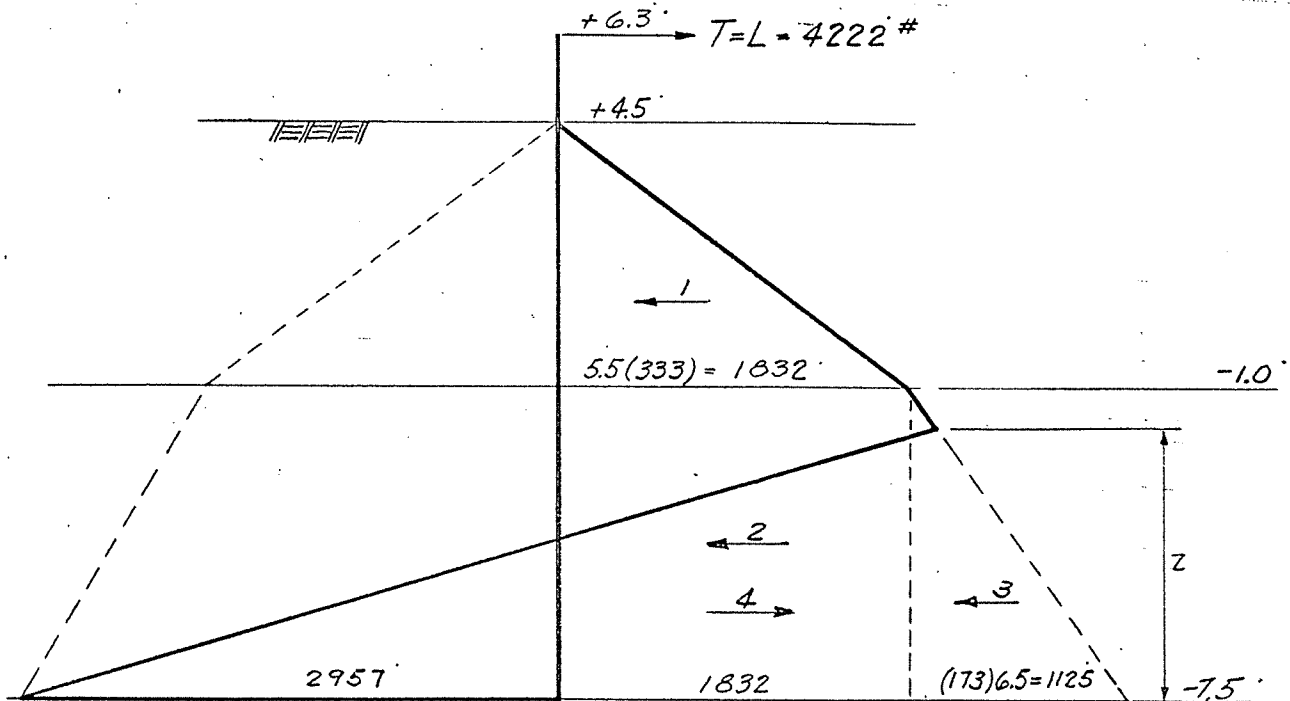
Computed by H.A.J

Checked by DWL

Date FEB '63



Assume bottom of pile at - 7.5.



$$Z = \frac{(P_p - P_a) X^2 - 2L}{2(P_p - P_a) X} = \frac{1832(5.5) + 2(1832)6.5 + 6.5(1125) - 2(4222)}{2(2957)}$$

$$Z = 5.54'$$

Subject OLCOTT HARBOR, N.Y.Computation of WEST PIER REPAIR - STA. 8+40Computed by H.A.J. Checked by DWL Date FEB 63Moments at base of pile:

→ T	4222	= 4222# × 13.8' =	58,264' #
← 1	$1832(\frac{5.5}{2})$	= 5038# × 8.3' =	41,815' #
← 2	1832(6.5)	= 11,908# × 3.25' =	38,701' #
← 3	$1125(\frac{6.5}{2})$	= 3656# × 2.1' =	7678' #
← 4	$2(2957)(5.54)\frac{1}{2}$	= 16,382# × 1.8' =	29,488' #
			88,194' #
			- 87,752' #
			442' #

Use penetration to -8.5

Point of zero shear

$$4222 - 166.5x^2 = 0$$

$$x^2 = 25.35$$

$$x = 5.0' \text{ below } +4.5' \text{ (El. } -0.5')$$

Maximum bending moment

T	4222	6.8'	28,710'
1	$-166.5(5.0)^2 = 4163$	1.7'	-7077'
			ΣM = 21,633' #

Section modulus required

$$S = \frac{21,633(12)}{24,000} = 10.82 \text{ in}^3$$

Z-27 furnishes 30.2 in³