

BALTIMORE INNER HARBOR, PIER 4
South side of Pratt Street between
Frederick Street and Market Place
Baltimore City
Maryland

HAER No. MD-86-C

HAER,
MD,
4-BALT,
225C-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

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Baltimore Inner Harbor, Pier 4

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Location: South of Pratt Street between Frederick Street and Market Place
Baltimore, Maryland

UTM: 18.362620-4349470 ~~361385.4349435~~ **361385.4349435**
Quad: Baltimore East, Maryland

Dates of Construction: 1908-1910; 1989

Engineer: Oscar F. Lackey, Chief Engineer, Baltimore Harbor Board

Present Owner: City of Baltimore

Present Occupants and Uses: Power Plant (Vacant)
Chart House Restaurant (Restaurant)
Marine Mammal Pavilion (Aquarium)
U.S.S. Taney (U.S. Coast Guard Cutter)

Significance: Designed by Oscar F. Lackey and constructed in 1908-1910, remaining original bulkheads on Piers 4, 5, and 6 in the Baltimore Inner Harbor were among the first reinforced concrete structures erected in seawater in the United States. These and other early concrete piers in the U.S. pioneered the acceptance of reinforced concrete in American harbors. The solid piers, consisting of filled reinforced concrete bulkheads, played a significant role in the evolution from timber pile to reinforced concrete for seawater construction.

Project Information: Betty Bird, 2025 Eye Street, N.W., Suite 801, Washington, D.C. prepared documentation under contract to Christopher Columbus Center Development, Inc. from October 1992 through March 1993. The Christopher Columbus Center, an underwater archeology and marine research and education center, will construct a facility on Piers 5 and 6 that will require reinforcement of remaining original bulkheads on Piers 4, 5, and 6. Reinforcement will be constructed in front of existing material, obscuring the original concrete cylinders and sheet piles. This documentation was completed pursuant to 36 CFR 800.8 to mitigate the adverse effects of this undertaking.

DESCRIPTIVE INFORMATION

Pier 4 is a solid finger pier consisting of back-filled concrete bulkheads. The pier extends from East Pratt Street south into the Baltimore Inner Harbor. The Inner Harbor is located on the Northwest Branch of the Patapsco River, which empties into the Chesapeake Bay. The Pratt Street Power Plant, a complex of three early 20th century brick and terra cotta structures measuring 132 ft. x 326 ft., occupies the head of the pier and the Marine Mammal Pavilion of the Baltimore Aquarium, a reinforced concrete structure completed in 1990, occupies the foot. The Chart House Restaurant, comprised of two low-rise brick early 20th century buildings, is situated between the Power Plant and the Marine Mammal Pavilion. Foot bridges at the center of the pier connect Pier 4 with Pier 5 to the east and Pier 3 to the west. An elevated enclosed pedestrian bridge connects the Marine Mammal Pavilion with the Baltimore Aquarium.

Pier 4 was part of a 1904-1910 harbor improvement that originally consisted of 6 trapezoidal piers extending south into the Inner Harbor between Light Street and Jones Falls. These piers were constructed on the site of similar solid piers that had been thickly settled prior to the Baltimore Fire of 1904. As designed, Pier 4 was originally 978 ft. long on the east and 877.5 ft. long on the west. The head of Pier 4 was 220 ft. wide. Two finger piers extended from the foot of Pier 4, giving the foot of the pier a U-shaped configuration.

The original construction of the piers is depicted in engineering drawings. The following description appeared in 1909 in *The Engineer*, a British publication:

The face structures consist of series of steel cylinders, filled with concrete, connected by reinforced concrete sheet piling, and the superstructures are of reinforced concrete or masonry. The cylinders are 10 ft. in diameter, and built of 3/8 in. steel plate, stiffened by 3 in. by 3 in. by 3/8 inch angles. They are sunk to a depth of 27 ft. below low water and spaced 25 ft. centres. . . .

In the typical section the floor is carried by two 15 in. -- 45 lb. per foot -- steel channels on the face of the cylinder, and a 4 in. thick reinforced concrete wall in the rear, the wall resting directly on the top of the sheet piling. The latter is of reinforced concrete, gauged in the proportions of 1 cement, 2 sand, and 4 crushed stone or gravel. The piles are 18 in. wide by 12 in. thick, with four 3/4 in. steel bars in tension and four 3/8 in. square bars in compression. The longitudinal reinforcement is connected by 5/16 in. round steel hoops placed 18 in. apart. On the water side the reinforcement is covered by 2 in. thickness of concrete. The outward thrust of the sheet piling at the top is taken by a steel lattice girder, embedded in concrete, placed at a distance of 4 ft. to 5 ft. behind the face line of the pier. The girder, which is 2 ft. 6 in. deep horizontally, consists of four 6 in. by 6 in. by 7/8 in. angles double braced with 3 in. by 1/2 in. flat bars spaced 14 in. centres. The cylinders are tied back to anchor beams and piles by means of eight 1-1/8 in. square steel bars to each cylinder, or 25 ft. apart centre to centre of tie clusters. The tie bars are embedded in concrete measuring 18 in. by 10 in. in section. The anchor beam is 28 ft. back from the face line of the pier, and consists of concrete 3 ft. deep and 15 in. thick, reinforced by eight

1-1/4 in. square bars. The anchor beam rests on and is tied to two 15 in. diameter reinforced concrete piles abreast of each cylinder.¹

The Power Plant, located at the head of the pier at Pratt Street, is one of 11 extant structures in downtown Baltimore that survived the great fire of 1904 and the only structure that remained on the intensively developed Inner Harbor piers. (Please see Pratt Street Power Plant, HAER No. MD-) for information about the Power Plant.) The 1914 Sanborn Map, the first issued after the reconstruction of Pier 4, depicts the early appearance of the pier. The map shows that Pier 4 was bisected by Wood Street (also evident in the pre-fire 1902 Sanborn Map) at the head of the U-shaped finger piers that extended south of the Power Plant. A two-story office, which served as the Harbor Board headquarters, was situated between the two finger piers south of Wood Street. Several smaller shop and supply structures associated with the Power Plant were situated between Wood Street and the Power Plant clustered on the east side of the pier. No structures were shown on the finger piers, which are labeled "STONE LUMBER WHARF." The east side of the pier adjacent to the Power Plant is labeled "Dugans Wharf" and the west, "O'Donnell's Wharf," a designation also shown on the 1902 Map. The 1928 Sanborn Map for this area of Baltimore is missing.

The ca. 1951 paste-up Sanborn Map depicts additional structures, all of which are now gone, on the finger piers at the foot of Pier 4. The U.S. Coast Guard occupied the western finger pier. Three adjoining one-story U.S. Coast Guard warehouses are shown on the west side of the western pier. A freight warehouse for Victor Lynn Lines was situated on the west side of the eastern finger pier. Of the earlier structures occupying Pier 4, only the Power Plant and two of the shop and supply structures consolidated as the Chart House Restaurant presently remain.

Although the remaining original bulkheads on the east and west sides of the north end of the pier are presently in deteriorated condition, for the most part the basic structural system of Pier 4 remains. Several engineering studies conducted over the past 20 years have documented the condition of this resource. A 1973 feasibility study by Whitman, Requardt and Associates assessed the condition of Piers 4, 5, and 6. Whitman Requardt found deterioration that was particularly severe toward the southern ends of the pier, which had been subjected to the greatest turbulence. Steel jackets encasing the cylinders had eroded and cylinders were disintegrating. The top portions of many of the cylinders were missing and remaining cylinders had holes. The beam at the face of the pier was damaged in several places. Concrete sheet piling was in "poor condition" and had shifted in several locations creating voids behind the sheeting. The timber fender system, which was continuously altered and replaced over the years, was still present, in good repair only in areas of use. In describing the condition of Pier 4, Whitman, Requardt wrote,

In general the concrete used for the beams, girders, and cylinders is of very poor quality. Pieces can be easily removed or chipped away. Examination of such pieces reveals that there was insufficient cement paste to completely fill the voids in the aggregate. In addition such pieces can be easily crumbled by hand.²

¹"New Harbour Works at Baltimore," *The Engineer*, January 29, 1909, pp. 105-107.

²Whitman, Requardt and Associates, "Engineering Feasibility Report: Inner Harbor East," p. I-3.

The City of Baltimore acquired the Power Plant in 1977 and in 1979 tore down the elevated coal hoists on the west side of the Power Plant. Six Flags undertook a major rehabilitation of the Power Plant for an entertainment center, which opened in 1985.³ This venture subsequently failed, leaving the Power Plant vacant. (Please see Pratt Street Power Plant, HAER No. MD- for additional information about the Power Plant.)

In the late 1980s, the U-shaped finger piers at the foot of Pier 4 were infilled and the original bulkheads on the southern half of Pier 4 were reworked with new concrete sheet piles in conjunction with the construction of the Marine Mammal Pavilion. The Marine Mammal Pavilion of the Baltimore Aquarium now occupies the southern half of Pier 4 on the site of the former finger piers.

HISTORICAL INFORMATION

The piers in the Inner Harbor were built on the site of earlier piers that the devastating fire of February 1904 reduced to rubble. Along with the piers, the fire destroyed much of downtown Baltimore. The Burnt District Commission, formed to oversee the rebuilding of the city, had the power to condemn property for street-widening and to establish new building codes. Exercising this authority, the Commission condemned property extending into the Inner Harbor shifting the former privately owned piers to municipal control. The Harbor Board rebuilt the six Inner Harbor piers under the authority of Ordinance No. 149, November 10, 1904.⁴ Piers 1, 2, and 3 were constructed of timber under the administration of N.E. Hutton, Chief Engineer for the Harbor Board until his death in 1908. Oscar F. Lackey, who succeeded Hutton, had extensive experience in harbor construction and pioneered the use of reinforced concrete construction in Piers 4, 5, and 6. (For additional information about Lackey and the decision to employ reinforced concrete in seawater construction, please see Inner Harbor: Pier 5, HAER No. MD-86-A).

In the planning of improvements for the Inner Harbor, Pier 4 was designated for market use and designed specifically for smaller boats plying the Chesapeake Bay.⁵ Marsh Market, at Market Place one block northeast of Pier 4, was one of the city's major markets:

Pier 4 is at the foot of Market Place which has been widened to 150 feet. Along Market Place the city has erected three handsome commodious buildings, a Retail Market, a Fish Market and a Wholesale Market with a Comfort Station nearby, all within a stone's throw of Pier 4, set apart for the use of the market boats.⁶

Pier 4 presented the Harbor Board with a unique set of circumstances. In addition to its proximity to Market Place, it was the only pier that was not a cleared site. Unlike the other piers, which were cleared sites that could be reconfigured and reworked, Pier 4 presented significant constraints. The United Railways and Electric Company Power Plant, one of only 11 structures to survive the 1904 fire dictated how the pier could be configured and used.⁷ Further, since the Power Plant was critical to

³National Register Nomination, Pratt Street Power Plant, pp. 7-4 and 8-10.

⁴Harbor Board Report for 1904, p. 1.

⁵Harbor Board Report for 1908, p. 22.

⁶Harbor Board Report for 1914, p. 31.

⁷National Register Nomination for the Pratt Street Power Plant, Statement of Significance.

running streetcar lines and supplying power to the city, its operation could not be disrupted by pier construction.

The Power Plant, constructed between 1900 and 1909, consists of three structures separated by fire walls: a northern engine house on Pratt Street (1905-1909); a central boiler house dominated by four huge stacks adjoining the engine room on the south (1900-1902); and the southern engine house (ca. 1903). Pierre Otis Keilholtz, the chief electrical engineer for United Railways was responsible for the plant design. The northern engine house was rebuilt on the site of an earlier engine house because of fire damage and the widening of Pratt Street after the fire. For the most part, coal was delivered by boat. The Power Plant featured elevated coal bins on the west side of the pier adjacent to the boiler room. Although the plant used city water for feed pump supply, it also took advantage of its waterfront location by constructing intake and discharge wells for cooling water for cooling and condensing.

Two supply wells are provided in the bay on the boiler room side of the station. Many fruit vessels unload their cargoes in this port, and much decaying vegetable matter is dumped here, necessitating an elaborate system of gates, screens and strainers for these injecting wells. Mr. P.O. Keilholtz, electrical and mechanical engineer for the railroad company has designed a very satisfactory well, which has materially lessened the trouble from this source. The injection piping is cast iron flanged pipe and is so arranged that water for any condenser may be taken from either well, while the other is being cleaned. A separate valve is provided at each condenser to regulate the flow of water or to cut out the condenser.

Discharge pipes from the air pumps are connected together into one large main, which is carried out through the engine room basement wall below the street level and discharged into the bay on the opposite side of the power house from the injection supply. A cut-out valve is provided in each pipe near the air pump. The discharge pipes are of cast iron flanged and the valves are brass mounted.⁸

A later article noted that, "the water for condensing purposes is taken from one slip and returned to the other so the temperature of the water in the first slip is not raised."⁹ Diagrams of the Power Plant show 5 intake wells situated on the west side of the pier and 5 discharge wells on the east. A discharge well for overflow is shown adjacent to Discharge Well No. 4.¹⁰ (Please see Pratt Street Power Plant, HAER No. MD- for further information about the Power Plant.)

The United Railways and Electric Company Power Plant played an indirect but important role in the development of reinforced concrete bulkhead construction. The existing conditions on Pier 4 required modifications to the original construction plans for the piers that turned out to be less costly and more structurally efficient:

⁸"Power Plant of the City and Suburban Railway Co., Baltimore, MD.," p. 3.

⁹"Increased power Facilities for the United Railways & Electric Co., of Baltimore, MD.," p. 335.

¹⁰"Diagram Showing Location of Condensing Water Intake and Discharge Wells" (1919)

Owing to the conditions existing on Pier 4, at the power house, it being impossible to get plans showing the true location of pipes, conduits and other connections relating to the power house machinery, and to avoid the possibility of closing down the plant and tying up the car lines in the city by disconnecting feeder wires or destroying pipes and other connections, it was decided for the best interests of the community to somewhat change the class of construction. This was done by changing the location of tie piles from their original position to a position immediately back of cylinders, and changing the steel channel tie to steel rods, covering the same with three inches of concrete as protection. This later change was made advisable, due to the fact that owing to the many obstructions found in the path of driving piles at a fixed distance back of the bulkhead line, that it would have necessitated special connections for almost each and every pile driven, whereas with the steel rod connection, or tie, it was simply a question of introducing a longer or shorter steel bar, as the case might require.

After going into details of the cost of such a change, it was felt advisable to adopt this method throughout the piers, as the general results would be cheaper and the strength of the piers not injured. Further, the changing of the tie piles and locating same directly back of the cylinders, instead of placing two piles equally distant between cylinders, enabled the driving of the sheet piling straight through, from cylinder to cylinder, without cutting away or casting special piles to fit around the tie, it not being definitely determined when original plans were designed that reinforced concrete sheet piling would be adopted. In addition to a saving of money to the city, the work should advance very much more rapidly than under the original design. There will be a saving of practically \$43,939 to the city.¹¹

By August 1909 all but 200 ft. on the east side of Pier 4 had been completed. (For additional information on the design and construction of the reinforced concrete bulkheads, see Baltimore Inner Harbor: Pier 5, HAER No. MD-86-A). The installation of intake and overflow wells for the United Railways and Electric Company Power Plant substantially delayed construction of the pier. United Railways and Electric Company installed the wells themselves some time after 1910.¹²

When Pier 4 was almost complete the Harbor Board recommended construction of a two-room building on the pier. One room would house the Harbor Master's Office and the other would provide free office space for commission men doing business on the pier.

At the request of the commission men, the Board of Estimates changed the plans of the Harbor Board and authorized construction of a two-story building, consisting of five rooms, one room to be used as an office for the Harbor Master, and the other rooms to be leased to the commission men, as desired by them, for their use as private offices. After the completion of this building there was but one applicant for space and the same was not considered by the Board of Estimates, and they recommended that the

¹¹*Harbor Board Report for 1908*, p. 21.

¹²*Harbor Board Report for 1909*, p. 15.

building be reserved for the use of the Harbor Masters, also as an annex office for the Harbor Board.¹³

The building, which is depicted in the later Sanborn Map, was constructed between the two finger piers at a cost of \$5000.¹⁴

Historic maps show that with the exception of Pier 4, the new Inner Harbor piers were designed with wharves and docks along each side with a circulation spine running down the center of the pier. Because of the United Railways Power Plant, which occupied the center area of Pier 4, the docks at the end of the pier were serviced from roadways to either side of the Power Plant.¹⁵ It is possible that only the roadway to the east of the Power Plant, that closest to Marsh Market at Market Place, provided public access because of the location of the coal lifts on the west side of the Power Plant.

¹³*Harbor Board Report for 1909*, p. 17.

¹⁴*Harbor Board Report for 1909*, p. 17.

¹⁵*Harbor Board Report for 1909*, map facing Plate 17.

SOURCES OF INFORMATION

For general sources and additional sources of information on Piers 4, 5, and 6, please see Baltimore Inner Harbor, Pier 5, HAER No. MD-86-A. For information on the Power Plant, please see Pratt Street Power Plant, HAER No. MD

A. Engineering Drawings:

Pier 4:

Working drawings: Collection of Peter Van de Castle (private collection to be donated to the Baltimore Museum of Industry.)

Plans, site plans, schematic drawings, and structural diagrams: *Reports of the Harbor Board*, 1904-1914 (Enoch Pratt Free Library)

Plans and structural cross-sections of bulkheads in Harbor Board of Baltimore, *Survey of the Port of Baltimore, Nov. 15, 1920, vol. 1.* (Enoch Pratt Free Library)

Structural diagrams. "New Harbour Works at Baltimore," in *The Engineer* (Jan. 29, 1909), pp. 104-106. (Library of Congress)

Power Plant:

Cross-Section Through Boiler House showing discharge well in "Increased Power Facilities for the United Railways & Electric Co., of Baltimore, MD.," *Street Railway Review* (June 20, 1902), p. 335.

Coal Hoist Tower, in "Increased Power Facilities for the United Railways & Electric Co., of Baltimore, MD.," *Street Railway Review* (June 20, 1902), p. 336.

"Diagram Showing Location of Condensing Water Intake and Discharge Wells," (Drawing A-552) January 23, 1919.

"Layout of Discharge Water Piping for No. 4 - 20,000 K.W. Turbine," (Drawing C-503) April 25, 1918 with revisions June - August 1918.

"Water Discharge Well and Tunnel for No. 4," (Drawing A-519) June 24, 1918 Revisions

B. Historic Views:

Please see Baltimore Inner Harbor (HAER No. MD-86) for information on general views of the Inner Harbor, including Pier 4. *The Reports of the Harbor Board* for this period also contain numerous photos of the piers and the piers under construction. Please see Baltimore Inner Harbor, Pier 5

(HAER No. MD-86-A) for additional detail on *The Reports of the Harbor Board*. Specific views pertaining to Pier 4 include the following:

Keith, Robert C. *Baltimore Harbor: A Picture History*. Baltimore: Ocean World Publishing, Inc., 1982.

Bay vessels unloading on the east side of Pier 4 in the 1930s and 1940s (pp. 110 and 112)
Aerial view of Pier 4 in 1948 (p. 113).

The Peale Museum. *Harbor 1854-1955: A Century of Photographs of the Port of Baltimore*. Baltimore: Peale Museum, ca. 1955. (MD.XHE554.B2A34)

"Fleet of Bugeyes in the Long Dock at Marsh Market," prob. pre-1904, (p. 13)

View of "Exterior of New Boiler House" (south building) showing coal hoist in "Increased Power Facilities for the United Railways & Electric Co., of Baltimore, Md." in *Street Railway Review*, 12 (June 20, 1902), p. 331.

C. Bibliography:

Please see Baltimore Inner Harbor, Pier 5 (HAER No. 86-A) for complete bibliography on Piers 4, 5, and 6.

"Increased Power Facilities for the United Railways & Electric Co., of Baltimore, Md." in *Street Railway Review*, 12 (June 20, 1902), pp. 331-337.

"Power Plant of the City and Suburban Railway Co., Baltimore, Md." in *Power* 16:7 (July 1896), pp. 1-5.

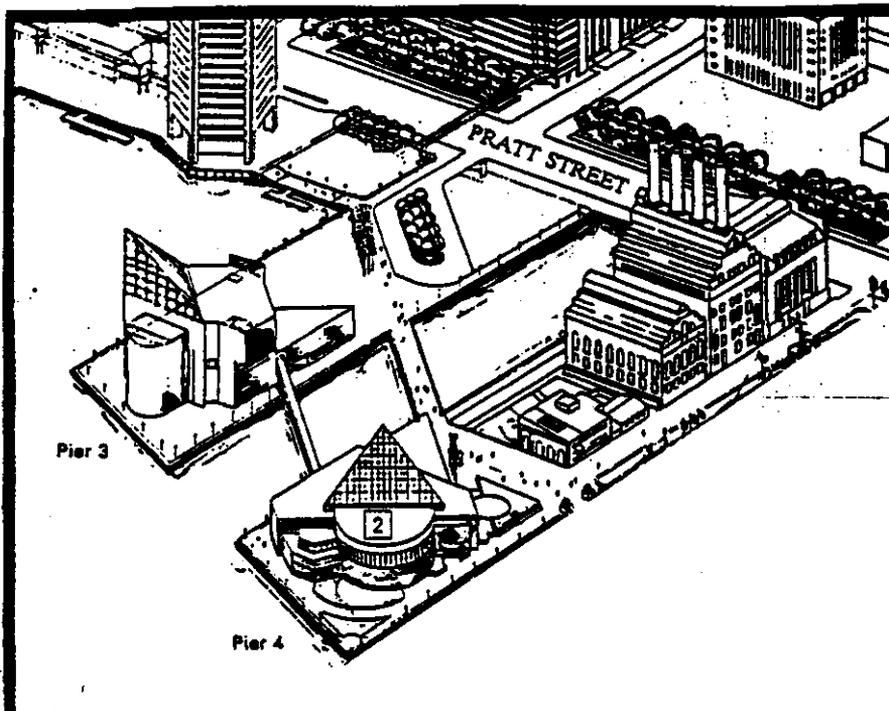
Shoken, Fred. National Register Nomination for Pratt Street Station, Pier Four Power Plant, 1985.

Simmons, Scott E. *An Investigation of the Archaeological Resources Associated with Piers 5 and 6 and the Harrison's at Pier 5 Complex (18BC62 and 18BC63) Baltimore, Maryland*. Baltimore: Baltimore Center for Urban Archaeology, 1990.

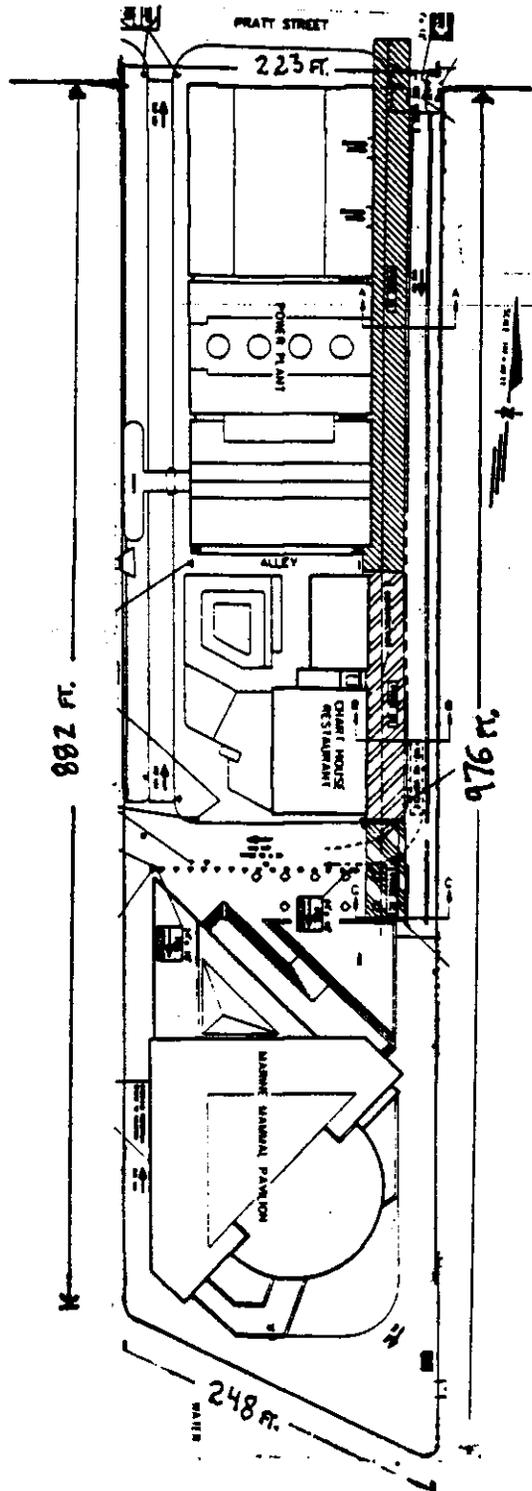
D. Likely sources not yet investigated:

Research for this project (Baltimore Inner Harbor, HAER No. MD-86) was driven by the documentation of the reinforced concrete technology for the bulkheads on Piers 5 and 6. Documentation of Pier 4 focused on water and discharge wells set within the bulkheads. Consequently, a wealth of sources that could offer information about Pier 4 were not investigated. In particular, U.S. Coast Guard and post-1920 Harbor Board records could provide information about the operation of the slips at the south end of the pier. Records of the municipal market, north of the pier, could illuminate the workings of this "market pier." The National Register Nomination contains an

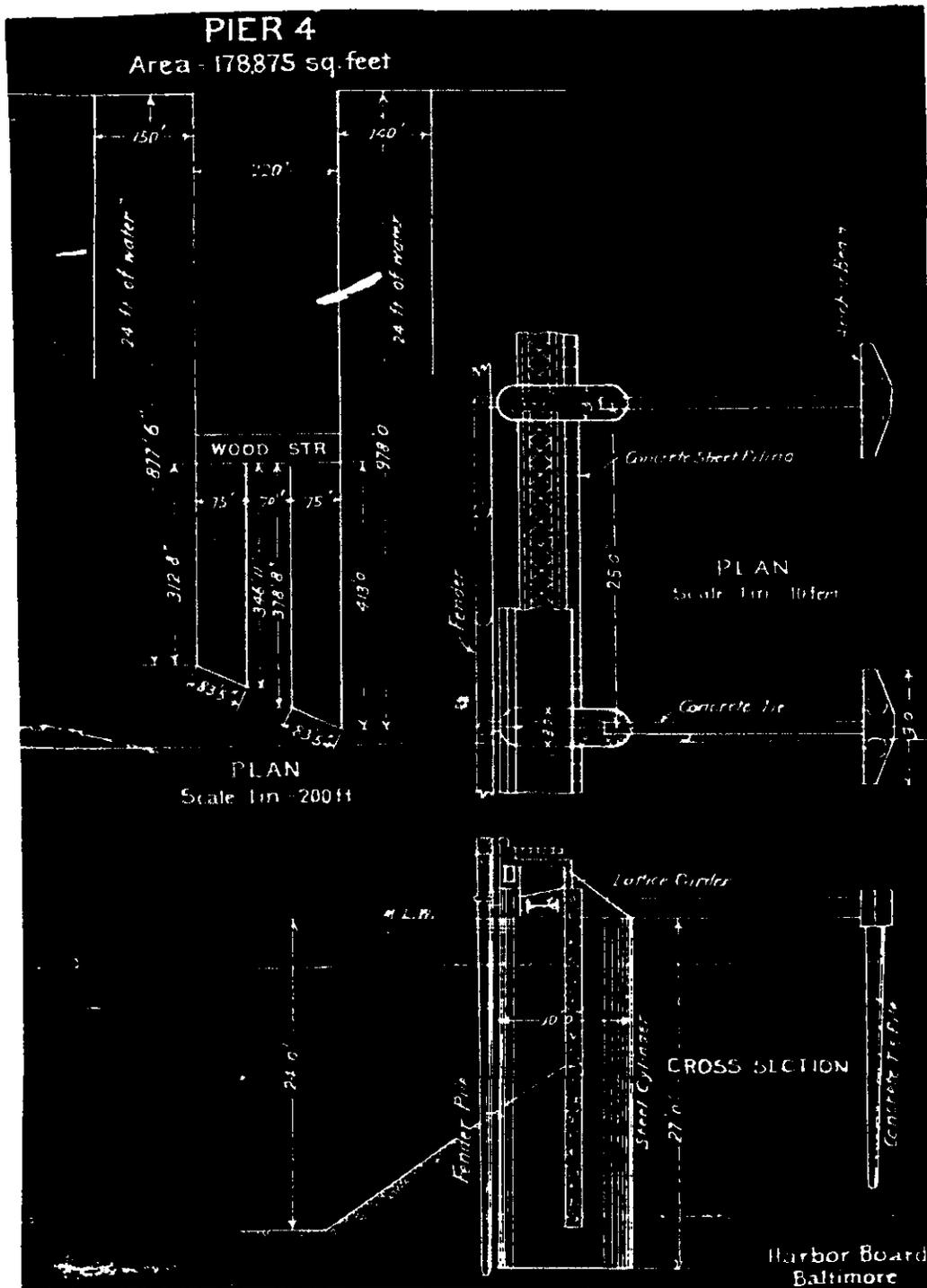
extensive bibliography on the Power Plant, which could also provide more information about Pier 4 incidental to specific information about the Power Plant.



Source: Adapted from architectural rendering of the Christopher Columbus Center in Simmons, *An Investigation of Archeological Resources Associated with Piers 5 and 6*, p. 151.
(Piers 5 and 6 not shown)



Source: Baltimore Bureau of Transportation drawing, Jan. 1993.
(Dimensions are approximate measurements taken with rotator wheel)



Source: Harbor Board, *Survey of the Port of Baltimore*, Vol. 1 (1920).