

U.S. NAVAL BASE, PEARL HARBOR, DRY DOCK NO. 1,  
APPROACH PIER & CAISSON DOCKING WHARF  
(U.S. Naval Base, Pearl Harbor, Naval Shipyard, Facilities Nos. GD  
-1, GD-2 & N-1)  
Ocean end of Fifth Street between Dry Dock Nos. 1 & 2  
Pearl Harbor  
Honolulu County  
Hawaii

HABS HI-515

HI-515

HABS

HI-515

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN BUILDINGS SURVEY  
PACIFIC GREAT BASIN SUPPORT OFFICE

National Park Service

U.S. Department of the Interior

1111 Jackson Street

Oakland, CA 94607

## HISTORIC AMERICAN BUILDINGS SURVEY

### U.S. NAVAL BASE, PEARL HARBOR, APPROACH PIER & CAISSON DOCKING WHARF (U.S. Naval Base, Pearl Harbor, Naval Shipyard) (Facilities Nos. GD-1, GD-2, & N-1)

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HABS No. HI-515

- Location:** Ocean end of Fifth Street between Dry Docks Nos. 1 and 2  
Pearl Harbor Naval Base  
City and County of Honolulu, Hawaii  
These facilities' UTM coordinates are: 04.607980.2361540.
- Significance:** Piers GD-1, GD-2, and N-1 are located within the Pearl Harbor National Historic Landmark. The quay walls and approach pier between dry docks No. 1 and 2 were built at the time of intense military build-up following the bombing of Pearl Harbor and are significant through their association with the expansion of the dry dock facilities during WWII.
- Description:** The pier and approaches<sup>1</sup> were designed and built to support the functions of Dry Docks No. 1 and No. 2. GD-1 and GD-2 are used for ship docking and N-1 is used for caisson docking. They are made of pre-cast monolithic reinforced concrete deck sections supported upon girders and beams running in the transverse direction, which are carried by square piles. They are level and flat, and are at the same elevation as the surrounding ground line. The wearing surface of the deck is 8'-0" above M.L.W. level.<sup>2</sup> For clarity reasons, this report will call the longer quay wall and approach pier portion (the present GD-1 and GD-2) as being the **Pier** and the shorter caisson-docking portion as the **Quay Wall** (the present N-1). The structural systems and

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<sup>1</sup> Quay walls and Approach Piers GD-1 and GD-2 are opposite sides of a single quay wall and pier form, which is located between Dry Dock No. 1 and Dry Dock No. 2. GD-1 runs the length of the east side of the approach pier, the side facing Dry Dock No. 1. GD-2 runs the length of the west side of the pier, including the quay wall portion that attaches to the land and one side of the approach pier, the side facing Dry Dock No. 2. The approach pier is surrounded completely by ocean; one side is the continuation of Pier GD-2 while the other side is Pier GD-1. The quay wall of Dry Dock No. 1 is presently called N-1, but it was originally constructed as part of the job under contract number Noy-4173, and was part of GD-1. As such, this portion of the job will be included in this report.

<sup>2</sup> The Mean Low Water (M.L.W) elevation is 100.0' and the Mean High Water (M.H.W.) elevation is 101.5'. Thus, the height of the deck is about 8 feet above the water level.

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physical properties of the two sections are too dissimilar to be described as one. The Pier will be described first and the Quay Wall will be described second.

**The Pier is described as follows:** The Approach Pier located between Dry Docks No. 1 and No. 2 is shorter by about half on the side of Dry Dock No.1 (GD-1) than on the side of Dry Dock No. 2 (GD-2). GD-1 measures 484'-4" in length, having a length of 24 bays at 20' center-to-center spans, with the exception of the first bay which has a 15'-0" span. The Approach Pier GD-1 measures approximately 227'-0" in length, having 11 bays at 20'-0" center-to-center spans. Together, the total width of the pier is approximately 50'. Quay Wall N-1 of Dry Dock No.1 runs perpendicular to GD-1. The deck is 1'-6" thick and is strengthened and supported by concrete girders and beams. The deck has strength sufficient to support a uniformly distributed live load of 500 pounds per square foot. The piles are made of composite materials, having a bearing capacity of 50,000 lbs.

The structural aspects of the piers are as follows: rows and grids of square straight piles and batter piles support the deck. The piles measure 18" x 18" thick. The ocean floor under the first half of the pier (bay grids 1 through 11) which is adjacent to land has, at its deepest end, a depth of approximately 45', which slopes up to land at a 1¼: to 1 slope. The ocean floor under the portion of the pier surrounded by water (from bay grids 12 to 25) is relatively level with a bottom depth of 45'-0" below M.L.W. (55'-0" from the ground plane). The piles extend down past the 10'-0" depth of selected fill on the ocean bottom. The deck, from bay grids 1 through 11, due to its connection to the land, are braced with 2 transverse diagonal struts, called batter piles, at each bay grid extending from the deck beams above into ocean floor below. The deck, from bay grids 12 to 25, is more firmly braced with two pairs of batter piles at each bay grid. These struts are 18" x 18" in section and are at a 3:12 batter. The ends of the struts are firmly embedded deep within the ocean floor at their lower ends and within the deck of the wharf at the upper ends. The piles pierced a thick stratum of hard material, which serves to materially strengthen and support the piles.

A row of 11 piles spaced almost evenly apart supports the deck at each bay grid line. In the longitudinal direction, the deck is supported upon two parallel rows (each pile is 5'-0" apart on-center in the longitudinal direction) of paired piles spaced 28'-0" apart on-center in the transverse direction. In transverse section, the outer edge of the deck extends 6'-0" beyond the centerline of the supporting piles on the GD-1 side of the pier. The GD-2 side of the pier extends only 2'-6" beyond the centerline of the piles. The outer edge of the deck is approximately 3' in height due to the fact that a girder beam is running along the outer edges.

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The pier was designed to support an integrated rail system that would allow for the traveling of a 15-ton locomotive crane and a 50-ton portal crane. A total of 4 rails are set into the deck. The 15-ton traveling crane has a 3'-0" gauge rail track that runs down the approximate center of the deck. The 50-ton traveling jib crane has a 28'-2 3/4" gauge rail track that spans the width of the pier. The girders are located directly under these rails. The girders under the 50-ton traveling jib rails are 3'-0" deep and 5'-4" or 5'-6" wide.

At the underside of the deck are electrical and utility lines and a capstan. A duct beam is also located within the deck design. Pipes running on the underside of the deck are encapsulated by a hollow concrete square duct having wall thicknesses of 8". Manhole openings, with cast-iron frames and covers are located on the deck surface above the concrete duct for access to the electrical system. A capstan<sup>3</sup> is located at the ocean end of the pier and facilitated use of the traveling jib crane. The rectangular room under the deck where the capstan is secured measures approximately 10' x 13' in plan by 7'-9" in height.

On the ocean side(s) of the slab is a concrete curb. The concrete curb is 12" in width and 8" in height with beveled corners. Cleats are spaced at regular intervals and sit on trapezoidal concrete pads that are about 3'-6" in width and extend out 1'-3" from the concrete curb. There are seven cleats evenly spaced along the west side length of the pier. The cleats are typical of those installed during this time at Pearl Harbor. They are approximately 9.5" high and 10" wide at the base, which is bolted all the way through the concrete curb to the underside of the slab (approx. 24" thick). Seven bitts are spaced evenly down the east side length of the pier. Unlike the cleats, which are smaller in scale and are not designed to handle great loads, bitts are integral to the structure of the deck. The bollard is bolted all the way through the deck and beam below using 1 3/4" bolts and are located at every third bay grid, directly over a pile. Five small boat cleats were added along the east side curb, so as to not interfere with the larger bitts located behind them, in 1949.

Cylindrical wood fenders align the ocean side of the decks and extend beneath the water. The fender system is designed to protect the concrete slab of the pier. The timber fenders are of round creosoted timber piles measuring approximately 1'-6" in diameter. The timber pile is bolted to a 12" x 12" 'wale' piece. The wale is attached to the concrete curb with 4" x 12" x 12" blocking pieces between the wale and the concrete. Eight-inch by twelve-inch by twelve-inch or 12" x 30" 'chocks' run between the timber piles, giving the piece stability and strength. The timber piles along the straight lengths of the deck

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<sup>3</sup> A capstan is an apparatus used for hoisting weights, consisting of a vertical spool-shaped cylinder around which a cable is wound.

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are spaced at 6'-8" on-center and are supported by a horizontal row of chocks and blocks that is attached to the top of the curb. The outboard corners of the piers are more securely protected by a strong fender system that has only a few inches of gap between the cylindrical timber piles.

The most recent repairs on record were done in 1972 when drain openings were cut into the concrete curb, cleat bases were modified, and steel platforms were added to the deck. Presently, the piers are in relatively poor condition. The deck is spalling and cracking and the utility lines do not appear to be in use and do not appear to be in operable condition. The fender system is in great disrepair, with many of the piles missing completely.

**The quay wall is described as follows:** Quay Wall N-1 measures 131'-2" in length by 45'-0" in width. The Quay Wall portion is designed having a square grid pattern of piles upon which concrete beams are supported. On top of these concrete beams are wood stringers and a wood plank decking. Quay wall N-1 is not designed to support crane loads; therefore, the structure of the deck is designed to hold much less of a load than that of the Pier.

Like the Pier deck, the Quay Wall deck is supported by rows and grids of square straight composite piles and batter piles measuring 18" x 18" thick. The deck is braced with a single transverse diagonal struts, called batter piles (at a 3:12 batter), at each bay grid extending from the deck beams above into ocean floor below. The ends of the struts are firmly embedded deep within the ocean floor at their lower ends and within the deck of the wharf at the upper ends. The piles pierced a thick stratum of hard material, which serves to materially strengthen and support the piles.

The deck structure is a single direction beam layout design supported by a grid of square piles. In the longitudinal direction, the deck is supported upon a total of 12 bays of piles: 5 bays at 10'-6" on-center, 2 bays at 9'-3" on-center and 5 bays at 11'-0" on-center. In transverse section, there are five bays spaced at 7'-6" on-center with the outer edge of the deck extending 3'-9" beyond the centerline of the supporting piles. Two foot square beams running in the transverse direction are attached to the tops of the piles. There are no tracks to be supported on this Quay Wall, which allows the structural system of the deck to be extremely simple and straightforward. Also, there are no electrical lines, utility lines, duct beams, or spaces under the deck of the Quay wall. The outer edge of the deck is approximately 4'-0" in height due to the height of the curb.

The deck is a system of 4" x 6" wood planking with ½" opening between planks. They are connected to wood stringers below by boat

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spikes that are 3/8" diameter by 8" long. The 6" x 12" wood stringers are set at 2'-0" on-center in the longitudinal direction.

On the ocean side of the slab is an 18" x 18" timber curb. Two cleats are located at the curb edge and sit on trapezoidal concrete pads that are about 3'-6" in length and 2'-1" in width. The cleats are typical of those installed during this time at Pearl Harbor. They are approximately 9.5" high and 10" wide at the base, which is bolted all the way through the concrete base to the underside of the slab (approx. 4'-0" thick).

In 1953, the timber deck was replaced with a concrete deck. The concrete deck is comprised of several sections of rectangular precast concrete sections. They are bolted through the concrete beams with 2" drill caps. The concrete slabs are 1'-4" thick and are approximately 11' x 15' in area, depending upon the beam spans. Presently, the piers are in relatively poor condition. The fender system is in great disrepair, with many of the piles missing completely.

**Historical Context:**

The quay walls and approach pier between dry docks No. 1 and 2 were built at the time of intense military build-up following the bombing of Pearl Harbor. They were built as part of the dry dock facilities' expansion program during World War II.

The contract for construction of Piers GD-1 and GD-2 (including the section now named N-1) was awarded to Contractors Pacific Naval Air Bases under contract number Noy-4173, and project number 961. The first drawings of Piers GD-1 and GD-2 were completed on May 16, 1940. These early drawings included dredging plans, foundation studies, test piles records, and schematic plans and sections of the piers. The construction of Dry Dock No. 1 was already completed by this time. The next set of drawings was dated September 1942 and July 1943. The piers were completed by January 1944.

The contract for the construction of Dock No. 2, No. 3, and No. 4 was awarded to Pacific Bridge Company on October 4, 1941 (U.S. Navy Bureau of Yards and Docks 1947:122). The quay walls and piers, including Piers GD-1 and GD-2, were awarded to Contractors Pacific Naval Air Bases, due to the latter's better equipment and facilities for casting and driving the concrete piling required (*Pacific Bridge Co.* 1944:53).

In 1953 the original timber decks were replaced with the present concrete decks. These replacements have lowered the piers' integrity. The work was completed under contract number 434433100, Project number 8082. Work began on September 22, 1952 and was completed April 23, 1953. The total cost was \$7,699. Apparently, no major alterations have taken place since this time.

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For an overview of the Naval Shipyard see HABS No. HI-483. For an overview on Pearl Harbor's waterfront facilities see HABS No. HI-53. For more information on Dry Dock No. 1 see HAER report No. HI-65, and for more information on Dry Dock No. 2 see ~~HAER report No. HI-65A.~~ HAER HI-66

**Sources:**

The original drawings for Dry Dock Nos. 1 and 2 are on microfilm at NAVFACPAC Plan Files. They include:

- Quay Walls and Approach Pier, Location Plan, Drawing No. I-N16-248, dated 5/16/1940
- Quay Walls and Approach Pier, Dredging Plan, Drawing No. I-N22-324, dated 9/16/1942
- Piers GD-1 and GD-2, Plan and Sections, Drawing No. I-N16-457, dated 9/27/1942
- Piers GD-1 and GD-2, Typical Section of Pier, Drawing No. I-N15-457, dated 9/27/1942
- Piers GD-1 and GD-2, Piping Layout and Details, Drawing No. I-N15-460, dated 9/27/1942
- Piers GD-1 and GD-2, Plan and Sections at Electrical Manhole and Ducts, Drawing No. I-N16-547, dated 6/18/1947
- Piers GD-1 and GD-2, Plan and Sections of Cleats and Bits, Drawing No. I-N15-460, dated 9/27/1942
- Piers GD-1 and GD-2, Fender System Details, Drawing No. I-N15-458, dated 9/27/1942
- Quay Wall N-1, Plan and Sections, Drawing No. I-N15-551, dated 7/17/1943
- Quay Wall N-1, Structural Details, Drawing No. I-N15-552, dated 7/17/1943
- Quay Wall N-1, Timber Deck Replacement with Concrete Deck, Drawing No. I-N15-652, dated 4/14/1952

Contractors Pacific Naval Air Bases. *Technical Report and Project History, Contracts NOy-3550 and NOy-4173*, Chapter XXIX – Navy Yard, Pearl Harbor, n.d. Microfilm of report at Pacific Division Naval Facilities Engineering Command Library.

Helber Hastert & Fee Planners, Inc. *Pearl Harbor Naval Complex Integrated Cultural Resources Management Plan*, 2002. Prepared under Contract with Pacific Division, Naval Facilities Engineering Command for Commander, Navy Region Hawaii.

National Archives II, Still Photo Collection.  
Photos in group RG71CB, Box 103-F

Pacific Bridge Co. Technical Report and Project History, Contracts Noy-5049, for Construction of Dry Dock and Power Plant,

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Moorings and Additional Facilities, 1944. Prepared for the Navy Department, Bureau of Yards and Docks. Microfilm of report at Pacific Division Naval Facilities Engineering Command Library.

Pearl Harbor Shipyard. Structures and Miscellaneous Utilities-Navcompt Form 267 (5 pt) (Rev. 8-57), 1962.

U.S. Navy Bureau of Yards and Docks. *Building the Navy's Bases in World War II, History of the Bureau of Yards and Docks and the Civil Engineering Corps 1940-1946 Volume II*, 1947. United States Government Printing Office: Washington, 1947.

**Likely Sources Not Yet Investigated:**

National Archives, Pacific Sierra Region, 1000 Commodore Drive, San Bruno, California 94066, ph. (415) 876-9009.

Navy Historical Center, Washington Navy Yard, 805 Kidder Breese, S.E., Washington, D.C. 20734, ph. (202) 433-4131.

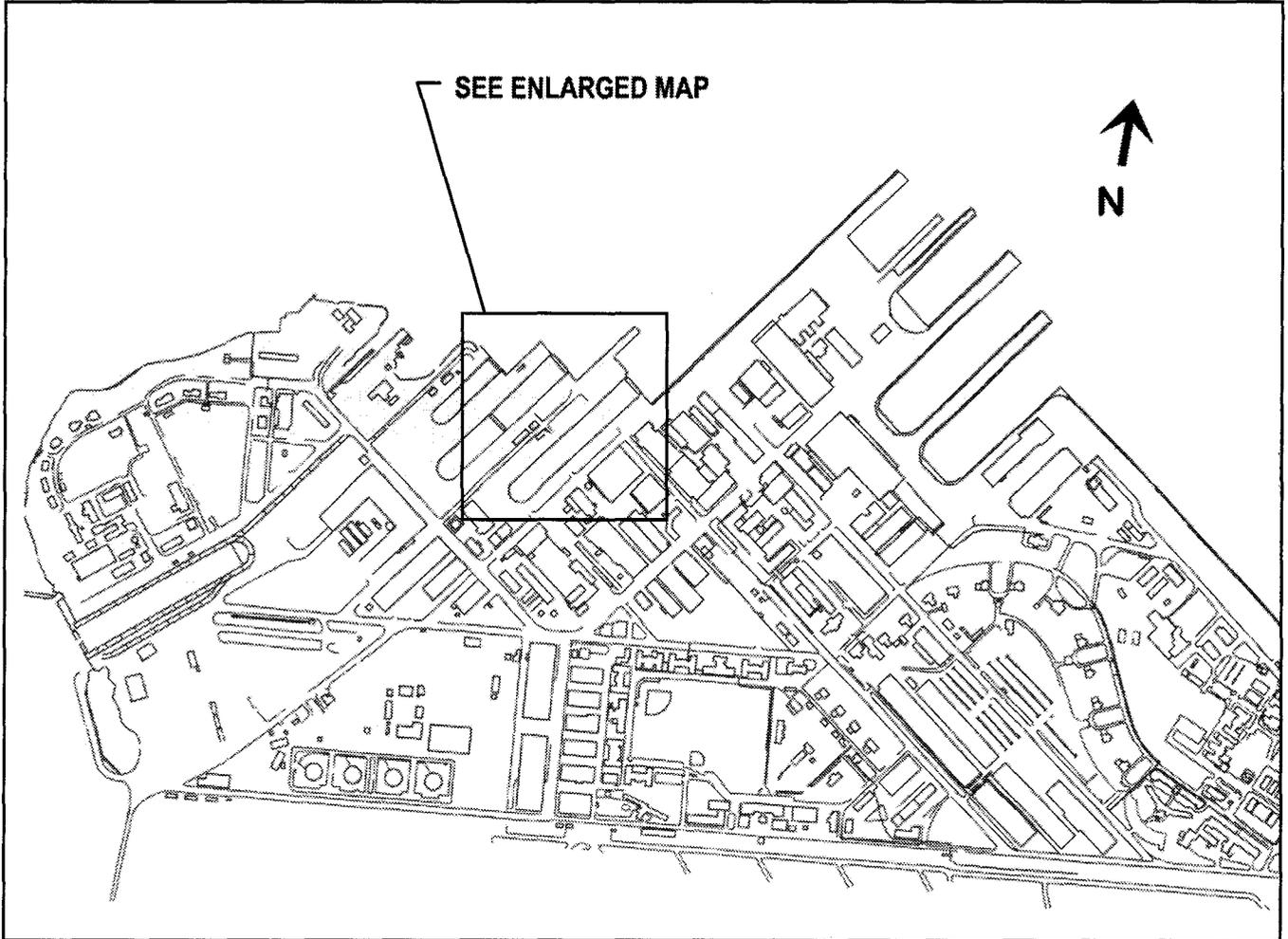
Port Hueneme NAVFAC Archives, 621 Pleasant Valley Road, Port Hueneme, California 93043, ph. (805) 982-5563.

**Project Information:**

Photo documentation and recordation of this facility by the Navy has been done in anticipation of future alterations or potential demolition of the structure. Photo documentation of historic facilities by the Navy assists in expediting planned undertakings by having the documentation prepared prior to taking actions. Also, photo documentation assists the Navy in gaining more information about its historic facilities to assist in making proactive management decisions. This project is being supervised by Jeffrey Dodge A.I.A., Historical Architect NAVFAC Hawaii. The photographic documentation was undertaken by David Franzen, photographer. Lorraine M. Palumbo, Ph.D. Architectural Historian, of Mason Architects, Inc. prepared the written documentation. The field work and research was conducted for this report between July 2001 and December 2001.

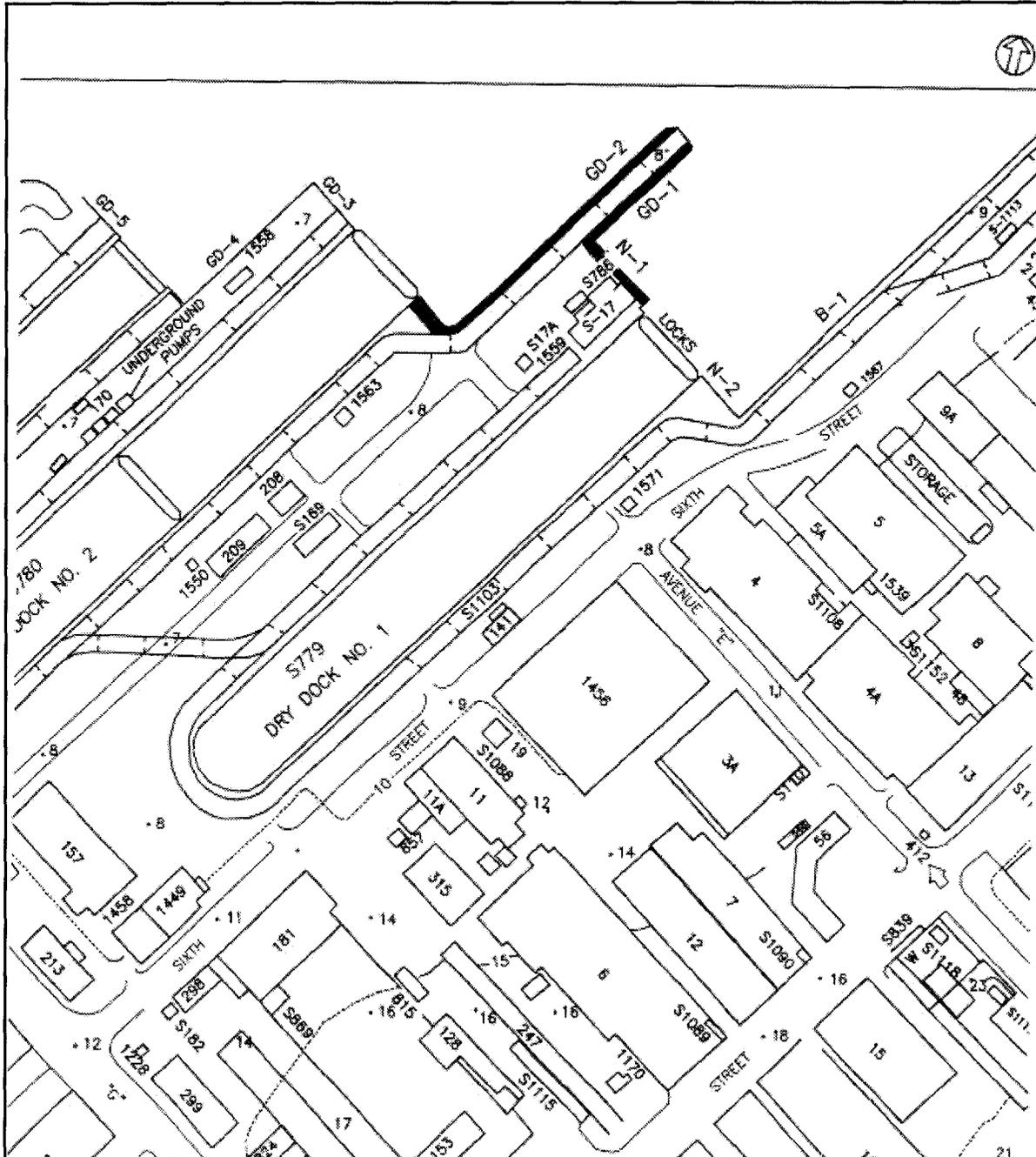
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**Shipyard Map**



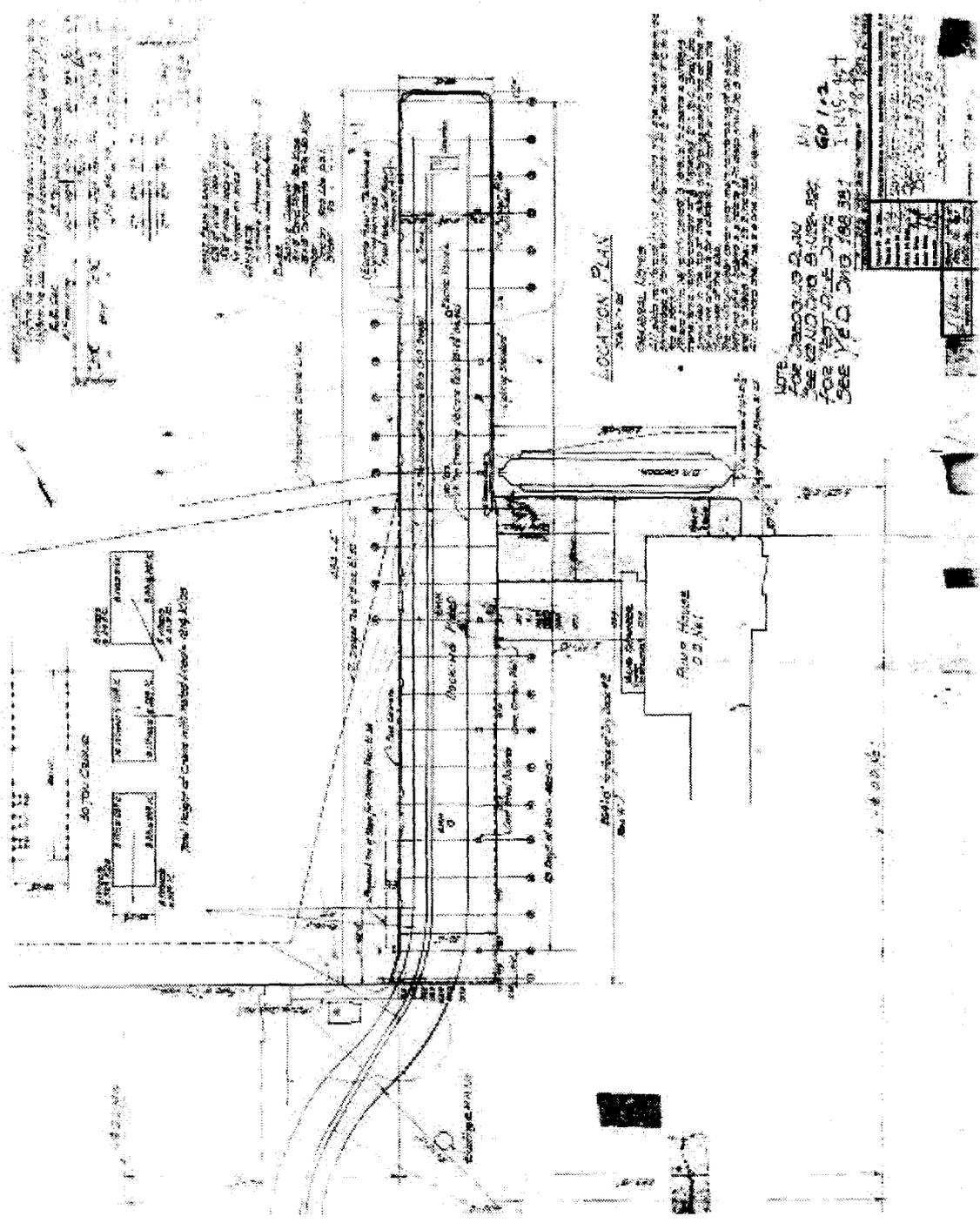
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**Enlarged Area Map (reduced, not to scale)**



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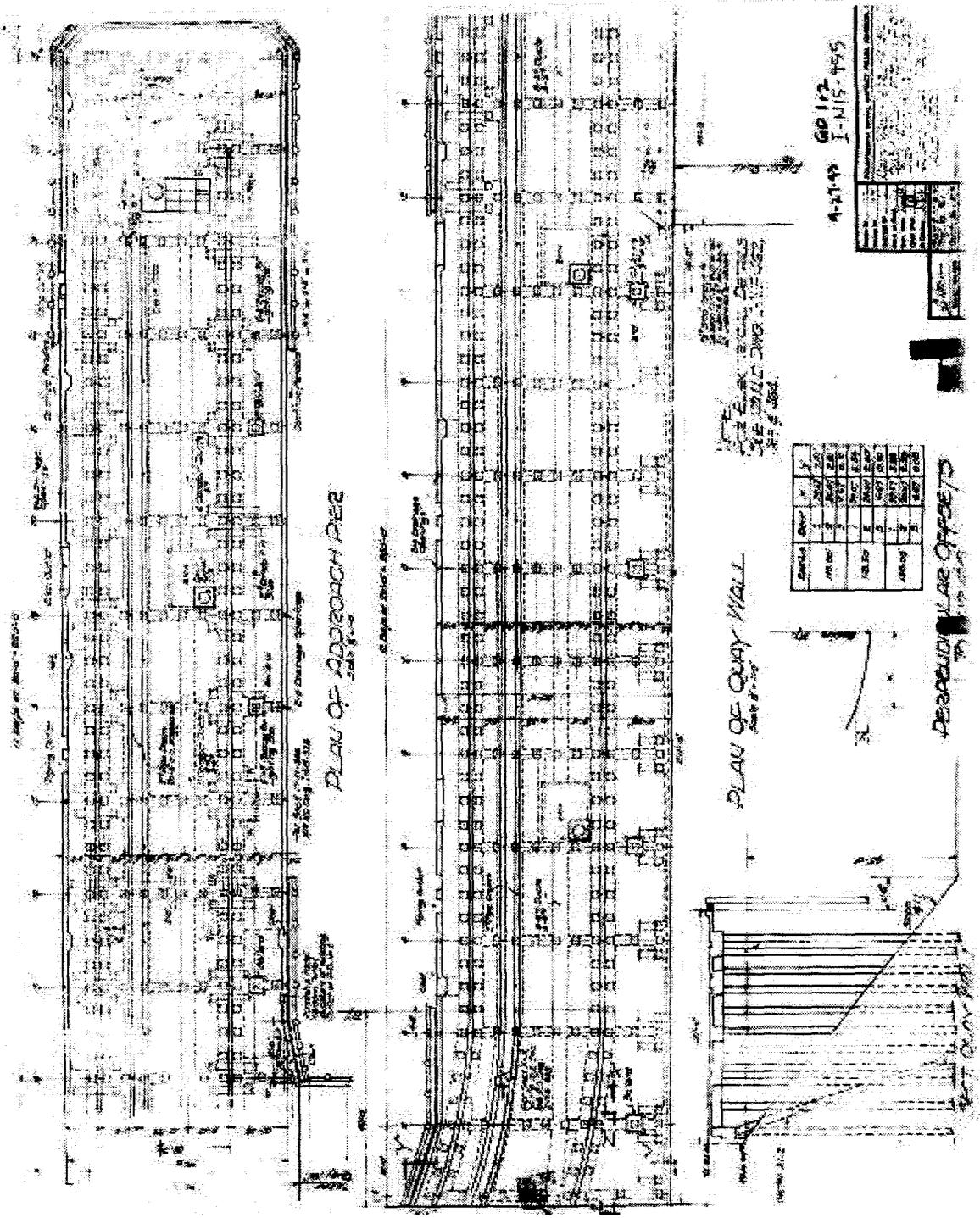
Quay Walls and Approach Pier, Location Plan (Drawing No. I-N16-248, dated 5/16/1940)  
(reduced, not to scale)





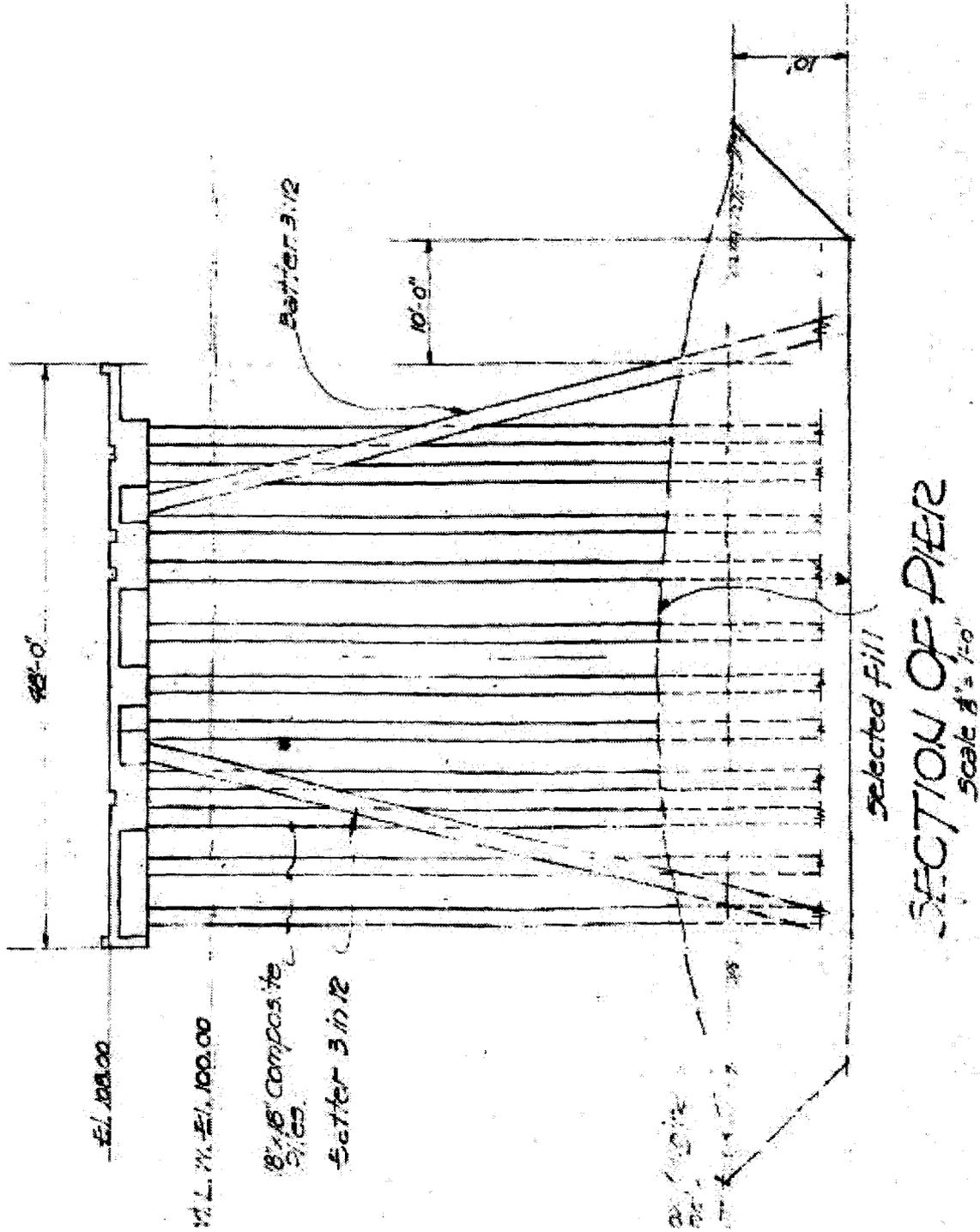
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**Piers GD-1 and GD-2, Plan and Sections (Drawing No. I-N16-457, dated 9/27/1942)  
(reduced, not to scale)**



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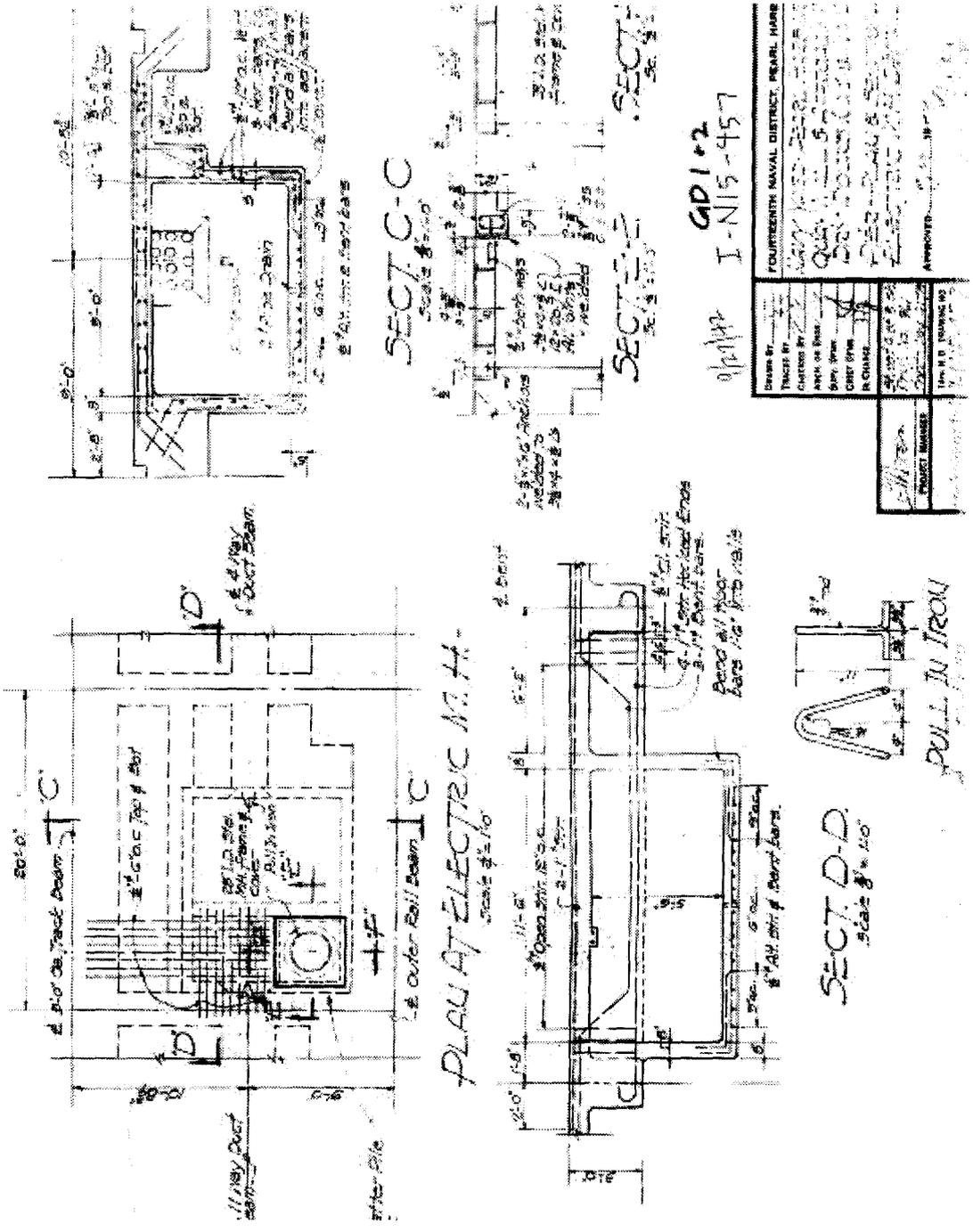
Piers GD-1 and GD-2, Typical Section of Pier (Drawing No. I-N15-457, dated 9/27/1942)  
(partial drawing, reduced, not to scale)





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**Piers GD-1 and GD-2, Plan and Sections at Electrical Manhole and Ducts  
(Drawing No. I-N16-547, dated 6/18/1947) (partial drawing, reduced, not to scale)**

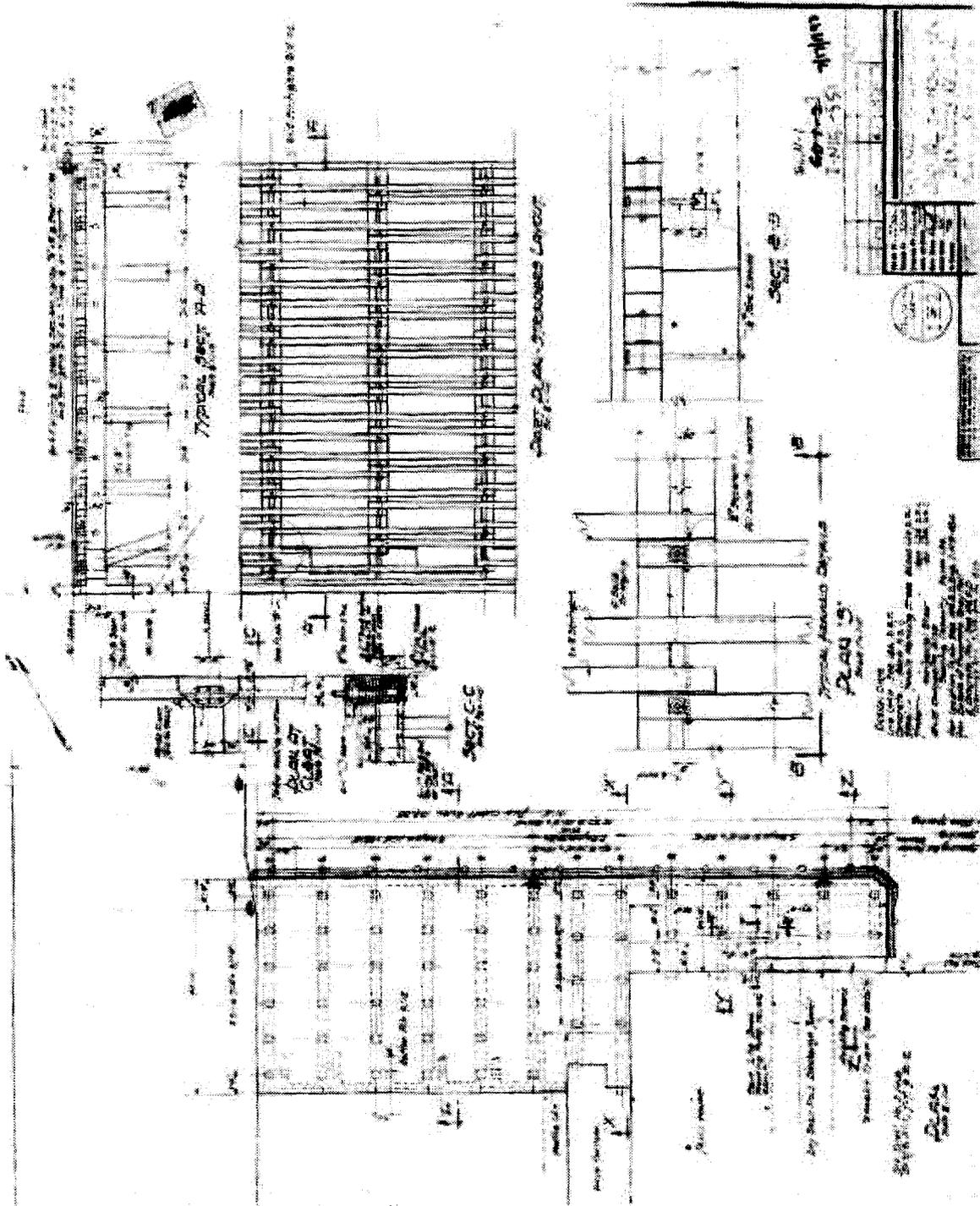






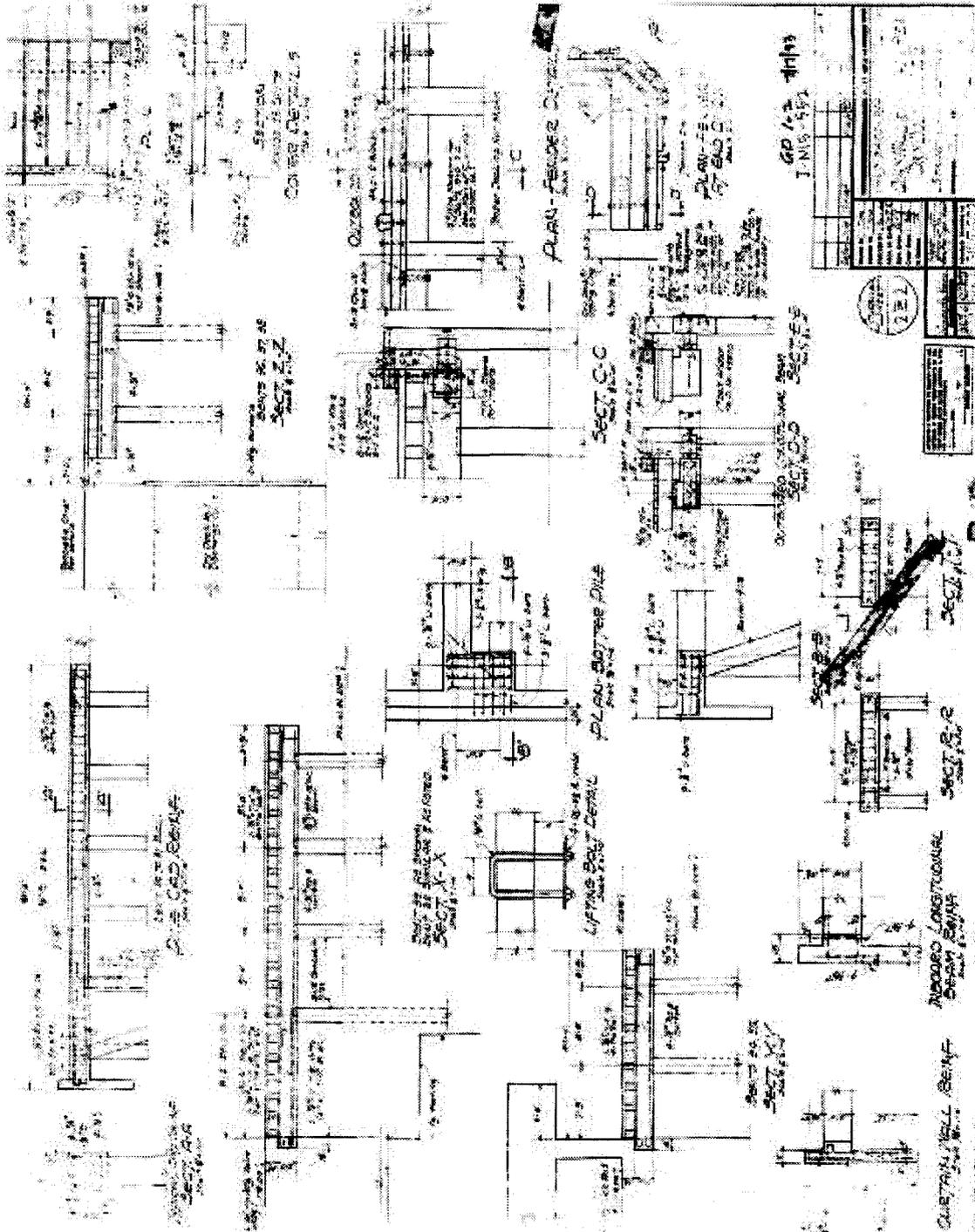
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Quay Wall N-1, Plan and Sections (Drawing No. I-N15-551, dated 7/17/1943) (reduced, not to scale)



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Quay Wall N-1, Structural Details (Drawing No. I-N15-552, dated 7/17/1943) (reduced, not to scale)



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Quay Wall N-1, Timber Deck Replacement with Concrete Deck  
(Drawing No. I-N15-652, dated 4/14/1952) (reduced, not to scale)

