GRAVING DOCK, CAISSON GATE
(Puerto Rico Drydock and Marine Terminals)
Southern end of Central Street bounded by Villaverde and La Paz
Streets
Miramar
San Juan County
Puerto Rico

PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA
FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
SOUTHEAST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
100 Alabama St. NW
Atlanta, GA 30303
HISTORIC AMERICAN ENGINEERING RECORD

GRAVING DOCK, CAISSON GATE
(Puerto Rico Drydock and Marine Terminal)

HAER No. PR-49

Location: Southern end of Central Street, bounded by Villaverde and La Paz Streets. Miramar Ward, San Juan, Puerto Rico. U.S.G.S. San Juan Quadrangle, Universal Transverse Mercator Coordinates: 19.192416.2042294

Date of Construction: 1939 – 1941

Engineer: Frederic Harris Inc. New York City, NY

Builder: E. H. Latham & Co. West Palm Beach, FL (Graving Dock)

Sues. De Abarca
San Juan, PR (Caisson Gate)

Present Owner: Puerto Rico Ports Authority P. O. Box 362829, San Juan, PR 00936-2829

Present Use: Maintain watertight conditions at graving dock

Significance: This is the only graving dock facility in the Eastern Caribbean. Thus, the facility played an important role in the repair and redeployment of battleships, carriers and smaller warships for the duration of World War II. Afterwards it has remained the only facility in this region capable of repairing tankers, cargo ships, cruise ships and ocean-crossing ferries.

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Date: March 2008
This historical report on the construction of the San Juan graving dock provides a brief historical context for the construction project that highlights its economic, social, and military significance in the Puerto Rico of the late 1930s and early 1940s. The report also provides information on the planning stages of the dry dock’s construction, including various contemporary discussions and reports on the subject. It also offers information on the construction of the dry dock, its use by the U. S. Navy in the context of World War II, and its later history during the balance of the twentieth century. The bibliography at the end of the report offers information on the materials consulted for this study, including archival materials, newspapers, contemporary publications, and interviews.

General Historical Context

The period between the initial plans for the construction of the San Juan Graving Dock (1935) and the completion of its construction (1941) was characterized by worldwide economic depression and political convulsion, and the start of World War II. Attention to some of the period’s highlights in the international context, the United States, and Puerto Rico provides a historical context for the circumstances surrounding the construction of the dry dock in the port of San Juan.

The Great Depression that began with the collapse of the U.S. stock market in 1929 spread throughout the world and its effects continued to reverberate for over a decade. In response to the depression, the administration of President Franklin D. Roosevelt unveiled a broad set of strategies to deal with the collapsed economy and its social repercussions. The New Deal strategies of the Roosevelt administration rested on state activism and massive investments to reactivate the economy and generate employment. In 1933, the U.S. Congress passed the Federal Emergency Relief Act. Numerous other initiatives followed. The New Deal reached Puerto Rico through various federal agencies and with the establishment of the Puerto Rico Emergency Relief Administration (PREPA) in 1933 and the Puerto Rico Recovery Administration (PRRA) in 1935. Because unemployment levels in Puerto Rico had reached 60 percent in 1930 insular and federal agencies joined efforts to generate employment through construction projects and other initiatives.¹

While the Great Depression ravaged on, Hitler and his Nazi party rose to power in Germany in 1933. German persecution of Jews and military expansionist moves began soon thereafter. In 1936 Hitler and Mussolini establish the Rome-Berlin Axis. Meanwhile, Japanese troops moved on China in 1939 with the German invasion of Poland and the British and French declaration of war against Germany. In light of the expanding Nazi threat, in 1940 the United States began to prepare for war with the passing of the Selective Service Act and other military measures. On December 7, 1941, Japan attacked Pearl Harbor and the U.S. responded by declaring war on Japan, Germany, and Italy. During 1942 the Caribbean became a war theater with German naval

¹ See Thomas Matthews, La política puertorriqueña y el Nuevo Trato (Rio Piedras, PR, 1973).
activity peaking. The strategic importance of Puerto Rico became evident with the expansion of U.S. military presence on the island and the construction of the Roosevelt Roads Navy Base and other military installations.

**Planning Stages**

The initial steps toward the construction of a dry dock in the San Juan harbor were taken by Puerto Rico Governor Blanton K. Winship, a retired Army general, who on September 5, 1935 applied for a grant from the Federal Administration of Public Works, headed at the time by Harold L. Ickes. While federal authorities evaluated the petition, Representative Miguel Angel García Méndez presented House Bill 446 on March 20, 1936, seeking authorization for Puerto Rico’s Commissioner of the Interior to build a dry dock (*dique de carena* in Spanish) in San Juan. The bill became law on April 18, 1936. It authorized a bond emission of $1.8 million dollars at no more than 5 percent interest to fund the construction costs. The law authorized the island’s Commissioner of the Interior to oversee the construction and operation of the proposed dry dock. According to the insular legislation, the dry dock could be used by both public and private interests, and fees collected by its operators would be used to pay for the issued bonds. Given the critical state of employment on the island and the need to stimulate commercial navigation, the island’s lawmakers deemed the project an urgent necessity and demanded its immediate implementation.

Numerous pre-construction studies were conducted by insular and federal government agencies to assess the viability of the proposed dry dock and to measure the impact that it would have on navigation, commerce, employment, and defense capabilities. Governor Winship deemed the construction of the dry dock as part of a larger plan to establish a free trade zone in San Juan to stimulate the insular economy. Some of the pre-construction studies included statistics on trade and navigation. One such study demonstrated that Puerto Rico’s maritime trade with the United States was substantial. In 1936 Puerto Rico imported $77,176,000 worth of U.S. goods and exported $96,991,000 to the mainland. Trade with the United States represented over 95 percent of Puerto Rico’s foreign trade. The island was the third largest Latin American market, and the world’s ninth, largest exporter of goods to the United States. It was also Latin America’s first, and the world’s seventh, importer of U.S. goods. Navigation statistics included a total of 2,492 U.S. vessels calling in the port of San Juan in 1934, averaging 2,780 tons. Based on utilization statistics from other dry docks, one study calculated that 2.3 percent of the incoming ships (57)

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2 Loan Application, Archivo General de Puerto Rico (hereafter AGPR), Obras Publicas (hereafter OP), Puertos y Muelles (hereafter PM), Box 176; “Government of Puerto Rico, Department of the Interior, memorándum on the Construction of a Graving Dock at San Juan, Puerto Rico, id., box 170.
3 Bill #446 of the Puerto Rico House of Representatives, in AGPR, OP, PM, box 175; Puerto Rico, Legislatura de Puerto Rico, Leyes y resoluciones de la cuarta legislatura ordinaria de la décimocuarta asamblea legislativa de Puerto Rico (San Juan, 1936), Act #29, pp.231-237.
4 “Graving Dock at St. Thomas, Virgin Islands, “ February 16, 1937, AGPR, OP, PM, box 170.
5 “Graving Dock at St. Thomas, Virgin Islands,” February 16, 1937, AGPR, Op, PM, box 170.
would require dry docking services. Studies projected that dry docking fees would amount to $3.00 per ton, generating a yearly income of $660,000; operational costs, including payment of loans, were estimated at $490,682 for the first year, thus leaving a substantial profit margin.

Another advantage of the dry dock construction highlighted in pre-construction studies and documentation was the generation of badly needed employment for hundreds of Puerto Ricans. One of the project bidders highlighted the fact that:

*It is a long felt need in the Municipality of San Juan to provide work for numberless persons, which are at present unemployed. For the proper operation of the graving dock it is absolutely necessary to organize a colony of laborers on the grounds neighboring the dock.*

Preliminary discussions on the need and viability of a dry dock in San Juan also included military considerations. Puerto Rico's Commissioner of the Interior José E. Colom stated that the construction of a dry dock would "be greatly beneficial for the U.S. Navy which at present has no facilities for repairs in the Caribbean." The U.S. Navy shared an interest in the project as attested in a letter of the Secretary of the Navy to the Secretary of the Interior dated January 27, 1937:

...it would be necessary in the case of extended war operations in the Caribbean theater to establish an operating base in the Eastern Caribbean. San Juan is located within this area of possible base activities, and moreover is the most suitable location of all those available for the establishment of a base. Therefore, a dry dock in existence at the outbreak of war would be of great value to the Navy.

The most comprehensive needs assessment study pertaining to the dry dock was carried out by a special commission appointed by Secretary Ickes in 1937. It was composed of five members: John C. Page of the Department of the Interior (Chair), Lt. Col. D. McCoach of the War Department, Captain C.M. Austin of the Navy Department, Commander H.L. Vickery of the Maritime Commission, and Thomas E. Lyons of the Commerce Department. The commission was charged with establishing whether or not there was a need for building a dry dock in the Caribbean and whether San Juan or the island of St. Thomas, in the U.S. Virgin Islands, was the most suitable location for the proposed construction. Governor Lawrence W. Cramer, had made a bid for construction funds for a dry dock in St. Thomas and highlighted nationalist Puerto Rican

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10. Secretary of the Navy to the Secretary of the Interior, January 27, 1937, AGPR, OP, MP, box 170.
Rican activism as a reason not to build the dock in San Juan. The commission considered a variety of evaluation criteria in comparative perspective: commercial advantages, available infrastructure and support facilities, and defense considerations.

The commission issued its report and recommendations in October 1937. It stated that considering the current navigation and commercial volume, “San Juan would be more apt to profit by business which might be found in that part of the world, than would the same dock if built at St. Thomas.” While the bulk of navigation into San Juan consisted of U.S. ships, most of the vessels calling in St. Thomas were European. The report also recognized that facilities such as shops and foundries in San Juan were “superior” to those in St. Thomas. The report added, however, that, “the board is inclined to the opinion that from a purely business point of view...the proposed construction probably is not warranted either at San Juan or St. Thomas at the present time.”

Regarding the defense applications of the dry dock, the study stated that: “It appears the Navy Department in time of peace could not give the proposed dock any business except, perhaps, in emergency cases.” The report added, nonetheless, that:

> From a defense standpoint a dry dock located in the Eastern Caribbean would be a great value to the naval service in case of extended war operations in the Caribbean theatre. A dock in that area either at San Juan or St. Thomas in operation at the outbreak of the war would be of great value in such campaign.

The final conclusions of the commission’s report were that while San Juan was clearly the more suitable location for a dry dock in the region, there was no urgent or pressing need for its construction. It considered the economic advantages minimal and the risk of an extended war in the region “remote.”

Despite the recommendations of the special commission, the federal government, through its Department of the Interior, granted the insular government of Puerto Rico a Public Works Administration loan in the amount of $972,000 and a grant of $795,273 for the construction of a dry dock in San Juan. Governor Winship requested Secretary Ickes’s assistance in the selection of a firm that could prepare the preliminary plans for the construction of the dry dock and oversee the technical aspects of the project. The Department of the Navy recommended Retired Admiral Frederic R. Harris. Harris had vast experience in naval matters with direct bearing on the proposed construction. He had served as Commander of the Navy Corps of Engineers and Chief of the Navy’s Bureau of Shipyards and Ports. Retired from the Navy in 1927, he later directed the construction of dry docks in Charleston, South Carolina and New York City.

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13 Report by Ickes Commission, October 1937, AGPR, OP, PM, box 175.
14 Report by Ickes Commission, October 1937, AGPR, OP, PM, box 175.
15 Report by Ickes Commission, October 1937, AGPR, OP, PM, box 175.
Harris arrived in Puerto Rico in August 1938 and signed a contract with the insular government of Puerto Rico to produce the plans for the dry dock.\(^\text{17}\) He designed a gravitational dry dock measuring 721' in length, 120' in width (90 at the bottom), and 33' in depth. Its capacity was proposed to be 1,902,000 cubic feet of water. The plans also included a hydraulic gate, a pump house and a temporary cofferdam inside of which the actual dry dock would be built. The Government of Puerto Rico commissioned submarine soil tests (borings) to ascertain that the identified location could sustain the proposed construction. The tests were carried out by W. D. Noble.\(^\text{18}\) Most of the land for the proposed construction belonged to the Government of Puerto Rico but neighboring land and buildings were also acquired at a cost of $99,996. The acquired plots included 3,000 square meters belonging to Sucesores de Abarca, 17,500 square meters belonging to David Noble, and several plots and houses owned by D. Villaverde.\(^\text{19}\)

Once the plans were ready, the government of Puerto Rico opened bids for the various phases of the construction. The specifications of the bids established the details of the various construction phases, a deadline for completion of June 30, 1940, and that employment priority would have to be given to Puerto Rican workers receiving public relief funds. Salaries were stipulated at 40 cents per hour for skilled workers and 25 cents per hour for helpers.\(^\text{20}\) The major contract for the construction of the actual dry dock was awarded to E.H. Latham, Inc. of West Palm Beach, Florida. Sucesores de Abarca, a local firm whose iron foundry shops were adjacent to the site of the planned dry dock, received the contract for the building of the caisson gate and Raisler Corporation of New York City received the contract for the pumping plant and related equipment.\(^\text{21}\) It was agreed that Sucesores de Abarca would operate the dry dock once it was completed. This company, with origins in 1867, owned the island’s largest machine and foundry shop. It had extensive experience in the repair of ships and the construction of complex machinery used by some of the island’s largest sugar mills.\(^\text{22}\)

**Construction of the Graving Dock**

Construction of the San Juan graving dock began on September 12, 1938.\(^\text{23}\) The first steps included the dredging of 200,000 cubic yards of soil by the U.S. Corps of Engineers in conjunction with the Malaria Control Project. The dredging was followed by the erection of a temporary structure called a caisson gate that was built by Sucesores de Abarca. The dry dock gate was imported partially fabricated from the United States and so were the Worthington

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\(^{17}\) "Hoy llega a la Isla el Almirante Frederick (sic) R. Harris." *El Mundo*, August 21, 1938; Contract dated August 24, 1938, AGPR, OP, PM, box 170.


\(^{19}\) Memorandum of Jorge V. Dávila, Superintendent of Public Works to the Commissioner of the Interior of Puerto Rico, November 29, 1938, AGPR, OP, PM, box 178.

\(^{20}\) Graving Dock, San Juan, Puerto Rico, Instructions to Bidders, December 27, 1938," AGPR, OP, PM, box 170.

\(^{21}\) Caisson gate contract, AGPR, OP, PM, box 173; and Bids for pumping plant, id., Box 174.


\(^{23}\) Jorge V. Dávila to R.C. Hardman, September 15, 1938, AGPR, Op, PM, box 173.
pumps used to empty and fill the dock.\textsuperscript{24} The project was concluded on schedule in mid-1941 but it reportedly had the first dry docking a few months earlier on December 10, 1940.\textsuperscript{25} A report dated September 23, 1941 included information on the final costs of the dry dock construction that added to $1,795,655.48.\textsuperscript{26}

The San Juan Graving Dock and World War II

In December 1939, the Puerto Rico government offered to sell the San Juan graving dock to the U.S. Navy. Two months later the Chief of Naval Operations replied to Governor William Leahy that it had no interest in acquiring or operating the graving dock.\textsuperscript{27} With the increasing German military threat dramatized by the occupation of France in the summer of 1940, the strategic importance of Puerto Rico and the potential use of the San Juan graving dock increased sharply. On that year the Tenth U.S. Naval District was established in Puerto Rico and made responsible for:

\begin{quote}
...the maintenance and upkeep of all naval shore installations in the area, for providing logistics support for both shore and fleet activities, and for coordinating all naval matter of an administrative nature throughout Puerto Rico, the Virgin Islands and the smaller islands of the Caribbean Sea and Atlantic Ocean....\textsuperscript{28}
\end{quote}

Reflective of intensified naval activity in Puerto Rico was the construction of the Isla Grande Naval Air Station next door to the graving dock and the Roosevelt Roads Naval Station on the eastern coast of Puerto Rico.\textsuperscript{29}

By early 1941 the U.S. Navy deemed the San Juan dry dock an essential component of the mounting naval presence and infrastructure on the island. The scenario of an extended war in the region that had seemed so “remote” in 1937 was now a likely possibility. On May 1, 1941, the Puerto Rican legislature passed Act No.77 authorizing the sale of the recently completed graving dock. In response to the legislation, Commissioner of the Interior, Sergio Cuevas wrote to Commander H. W. Johnson:

\begin{quote}
In view of the unlimited national emergency which has been declared by the President of the United States, it is recognized that the earliest possible use of the graving dock by the Navy department is an urgent military necessity. The Insular Government desires to cooperate to the fullest practicable extent in the National Defense of the
\end{quote}

\textsuperscript{24} Interview with Bertil Anderson, June 24, 2003; Bids for pumping plant, AGPR, OP, PM, box 174.
\textsuperscript{25} Interview with Bertil Anderson, June 24, 2003
\textsuperscript{26} “Financial Statement of the Construction of the Graving Dock, September 23, 1941,” AGPR, OP, PM, box 177.
\textsuperscript{27} José E. Colom to the Chief of the Bureau of Yards and Docks, December 11, 1939; and Chief of Naval Operations to William Leahy, February 3, 1940, both in AGPR, OP, PM, box 178.
\textsuperscript{28} Public Affairs Office, Commander Caribbean Sea Frontier, Your Navy in Puerto Rico (Lubbock, TX, 1969), p.4
\textsuperscript{29} William Leahy, Annual Report of the Puerto Rico Reconstruction Administration (San Juan, 1940), p.25; Samuel Ewer Eastman and Daniel Marx, Jr., Ships and Sugar: An Evaluation of Puerto Rican Offshore Shipping (Rio Piedras, P.R., 1953)
United States, and, I as the Commissioner of the Interior of Puerto Rico, by virtue of the authority vested in me by Act No. 77 of the Puerto Rico Legislature approved May 1, 1941, authorize the Navy Department to enter upon the graving dock property and adjacent lands owned by the People of Puerto Rico, and to operate the graving dock and all of its accessory equipment, for the use and benefit of the United States, without rental or other charges pending the final settlement of transactions for the sale of the graving dock to the United States. 30

The actual transfer of the lands to the United States was formalized in the U.S. District Court of San Juan in August 25, 1941. 31

Following the declaration of war on Germany in December 1941, the Caribbean became an active theater of the war as what came to be known as the Battle of the Caribbean ravaged on. Germany had a significant submarine presence in the region. German submarines torpedoed 263 merchant ships weighing 1,367,278 tons. German aggression in the region also included the bombing of ports and small trading vessels. 32 The Tenth Naval District played a key role in the Battle of the Caribbean; it aided the blockade of ports in the French Caribbean that remained loyal to Vichy France and protected refineries in ports of the Dutch Caribbean. German activity in the region severely curtailed trade and navigation to the point that food supplies were cut sharply resulting in prolonged food rationing. 33 To restore the flow of goods into and out of the region, the United States put in place the Emergency Land-Water Highway that significantly reduced the risks of vessel sinkings by making use of overland transportation and linking the region’s islands by small merchant boats. 34 The Battle of the Caribbean abated beginning in late 1942 and the war with Germany came to an end in 1945. During the peak of the war, the San Juan graving dock played a crucial role in the repair and maintenance of merchant and naval vessels. According to a contemporary observer, the dry dock operated twenty-four hours a day during the peak of its wartime activity. 35

The Graving Dock in the Post War Era

In the aftermath of World War II the United States Navy lost interest in the San Juan graving dock and closed it down in March 1947. The insular government under Governor Jesús T. Piñero sought to reactivate the dry dock so that it could be used to help support insular commerce and navigation. 36 The facility was leased to Sucesores de Abarca and Co. for $50,000 and renewed operations in 1950 under the name of Puerto Rico Drydock and Marine Terminal. 37

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30 Sergio Cueva, Interior Commissioner of Puerto Rico, to Commander Johnson, May 29, 1941, AGPR, OP, PM, box 175.
31 Condemnation Proceedings in San Juan District Court, AGPR, OP, PM, box 175.
34 United States Department of State, The Caribbean Islands and the War (Washington, 1943), p.27.
During this period the Insular government also sold several factories that it had built during the depression years such as cement, paper, glass, and cardboard factories.

Under the operation of Abarca, the San Juan graving dock served numerous vessels during the 1950s, 1960s, and 1970s that required repairs or scheduled maintenance. Among the vessels serviced at the dock were U.S. Navy submarines, Greek merchant ships, oil tankers belonging to Esso and other oil companies, vessels of Alcoa Shipping, and cruise ships of the Cunard and passenger lines. Cruising tourism into and out of San Juan increased during the 1960s and 1970s, from 77,500 passengers in 1966 to 211,200 in 1972. Because of its size, however, the San Juan graving dock could not be used for the newer larger vessels. In 1978 the operation of the graving dock passed from Sucesores de Abarca to Pérez Y Cia. which operated it until June 1, 1999, when the government of Puerto Rico purchased the graving dock from the federal government and the Puerto Rico Ports Authority assumed the operation of the graving dock. At present it is used to service the local Cataño, Vieques, and Culebra ferries as well as smaller inter-island cargo vessels.

Physical Description

The facility is located on the southwest corner of the Isla Grande peninsula and situated to the east of San Juan Bay (Exhibit #1 & #2). The graving dock is located on the waterfront at the end of an industrial area. In the vicinity of the graving dock are other piers for shipping lines, warehouses and the abandoned facilities of an iron works foundry. The graving dock is situated along Piers 15 and 16. Shop buildings, storehouses, and other industrial structures are situated adjacent to or in close proximity to the graving dock.

The graving dock is a 672.5 foot long by 91 foot wide pressure relieved type, one section drydock originally constructed between 1939 and 1941(Exhibit #3 & #4). It is a concrete structure supported directly on soil. A railroad track utilized for portal crane purposes surrounds the graving dock on the shoreward side. The facility includes an underslab hydrostatic pressure relief drainage system, perimeter culverts and one pump house. A connecting tunnel runs from the pump house to the graving dock. These components create a system of flooding, draining and dewatering this drydock. Other key components of the industrial operation of this facility include the removable steel caisson and the flooding sluice gate.

41 Interview with Bertil Anderson, San Juan, PR, June 24, 2003.
The concrete graving structure was built in reclaimed mangrove swamp, which was drained and filled with compacted soil. Hydrostatic relief is provided by weep holes in the walls and gravel drains spaced transversely and longitudinally below the entire floor slab. The floor level within the drydock measures 35' in depth. The walls are of reinforced concrete. The original four concrete access stairs located at both sides on the head and bulkhead ends of the graving dock remain in place although only one is safe for access purposes due to safety issues.

The caisson gate is a reversible, hydrometer type floating steel caisson. It is steel riveted construction with hull plates (See exhibits 5 thru 8). The caisson is supported internally by horizontal girders and trusses below the operating deck. The operating deck or main deck is located approximately 9'-3" below the weather or top deck. Access to the operating deck is through a watertight hatch in the weather deck. Watertight vertical bulkheads and trim tanks are provided near each end of the caisson. Operating equipment and piping within the caisson are arranged so that it can be flooded and dewatered from either side. The caisson was originally built to provide dry dock flooding through the caisson. The two pipes originally provided for this purpose are not operable.

**Equipment and other Structures associated with the**

**Operation of the Graving Dock**

**Pumphouse** – This pumphouse provides the primary means by which the graving dock is dewatered. The pumphouse is located on the south side of the graving dock, near the bulkhead side. Flow from the graving dock is collected by drainage trenches, which feed into a wet pit at the bottom of the pumphouse. There are three main dewatering pumps and two drainage pumps.

**Flooding system** – The flooding system consists of one short culvert to the south side of the bulkhead. The culvert is 3'-0" x 4'-6" feet square and equipped with a single sluice gate. The original construction included through-caisson flooding, however this is no longer feasible since the pipes within the caisson gate for this purpose are deteriorated beyond repair.

**Fittings and Capstans** – Seventeen bollards are positioned along the north and south sides of the drydock and spaced at approximately 55' on center. Three powered capstans are located one on the south and two on the north side. Currently only the one on the south side is operating, driven by reversible induction motors. Non-historic removable pipe guardrails surround the shore ward perimeter of the drydock.

**Ship Blocking** – Blocks used at the facility are one-piece type made of composite concrete and hardwood caps, measuring 4'-0" x 3'-6" in plan and 4'-0" feet high. Blocking arrangement is made by fingerlifts.
A substantial collection of historic photographs that document the construction of the graving dock are held in the Puerto Rico Historic Archives, San Juan, Puerto Rico. The construction process began on September 12, 1938 and was in use by December 10, 1940. Construction required a substantial amount of earthwork, landfill and dredging since the area was originally a mangrove swamp common to the San Juan Bay estuary environment. An elaborate pier and rail system was constructed in order to undertake the drydock construction. A concrete plant and construction sheds were established on the site and within the dry dock floor area itself for construction purposes. The drydock was gradually constructed in stages with the head end and eastern section completed prior to the western section. The steel caisson appears to have been constructed in place at the drydock floor area.
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