U.S. NAVAL BASE, PEARL HARBOR, EXTERIOR CRANES
(U.S. Naval Base, Pearl Harbor, Naval Shipyard, Locomotive Cranes, Portal Cranes, Floating Cranes, Bridge Gantry Cranes)
Waterfront Crane Track System
Pearl Harbor
Honolulu County
Hawaii

HAER HI-68
HI-68

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC GREAT BASIN SUPPORT OFFICE
National Park Service
U.S. Department of the Interior
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U.S. NAVAL BASE, PEARL HARBOR, EXTERIOR CRANES
(U.S. Naval Base, Pearl Harbor, Naval Shipyard)
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HAER No. HI-68

Location:

On the Waterfront Crane Track System
And other areas throughout the Pearl Harbor Naval Base
Pearl Harbor Naval Base
City and County of Honolulu, Hawaii

Most of the cranes discussed in this report are no longer extant. The only cranes extant and still in use are crane numbers P-59, P-67, P-68, and P-71. (These cranes are scheduled for demolition by the end of year 2002 and will be replaced with new units.) These mobile structures fall within the UTM coordinates of the Pearl Harbor, Naval Shipyard as defined in the location section of the main report, HABS No. HI-483. The location of all the cranes covered in this report are within the following UTM Zone 4 coordinates:

A. 609509.2361260
B. 609500.2360940
C. 607280.2360520
D. 606890.2361180
E. 608470.2362070

Significance:

Crane use at Pearl Harbor is intrinsically tied to the construction of the dry docks and the daily functions of the dry docks and wharfs. The procurement of cranes throughout the history of Pearl Harbor, including the types of cranes and the number of cranes, help to tell the story of Pearl Harbor's early development and its rapid expansion during World War II.

HAER reports for individual crane types have been prepared and can be reviewed for additional information:

Report Number	Crane No.	Date	Report Name (all preceded by U.S. Naval Base, Pearl Harbor)
HAER No. HI-68C	BG-1	1941	BRIDGE GANTRY CRANE NO. 1
HAER No. HI-68B	P-59 and P-63	1942 and 1943	A 50-TON PORTAL CRANE TYPE
HAER No. HI-68A	Cranes P-58, -60, -61, -62, -65, and P-68 to -72	1942-1945	A 25-TON PORTAL CRANE TYPE

Description:

Several types of cranes were involved in ship repair and in the handling and lifting of machinery and other objects at the Shipyard. The type of crane used was determined by several factors:

1. The weight of the lift.

2. The point from which the object is being lifted. The object's location in relation to rail tracks or position in the water may dictate the length of jib needed.
3. The location within the base. Each zone, whether on the water, near the dry docks or near the repair basins, was supported by different cranes and/or crane types.

Before World War II, there was much more variation in crane design than there is today. Choices concerning the type and height of the base such as pintle, portal or a non-portal gantry (fixed or traveling); the length of reach including whether it had a whip hoist or not; a rotating or non-rotating superstructure; a luffing boom or a non-luffing boom; and other options of design.[1] This flexibility was dictated by the variety of dry docks and ships that existed early in America's history.

Shipbuilding and ship repair, one of the major roles of a dry dock, to a large extent, governs the dry dock's size and shape. Before World War II, the navy built virtually all of its own vessels, from small tugs to aircraft carriers and each harbor specialized in building a specific ship type, whether it was ferry, submarine, or aircraft carrier (note, however, that Pearl Harbor was limited to ship repair). As such, dry docks were not standardized, and this non-standardization mirrored the variety of crane components of the time[2] (Kilikewich 2002).

Eleven general types of exterior cranes were procured between the establishment of the Pearl Harbor Naval Base and the Post World War II period. The following descriptions depict the cranes built during this period. Modern crane descriptions are not included here.

Locomotive Cranes

A locomotive crane runs on a track system and is of the eight-wheel type. They are equipped with self-propelling, rotating and hoisting mechanisms, variable radius boom, non-reversing horizontal engines, and (sometimes) outriggers. Until the 1930s, the locomotive cranes were powered by a steam engine. These steam engines had a vertical boiler, furnace for burning fuel oil, and a steam and hand brake. Since the 1930s, most were operated by a diesel engine, and equipped with air brakes. They were used for general hoisting work, including bucket operation. The locomotive cranes were designed to carry between 10 tons and 30 tons.

[1] To luff is to raise or lower the boom of a crane or derrick. Therefore, a luffing boom is a boom that raises and lowers. A boom is the lifting arm of a crane; the boom is also referred to as a jib.

[2] Over the years, two trends developed that brought standardization to dry dock design. First, gradually, the types of ships built became standardized; second, much of the smaller craft shipbuilding began being farmed out so that there were fewer ship types being built by the navy. As dry dock design became standardized, crane use also followed suit, because crane design is dependent on track design, which is dependent on dry dock design and layout, which is governed by the types of ships being built and dry-docked (Kilikewich 2002).

However, there was one 42-ton locomotive, the LC-28, which was purchased during WWII.

Crawler Cranes

Crawler cranes are used primarily on undeveloped land where the grade may be uneven or the soil may be rocky. The advantage of the crawler is that the length of the crawler tracks gives a considerable amount of stability to the crane; therefore, negating the need for outriggers. For added stability for heavy loads, the tracks can extend outward to increase the width of the crane, thus minimizing the moment. Crawlers are either diesel or gasoline-driven self-contained lifting cranes. "They are full-revolving, convertible, one-yard, endless-track crawler types (similar to that of a tank) with an extended type boom high gantry, gasoline drive, and power clutch control" (Crane Division file "Contr. N311s-18934 4 Marion Cranes"). They provide full circle operation with the boom and machinery assembly swinging as a unit and maintaining stability in all positions. The crane can perform simultaneous operation of the steering and travel movements and independent and simultaneous operation of boom topping, swinging and both hoists. The operator has full and instant control of the crane from the cab operating station within the unit

A 20-ton crawler weighs approximately 50,000 pounds. The overall size of the crawler machinery house and structure is approximately 9' by 8'. The elevation of the machinery platform is approximately 5 feet. The track unit has a bearing of approximately 28" wide x 12' long, which provides uniform load distribution. The track sections are designed to permit traversing standard pavements without causing damage.

Crawler cranes developed much later than most other types of mobile cranes. The first one to be acquired at Pearl Harbor was in 1929. The standard crawler capacities ranged between 5 to 15 tons. There were several exceptions, however, where crawler capacities were up to 30, 40 and 50 tons. The only 50-ton crawler was the C-55 built by Manitowol Speed Crane Mfg. Co. in 1943. They are no longer used at Pearl Harbor because, although, they are useful in undeveloped land, their heavy tracks caused damage to paved asphalt roads with continued use (Mondik 2002).

Truck Crane

The Truck crane is a mobile crane that runs on rubber wheels and is the most versatile land crane type developed. The crane consists of a rotating superstructure (center post or turntable), boom, operating machinery, and one or more operator's stations mounted on a frame attached to a commercial truck chassis, usually retaining a payload hauling capability whose power source usually powers the crane. Its function is to lift, lower, and swing loads at various radii. (ASME/ANSI 1990: 5)

Pintle Crane

A pintle crane is an elevated crane that rotates primarily on a central cone-like shaped structure that has a bearing at the bottom of the cone, which accepts its weight and allows it to rotate. The central cone-shaped structure stabilizes the weight of the machinery house and boom; therefore, the four-legged structure surrounding the cone-shaped part can be relatively lightweight. Pintle cranes are no longer made, probably because portal cranes offer a greater amount of flexibility and took the place of pintle cranes early on. The only pintle crane acquired by the Pearl Harbor Naval Base was crane number P-102 in 1919. In order to increase its flexibility, it was placed on a gantry base in 1922. It was originally a steam-powered crane but was converted to electric-power in 1933.

Portal Crane (Gantry Crane)

Portal cranes, commonly called gantry cranes, are termed such because the cranes are elevated upon large bases that allow trains, locomotive cranes, and other vehicles to pass under and through them.[3] There are several classes of portals designated by their lifting capacity. The Pearl Harbor Shipyard has used, or is using, the 50-ton, 25-ton, and 15-ton portals.[4]

The cranes consist of a revolving hinged jib (sometimes referred to as a boom), an A-frame, and a machinery house mounted on a traveling portal base. All of the cranes have at least a main hoist and an auxiliary hoist and the larger portals usually have a whip hoist for smaller and quicker lifts.[5] The machinery house contains the counterweight, tanks, generating unit, operating machinery, and operator's stand. The machinery house includes brakes, drums, shafts, gears, motors, controllers, wire ropes, and sheaves, ladders, platforms, and walks. It also has safety devices, engine-generator unit, electric-lighting system, switchboard, wiring, and tools. The travel base sits on equalizing trucks, which allow the portal to move on the tracks. The base has several wheels, measuring at least 30" in diameter, double-flanged, built of rim-toughened wrought-steel. The cranes were designed to be safe, reliable, durable, and easy to operate and could travel satisfactorily on the dry dock track systems with proper allowance for imperfect alignment and grade[6].

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[3] A gantry is defined as "a mount for a traveling crane consisting of a bridge-like frame designed to move along a set of tracks."

[4] Cranes used primarily for lifting loads for ships, such as the portal cranes, floating cranes, yard derricks, and pile drivers are measured in terms of long tons (2240 pounds). The term "long ton" is a shipping term developed in historic times. It equals 2000 pounds plus the amount of additional cribbing used to protect the material being shipped, which amounts to approximately 2240 pounds. All other cranes, including the Hammerhead Crane, are measured in standard short tons (2000 pounds.)

[5] A whip hoist is a single-line auxiliary cable located at the boom tip.

[6] The crane wheels are designed to have float tolerance, and the body is designed to have a "limber deck design." As for the track's gradation change and slope, a high standard is maintained. Most of Pearl Harbor Shipyard is

Though there are several designs and sizes of the portal cranes, overall dimensions describing its rough form should be stated here. General dimensions of the cranes are as follows: The traveling portal base of the crane measures approximately 30' high; normally half of the total height of the crane's body from grade to the top of it's A-frame, which measures about 70'. The machinery house sits on a large turntable (roller paths) whose axis is also the centerline of the crane from which the luffing radii is measured. The rollerpath and its mechanisms measure 5 feet deep in section and about 23 feet in diameter. The machinery house is rectangular in plan, measuring slightly wider than the diameter of the rollerpath in width and between 35' and 40' in length. The traveling portal base has a clearance of 22'-0 ¾" in width and 25'-2" in height, for two locomotives to pass under and through. The wheel span is always exactly 28'-2 ¾" center-to-center. A 25-ton capacity portal crane weighs approximately 300 tons. A 50-ton capacity crane weighs approximately 400-500 tons.

As described in the Specification No. 11220 for the 50-ton portal cranes P-66 and P-67: "The motions of the cranes are operated by separate direct-current motors from current generated by a self-contained diesel-engine power plant. The cranes shall have a main-hoist capacity of 50 tons at a 102-foot radius, an auxiliary-hoist capacity of 15 tons at a 137-foot radius, and a whip-hoist capacity of 5 tons at a 142-foot radius . . . The work includes the provision of supervising services for the erection of the cranes and for testing after erection" (Crane Division. File "Contract No. NOy-6257, 2 50-ton D.D. Cranes."). Specifications varied slightly between contracts; however, except for the prescribed radii of the hoists, most of the information above would be standard for all portal cranes.

Rotating Tower Crane

A tower crane is similar to a portal crane, but with a tower intervening between the superstructure and the gantry or other base structure. To resist overturning moments, the assembly may be ballasted, fixed to a foundation, or a combination of both. The crane may be fixed or on a traveling base. The only Tower Crane at Pearl Harbor was the TO-1 located at the end of Pier No. 4 (Fac. S8/S9). It was a fixed crane, which ran on electric power and was capable of lifting 30 tons. It was built by the R.W. Kaltenbach Corp. under contract NOy 1165 and erected about 1935. It was removed by the late 1940s. (This crane is not discussed in the history section of this report due to its location outside of Shipyard.)

Two other fixed cranes were located on Ford Island at carrier moorings F-12 and F-13. Drawings dated November 1942 for F-12

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level, except for the stretch at Third Street (now renamed Cushing Street). The grade along this street is .75 degrees, sloping up from Dry Dock No.3 to Dry Dock No.4. Since portals do not have brakes, the operator of the portal must navigate this street with caution when traveling from Dry Dock No. 4 to Dry Dock No. 3.

show that the crane was a Bucyrus-Erie class III special dragline excavator that was mounted on a 58' high crane tower (NAVFACPAC Plan Files, drg 02725 thru 02728). The crane was powered by a 210 HP diesel engine. Two variations of the crane were shown on the 1943 drawings, one with the original 105' boom and one with a substitution 80' boom which allowed a higher working load. A note on the drawing states "Because this machine was designed for exclusive dragline operation, it is impossible to boom up high enough to make an efficient crane. If the boom is shortened to 70' by removing central section, the capacity as a crane will be increased to only 26,600#, being limited to this amount by the capacity of the boom" (NAVFACPAC Plan Files, drg 02725). Apparently there was also a fixed crane at F-5 mooring on Ford Island; a note on a drawing for F-13 dated August 1943 states "Cranes at F5 and F12 shall be similar" (NAVFACPAC Files, drg V-N15-170). After moorings F-12 and F-13 were connected in 1945, the two fixed cranes were replaced with a Clyde Whirley 30-ton portal crane, mounted on rails spanning the length of the connecting quay.

Stiff Leg Crane

A stiff leg crane is a stationary crane with a single jib that rotates about a center post. The crane has two other legs, which give stability to the crane, but do not rotate or move. The jib leg luffs and hoists. The crane is relatively lightweight, able to lift only 10 tons. This crane type was used for early construction at Pearl Harbor Navy Yard, especially for Dry Dock No. 1. There was only one of this type at Pearl Harbor remaining after WW II. The S74 was built in 1939 and located at Ford Island. It was demolished in 1984.

Hammerhead Crane

The largest crane at Pearl Harbor was the Hammerhead crane (HH1), which was a stationary crane that could lift 200 tons (400,000 pounds) at 85 feet from the centerline of the crane.[7] There are three components to the structure: the Support Structure, which includes the four outside columns and main support girders and the associated bracing systems; the Rotating Structure sits on top of the four columns up to the ring gear and includes the associated bracing systems; and the Superstructure, which includes the two horizontal trusses that support the load block and the rail beam. The hoist house is included in the superstructure. This crane had a height of 166'-1 ½", a boom[8] extending horizontally 134'-6" from the

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rane is the center of rotation of the crane. All the radii of the crane are measured from the center of rotation. The centerline is the vertical line about which a crane swings, and is sometimes referred to as the focal point of the crane (ASME B30.4, 1990; p.5).

[8] A member for supporting the hoisting tackle, hinged to the front of the rotating superstructure, supported by ropes or hydraulic cylinder from the rotating superstructure (ASME B30, 4-1990, p.5).

centerline, and a load block 69'-6" from centerline. It weighed 960 tons and was one of the most prominent structures at the Naval Base.

The crane was powered by electricity, with power being supplied from a substation located on the pier (Fac. S132). The main hoist ran off two motors, each 110 H.P. The auxiliary hoist ran off one motor of 110 H.P. The main hook has a maximum radius of 85 feet with a lift height of 130 feet from the water line. The design capacity of the auxiliary hook is 60,000 pounds. It has a maximum radius of 125 feet with a lift height of 138 feet from the water line. The various individual members of the crane are fabricated from steel plate and hot rolled structural shapes. All connections are made using driven rivets except in those members that were replaced or repaired subsequent to the initial erection, in which case bolts were used in the connections.

Because of the great capacity of this crane, it could be used for several purposes. Among its most notable lifts: lifting 15-ton and 25-ton capacity portal crane cabs for work on their rotating platforms and portal crane legs for work on the crane track wheels; lifting gun mounts and other heavy equipment off and onto ships; lifting the M-130 container off and onto the transport ship to support nuclear submarine refueling (M-130 container weight: empty – 257,240 pounds; fully loaded – 269,740 pounds.) (Crane Division file "385-69-75 Hammerhead Crane Study" and Pearl Harbor Naval Shipyard Code 385.41:BK 1973)

Floating Cranes, Yard Derricks, and Pile Drivers

Floating cranes, yard derricks, and floating pile drivers of varying capacities supported the dredging and shoreline construction, assisted shore cranes in the fitting out of vessels, and were used in connection with repairs to ships. A floating crane consists of a rotating, yet non-luffing jib and a machinery house, which sits on a floating base. The crane's function is to handle loads at various radii. (ASME 1999: 6) In smaller capacity floating cranes, the machinery house and jib are contained within a single structure; however, in the larger capacity cranes, the jib and machinery house are separate structures. The mechanical and hoisting unit included the steel boom; A-frame; housing; rotating platform; rollers; roller paths and supporting framing; diesel engine power unit; hoisting, rotating and luffing machinery; ropes; ladders; platforms and walks; auxiliary equipment; tools and all accessories. The largest floating crane was the YD-121, which had a capacity of 125 tons. It was manufactured by Anthony Meyerstein, Inc in 1946.

A floating derrick is defined as a mast or equivalent member held at the head by guys or braces, with or without a boom, for use with a hoisting mechanism or operating ropes, mounted on a barge or pontoon. The power source is usually mounted on the pontoon but

may be located below decks. (ASME 1999: 6) The YD-025 was the largest of the floating derricks at Pearl Harbor, with a capacity of 150 tons. It was manufactured by Wellman, Seaver, Morgan, Co. in 1913.The only wooden floating derrick was the YD-5, a 50-ton floating derrick manufactured by Haviside Harrison Co.

The floating crane and derrick was designed to function as both a dredging mechanism and a crane mechanism. As a dredging mechanism, a clamshell bucket was attached to the end of the line, instead of a hook for lifting. The bucket is capable of moving vertically from 80 feet below water level to 35 feet above water level. When it is used for crane service, the main hook is able to move vertically from the level of the deck to 50 to 100 feet above it, depending upon the size of the jib and the capacity. The machinery house was a watertight section used for housing the crane-dredge machinery and operator's stand, securely fastened to the rotating platform or the pontoon, whichever may be the case. Power for driving the crane-dredge machinery was provided by a diesel engine.

Mooring and scow-handling winches complete with motors and controls, auxiliary equipment as needed, and a diesel generator for operating the equipment were installed on the pontoon proper for navigation and anchoring of the pontoon. The mooring and drums were to operate completely independent of the crane-dredge proper.

The standardized pontoon base of WWII was developed during World War II and is considered one of the most significant designs that contributed to the war effort. Pontoon sections were built with quarter-inch steel plates at the top and bottom, and 10-gauge metal for sides and ends. Inside, there were braces to withstand an internal pressure of 25 psi.

> There were three types of pontoons [sections]: the 5-by-7-by-5 foot, for universal use, the curved-bow pontoon for transport service, and the wedge-box pontoon for landing use. The pontoons were assembled into three standards sizes of barges, three by seven, 50-ton; four by twelve, 100 ton, and six by eighteen, 150 ton (U.S. Department of the Navy Bureau of Yards and Docks; 1947, vol. 1: 157, 158).

However, other sizes of pontoon barges were made as required. Cranes, gasoline tanks, drilling rigs, pile drivers were mounted on barges, of which, crane pontoons being the most common pontoon type at Pearl Harbor (U.S. Department of the Navy, Bureau of Yards and Docks; 1947, vol. 1: 156-158).

<u>Bridge Gantry</u>

The bridge gantry is an assembly of two steel trusses supported on H-section columns. There were two bridge gantries at Pearl Harbor: BG-1 and BG-2. Both had a 340-foot distance between legs, which

completely spanned the width of Dry Docks No. 2 and 4. BG-2 had an extra 178-foot cantilever extension that projected over Dry Dock No. 3 and was used for the concurrent construction of Dry Dock No. 2 and 3. Two traveling power carriages developed a lifting capacity of 30 tons each, at 30 feet a minute.

> The entire assembly moved (at 250' per minute) on steel rails extending the full length of the dock, supported on wood piling. The crane placed the 180-foot tremie trusses of Dry Dock No. 2; handled cofferdam sections, form panels, reinforcing steel, and deposition of tremie concrete for the dry docks (Pacific Bridge Co., n.d.: 29).

Bridge Crane

Although most of the bridge cranes were interior cranes located within various industrial buildings, there was one, BC-1, which was an exterior bridge crane at Pearl Harbor. A bridge crane is a horizontal support truss with a hook for lifting that moves back and forth along a stationary support system. The hook itself is also mobile, traveling along the horizontal truss system. The bridge crane is similar to the Bridge Gantry in its function of being able to span a great distance, but differs in that the bridge and the hoist move along a stationary elevated rail supported by several pairs of intermittently spaced support structures (Mondik 2002 and Kilikewich 2002). This report does not cover the various interior bridge cranes used inside of industrial buildings.

Pearl Harbor Naval Base Complete Crane Table 1912 – 1950

The following table is a complete[9] list of all exterior cranes procured for the Pearl Harbor Naval Base from 1912 until the early 1950s. Cranes are listed by crane type, in chronological order. The dates listed here are dates when the cranes became operational at Pearl Harbor. This date should not be confused with the date of the beginning of crane production, which may be up to two years earlier than operational date. Crane capacity is given in tons. Cranes used primarily for lifting loads for ships, such as the portal cranes, floating cranes, yard derricks, and pile drivers are measured in terms of long tons. All other cranes are measured in standard short tons.

	Crane No.	Manufacturer	Contract No.	Date	Type	Power	Cap. (Tons)	Comment
1	BC-1	St. Louis Shipbuilding Corp.	5193	1912	Exterior Bridge Crane		25	
2	BC-1 (Fac. 1236)	Yard Labor	No contract	1946	Exterior Bridge Crane	Electric		Along Central Avenue
3	BD-241			1945 (Year Transf. to PH)	Barge Derrick		30	
4	BG-1	Judson- Pacific Corp. / Pacific Bridge Company	NOy 5049	1941	Bridge Gantry	Electric	30 tons each hook	Built DD # 2,3, 4
5	BG-2	Judson- Pacific Corp. / Pacific Bridge Company	NOy 5049	1940	Bridge Gantry	Electric	30 tons each hook	Built DD # 2, 3, 4. Moved to Ford Is. Blew over 1960.
6	C-01	Harnischfeger Corp.	NOy 3712	1929	Crawler	Gas	10	
7	C-02	Harnischfeger Corp.	NOy 4365	1931	Crawler	Gas	10	
8	C-03	Koehring Co.	NOy 10463	1936	Crawler	Gas	15	
9	C-04B	Byers Shovel & Crane Co.	N311S 18201	1941	Crawler	Diesel	5	
10	C-05	Marion Steam Shovel Co.	N311S 18427	1942	Crawler	Diesel	15	
11	C-06	Marion Steam Shovel Co.	N311S 19032	1942	Crawler	Diesel	12	
12	C-07	Marion Steam Shovel Co.	N311S 19032	1942	Crawler	Diesel	12	
13	C-08	Marion Steam Shovel Co.	N311S 18034	1942	Crawler	Gas	12	
14	C-09	Marion Steam Shovel Co.	N311S 18034	1942	Crawler	Gas	12	
15	C-10	Marion Steam Shovel Co.	N311S 18034	1942	Crawler	Gas	12	

[9] The list is as complete as can be ascertained through the research done for this report. There may, however, be some truck cranes and locomotive cranes that were purchased but have not been identified in this report.

	Crane No.	Manufacturer	Contract No.	Date	Type	Power	Cap. (Tons)	Comment
16	C-11	Marion Steam Shovel Co.	N311S 18034	1942	Crawler	Gas	12	
17	C-13	Northwest Engineering Corp.	NOy 5049	1944	Crawler		40	
18	C-17	Marion Steam Shovel Co.	N311S 18034	1943	Crawler	Diesel	15	
19	C-18	Baldwin-Lima-Hamilton Corp.	N-160-249s-10103	1952	Crawler		48	
20	C-20	Thew Shovel Co.	N311S 22288	1941	Crawler	Gas	10	
21	C-24	Hughes - Keenan Co.	NOs 74705	1944	Crawler Hoist	Diesel	3	
22	C-30	Austin Western Mfg. Co.	600-5784	1944	Crawler	Gas	4	
23	C-31	Byers Crane & Shovel Co.	NXSY 38597	1944	Crawler	Gas	5	
24	C-38	Northwest Engineering Co.	NOy 8173	1944	Crawler	Diesel	15	
25	C-39	Northwest Engineering Co.	NOy 8173	1944	Crawler	Diesel	15	
26	C-40	Northwest Engineering Co.	NOy 8173	1944	Crawler	Diesel	15	
27	C-41	Northwest Engineering Co.	NOy 8173	1944	Crawler	Diesel	15	
28	C-42	Byers Crane & Shovel Co.		1945	Crawler	Gas	5	
29	C-43	Byers Crane & Shovel Co.		1945	Crawler	Gas	5	
30	C-44	Hughes - Keenan Co.		1945	Roustabout Crawler	Diesel	5	
31	C-45	Hughes - Keenan Co.		1945	Crawler	Diesel	5	
32	C-46	Hughes - Keenan Co		1945	Roustabout Crawler	Diesel	5	
33	C-47	Hughes - Keenan Co.		1945	Roustabout Crawler	Diesel	5	
34	C-48	Hughes - Keenan Co.		1945	Roustabout Crawler	Diesel	5	
35	C-49	Northwest Engineering Co.		1945	Crawler	Diesel	23	
36	C-50	Northwest Engineering Co.	NOy 5049	1944	Crawler	Diesel	30	
37	C-51	Northwest Engineering Co.	NOy 5049	1944	Crawler	Diesel	30	
38	C-52	Northwest Engineering Co.	NOy 5049	1944	Crawler	Diesel	30	
39	C-53	Northwest Engineering Co.	NOy 5049	1944	Crawler	Diesel	40	
40	C-54	Northwest Engineering Co.	NOy 5049	1944	Crawler	Diesel	40	
41	C-55	Manitowol Speed Crane Mfg. Co.	NOy 5049	1943	Crawler	Diesel	50	
42	C-57	Northwest Engineering Co.		1944	Crawler	Diesel	9	
43	C-58	Northwest Engineering Co.		1944	Crawler	Diesel	9	
44	C-59	Northwest Engineering Co.		1944	Crawler	Diesel	30	
45	C-60	Linkbelt Crane Co.		1944	Crawler	Gas	5	
46	C-61	unknown		1944?	Crawler			
47	C-62	unknown		1944?	Crawler			
48	C-63	unknown		1944?	Crawler			
49	C-64	unknown		1944?	Crawler			
50	C-65	unknown		1944?	Crawler			
51	C-66	unknown		1944?	Crawler			
52	C-67	unknown		1944?	Crawler			
53	C-68	unknown		1944?	Crawler			
54	C-69	unknown		1944?	Crawler			
55	C-70	unknown		1944?	Crawler			
56	LC-01	Brown Hoisting Machinery Co.	NOy 1876	1912	Locomtv. Crane	Steam	15	

	Crane No.	Manufacturer	Contract No.	Date	Type	Power	Cap. (Tons)	Comments
57	LC-02	Brown Hoisting Machinery Co.	NOy 1908	1912	Locomtv. Crane	Steam	15	
58	LC-03	Brown Hoisting Machinery Co.	NOy 1943	1913	Locomtv. Crane	Steam	15	
59	LC-04	Brown Hoisting Machinery Co.	NOy 1943	1913	Locomtv. Crane	Steam	15	
60	LC-05	Brown Hoisting Machinery Co.	NOy 1943	1913	Locomtv. Crane	Steam	15	
61	LC-06	Brown Hoisting Machinery Co.	NOy 1943	1913	Locomtv. Crane	Steam	15	
62	LC-07	Brown Hoisting Machinery Co.	NOy 1943	1913	Locomtv. Crane	Steam	15	
63	LC-08	Brown Hoisting Machinery Co.	NOy 1943	1913	Locomtv. Crane	Steam	15	
64	LC-09	American Hoist & Derrick Co.	NOy 2127	1915	Locomtv. Crane	Steam	10	
65	LC-10	American Hoist & Derrick Co.	S & A	1915	Locomtv. Crane	Steam	10	
66	LC-11	Brown Hoisting Machinery Co.	NOy 34363	1918	Locomtv. Crane	Steam	10	
67	LC-12	Brown Hoisting Machinery Co.	NOy 1943	1923	Locomtv. Crane	Steam	10	
68	LC-13	Browning Engineering Co.	Y & D 1552	1911	Locomtv. Crane	Steam	15	
69	LC-14	Ohio Locomotive Crane Co.	Y & D Req. 111 Noy 23374	1917	Locomtv. Crane	Steam	15	
70	LC-15	Browning Crane & Shovel Co.	NOy 4854	1941	Locomtv. Crane	Steam	30	
71	LC-16	Orton Crane & Shovel Co.	NOy 4965	1942	Locomtv. Crane	Diesel Friction	16.5	
72	LC-17	Orton Crane & Shovel Co.	NOy 4965	1942	Locomtv. Crane	Diesel Friction	16.5	
73	LC-18	Orton Crane & Shovel Co.	NOy 4965	1942	Locomtv. Crane	Diesel Friction	16.5	
74	LC-19	Orton Crane & Shovel Co.	NOy 4965	1942	Locomtv. Crane	Diesel Friction	16.5	
75	LC-20	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
76	LC-21	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
77	LC-22	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
78	LC-23	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
79	LC-24	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
80	LC-25	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
81	LC-26	Orton Crane & Shovel Co.	NOy 5073	1942	Locomtv. Crane	Diesel Friction	16.5	
82	LC-27	Browning Crane & Shovel Co.	NOy 4854	1942	Locomtv. Crane	Steam	30	
83	LC-28	Ohio Locomotive Crane Co.	NOy 5489	1942?	Locomtv. Crane	Diesel Friction	42	

	Crane No.	Manufacturer	Contract No.	Date	Type	Power	Cap. (Tons)	Comments
84	LC-29	Industrial Brownhoist Corp.	NOy 5559	1942	Locomtv. Crane	Steam	30	
85	LC-30	Ohio Locomotive Crane Co.	NOy 5913	1943	Locomtv. Crane	Diesel Friction	30	
86	LC-31	Ohio Locomotive Crane Co.	NOy 6634	1944	Locomtv. Crane	Diesel Friction	30	
87	LC-32	Ohio Locomotive Crane Co.	NOy 6634	1944	Locomtv. Crane	Diesel Friction	30	
88	LC-33	Industrial Brownhoist Corp.	NOy 10600	1945	Locomtv. Crane	Diesel Friction	27	
89	LC-34	Industrial Brownhoist Corp.	NOy 10600	1945	Locomtv. Crane	Diesel Friction	27	
90	P-1 (later called HH-1)	Wellman, Seaver, and Morgan	Noy 2231	Procured / 1933 Erected/ 1935	Hammerhead	Electric	Tested / 200 Rated/ 300	
91	P-102	Variety Iron & Steel Works	12053	1919	Pintle	Steam, mod. to electric 1933	15	Assigned to Marine Railway. Gantry added1922.
92	P-51	Victor E. Browning Co. Inc.	NOy 2261	1918	Portal	Electric	50	
93	P-52	Star Iron & Steel Works, Inc.	NOy 2031	1934	Portal	Diesel Electric	50	
94	P-53	Star Iron & Steel Works, Inc.	NOy 2031	1935	Portal	Diesel Electric	15	
95	P-54	Star Iron & Steel Works, Inc.	NOy 2031	1935	Portal	Diesel Electric	15	
96	P-55	Star Iron & Steel Works, Inc.	NOy 2031	1935	Portal	Diesel Electric	15	
97	P-56	R.W. Kaltenbach Corp.	NOy 4117	1941	Portal	Diesel Electric	15	
98	P-57	R.W. Kaltenbach Corp.	NOy 4621	1941	Portal	Diesel Electric	15	
99	P-58	R.W. Kaltenbach Corp.	NOy 4621	1941	Portal	Diesel Electric	25	
100	P-59	Star Iron & Steel Works, Inc.	NOy 4753	1942	Portal	Diesel Electric	50	
101	P-60	R.W. Kaltenbach Corp.	NOy 5298	1943	Portal	Diesel Electric	25	
102	P-61	R.W. Kaltenbach Corp.	NOy 5298	1943	Portal	Diesel Electric	25	
103	P-62	R.W. Kaltenbach Corp.	NOy 5298	1943	Portal	Diesel Electric	25	
104	P-63	Star Iron & Steel Works, Inc.	NOy 5652	1943	Portal	Diesel Electric	50	
105	P-64	Star Iron & Steel Works, Inc.	NOy 5761	1943	Portal	Diesel Electric	15	
106	P-65	R.W. Kaltenbach Corp.	NOy 5298	1943	Portal	Diesel Electric	25	

	Crane No.	Manufacturer	Contract No.	Date	Type	Power	Cap. (Tons)	Comments
107	P-66	Anthony M. Meyerstein, Inc.	NOy 6257	1945	Portal	Diesel Electric	50	
108	P-67	Anthony M. Meyerstein, Inc.	NOy 6257	1945	Portal	Diesel Electric	50	
109	P-68	R.W. Kaltenbach Corp.	NOy 10593	1945	Portal	Diesel Electric	25	
110	P-69	R.W. Kaltenbach Corp.	NOy 10593	1945	Portal	Diesel Electric	25	
111	P-70	R.W. Kaltenbach Corp.	NOy 10594	1945	Portal	Diesel Electric	25	
112	P-71	R.W. Kaltenbach Corp.	NOy 10595	1945	Portal	Diesel Electric	25	
113	P-72	R.W. Kaltenbach Corp.	NOy 10596	1945	Portal	Diesel Electric	25	
114	P-73	Wellman Engineering Corp.	NOy 8183	1944	Portal	Diesel Electric	25	
115	S-74			1939	Stiff Leg Crane		10	Ford Is. 1984 demo
116	T-12	Byers Machine Co.	N.A.*	1942	Truck	Gas	5	
117	T-13	R.G. LeTourneau, Inc.	N.A.*	1944	Truck	Diesel	10	
118	T-14	R.G. LeTourneau, Inc.	N.A.*	1944	Truck	Diesel	10	
119	T-15	Bay City Shovels, Inc.	N.A.*	1942	Truck	Gas	20	
120	T-16	Bay City Shovels, Inc.	N.A.*	1942	Truck	Gas	20	
121	T-18	Thew Shovel Co.	N.A.*	1942	Truck	Gas	15	
122	T-19	Thew Shovel Co.	N.A.*	1942	Truck	Gas	15	
123	T-21	R.G. LeTourneau, Inc.	N.A.*	1944	Truck	Diesel	30	
124	T-21A	R.G. LeTourneau, Inc.	N.A.*	1944	Truck	Diesel	30	
125	T-22	Hughes - Keenan Co.	N.A.*	1944	Truck	Gas	3	
126	T-23	Hughes - Keenan Co.	N.A.*	1943	Truck	Gas	3	
127	T-25	Hughes - Keenan Co.	N.A.*	1943	Truck	Gas	3	
128	T-28	Service Supply Co.	N.A.*	1943	Truck	Gas	3	
129	T-28A	Service Supply Co.	N.A.*	1943	Truck	Gas	3	
130	T-29	Byers Shovel & Crane Co.	N.A.*	1943	Truck	Gas	3	
131	T-32	Hughes - Keenan Co.	N.A.*	1944	Truck	Gas	3	
132	T-33	Hughes - Keenan Co.	N.A.*	1944	Truck	Gas	3	
133	T-34	Hughes - Keenan Co.	N.A.*	1944	Truck	Gas	3	
134	T-35	Hughes - Keenan Co.	N.A.*	1944	Truck	Gas	3	
135	T-36	Thew Shovel Co.	N.A.*	1944	Truck	Gas	15	
136	T-37	Thew Shovel Co.	N.A.*	1944	Truck	Gas	15	
137	T-38	Thew Shovel Co.	N.A.*	1943	Truck	Gas	15	
138	T-39	Thew Shovel Co.	N.A.*	1943	Truck	Gas	15	
139	T-40	Bay City Shovels, Inc.	N.A.*	1944	Truck	Gas	20	
140	TO-1 or Crane No. 10	R.W Kaltenbach Corp.	NOy 1165	1932	Tower or Revolving Crane	Electric	30	Assigned to Submarine Base. Removed c. 1940s

	Crane No.	Manufacturer	Contract No.	Date	Type	Power	Cap. (Tons)	Comments
141	YD-005	Haviside Harrison Co.	unknown	1941	Floating Derrick		50	
142	YD-09				Floating Derrick	Oil	10	
143	YD-025	Wellman, Seaver, Morgan Co.	NOy 1548	1913	Floating Derrick	Diesel	150	
144	YD-042			1957	Floating Derrick			
145	YD-068	Lidgerwood Mfg. Co.	30261	1940 transferred from San Diego	Floating Derrick	Oil	15	Loaned from San Diego but was not returned and was diposed of by PH
146	YD-069	Bucyrus Erie Company	NOy 4805	1942	Floating Derrick		50	
147	YD-080	Portland Tug & Barge Co.	NOy 6290	1943	Floating Derrick		15	
148	YD-082	Anthony M. Meyerstein, Inc.	NOy 5687 and 5801	1936	Floating Crane		50	20' Boom extension in 2/1946.
149	YD-107	Hawaiian Dredging Co.	NOy 5949	1944	Floating Derrick		120	Reactivated 1951
150	YD-118	Clyde	NOy 9039	1945	Floating Crane		27.5	
151	YD-121	Anthony M. Meyerstein, Inc.	NOy 6303	1946	Floating Crane		125	inactivated late 1980s
152	(Y)D1256	Marion Steam Shovel		1945?	Floating crane	Diesel		Steel Pontoon
153	YD-152							inactivated c. 1950
154	YD-173	Northwest Engineering Co.	23527	1943	Yard Derrick		10	
155	YD-174	Marion Steam Shovel Co.	NOy 13531	1942	Floating Crane Yard Derrick		30	
156	YPD-16	Navy Yard Pearl Harbor		1942	Floating Pile Driver		50	
157	YPD-42	Cleaver Brooks	NOy 90466	1957	Floating Pile Driver		200 H.P.	
158	YSD-19	American Hoist and Derrick Co.	None	1948?	Yard Salvage Derrick No. 19	Diesel	60	
159	YSD-9			c. 1932	Seaplane salvage Derrick			1951 inactivated

N.A.* Trucks did not receive contract numbers
NOy : Contract for Bureau of Yards and Docks
NOs : Contract for Bureau of Supplies and Accounts

Historical Context:

1. Crane Use during the Early Establishment of the Navy Yard (1901 – 1916)

The first cranes to be acquired by Pearl Harbor were the cranes that would support base development and construction. Until the entrance channel at Pearl Harbor had been dredged, which was not substantially accomplished until 1911, it was not practical to develop facilities there. However, soon after dredging was completed, four cranes were purchased to further the establishment of base facilities.

Locomotive cranes. Locomotive cranes were the first type of cranes acquired for the Pearl Harbor Naval Station. Locomotive cranes were ideal for the infant base where only standard rail tracks for trains had yet been established. The first crane purchased was a locomotive crane with a capacity of 15 tons in 1911 (LC-13). The other two cranes were locomotive cranes LC-01 and LC-02, both purchased in 1912. They were steam-powered locomotives with a 15-ton maximum lifting capacity, manufactured by the Brown Hoisting Machinery Co. The third order of locomotive cranes was filled to assist in the functions of the Coal Dock. Until the 1930s, power was still generated largely by coal fuel; this was true for the older ships and for the locomotive cranes. A coaling depot at Pearl Harbor (see HABS HI-517) with a 100,000-ton capacity was completed in 1918 [10] (Palumbo, 2000: 2). Six locomotive cranes (LC-03 to LC-08) for loading coal from the stockpile into cars were ordered in 1913. These were all 15-ton cranes built by Brown Hoisting Machinery Company under Contract No. NOy-1943. The total cost of six locomotive cranes built, erected and ready for use was $56,178.36 (U.S. Navy, Bureau of Yards and Docks 1916: n.p.). Two more locomotive cranes, LC-09 and LC-10, were funded for Pearl Harbor under the congressional Act of March 4, 1913, and titled "Naval Station, Pearl Harbor; Railroad Equipment". The contract, number NOy-2127, was awarded on February 8, 1915 to the American Hoist & Derrick Co. in St. Paul, Minnesota. The work, including delivery and erection on tracks at Naval Station, Pearl Harbor, was completed in August 18, 1915. The cost of the contract was $13,939.00.

Bridge Crane. The second crane at Pearl Harbor, ordered just after LC-13, was an exterior bridge crane (BC-1) installed in 1912.[11] This crane was built by the St. Louis Shipbuilding Corp. and was capable of lifting 25 tons. The location and exact use of this crane is unknown, but it may have been located within the Coal Dock or near Marine Railway No.1, or may possibly have been the bridge crane for the boiler and shipfitters' shop (Fac. 4), as an interior/exterior bridge crane (Marocef, 1929).

Dry Dock No. 1 and the Floating Crane YD-025. The ingenious construction methods for Dry Dock No. 1 necessitated the purchase of a substantial floating crane. Dry Dock No. 1 construction began about the same time as the dredging of the channel, starting in 1909. However, completion of the dry dock was delayed for several years due to a major accident more than halfway through the first undertaking. After four years of construction, the partially completed dry dock burst because of hydrostatic pressure in 1913. Construction resumed two

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[10] The coal plant was a huge complex comprised of the coal dock; coal storage basin on shore; standard gauge railroad tracks on steel trestle (an open-based framework for supporting the elevated train tracks) over the wharf and storage basin; and two coal hoisting towers running upon rails supported on the wharf trestle.

[11] This crane should not be confused with crane BC-1 (Fac. 1236) installed in 1946 along Central Avenue near the Sixth Street intersection.

years later when additional funds and materials were made available for a new undertaking.[12] Construction of the "new" project continued until 1919 and was considered a substantial feat by the Navy. The YD-25 was a magnificent sight to see along the barren shoreline. It had two main hoists, which had a maximum lifting capacity of 150 tons and one auxiliary hoist with a maximum lifting capacity of 15 tons. These hoists traveled on trolleys that spanned the length of the bridge. Its barge size was 70' by 125' by 14'. It was manufactured by Wellman, Seaver, Morgan Co. in 1913 under contract number 1548 and was brought from the New York Shipyard. It was a diesel electric powered crane with a bridge length of 289'-7". YD-25 was used to construct several other piers and wharfs at Pearl Harbor after its main task was compete. One such project was the construction of the Torpedo Boat Piers in 1917 that were located adjacent to the Marine Railway No. 1 (These piers were replaced by the Repair Basin constructed in 1942.)

Dry Dock No. 1 and the P-51. Dry Dock No. 1 (see HAER HI-65), designed like other dry dock systems at the time, had an integrated rail system. The development of a complex rail system, which could service practically all the needs of transportation and material handling on base, allowed for the simultaneous use of locomotives, locomotive cranes, and large portal cranes. Just as the dry dock was nearing completion, the first 50-ton Portal crane, the P-51, was brought to Pearl Harbor. It was erected in 1920, as the first portal crane for Dry Dock No.1.

2. World War I at the Navy Yard (1917-1919)

The growth of the Navy Yards on the continent during 1917 and 1918 was phenomenal. The great naval three-year program of 1916 provided for the expansion of the fleet. After the beginning of the World War in 1914, America realized that immense additions to the fleet, the naval shore facilities, and the merchant marine would be necessary, less it be drawn into a war unprepared (U.S. Department of the Navy, Bureau of Yards and Docks 1921:19). With this expansion was the acquisition of several types of locomotives and cranes (U.S. Department of the Navy, Bureau of Yards and Docks 1921: 470-474).

Although World War I had centered in Europe, it had an effect on the Pacific. Even before World War I, U.S. Navy officers had started viewing the Pacific as the next likely center of conflict, and the Japanese as potential enemies. With the completion of the Panama Canal in 1914, the Atlantic Fleet was able to more quickly move to the Pacific. In May 1919, the U.S. Fleet had been divided into Atlantic and Pacific components. At this time, Pearl Harbor did not have the facilities to support the whole U.S. fleet, but the goal was to develop the installation so that it could accommodate the entire fleet (Yoklavich 2000: 5).

Portal Crane Development. Portal crane development was a new technologically advanced tool for the Dry Docks. They were described as "Special Locomotive Cranes" in the 1921 publication *Activities of the Bureau of Yards and Docks*. In this publication, the need for

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[12] In 1909, the initial contract was awarded to Pacific Bridge Company, and the price for the dry dock totaled over $3 million by 1913. In February 1913, the partially completed facility was destroyed by hydrostatic pressure, which burst the concrete bottom, and collapsed side sections. Luckily, workers were able to get out before the dry dock exploded, but four years of construction lay in ruins (*Pearl Harbor Log* 1953:5).
Construction of the dry dock resumed about two years later. The new design was ingenious, utilizing precast sections that were lowered into place under water, then joined together with poured concrete. This was the critical facility for the Navy Yard, and its main function of ship repair could not be optimized until this dry dock was completed.

producing more of the portals was expressed. It states that the Navy purchased four 50-ton portal cranes: New York 1; Philadelphia 2; Norfolk, 1; and Pearl Harbor, Hawaii, 1. It is interesting to note that at the time, there were 9 naval yards, but only four were sent cranes, Pearl Harbor, being among them. Pearl Harbor received three cranes during the three-year program of 1916, two locomotive cranes and one portal crane, the LC-14 (1917), the LC-11 (1918), and the P-51 (1918) (U.S. Department of the Navy, Bureau of Yards and Docks 1921: 412).

Marine Railway No. 1 and the Pintle Crane P-102. Marine railway development was considered a priority for the Navy because it was a convenient and economical way of repairing and overhauling the numerous smaller vessels of the Navy. The Congressional Act of October 6, 1917 contained an appropriation of $350,000 for the "marine railways at navy yards and stations." The naval appropriation acts of March 4, 1913, and July 1, 1918, made specific appropriations for a marine railway at "the naval station, Pearl Harbor, Hawaii". The construction of the 2,500-ton marine railway, measuring 332' long by 42' wide, was started at Pearl Harbor in 1918 and continued through 1920 (U.S. Navy, Bureau of Yards and Docks, 1921: 210-214). The pintle crane, the P-102, was the first crane used for ship repair at Pearl Harbor in 1919, at Marine Railway No. 1. However, in 1922, the pintle was disassembled and reassembled on a large portal base and assigned to Marine Railway for the remainder of its life.

3. Between the World Wars at the Navy Yard (1920s & 1930s)

Fleet maneuvers were frequently held in Hawaiian waters in the 1920s and 1930s, and these exercises often led to increased appropriations for improvements at Pearl Harbor. During the 1935 war games, 163 ships were anchored in the Pearl Harbor lochs. The importance of Pearl Harbor as the westernmost repair base in the Pacific was recognized by the Chief of Naval Operations. In the late 1930s, ships were purposely sent to Pearl Harbor, rather than to mainland shipyards, for repair and overhaul, to prepare this Navy Yard for the types of workloads that were expected with a Pacific war looming (Yoklavich 2000: 4 and Coletta 1985: 448).

Portal Cranes P-52, P-53, P-54, P-55 and the Repair Basins. In the 1930s, a major project in the Pearl Harbor Navy Yard was the construction of two additional Repair Basins located adjacent to the Marine Railway No. 1. In order to support these facilities, a used Hammerhead crane and four new portal cranes were delivered to Pearl Harbor. Portal cranes P-52 (50-ton), P-53 (15-ton), P-54 (15-ton), and P-55 (15-ton) were diesel electric traveling cranes ordered under contract number NOy-2031. They were manufactured by Star Iron and Steel Works, Inc. in 1934 and were erected at the naval shipyard in 1935.

The Hammerhead Crane was brought in from the Brooklyn Navy Yard in 1933 in order to support the developing Naval Fleet at Pearl Harbor. It was erected near berthing facility B-12 at the Repair Basin. This crane was the largest and most visible crane at Pearl Harbor. It was purchased for the sum of $422,444.24. It took almost two years for the crane to be erected and it was operational by 1935 (File "385-69-75 Hammerhead Crane Study and "Demolition of Hammerhead Crane HH-1"). According to an interview with David Kilikewich, an employee of the Pearl Harbor crane division between the years 1967-2002, the hammerhead was originally built in 1915 and it was rated at a 300-ton capacity when it was first constructed. However, when it came to Pearl Harbor, it was tested for a maximum of 200 tons, because that was all that was required. If a load of 300 tons was likely to be carried at

Pearl Harbor, they would have tested it for the 300-ton load and it would be rated as such; however, gathering enough materials to test the lift was a substantial effort.

4. Intensified Crane Procurement Prior to and during WWII (1939-1945)

Crane procurement and erection at Pearl Harbor was at a frantic pace prior to and during World War II.[13] Between the years 1939 to 1945, the Pearl Harbor Naval Shipyard procured cranes of every type. Before 1939, Pearl Harbor had only 1 exterior Bridge Crane; 6 Portal cranes (including a converted pintle crane); 1 Floating crane; 1 Hammerhead crane; 14 Locomotive cranes; 3 Crawler cranes; and 1 Tower crane, for a total of 27 cranes. By January 1, 1946, the fleet had 1 Bridge Crane; 22 Portal cranes, 2 Bridge Gantry cranes; 9 Floating cranes including YD-16 and YSD-19; 1 Hammerhead crane; 25 Locomotive cranes; 33 Crawler cranes; 19 Truck cranes; and 6 boats, fuel barges etc. for a total of 115 cranes (Pearl Harbor Naval Shipyard 1946).

The pace of ordering, fabricating, and erecting the cranes and pontoons was accelerated. Just after the outbreak of the war, 4 Marion Crawler Cranes were ordered. Apparently, just two days before the attack on Pearl Harbor, two crawler cranes were to be ordered (Chandler, 1941). However, by December 11, a specification for four cranes had been written and distributed to the various companies for bid. Time was a factor. It states, "Due to the urgent need for this material the right is reserved to make award to the bidder offering delivery and price which will best meet the needs of the Government" (Crane Division File "Contr. N311s-18934 4 Marion Cranes"). The specification was necessitating a delivery date of February 2, 1942, less than three months from time of purchase.

Of course, this rapid escalation of crane procurement did not go without delays and hindrances; however, the high morale of the crews was a significant factor in the rapid completion of the cranes and pontoons. This is stated in several of the letters and memos in the crane files. In one such file, regarding the 50-ton floating crane, a letter dated 7, July 1944, from the Public Works Officer to the Pearl Harbor Ship Repair Unit, states:

> Many handicaps were experienced during the programs of the work, which tended to delay the completion of the project. But the effort of the individuals,

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[13] Most of the work done during the time of intense military buildup during World War II was contracted to two firms, the Pacific Bridge Company and the Contractors Pacific Naval Air Bases. The contract for the construction of Dry Dock No. 4 and other facilities was awarded to Pacific Bridge Company on October 4, 1941. The contractor, already at work on Dry Docks No. 2 and No. 3, began work on these new facilities during November 1941 (U.S. Navy Bureau of Yards and Docks 1947: 122). Dry Dock No. 4 was ready for emergency use by July 19, 1943. By October 1, 1943, both main pumps (on the west side), and one east-side pump were ready for operation (except for the substitution of different-type propellers specified by the Bureau). By this date, also, the floor and bottom altar were complete, keel blocks in place; fresh- and salt-water, air and steam lines were completed and connected. The first docking occurred on October 6, 1943 (Pacific Bridge Company 1944: 84).

[14] The contract to begin building Dry Docks No. 2 and 3 was signed on December 20, 1939 and final plans issued December 22, 1939. Fieldwork for Dry Dock No. 2 was begun December 27, 1939. Construction length was anticipated to be 2 years; however, the dry dock was completed faster than scheduled, and several weeks before the Japanese attack, Dry Dock 2 had been brought to a stage of completion such that it was used to repair Navy craft affected by the "blitz." Construction of Dry Dock No. 3 was constructed concurrent to Dry Dock No. 2, but it was completed just after Dry Dock No. 2, in January 1942. Construction of Dry Dock 4 began in October 1941. Construction of Dry Dock No. 4 differed from that of Docks No. 2 and 3 in that the pile types were different and most of the dock was poured to high-water line by the tremie method, whereas the walls of the Dock No. 2 and 3 were poured entirely in the dry (Pacific Bridge Company 1944: 84).

> coupled with the harmony among the personnel as a group, affected the timely completion of the subject crane in a very satisfactory and efficient manner (Rossell 1944:1).

The average time that it took, from the time the cranes were ordered to when they were ready for service was between 6 months and a year. Portal cranes, depending on their size, took between 200 to 260 days to be shipped out to Pearl Harbor, and then another 90 days or so to erect them. During wartime efforts, there was usually a charge for liquidated damages in the case of delay when cranes where ordered.

Bridge Gantry Cranes BG-1 and BG-2. The development of Pearl Harbor under the National Defense construction program began in the fall of 1939, together with the fortification of other Pacific Island possessions. Some of the major projects were the construction of Dry Docks No. 2 and 3, and later No. 4. The construction of Dry Docks No. 2, 3, and 4 (see HAER HI-65, HI-65A, HI-65B) required the purchase of two Bridge Gantry cranes, BG-1 and BG-2, both manufactured by Judson-Pacific Corp, subcontracted by the Pacific Bridge Company.[14] Judson-Pacific Company was a bridge manufacturer, which also built several of the larger bridge cranes and bridge gantry cranes for the Navy (Kilikewich 2002). BG-2 was received a year earlier than BG-1 and was used to build Dry Dock No. 2 and 3. BG-1 was received in 1941 and was used to build Dry Dock No. 4. Both cranes were built having the same span between legs of 340', which was necessary to span the width of the dry docks; however, BG-2 had a 148' cantilevered arm that was used to build the smaller, Dry Dock No. 3, simultaneously with the larger Dry Dock No. 2. (Pearl Harbor Naval Shipyard 1946).

The success of the construction of Dry Dock No. 4 depended upon the skillful integration of many plant set-up items. The 340-foot span gantry cranes, were moved without disassembly, by extension of its tracks to the new location. The original gantry cantilever extension was removed and a second bridge gantry crane was erected on the same tracks. These two gantries, BG-1 and BG-2, were the primary means of constructing and placing all forms, and carrying concrete buckets to the tremie rigs (U.S. Department of the Navy, Bureau of Yards and Docks n.d.: 124, 125). After the construction of the dry docks was complete, jurisdiction of BG-1 was given to Shop 72, and it was brought to the Welding Slab located along Third Street (now renamed Cushing Street) near the intersection of Avenue G (now renamed Ingersol Avenue) The jurisdiction of BG-2 was given to Shop 72 as well, and it was brought to Waipio Point and later to Ford Island where it was used to build small boats. It blew down the tracks, hit the stops, and toppled, sometime around 1960 during a thunderstorm and was hence decommissioned (Mondik 2002 and Kilikewich 2002). Other bridge cranes were used at Pearl Harbor outside the Naval Shipyard. Reportedly there was one at Waipio Peninsula and a small one at Ford Island (Dodge, 2003)

Floating cranes and Pontoon Development. Floating derricks were very useful during World War II. They were used to assist in the construction and daily needs of the dry docks when the dry dock rail system was being completed at the start of the War. For example, the YD-69, "a 5-W Floating Clamshell Crane No. 21018" was purchased for the dredging operations in Pearl Harbor related to the construction of Dry Dock No. 4. The YD-69 was ordered from Bucyrus-Erie Company in July 1941 after a bid for proposal (specification 10262) was sent 9 April 1941. The crane unit was completed 22 May 1942, and although some trouble developed with the piston, the problem was fixed and the crane was operational by July 1942 (McArthur, 1942).

A letter dated April 29, 1940 had recommendations regarding cranes and future developments in the 14th Naval District,

> The yard has frequently recommended that these berths be equipped with 50-ton traveling cranes. Failing these, two fixed cranes have been recommended and finally a 50-ton floating crane. The Bureau of Yards and Docks has not favored these improvements because of the cost of providing heavy capacity traveling cranes on 1010 Wharf due to the unknown difficult foundation conditions and because of the assumed availability of adequate berthing facilities at the Repair Basin (Almy, et al 1940).

The development of the standardized pontoon was, along with the development of the Quonset hut, one of the most significant standardized designs of the war. Standardization allowed the pontoons to be built very quickly (approximately 7 weeks) and very inexpensively.[15] The pontoons were built by a company on the mainland U.S. and shipped to Pearl Harbor, knocked down. The Pearl Harbor Repair Unit would then assemble them and installed the cranes. With this standardization, Pearl Harbor acquired several floating derricks during the war years, by temporary borrowing from other shipyards, and by procuring their own. They had, in total, 16 floating crane derricks in use. Before this time, the only floating crane procured and used at Pearl Harbor was the YD-025. A typical WWII example was the construction of the YD-82 pontoon.[16] The YD-82 was built in 1943, but it was built as a steel pontoon with an integrated crane structure; the roller path portion of crane was set into the pontoon, so that when the pontoon was built, a large steel ring was located at one end of the pontoon to accept the roller path. The 50-ton floating crane was ordered in December of 1942 under contract Noy-5801 (pontoon portion) with American Bridge Company for the amount of $56,000 and NOy-5687 (crane portion) by Anthony M. Meyerstein, Inc. for the amount of

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[15] It is assumed that most of the pontoons built during this time, were fabricated from this standardized plan. The exception here, however, is the YPD-16, a 5-ton floating pile driver, which was designed and built in 1943 and fabricated with wood, not in the standardized sections of the steel pontoons. The pontoon was built by the Pearl Harbor Ship Repair Unit at the Naval Yard Pearl Harbor, and was designed by the Public Works section (drawing number X-N34-123-129). The pontoon was designed to have a capacity of 50 tons. Its overall dimensions were 70' by 34' with a height of 67". Its maximum mean draft was 29". It could hold 8 crewmembers. The tower of the pile driver was 97'-3" high and it was equipped with one hammer, a #1 Vulcan. It was powered by two steam boilers, each having 40 horsepower- 150# upright, which drove 3 drum steam hoists. Its fuel capacity was 1060 gallons. It is possible that an older existing steam pile driver was placed on a new wooden barge. (Crane Division File "YPD-16")

[16] The history of the Navy lightering pontoon gear invention and development began in 1935 and 1936, when the War Plans Division of the Bureau of Yards and Docks were considering problems connected with the development of advance bases. An officer in the Bureau of Construction and Repair, on duty with a western steel company, observed the construction of a sectional barge for use by a dredging company. It occurred to him that this section idea might be of value in connection with the advance-base problem. He sent his drawing to the Bureau of Yards and Docks, showing his idea of how steel box sections might be fitted together to form a barge. After several experiments and problem solving, a method of assembly was adopted and the size and structural form were established. The beginning of the Quonset Pontoon Experimental Area began in 1935 to satisfy the requirements that advance-base construction imposed upon equipment, considerable experimentation was carried on at various locations within the United States. Most of this development in materials and equipment was carried out by the Advance Base Department of the Bureau of Yards and Docks in conjunction with the Advance Base Proving Ground at Allen's Harbor, Davisville, R.I. The Advanced Base Proving Ground was an outgrowth of the Quonset Pontoon Experimental Area, which was established before the war. (U.S.Navy, Bureau of Yards and Docks, Vol. 1 1947: 156, 157)

$178,650.00. The contract was filled and the crane was being erected at Pearl Harbor by May of 1943. The pontoon measured 70' x 125' and was fabricated within 7 weeks (Crane Division File: "YD-82 records") .

World War II Portal Cranes

The newly constructed dry docks at Pearl Harbor were outfitted with an elaborate integrated rail system. The rail system was designed to accommodate the 50-ton, 25-ton, and 15-ton portal cranes. Traveling portals are the most usable and versatile crane, allowing locomotives and locomotive cranes to pass under them. The rail system at the Pearl Harbor Shipyard, called the Waterfront Crane Track System, was a continuous rail system, connecting all the dry docks, piers, and repair basins. The track system and the portal design was an ingenious pairing. The rail system was built to exceptionally exact standards and was built to withstand great loads. The maximum allowable gradation change is ¼" to 30', which is the same standard to which railroads are built. The concrete pier is designed to support a load of 500 pounds per square foot. The crane track system is much higher, as much as 87,000 to 88,000 pounds per crane wheel. Wheels are spaced approximately 4 feet center-to-center. The portals, constructed of standard A-36 steel, were designed with two features to accommodate track imprecision and curves. First, the portals have a "limber deck design", which means that their bases are flexible enough to adjust to the unevenness of the track rails. Second, the wheels have a 6" float tolerance, which means that the wheels are able to move horizontally 6" to make the turns (Kilikewich 2002).

P-56, P-57, P-58. These three cranes were the first cranes to be ordered after the completion of Dry Docks No. 2 and 3. They were all small-capacity cranes. Portal crane P-56 (contract no. NOy-4117) was ordered first, with a second contract P-57 and P-58 (contract no. NOy-4621). The two contracts were signed on June 20, 1940 and November 30, 1940, respectively. The contract sum for the P-56 cranes was a total of $95,600. The contract sum for the two cranes, P-57 and P-58, was a total of $236,500. The time for completion of crane P-56 was 285 days, which was to be on April 21, 1941. It was completed after this day, on July 3, 1941 so that liquidated damages of $60.00 per day, a total of $500.00 was paid to the U.S. Government. The time for completion of P-57 was 270 days and P-58 was 300 days.

The choice of small-capacity cranes was greatly influenced by the recommendations of a 1940 task force established to help direct the developments of the 14th Naval District. The task force recommended a study of the costs to interconnect the dry dock and the repair basin crane tracks:

> This study gives full consideration to the overall efficiency and greater usefulness as well as lower costs of 15 to 20-ton fast moving dry dock cranes in comparison with the present 50-ton DD cranes. The latter should be limited to the minimum number giving full consideration to the infrequency of lifts between 20 and 50 tons (Almy et al. 1940: 9).

The direction to order lighter, faster-moving cranes was taken seriously, and of the 17 portal cranes ordered between 1940 and 1944, only three were 50-ton cranes.

P-59. Star Iron and Steel Works Company received a contract to build a 50-ton portal crane under the contract number NOy-4753 in 1941, before the start of the War. Detailed historic records allow us to see the process by which cranes were ordered, shipped and erected at Pearl Harbor during the World War II, including some of the difficulties and cost overruns. The records show the following:

1. The offer to erect a 50-ton portal crane for a cost of $212,500.00 was made on February 26, 1941 by Star Iron and Steel Works Company. Delivery of the portal base was to be made within 200 calendar days and the superstructure within 260 calendar days from the date of receipt of notice to proceed (Crane Division File "4753 D.D. Crane 10245"; Moreell 1941).
2. Drawing and specification were received by Star Iron and Steel Works Company on 2 May 1941 (Chandler 1941).
3. Notice to proceed was received 23 May 1941. Soon after the notice to proceed was issued, there was some confusion over whether or not the contract included transportation costs from the west coast to Pearl Harbor and erection at Pearl Harbor.
4. It was decided that transportation to and erection at Pearl Harbor were not included in the contract. In a letter from the Commandant of the Navy Yard to the Chief of Bureau of Yards and Docks, dated 28 June 1941, he states, "It is recommended that the erection of subject crane be made by separate contract." He goes on to say, "It is probable that the R.W. Kaltenbach Corporation of Cleveland, Ohio, will be interested in erecting the crane as they now have a force in the field" (Hartung 1941).
5. In a telegram from the Navy Yard Pearl to Budocks, dated 11 October 1941, the need for the crane is clear, "CRANE URGENTLY REQUIRED X CAN DELIVERY BE ANTICIPATED X." The crane was shipped October 31, 1941. According to historic records, the cost for shipping from the West Coast to Honolulu was $6,600 and to bring by rail from Honolulu to Pearl Harbor was $1,040.
6. The crane was received on November 6, 1941.
7. Erection of the crane was done under a separate contract, Number NOy-5049. Star Iron and Steel Works Company sent over its own foremen and "others with more responsibility" to Pearl Harbor to direct the work. They employed electrical, mechanical, and structural workers of Honolulu to carry out the work.
8. There were some delays, however. Due to missing parts and delays in filling orders. A letter dated December 2, 1941, shows that delivery of some parts used for the crane travel drive equipment were several months overdue, as were other pieces, but that they were expected to arrive in the 3rd week of December.
9. Erection of the crane was expedited with 10-hour work days, 7 days a week, increasing the contract price to cover the additional cost of overtime work from December 24, 1941 to February 1, 1942.
10. The request for final payment of NOy-4753 is dated February 1, 1942.
11. The crane was completed, accepted and placed in service May 10, 1942.
12. However, in January 12, 1943, trouble developed in the turret roller paths. The cast roller path had insufficient strength to hold the weight of the upper crane due to configuration of the casting. The roller path castings were strengthened by adding vertical gusset stiffeners at the cast lightening pockets in the roller path segments. By July 1943, the crane was back in full service (Crane Division File "4753 D.D. Crane, 10245").

P-60, P-61, P-62, P-63, P-64, P-65. These six portal cranes were the first portal cranes to be ordered after the start of World War II. The Kaltenbach Corporation and the Star Iron and

Steel Works Company received the contracts to build the new portal cranes between the dates of February 1942 and May 1942. The Kaltenbach cranes were ready for transportation to Pearl Harbor by October 1942. They were received and were erected on the site and deemed satisfactory as of January 1943. However, a couple of the engines had a malfunction, stalling completion of the cranes until the following September 1943 (Crane Division File "NOy-5298 Gantry Cranes- Spec 10776").

Nearing the end of the war. Several more portal cranes (P-66, -67, -68, -69, -70, -71, -72, -73) were ordered between 1943 and 1944, before the end of the war; however, by the time they were manufactured and shipped, the urgent need for them had passed, and it was just a matter of filling the orders made.

P-66, P-67. Another two 50-ton portal cranes were ordered in the summer of 1943 under contract number NOy-6257. A Mailgram dated June 22, 1943 from BUDOCKS to Anthony M. Meyerstein Inc. accepts the Meyerstein proposal of constructing two 50-ton portal cranes for the cost of $446,000.00. The cranes were to be shipped to San Francisco, California on or before February 1944. The cranes were completed and the cranes were booked for shipment during the month of February 1945 and the cranes arrived at Pearl Harbor on April 1945. The engineers arrived at Pearl Harbor February 25, 1945 in order to conduct the erection of the two cranes. P-66 and P-67 were tested as of August 1945 and were deemed satisfactory except the function of the traveling mechanism. By the time the cranes were brought to Pearl Harbor, the end of the War was near; the U.S. had invaded Iwo Jima. An urgent need for cranes was no longer present, so that fines for liquidated damages were repealed. Problems due to faulty workmanship occurred in February 1946, and $8,433.96 was deducted from the contract price. In May 1946 more problems were discovered, and another deduction of $7,910.72 was taken from the contract price (Crane Division File "Contract No. NOy- 6257, 2 50-ton D.D. Cranes").

P-68, P-69, P-70, P-71, P-72. In a letter to the Chief of Naval Operations, on the subject of *Navy Yard Pearl Harbor- Urgent need for cranes for handling of Ship Repair Facilities*, the Chief of Bureau discusses the proposal to transport and convert existing cranes at the Roosevelt Roads Base for use at Pearl Harbor. In order to save time and money, however, he dismisses the prospect and recommends that the Roosevelt Roads cranes be used at another station. He states, "Anticipating approval of the foregoing recommendations, the Bureau has taken preliminary steps to procure all five of the 25-ton cranes from the Kaltenbach Corporation." Kaltenbach Corporation received the contract (NOy-10593) to build five 25-ton portal cranes for Pearl Harbor under the appropriation of Naval Appropriation Act, 1945. The signed contract dated October 2, 1944 states that the scheduled delivery date will be on July 30, 1945. The date was apparently met, and the cranes were erected at Pearl Harbor between the dates of August 1945 and January 1946. Specification number 14990 outlines the description of the cranes (Crane Division File "NOy 10593 5-25 T. Portals").

P-73. The P-73 was built by the Wellman Engineering Co. located in Cleveland Ohio under contract number NOy-8183 in 1944. Little information could be found concerning this crane.

5. Post-World War II Period

Bridge Crane BC-1. BC-1, later called Fac. 1236, was built by the Navy Yard in 1946. It is one of the few larger cranes built after the war. It was located at the plate storage yard along Central Avenue near the Sixth Street (now renamed Lake Erie Street) intersection, where

large sheets of steel or aluminum were stored. Originally, the bridge crane serviced a pickling plant[17], which was located in the same area. The pickling plant was gone by the 1960s, but the plate storage yard was used up to 1980 when they were still overhauling several World War II submarines. After the 1980s, many of the older submarines were decommissioned and were replaced with new submarines so that the amount of overhauling needed in the shipyard dropped dramatically. Fac. 1236 was no longer active after 1980 and was removed in 1996. The steel sheets were moved to Fac. 155 where there was another bridge crane, number 1454. This is where all the sheet metal work is done today (Kilikewich 2002).

Pearl Harbor was designed to function most efficiently with a total of 17 portal cranes (assuming that that the Shipyard was busy and the four dry docks were operating at full capacity). On January 1, 1945, there were 17 portal cranes at Pearl Harbor, and by the end of WWII, as orders made during the war were filled; the Shipyard was working with 21 cranes (Kilikewich 2002). After World War II ended on August 14, 1945 (date Japan surrendered), the pace of work at the Navy Yard slowed dramatically, and by 1950 the Navy Yard work force had been cut from 16,000 to 3,500 (Yoklavich 2002: 6). The number of facilities, including cranes, was well above the number required for the mission of the Navy in Hawaii after World War II. (Moreover, many of the original cranes purchased during the 1910s and 1920s had long outlived their design-lives (anticipated 10- to 15-year economic life). Most of them were rusting and maintenance was high.

A memorandum dated June 11, 1951 (V. Fernandes) discusses the crane facilities and compares the number of cranes available at the production peak in Pearl Harbor's history in 1945 to the number available at that time in 1951. (This is not an official list and appears to be an inventory of the cranes being used by Shop 02 of the Naval Shipyard only. It is helpful, though, because it shows the general trends of the Shipyard and it lists the actions and concerns of the branch.) Many changes, including reduction and replacement of cranes, took place between 1945 and 1951, and are discussed in the Fernandes memorandum.

Type of Crane	1/1/1945	6/1/1951
Portal	15	21
Hammerhead	1	1
Pintle (berth 6)	1	0
Locomotive (36" gauge)	23	7
Locomotive (56" gauge)	9	4
Bridge Gantry	1	2
Truck	5	16
Roustabout Truck	7	1
Roustabout Crawler	6	2
LeTourneau Tournapul	4	0
Floating	8	6
Crawler	18	14

The following highlights the items of discussion in the memorandum:

The pintle crane (P-102) was the first item to be discussed. The first large elevated crane to come to Pearl Harbor, it had a great deal of significance even for the time. It was located at

[17] A pickling plant is a yard where surface rust is removed from steel before the steel is transported for use. A large vat of cyanide and another vat of neutralizing solution are the primary components of the plant. Large sheets of steel are dipped in the cyanide tank first and then the solvent solution tank.

Pier #1 to service Marine Railway and ships moored at Berth #6 until about 1950. It had had a lifespan of about 30 years, which equals 2 economic-life spans, but was finally removed and scrapped leaving no crane service available at this location. It was recommended that an engineering study of the pier be made to ascertain if it would support the weight of a crane similar to one of the existing portals. The two outboard tracks were of the same gauge as the portals and it was theorized the installation of switches at the head of the pier to connect the pier tracks to the portal track system would be far more economical than procuring a crane that would be restricted to this one area. (This was never carried out.)

As of 1951, six floating cranes were in service. Two 30 ton cranes, YD-118 and YD-152, had recently been inactivated and moored at Middle Loch.

The number of crawler cranes had also decreased since 1945, and the memo suggested that Pearl Harbor procure at least one more, mentioning that COMSERVPAC had one in stock of reserve equipment at the Pearl City Storage. It is likely, however, that this recommendation was not taken up due to the fact that the crawler tracks damaged the roads. They were phased out of use by the 1960s.

Between 1945 and 1951, there had also been a considerable reduction in the number of locomotive cranes but an increase in the number of truck cranes. By the 1950s, locomotive cranes were phased out of use because the truck cranes offered a greater flexibility of use. Another disadvantage with the locomotives was the many accidents that occurred due to overturning.[18] Locomotives were variable-rated, which means that how far the boom was extended determined the amount of weight the boom could hold. The operator had to be very careful when operating the boom. To prevent overturning, the locomotives were outfitted with train clamps (a mechanism by the wheel attached to the track) or outriggers. However, the outriggers could not be used if the locomotive was near the edge of the dry dock, which was often the case (Kilikewich 2002). The 1951 memo realized that truck cranes would take the place of the locomotive ones and recommend that no "additional equipment of this type [be ordered]." According to another memo dated December 18, 1950, there were only six truck cranes at Pearl Harbor but the need for more was great. The memo states:

> Request for truck cranes have increased to the extent that nine such cranes are required daily as of this date, compared to six as of 1 September 1950. Demands for this type of service are steadily mounting...it is suggested that the Bureau of Yards and Docks be urged to expedite the purchase of three new truck cranes with funds realized from the sale of seven Locomotive Cranes (Shafer 1950).

6. 1960s, 1970s, 1980s Removal of Older Cranes

By the early 1970s, discussion of what to do with the aging giant Hammerhead crane began. Costs to repair and maintain the aging crane grew and fear that the rusting and decomposing crane would injure passer-bys was very real. The Hammerhead's last lift was in October 1973. Before the final decision to demolish the crane was made, several studies were made, looking at whether the historic hammerhead could be revitalized. The first study appears to be a 1974 cost analysis report comparing the costs of repairing the Hammerhead to purchasing a new crane. This study was made by Code 385.41:BK. It suggested that the cost to refurbish

[18] Of course, the problem with overturning is also true of trucks, especially as manufacturers learned to make the trucker able to lift heavier weights, but the advantage of flexibility of movement was the benefit of the truck.

the existing crane would be $310,000 while the cost to purchase a new crane (does not specify what kind) would be $600,000, and that over the 10-year economic life of the cranes, a savings of $129,000 would be gained by repairing the existing crane. In June 1975, a call for an engineering services contractor to prepare a study to place the then inactive hammerhead crane in a preserved status was distributed (Rinnert 1978: 2). A later study in 1978 estimated that the rehabilitation of the Hammerhead would be $2,154,210. The decision to finally decommission the Hammerhead was not an easy one for the Navy to make, with the Navy calling for bids by crane companies for the overhaul of the Hammerhead just prior to demolition. Just about the time the navy announced its plans to dismantle the crane, they released a call for bids for "immediate" purchase of the Hammerhead crane. Bids were to be in by 4:00 P.M. January 30, 1980. Apparently, no bids were submitted, however, and the crane was scheduled for demolition. According to David Kilikewich, by the end of its life, it was costing $400,000 in yearly maintenance. Rust prevention was costly and could not be prevented entirely. The area surrounding the Hammerhead had to be cordoned off so that people would not accidentally be hit by falling pieces of rust.

In the late 1970s, five 15-ton portal cranes, P-53, -54, -55 (1935) and P-56 and -57 (1941), were sold. They were taken apart on site and loaded onto a barge for relocation to either Central or South America (Kilikewich 2002).

By the late 1980s, with the ending of the Cold War, it was soon evident that the number of cranes had to be reduced. In the 1980s, the crane division "right-sized" the number of cranes that would be needed to keep the Shipyard "fit to fight", reducing the number of portal cranes needed to eight cranes. From then on, as the cranes aged, they would be parked and scrapped, instead of repaired or replaced. A program to replace aging cranes came to fruition in the early 1990s with the award of several crane contracts for various shipyards in the U.S. Westmont Industries was awarded 10 crane contracts, two of which arrived to Pearl Harbor to support the nuclear program (Kilikewich 2002).

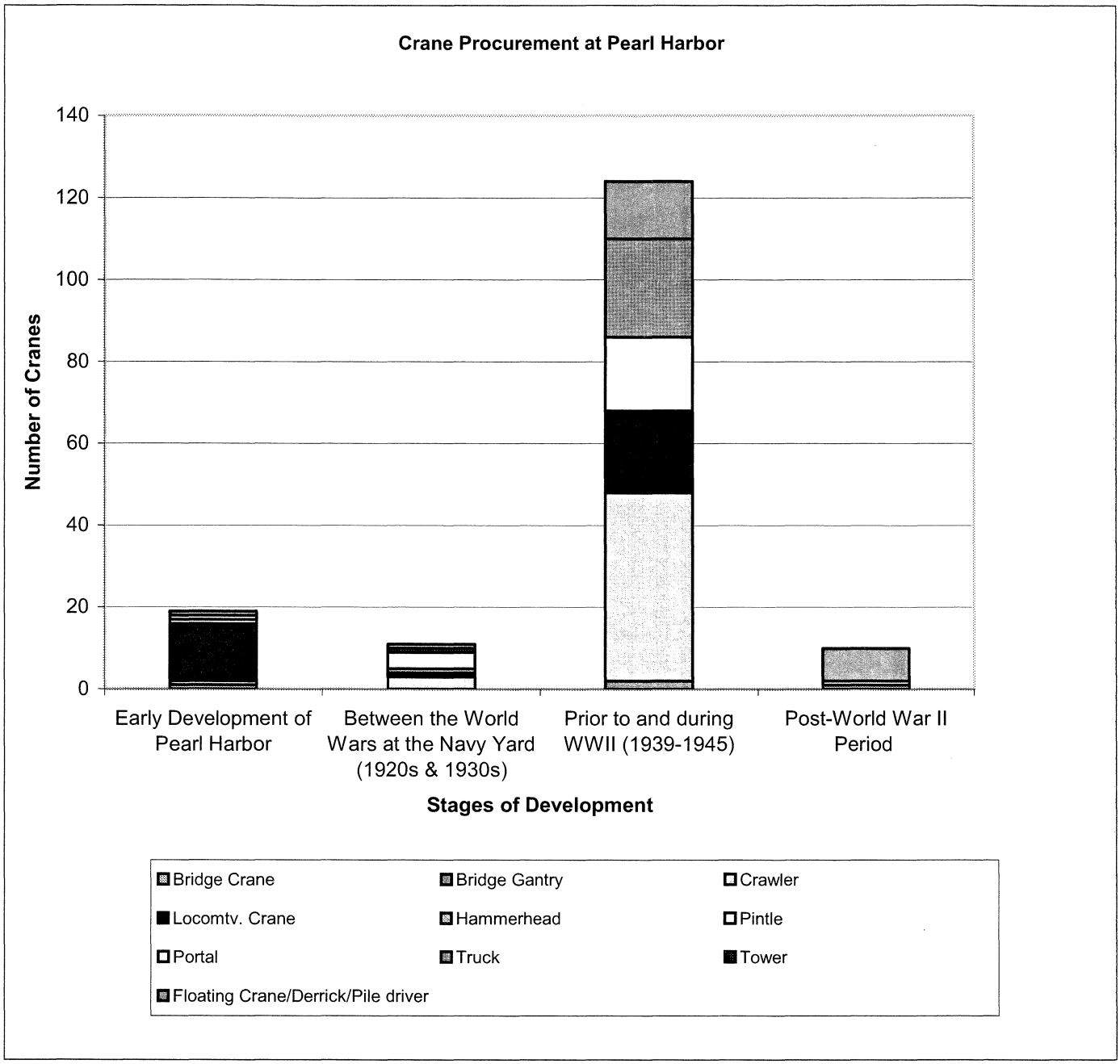
On August 14, 1998, an agreement between Captain Jeffrey Conners, PHNSY and IMF Commander and Don Anderson, President of Don Anderson Tanks and Equipment, was signed to have the Seattle-based company dispose of 11 of the World War II portal cranes. In an article that appeared in the 24 September 1998 Log (PHNSY internal newspaper), it states, "the contractor will dismantle the cranes at no cost. In addition, Anderson will pay the command $2,850 per crane or $31,350 in total." The contractor hoped to make a profit by salvaging machinery from the cranes and have the remaining portions be cut up and sold as scrap metal. Disposing of the cranes had been a difficult issue. First, the Defense Reutilization and Marketing Office (DRMO) tried to sell them but there were no buyers interested. DRMO then gave disposal authority to PHNSY and IMF. Bids to dispose the cranes were gotten from a government agency and two contractors for the disposal of the cranes, but these bids ranged from $605,000 to $4 million. Due to lack of funding, no action was taken. Fortunately, NAVSEA found Anderson Tanks and Equipment to do the job at no cost to the navy. (According to Kilikewich, the price of steel dropped dramatically after this agreement was made, causing the contractor and the Navy to have to renegotiate removal costs. The negotiation was successful, with the navy paying the contractor to remove the cranes at some cost.) Cranes P-52, P-58, P-60, P-61, P-62, P-65, P-66, P-70 and P-72 were dismantled near Dry Dock 4 and were lifted using the YD-121 floating crane onto the barge for shipment. P-64 was moved from pier B-7 to the DD-4 scrapping area at the crane track spur. P-69 was added to Anderson's list of cranes for scrapping. The cranes were removed by spring 1999. P-73 is trapped behind a structure built over the tracks at DD-2 and has not yet

been scrapped, but will be done so when the structure is cleared (expected shortly) (Kilikewich 2002).

By the end of year 2002, it is anticipated that none of the WWII portal cranes will be in use at Pearl Harbor. The four remaining cranes, P-59, P-67, P-68, and P-71, will be scrapped in the months following the completion of this report as they have reached an age where a complete overhaul would otherwise be necessary. The four cranes will be replaced with new units, as part of the replacement program of the crane division.

Both remaining WWII floaters, YD-82 and YD-121 were retired and are to be scrapped. Pearl Harbor has need for one floating crane and it has been assigned the 100-ton YD-261 (non-historic).

Trucks, crawlers, and mobile cranes have been consolidated at the regional Public Works Department (PWC). Pearl Harbor Shipyard no longer has significant mobile cranes. Only two mobile cranes, kept to support the nuclear ship maintenance program, are under the jurisdiction of the crane department, since PWC does not maintain mobile cranes to the standards required by the nuclear division.


Crane Procurement at Pearl Harbor
Number of Cranes
140
120
100
80
60
40
20
0
Early Development of Pearl Harbor
Between the World Wars at the Navy Yard (1920s & 1930s)
Prior to and during WWII (1939-1945)
Post-World War II Period
Stages of Development
Bridge Crane
Bridge Gantry
Crawler
Locomtv. Crane
Hammerhead
Pintle
Portal
Truck
Tower
Floating Crane/Derrick/Pile driver

Sources: The original drawings for cranes P-52, P-66 and 67, P-58, BG-1, YD-121 and various other cranes are held at the Crane Building, Facility 327 at the Pearl Harbor Naval Shipyard. Other original drawings of cranes, including the hammerhead crane (HH-1), are on microfilm at NAVFACPAC Plan Files.

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n.d Bureau of Yards and Docks- *Illustrated Reports of Construction Contracts*. Located in 71CR Box 2 (Vol. 3)

1933 Map. "Project No. 284. Navy Yard Pearl Harbor, T.H. Storm Drainage Annual Estimates for 1935. Estimate drawings No. 17. March 1933 Group B." Record Group 71, Bureau of Yards and Docks.

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Pacific Bridge Co.

n.d. *Technical Report and Project History , Contracts NOy-3825, for Construction of Dry Dock No. 2 and 3 at U.S. Navy Yard Pearl Harbor T.H.* Prepared for the Navy Department, Bureau of Yards and Docks. Microfilm of report at Pacific Division Naval Facilities Engineering Command Library.

Palumbo, Lorraine

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Rossell, F.A.

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Shafer, J.O.

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1947 *Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corps, Vol. I & II.* United States Government Printing Office: Washington, D.C.

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1941 *Specification 10262, Crane-Dredge YD-69 at the Navy Yard, Pearl Harbor, T.H.* 9 April 1941.

Woodbury, David O.

1946 *Builders for Battle: How the Pacific Naval Air Bases Were Constructed.* E.P. Dutton and Company, Inc.: New York.

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2000 U.S. Naval Base, Pearl Harbor, Naval Shipyard. Historic American Buildings Survey documentation. Draft Submitted to the National Park Service as HABS No. HI-60. Prepared by Mason Architect and Franzen Photography, for the U.S. Navy, Pacific Division Naval Facilities Engineering Command.

Pearl Harbor Naval Shipyard Code 385.41:BK.

1973 *Feasibility Study of Retaining Hammerhead Crane at Pearl Harbor Naval Shipyard.* Dated 7 September 1973. 1943 inspection records of crane tests. (Code 385 is the Production /Engineering Department of Pearl Harbor Naval Shipyard. The crane department, Code 384, was closely connected to the Production department at one time. In 1988, there was a reorganization that divided the two departments into more autonomous units.)

Pearl Harbor Naval Shipyard

1941 *Crane-Dredge YD-69 at the Navy Yard, Pearl Harbor, T.H. Specification No. 10262.* A call for bids and construction specification written for the proposed construction of YD-69. February 14, 1941.

1943 *Lists of tests for 50-Ton Floating Crane YD-82.* 1943 inspection records of crane tests.

1946 *XO2-R-PHNY Equipment Data.* 1 January 1946. A list of all equipment being held by the Pearl Harbor Naval Shipyard. Data title page initialed by E.R.D. The full name not given anywhere on data log.

Crane Division (Non-published letters, papers, and reports on file with Frank Mondik of the Crane Division at Pearl Harbor Naval Shipyard.)

File "385-69-75 Hammerhead Crane Study"

File "4753 D.D. Crane 10245"

File "Crane YD-82"

File "Contract No. NOy- 6257, 2 50-ton D.D. Cranes"

File "Contr. N311s-18934 4 Marion Cranes"

File "Contr. NOy-4805 YD-69"

File "Demolition of Hammerhead Crane HH-1"

File "NOy-5298 Gantry Cranes- Spec 10776"

File "NOy 5652 – Spec. 1087, 50-T Crane – DD #4"

File "NOy 5687 1-50 T. Floating Crane"

File "NOy 10593 5-25 T. Portals". Collection of letters, orders, telegrams, and contracts in relation to the ordering, shipping and directing of crane.

File "YPD-16" 1943 inspection records of crane tests.

Map of the "Waterfront Crane Track System", n.d.

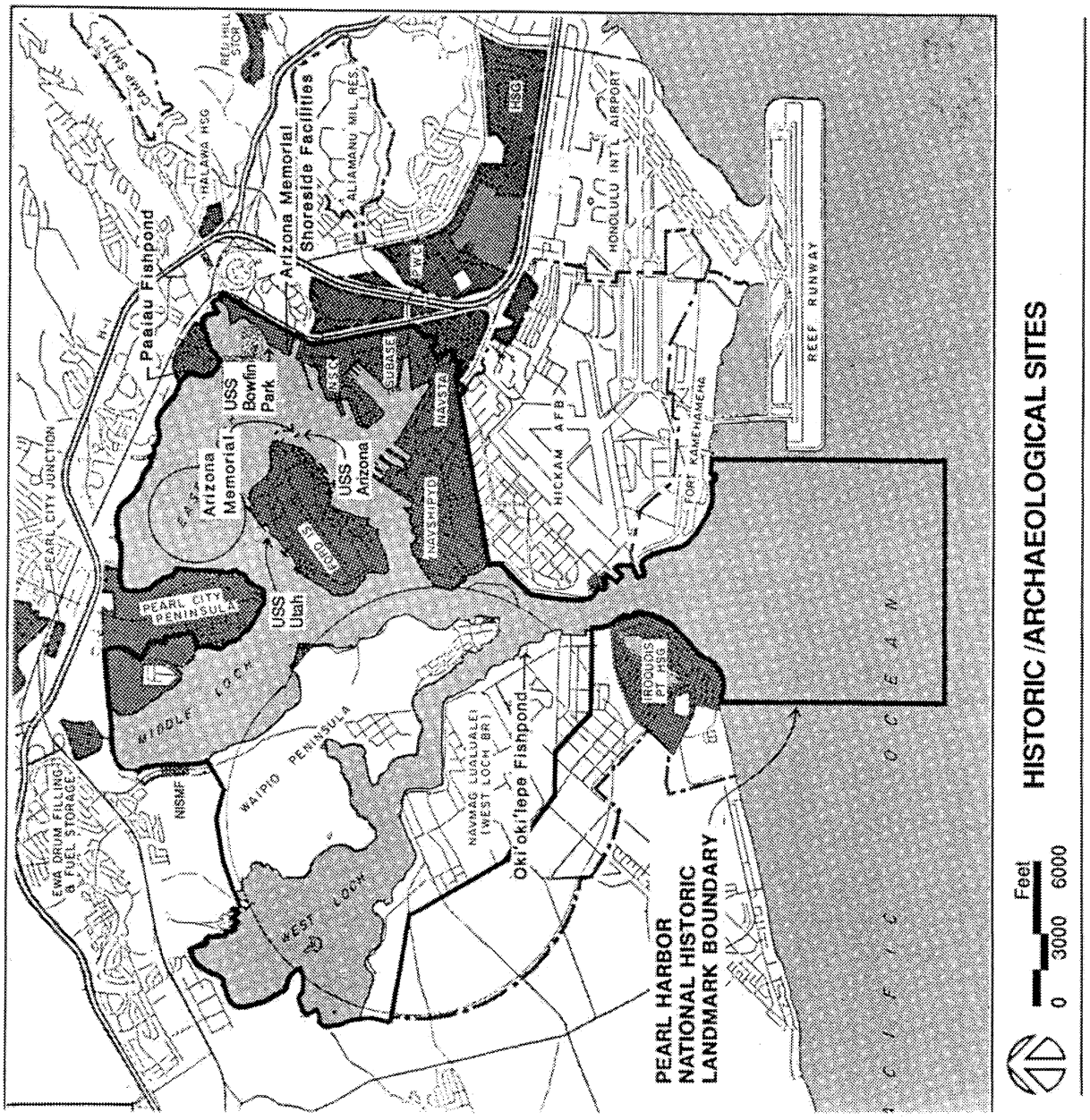
Acknowledgements: Special thanks to Frank Mondik of the crane division for his time spent gathering historical materials on the cranes, sharing his expertise of the workings of the shipyard cranes, and sharing his knowledge of the history of the Shipyard cranes.

Special thanks also to David Kilikewich for sharing his valuable knowledge of the history of the Shipyard cranes and for his thorough and insightful comments on the drafts of this report.

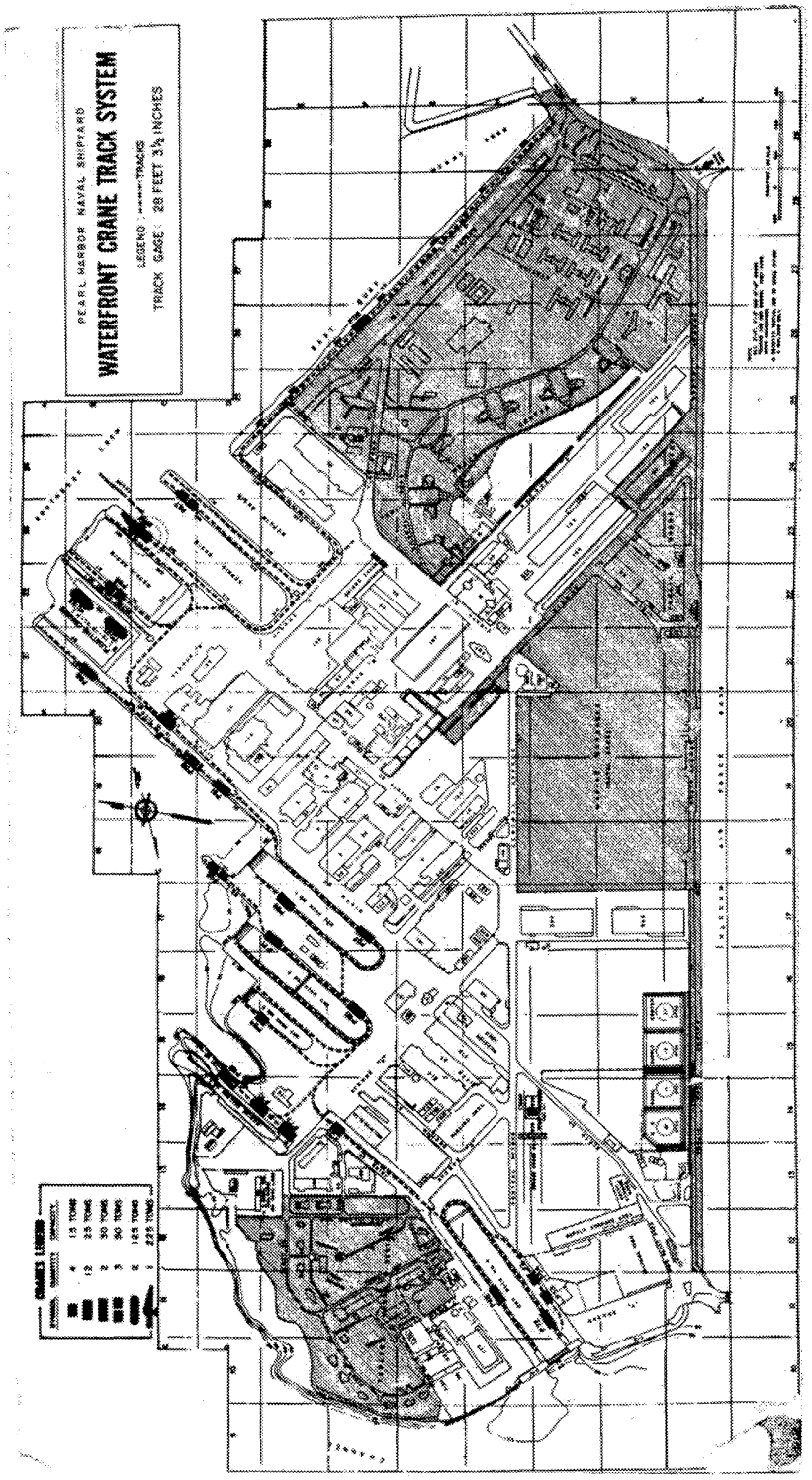
Project information: Photo documentation and recordation of this facility by the Navy has been done in anticipation of future alterations or potential demolition of the structure. Photo documentation of historic facilities by the Navy assists in expediting planned undertakings by having the documentation 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 Jeffery Dodge A.I.A., Historical Architect NAVFAC Hawaii. The photographic documentation was undertaken by David Franzen, photographer. Lorraine M. Palumbo, Architectural Historian, of Mason Architects, Inc. prepared the written documentation. The field work and research was conducted for this report between January 2002 and August 2002.

Prepared by: Lorraine M. Palumbo, Ph.D., Architectural Historian
Mason Architects, Inc.
119 Merchant Street, Suite 501
Honolulu, HI 96813
September 2002

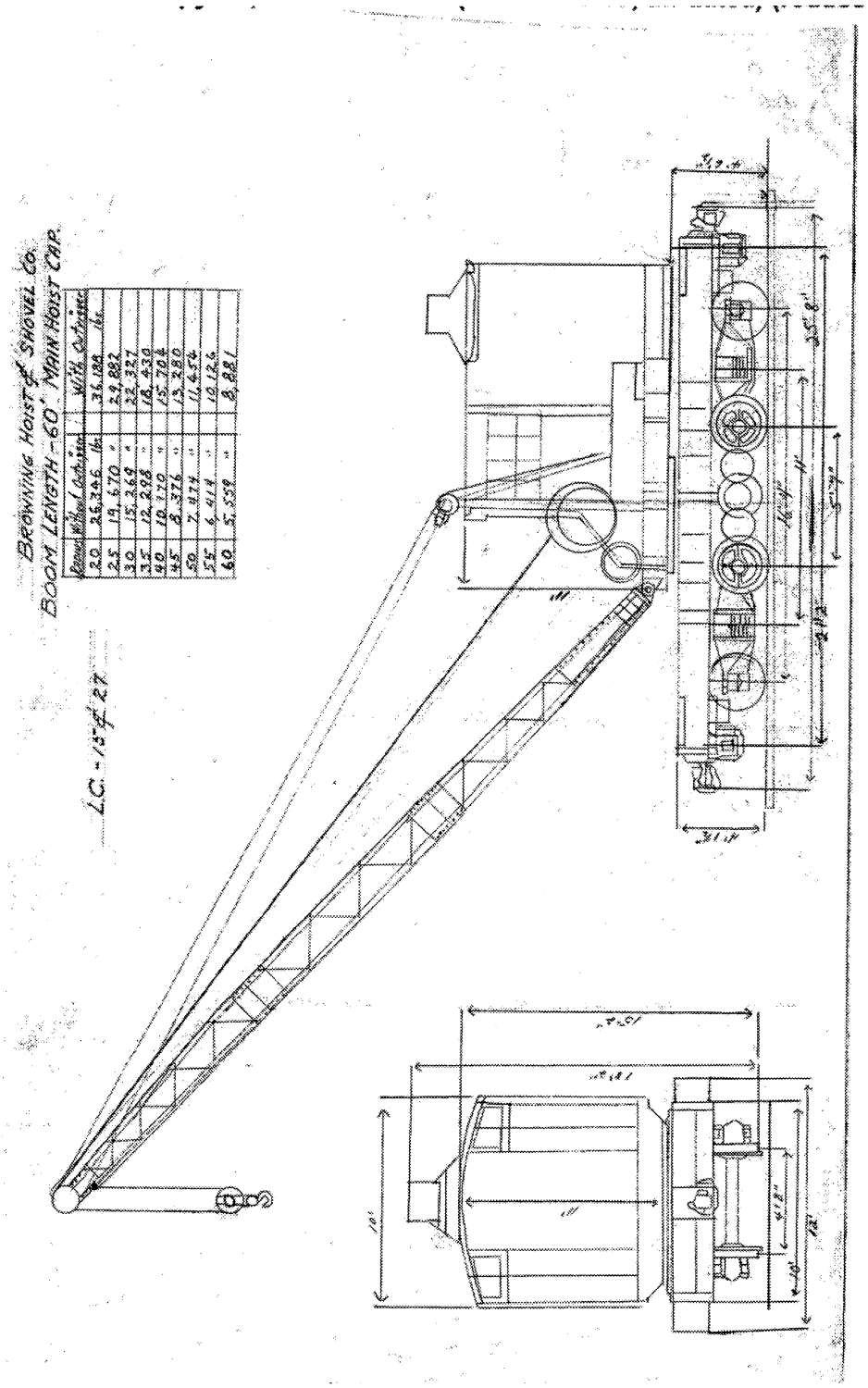
Pearl Harbor Area Map



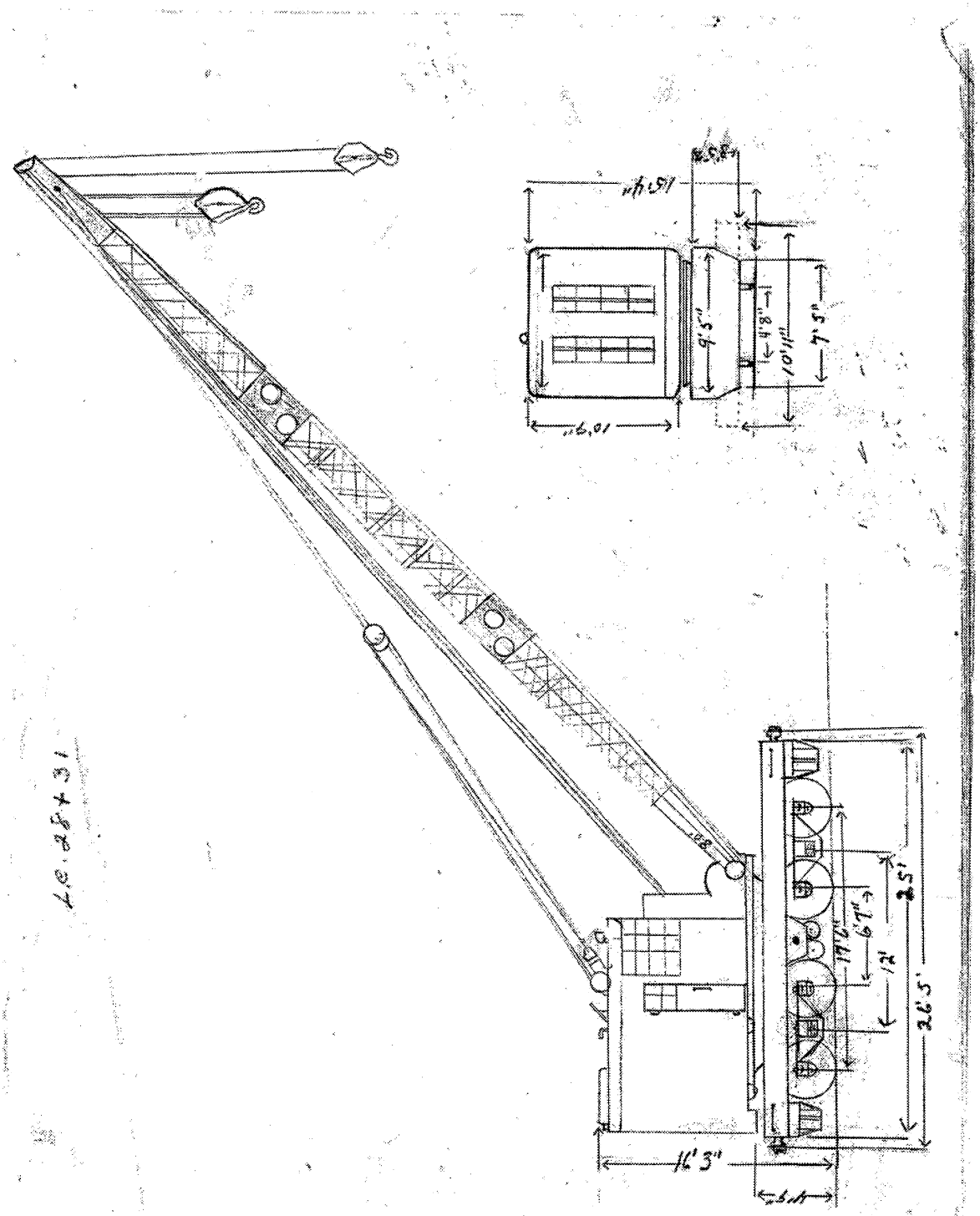
Waterfront Crane Track System
Date unknown



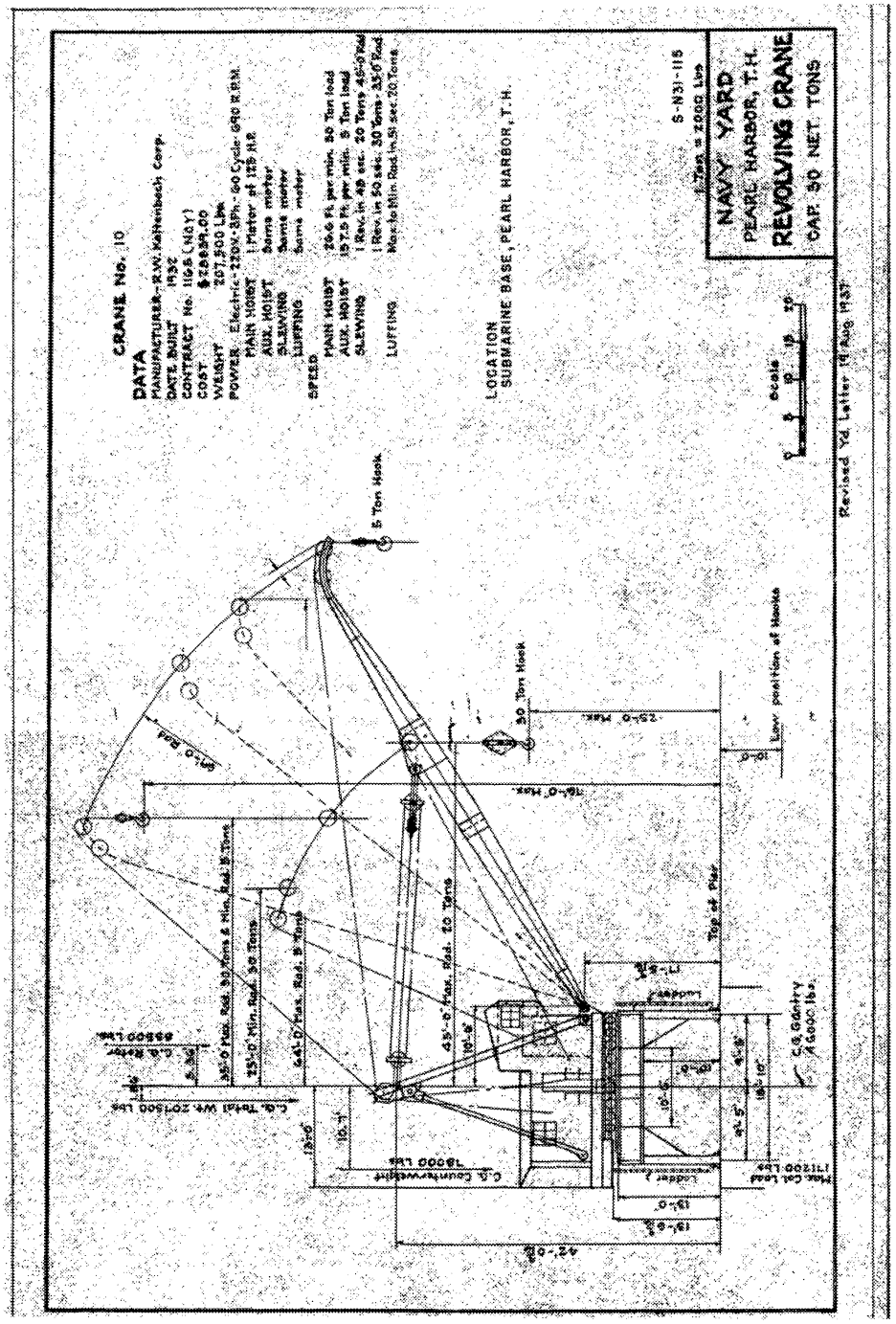
Locomotive Crane LC-15 and LC-27
30-ton Capacity, Steam-Powered
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



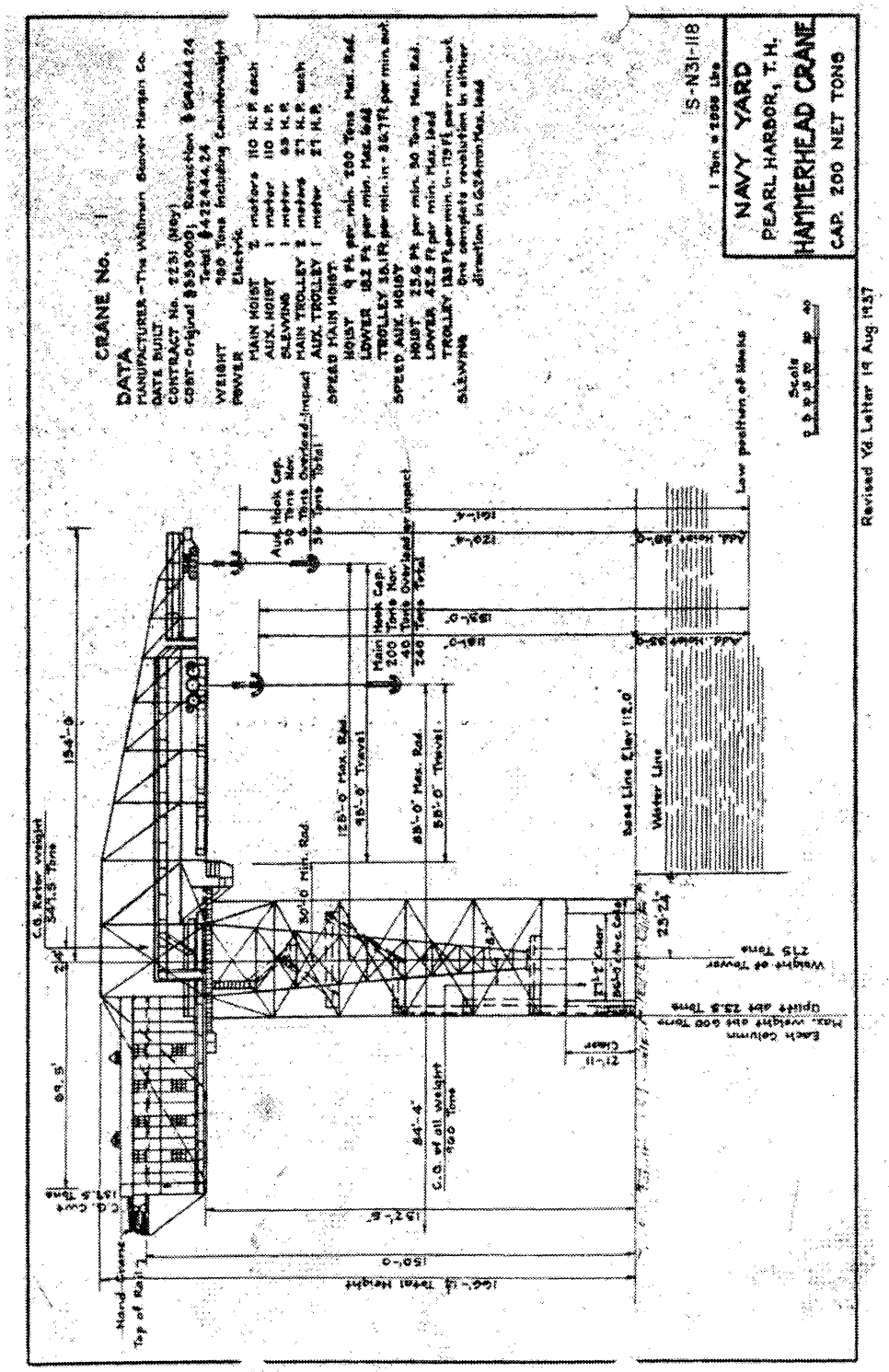
Locomotive Crane LC-28 and LC-31
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



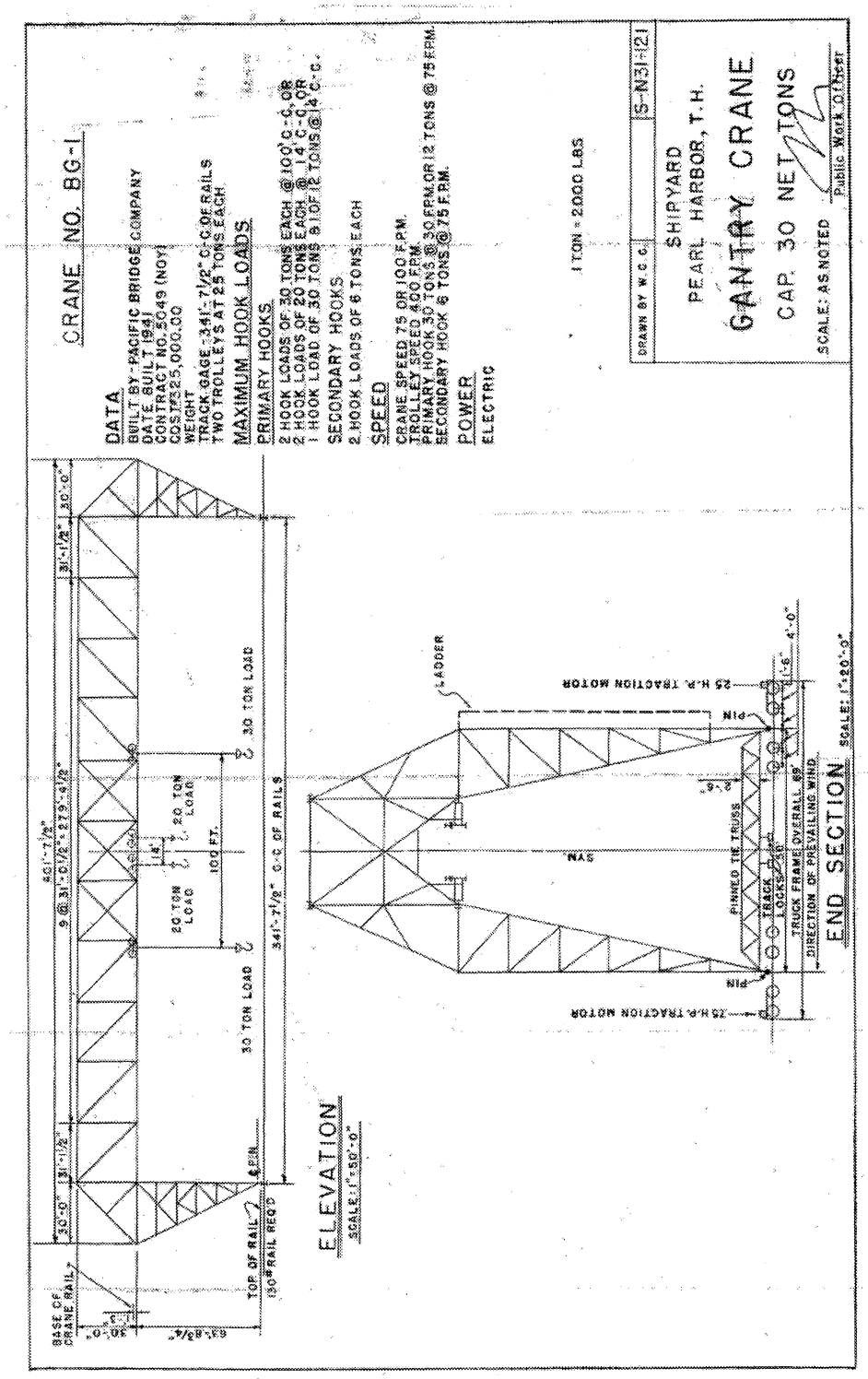
Tower Crane 10 (TO-1)
50-Ton Capacity
(Drawing No. S-N31-115, undated)



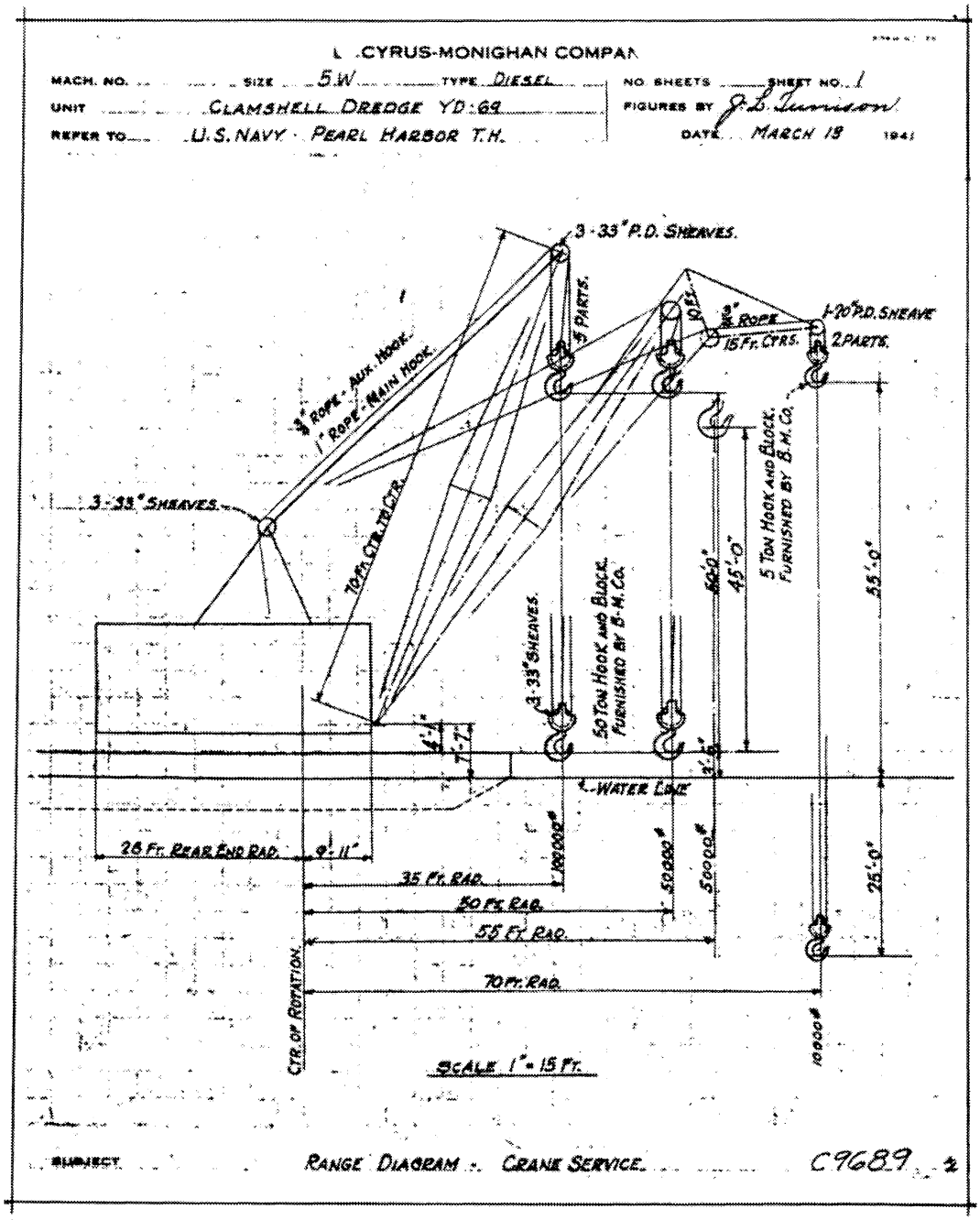
Hammerhead Crane
(Drawing No. S-N31-118, Revised Yd. Letter 19 Aug. 1937)



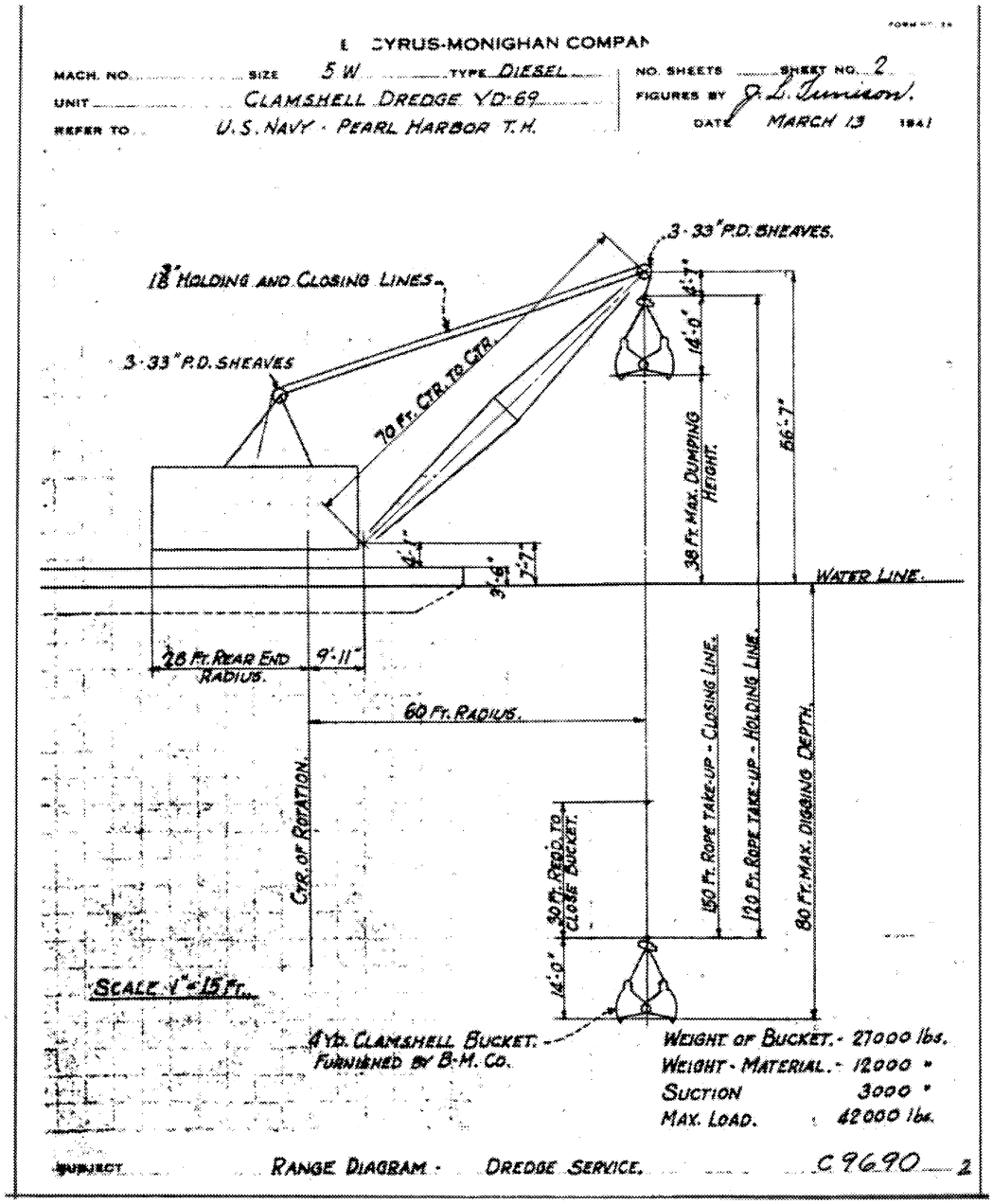
Bridge Gantry Crane BG-1
(Drawing No. S-N31-121, undated) (reduced)



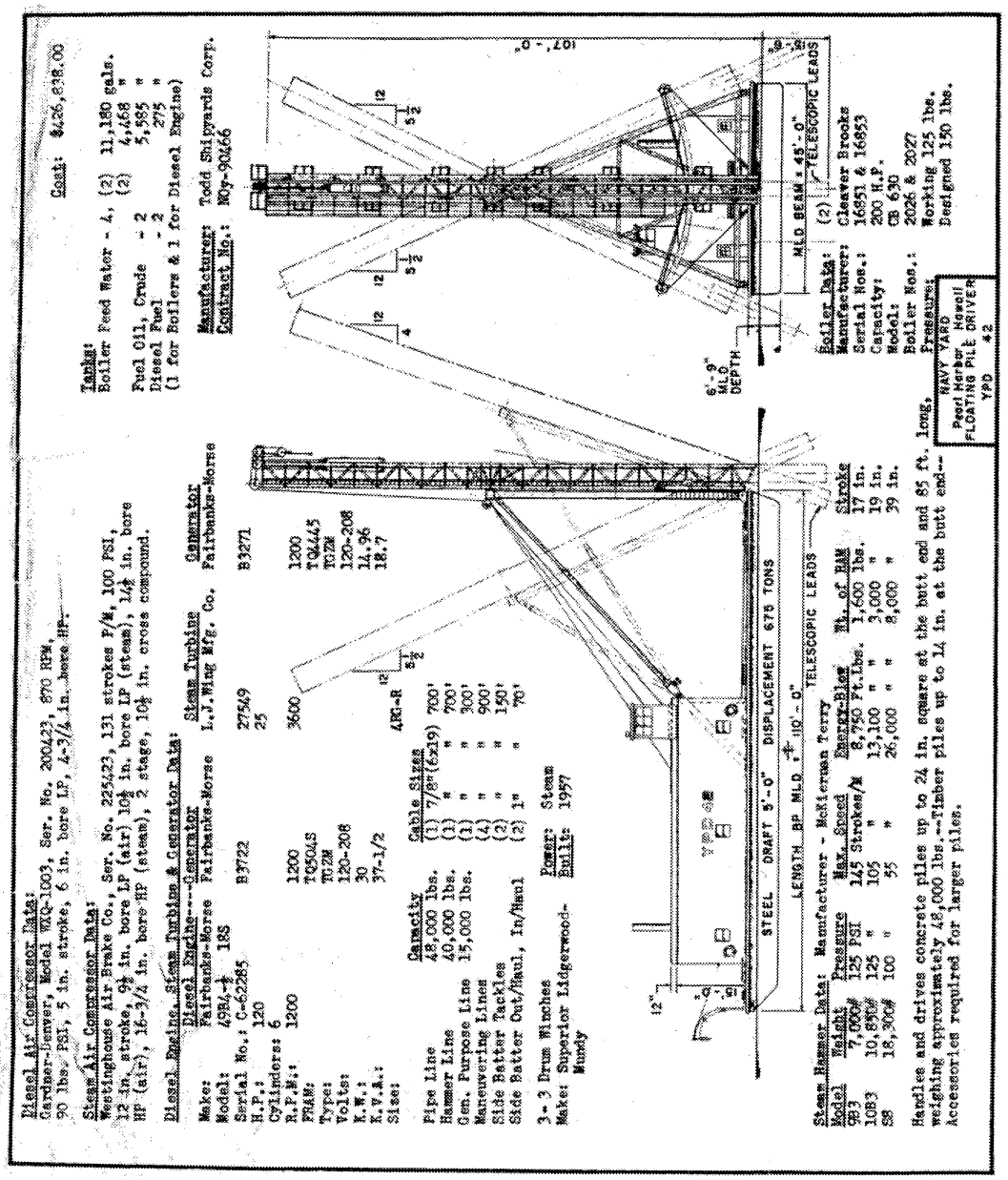
Floating Derrick YD-69
Crane Service Diagram
(Drawing No. C-9689, undated)



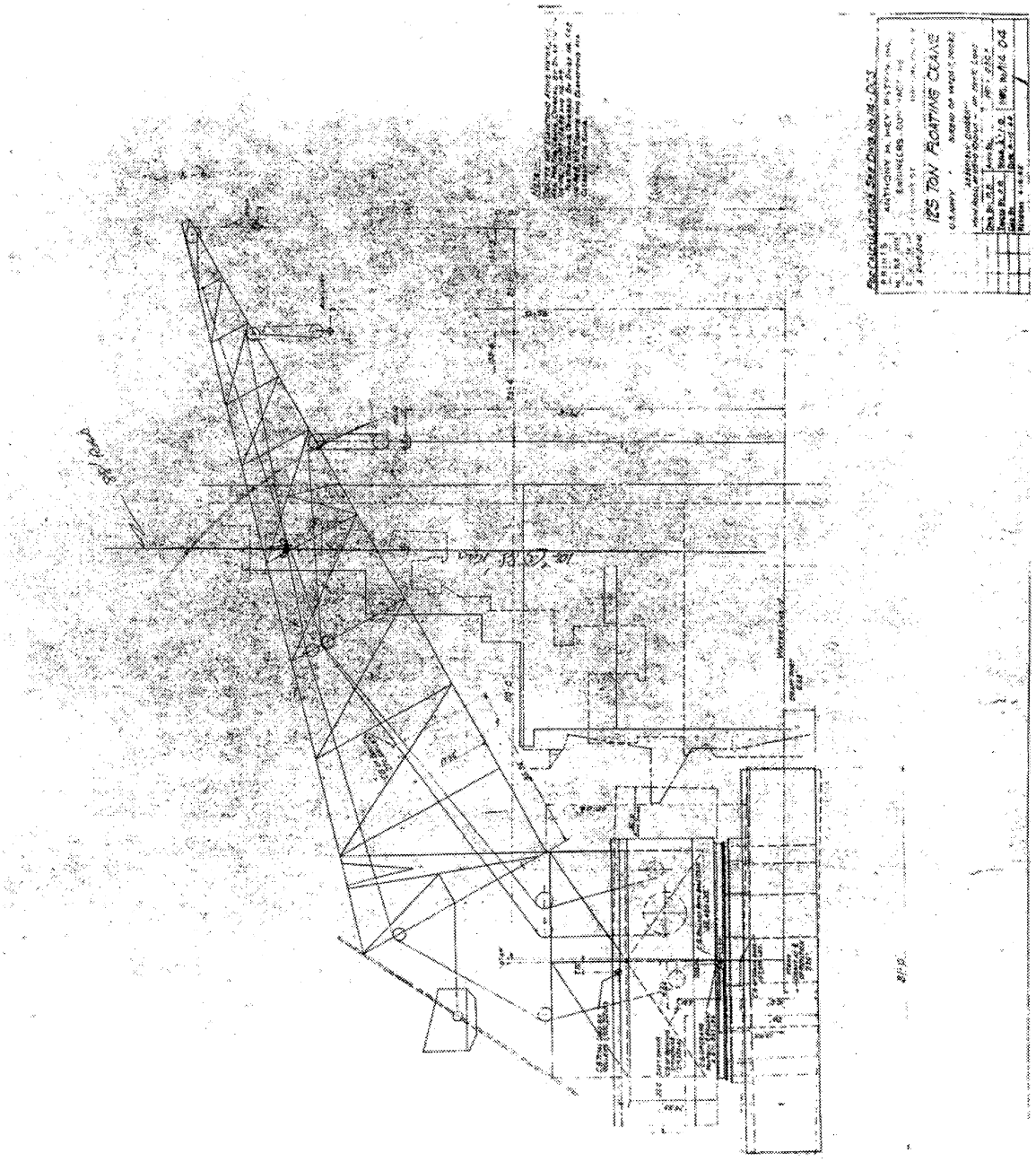
Floating Derrick YD-69
Dredge Service Diagram
(Drawing No. C-9690, undated)



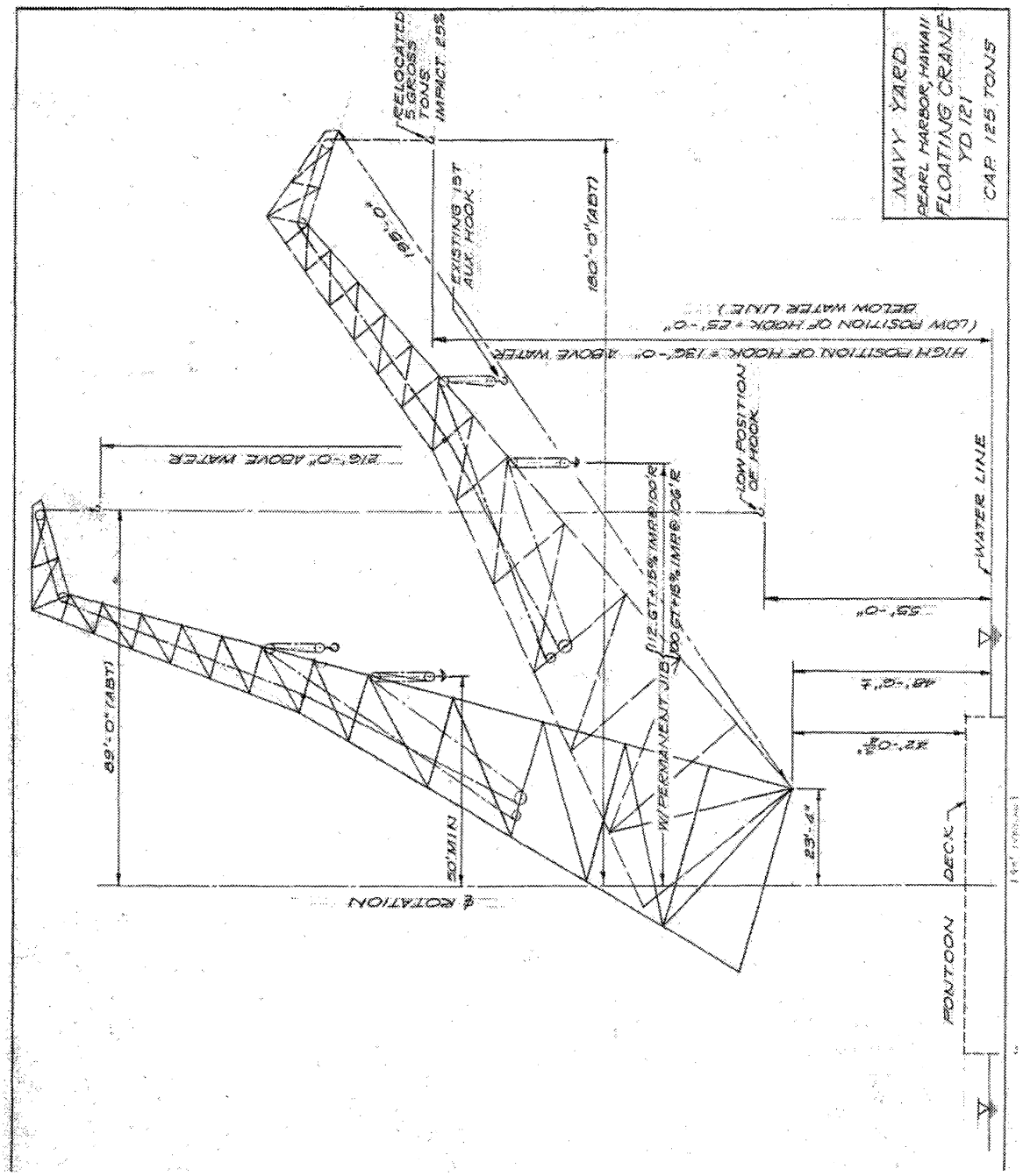
Floating Pile Driver YPD-42
(Drawing No. S-N31-110, undated)



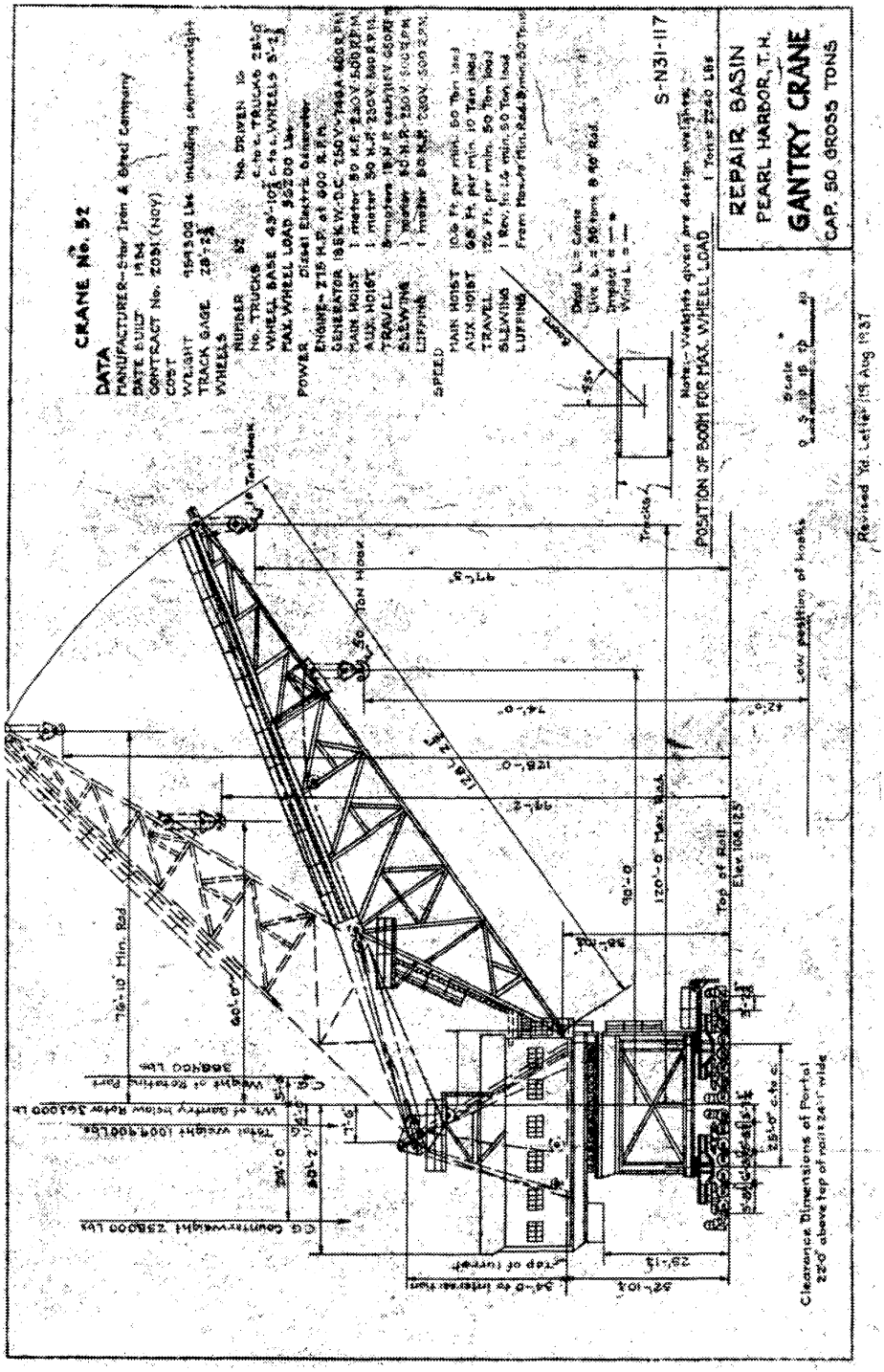
125-Ton Floating Crane YD-121
(Drawing No. 114-D4, dated 4-16-1945)



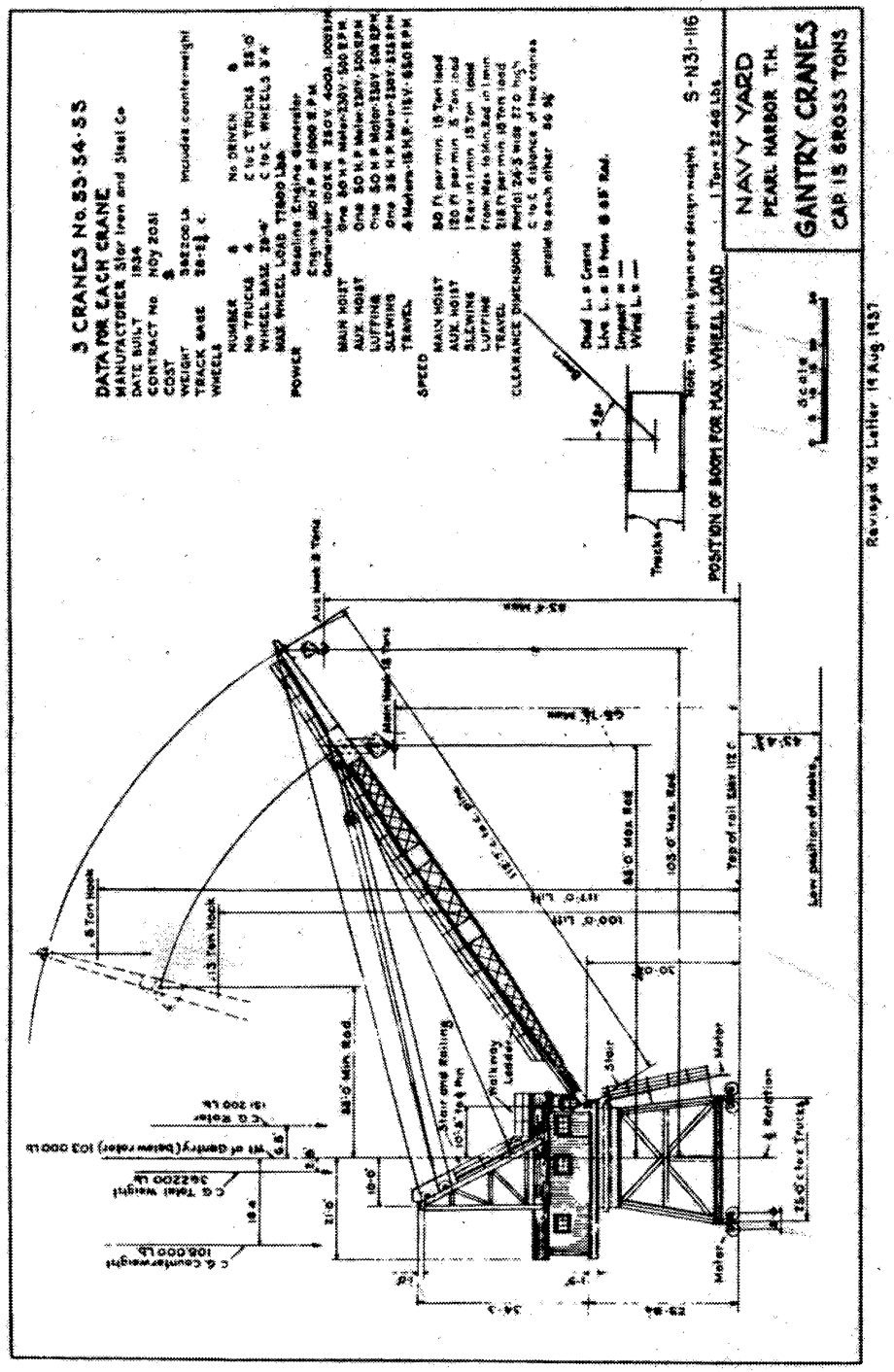
125-Ton Floating Crane YD-121
Hook Extension
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



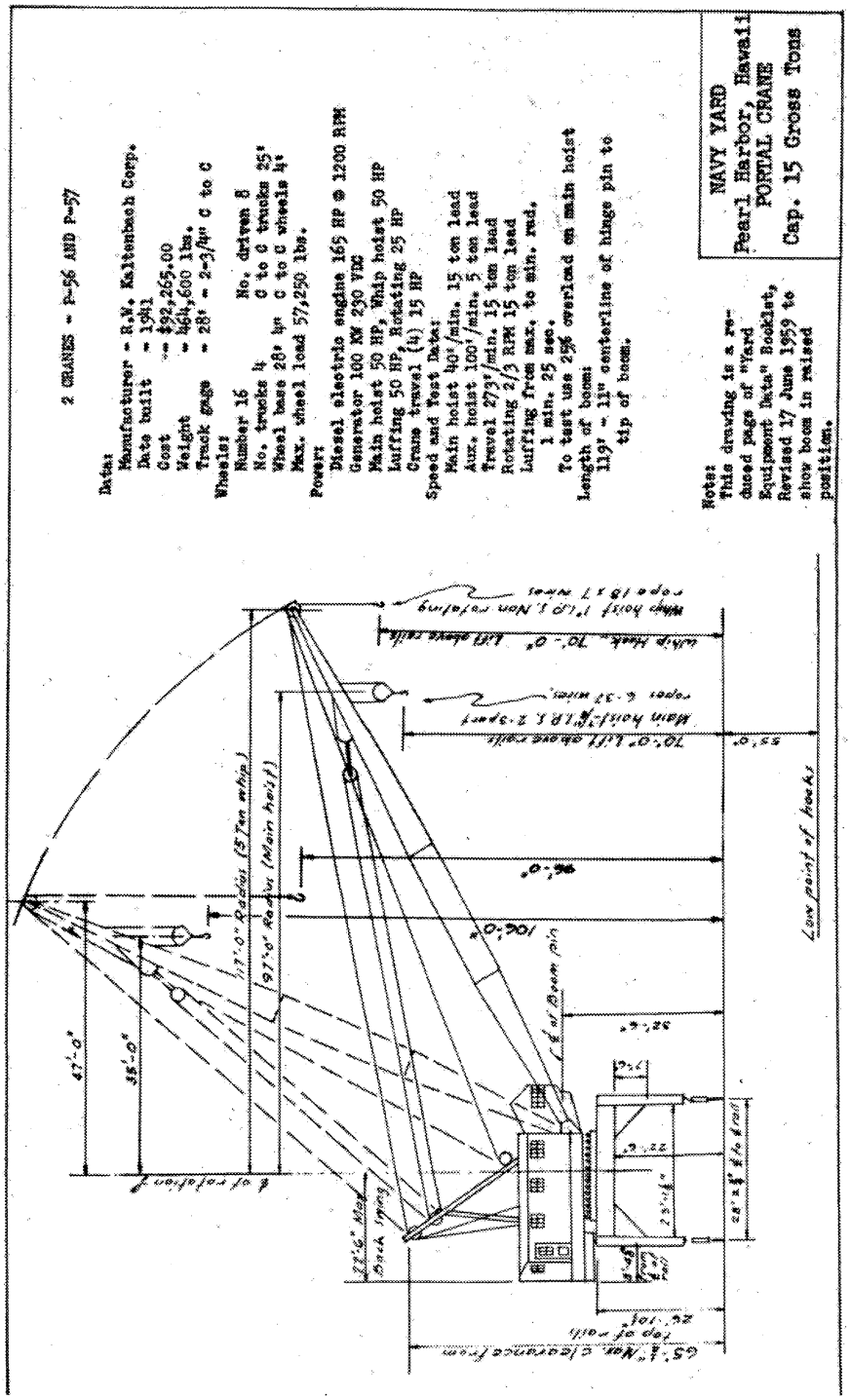
Portal Crane P-52
50-Ton Capacity
(Drawing No. S-N31-117, dated 19 Aug. 1937)



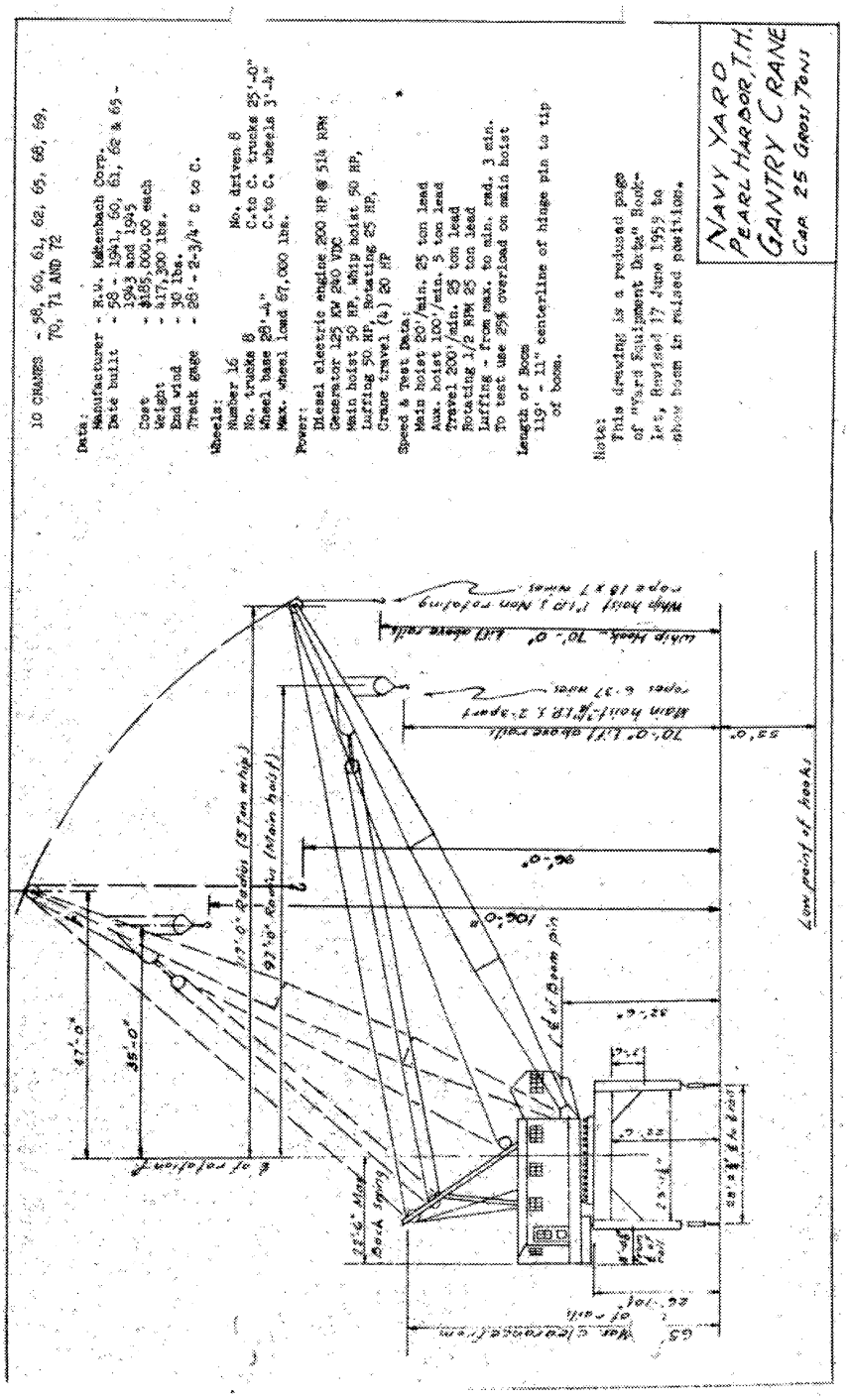
Portal Crane P-53, 54, 55
15-Ton Capacity
(Drawing No. S-N31-116, dated 19 Aug. 1937)



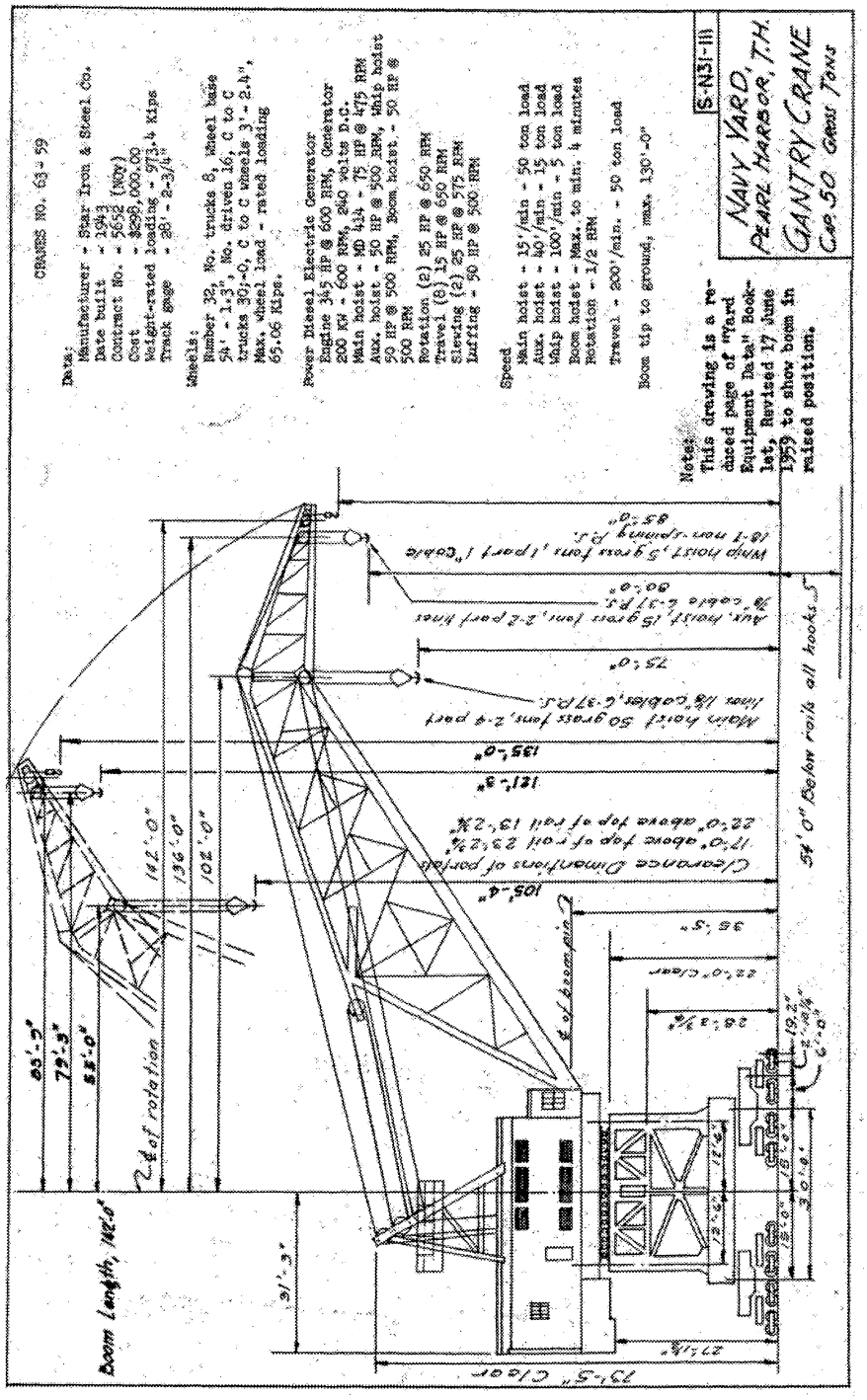
Portal Crane P-56 and P-57
15-Ton Capacity
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



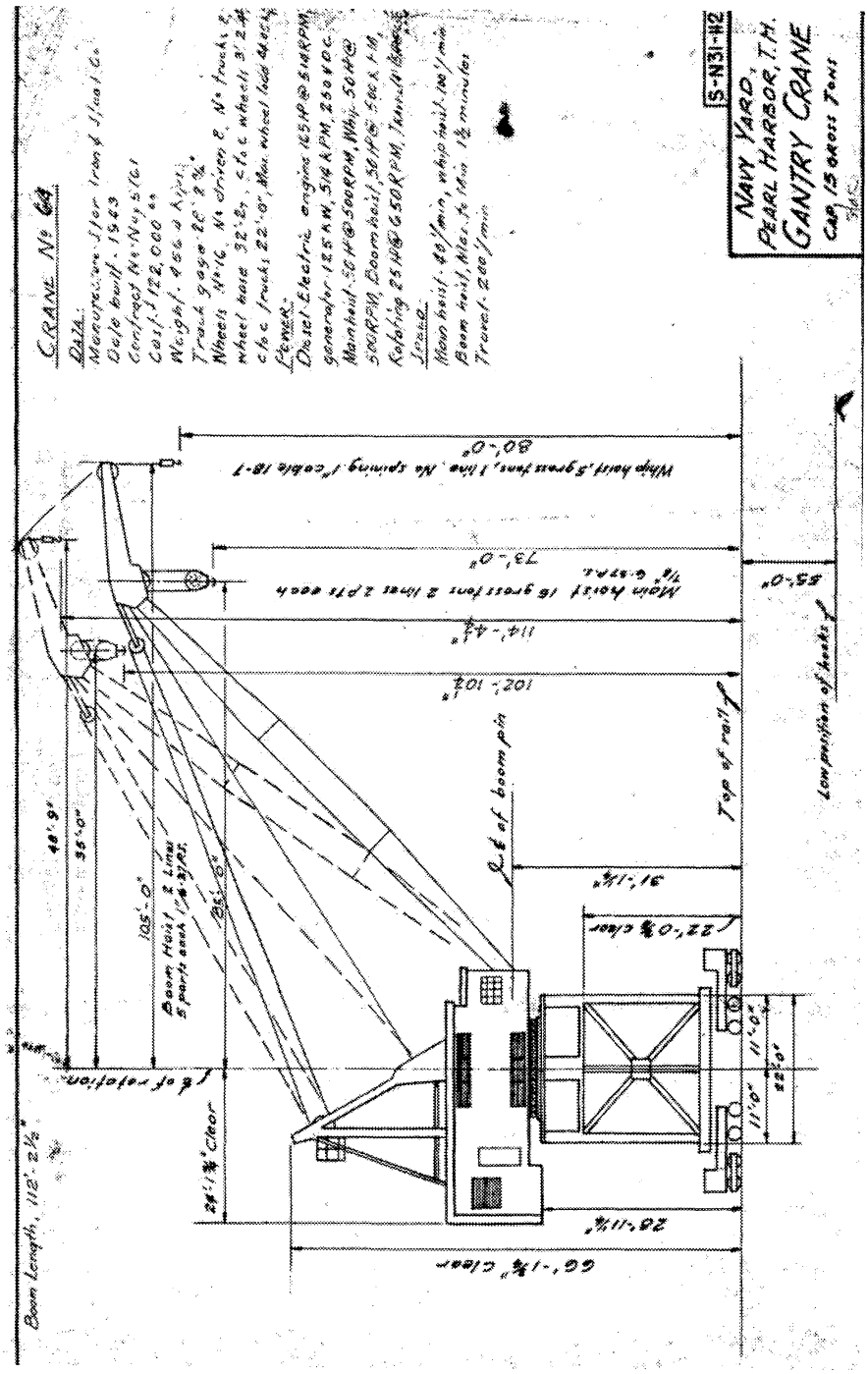
Portal Crane P-58, P-60, P-61, P-62, P-65, P-68, P-69, P-70, P-71, P-72
25-Ton Capacity
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



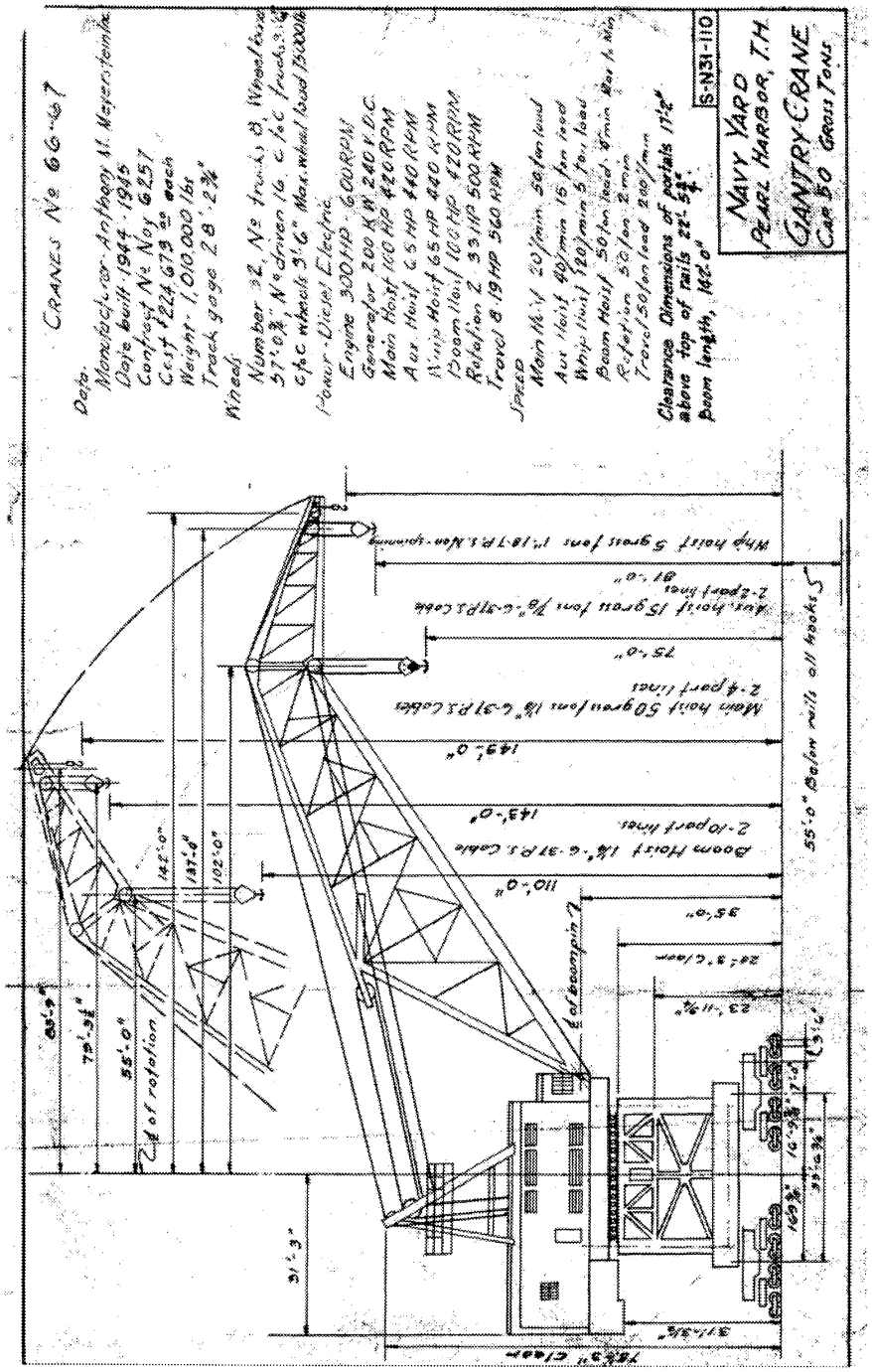
Portal Crane P-59 and P-63 showing 1959 Boom Extension
30-Ton Capacity (Reduced from 50-ton Capacity)
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



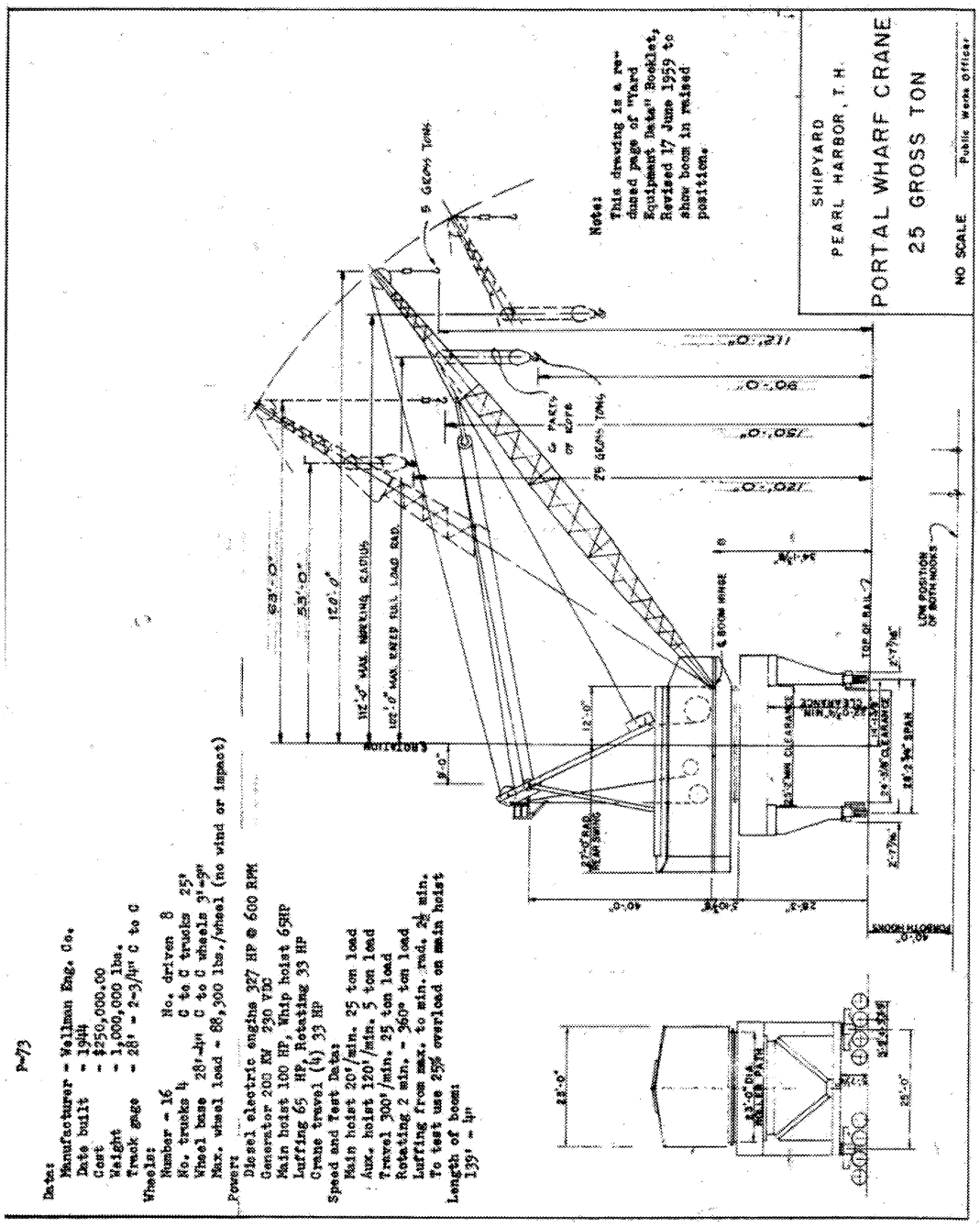
Portal Crane P-64
15-Ton Capacity
(Drawing No. S-N31-112, undated)



Portal Crane P-66 and P-67
50-Ton Capacity
(Drawing No. S-N31-110, undated)



Portal Crane P-73
25-Ton Capacity
Pearl Harbor Naval Shipyard, Crane Division (un-numbered, un-dated) (reduced)



1944 photo of a stationary crane hoisting an aircraft at Ford Island Aircraft Carrier berthing wharf. Photo from National Archives II RG 71 CB.