U.S. NAVAL BASE, PEARL HARBOR, SPLINTERPROOF AIR RAID SHELTERS
Various Locations Throughout Base
Pearl Harbor
Honolulu County
Hawaii

HABS No. HI-390

HABS
HI-390

PHOTOGRAPH

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN BUILDINGS SURVEY
National Park Service
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Oakland, California

HISTORIC AMERICAN BUILDINGS SURVEY

U.S. NAVAL BASE, PEARL HARBOR, SPLINTERPROOF AIR RAID SHELTERS

HABS No. HI-390

Location: Various Locations (see map)
Pearl Harbor Naval Base
City and County of Honolulu, Hawaii

See HABS No. HI-60 for UTM coordinates of the base and reports listed below for UTM coordinates of specific facilities.

Present Owner: U.S. Navy

Present Use: various

Significance: The erection of protective buildings was a direct response to the December 7, 1941 attack, and Pacific coast military installations are the only known locations of these categories of construction. Further air raids by the Japanese were expected and facilities, termed splinterproof, were built to protect personnel from bullets, bomb fragments or other material from explosions. There were four categories of air raid shelters constructed during the World War II period at Pearl Harbor. They are distinctive building types; of the three shelter categories that remain, all are windowless and built of concrete, or of concrete plus concrete masonry units (CMU), at least 10' thick. The most common were the arched-section shelters, since they were the most easily erected from pre-cast concrete modules. Shelters in this category were typically placed at ground level, although excavations could be made to place them partially or entirely below grade. Cast-in-place, rectangular-section, underground structures comprise another category of splinterproof shelter. Buildings in these two categories were typically intended solely as personnel shelters in the event of an air raid. Casualty stations were the third category of splinterproof shelter, built above ground, with a number of variations in type. Typically these casualty stations are cross-shaped buildings in plan, but at least one of them was built inside an arched shelter (Facility 4, Bishop Point). The fourth category of air raid shelters encompassed the temporary types, usually constructed partially or entirely with sandbags. No temporary shelter is extant. Only a few examples in the other three splinterproof shelter categories remain at Pearl Harbor. The splinterproof basement of the eastern wing of Facility 1 in the Shipyard is also discussed in this report, although it was designed before the Japanese attack.

For specific descriptions see these HABS reports on shelters in Pearl Harbor:

Report Number	Fac. No.	Area	Date	Report Name (all preceded by: U.S. Naval Base, Pearl Harbor)	Category
HABS No. HI-367	4	Bishop Point	1941	Dispensary and Casualty Station	Casualty Station in Pre-cast Arched Shelter
HABS No. HI-161	43	West Loch	1943	Medical Clinic	Casualty Station (Type "D")
HABS No. HI-423	216	Naval Station	1942	Type A Casualty and Decontamination Station	Casualty Station (Type "A")

HABS No. HI-217	S380 & S381	West Loch	1942	Fallout/Bomb Shelter Type	Pre-cast Arched Shelters
HABS No. HI-339	721	Kuahua	c. 1942	Fallout Shelter	Undergr'd rectangular-section shelter
HABS No. HI-186	681	Submarine Base	1942	Administrative Building	Casualty Station (Type "B")

HISTORICAL CONTEXT

Some of the facilities built in response to the December 7, 1941 attack were classified as "bombproof," or resistant to a direct hit by a 2000-pound (or less) bomb (see HABS No. HI-391). The "splinterproof" shelters were only designed to protect against the "splinter" effect of large near-by bombs, including their shrapnel and other debris sent flying by the blast, as well as to provide protection from bullets or small projectiles during an attack. The concrete walls and roofs were typically 10" to 14" thick in splinterproof shelters, while the bombproof facilities had heavily reinforced concrete walls and roofs, 4'-0" and 6'-0" thick. The bombproof buildings typically had dual functions, such as a command or communications center, as well as a shelter. The casualty station category of splinterproof shelters also had a dual function, to both treat casualties and to protect them and the medical staff. The exact number of each category of shelter that was built during WWII is difficult to know, since no comprehensive list or set of maps has been found dating from late 1945. At least 265 splinterproof shelters (either arched or rectangular-section categories, but mostly the former) were shown or listed on various WWII maps or building inventories of the Pearl Harbor area (Mason Architects 2004: 1.3-5). Most of these have been demolished, and only 18 shelters with facility numbers remain in the Pearl Harbor area (one is on Pearl City Peninsula land now controlled by the Marine Corps), plus six remnant shelters. So less than one-tenth of the arched or rectangular-section splinterproof shelters remain. On Ford Island only one of the 44 (or more) shelters constructed there during WWII is extant (see 1943 map of Ford Island reproduced in this report). Seven of the nine known casualty stations built at Pearl Harbor during WWII have been retained, since these larger buildings could be adapted to a wider variety of uses than the arched or rectangular-section shelters.

Most of the active defensive facilities (gun positions, etc.) as well as the passive defensive facilities (splinterproof shelters, etc.) constructed after the Japanese attack were built by Contractors Pacific Naval Air Bases (CPNAB), the consortium of construction firms that had been building many facilities for the Navy at Pearl Harbor and other Pacific locations. Their report on their work noted, however, that "local Navy and Marine Corps forces assisted the contractors in producing these emergency facilities" (Contractors Pacific Naval Air Bases n.d.: A-1197). "Air raid shelters were placed throughout the installation to protect the Navy's workforce, both civilian and military, from anticipated harm" (Mason Architects 2004: ii). The Navy's war-time priority was to ensure the continuation of the important work at Pearl Harbor, and the provision of these shelters, although never having to serve their intended purpose, helped maintain morale despite anticipation of another air raid.

All of the WWII shelters that survived to the present were built with concrete and concrete masonry units. This is notable because concrete was considered a critical material, and conservation orders for such materials were issued during World War II. However, concrete could best provide the required protection from anticipated future attacks, so it was authorized for use in shelters. Other materials, and even just open ditches, were used for air raid shelters (see following section on "Temporary Air Raid Shelters.")

Most of the splinterproof shelters had air locks, or at least gasproof doors, to provide protection against gas attacks, as well as bombs. Similar precautions were taken for all military installations in Hawaii. A 1941 Army publication

> called for gasproofing first aid stations, plotting rooms for 6- and 16-inch batteries, battery switchboard and radio rooms, harbor defense and groupment command posts, post and fire control switchboard rooms, post radio stations, and mine casements. In addition, toilets were gas-proofed to protect soldiers at their most vulnerable (Smith 1999: 80).

Gas-proofing meant having seals on all doors (and windows if any), and purifying the air supplied to the inside. The basic concept was that poison gas is heavier than air. Therefore, tall intake air pipes rose at least 25' above ground level to draw in relatively clean air. The air was filtered and sent to the gasproof room(s) under pressure. This higher pressure in the room(s) prevented the poison gas from entering. Valves controlled the escape of the air and maintained the proper interior air pressure. The machinery that provided the air pressure and included these valves was called a "collective protector."

Entrances were designed and placed to minimize formation of gas pockets. Air locks were small rooms at the entries that were designed to limit the introduction of gas into the protected spaces. The collective protector included an air blast mechanism, which was usually placed in the air locks. The blast of purified air "removed loose vapors from clothing, reducing the amount of gas carried into the protected space. The contaminated air was drawn back into the collector and refiltered" (Smith 1999: 82).

DESCRIPTION OF VARIOUS CATEGORIES AND TYPES OF SPLINTERPROOF SHELTERS

PRE-CAST CONCRETE ARCHED SHELTERS

The majority of the splinterproof shelters erected in Hawaii were in the arched pre-cast concrete category. The arched shape of these shelters, viewed in section, is not a common one. It somewhat resembles a parabolic arch or a catenary arch (such as used in the Gateway Arch of St. Louis), but does not meet the mathematical definitions of those kinds of arches. Contractors Pacific Naval Air Bases (CPNAB) called them "semi-parabolic" in their report (CPNAB, n.d.: A-921). There were many of these air raid shelters built during WWII because they were modular and thus easily fabricated, transported, and lifted into position. They were installed not only at Pearl Harbor, but also at Navy installations throughout the 14th Naval District. See the historic context report covering splinterproof shelters by Mason Architects, Inc. (2004: Chapter 1.3). See also HABS No. HI-279-D for information on a shelter located at Naval Air Station Barbers Point. This report includes the "Design, Construction and Location" notes for this category of shelter. The notes on the standard drawing for this shelter design note that removal of sections or units for re-use elsewhere was contemplated.

Usually these arched shelters were placed with the slab at grade, but sometimes they were placed in excavations, so that they were partially underground. In either case, an earth covering was usually added to aid in camouflage. Most examples of this kind of shelter were removed in the years following the war, but some have been retained for storage or other uses, all without the earth covering.

Seven remaining buildings in this category at Pearl Harbor retain substantial integrity. These are Facilities 4 (Bishop Point), S 51 (Hale Moku), S 830 (Kuahua), S 946 (Submarine Base), S 1133 (Shipyard), plus S 380 and S 381 (West Loch). Note that Fac. 4 appears to be unique in having been used as a casualty station within a form typically used as a shelter. There are four

other shelters in this category with lower integrity: Facilities 279 and 343 (Makalapa), S 402 (Waipio), and 465 (West Loch). There were also two low-integrity shelters (Fac. 20 and S 37) at Bishop Point which were recently demolished. These six shelters consist or consisted of only two to six pre-cast units, which had been moved from their original sites to a convenient location for their new use (usually storage). Some have one end open, or the ends have been enclosed with plywood or other material. There are also six known remnants of arched shelters, two each at Makalapa, Public Works Center compound, and Waipio Peninsula. All of these remnants are without facility numbers, and none are in the Navy's facility database. Five of the remnants consist of one or two units, most without end enclosures. One remnant, including at least 38 units, is used as fill or as a retaining wall in the PWC compound. One of the remnants without a facility number in the Makalapa housing area is used for lawn mower storage. The other one- and two-unit remnants are not in use.

This category of splinterproof shelters can be of varying length, but all are 13' 2" wide x 13'-0" tall. Such shelters are an assemblage of arched, pre-cast concrete units or modules. Each arched module is 5'-0" in length and has four metal loops embedded in the concrete for lifting. The end walls and partition wall pieces are 8" thick. Fan stacks typically rise above the roofline. These are usually metal cylinders, but sometimes rectangular, with a variety of caps. Drawings show stacks as high as 16' tall. The standard drawing shows a simple slanted rectangular cap over the stack, tilted lower on the trade wind side, to minimize wind-blown rain getting into the stack. The few remaining stacks, which are shorter than 16', have gabled or conical caps.

Foundation slabs for these shelters are poured-in-place concrete. The foundation usually has 4"-high and 8"-wide curb walls and measures 15'-0" in width; its length varies with the number of precast arched modules to be aligned within its curbs. The few inches remaining between the 13' 2"-wide pre-cast units and the foundation curbs were filled with a concrete mixture that was designed to allow future removal and relocation of the arched modules. Notes on a drawing (Fourteenth Naval District 1942e) for a standard arched shelter indicate that floor levels were usually one to four feet below natural grade. However, most extant buildings in this category at Pearl Harbor are at grade.

The slanted walls curve into the arched roof, and the concrete units or modules do not require any additional structural framework. The structural drawing for buildings of this design (Fourteenth Naval District 1942e) shows the thickness of the arch at the crown was 14", but the walls are only 10" thick at their lower portions. Reinforcing steel was used in all the modular pieces. To move and place the units, cranes and trailers with 8-ton capacities were required.

There are no window openings in these shelters. The entries are typically in the end units, but at right angles to the length of the building. Because the doorways are recessed into the sloping wall, they are set back approximately 3' from the foot of the wall, and 1'-6" from the wall at the top of the doorway. There are splay walls approximately 15" thick on either side of the doorways. The doorway openings are 2'-6" x 6'-6". Various doors have been installed over the years in these shelters, but a standard drawing (see at end of report) shows the original door as built of waterproof plywood, with an upper screened panel, and a small screened area at the bottom. No door of this design remains in the extant arched shelters at Pearl Harbor.

Just inside the entrance, in the first pre-cast unit of an arched shelter, there is typically a vestibule wall with opening between the entry unit and the main part of the shelter. The vestibule wall opening typically measures 2'-4" x 6'-6", with a 6" high curb or threshold. Notes on a drawing for a standard arched shelter (Fourteenth Naval District 1942d) indicate that usually the interior doors at these openings were solid and fitted with gaskets to make them gas proof. None of these gas-proof doors remain in the extant arched shelters at Pearl Harbor.

However, in Fac. S 51 at Hale Moku, portions of the rubberized fabric gaskets around the doors remain (Mason Architects 2004: 2.2-12). The notes on the standard drawing for this shelter state that the solid, gas-proof doors were to be left open between uses, with the outer, screened-panel door secured, to allow airing-out of the shelter.

The standard drawing shows that ventilation for these shelters was to be provided by two 4"-diameter pipe vents at the top of each unit, other pipe vents on the side wall of units that had toilets, plus one or more fan stacks. The extant pre-cast, arched shelters at Pearl Harbor do not seem to have been cast with 4"-diameter holes on top for pipe vents, but there are vent openings in the modules where toilets were. The fan stacks on most extant shelters have been removed. There are rectangular openings in the tops of the modules where fan stacks were located. In one vestibule of each shelter there was an auxiliary generator to run the fans and lights and to provide power in case the electric lines were knocked out by an attack. The notes on the standard drawing indicate that continuous power for ventilation was required if the shelters were housing their maximum capacity. If housing only their normal capacity, then shelter could be provided for ½ hour after power failure.

Since the shelters are no longer used for their original purpose, most do not have capacities indicated on them. Facility S 380 at West Loch, which is constructed of only three units plus an entrance unit, has "24 persons" painted on it. A sign on the 25-unit Fac. S 830 at Kuahua says "Capacity 90." Neither sign indicates if the number is normal or maximum capacity. Normal capacity could have been calculated by dividing the available length of the interior benches by an average person's width. Maximum capacity may have included the standing space between the benches lining the walls.

Toilets were typically provided in these shelters, and just as the length of the shelter could vary, the number of toilets provided could vary, depending on the personnel concentration in the area. If the shelter was not located near a sewer line, then chemical toilets were provided. The notes on the standard drawing state that these consisted of wooden seats over an empty five-gallon paint container, with a nearby one-gallon can of disinfectant. One such toilet remains in Fac. S 830. The toilet enclosures are shown on the standard drawing as being built of plywood on 2x4 studs, with two toilets for men and two for women, flanking a sink for each. No bathroom fixtures or partitions remain in this category of shelters at Pearl Harbor.

The standard drawing for this shelter category shows an entrance light at the end of a curved pipe. The bulb was a five-watt argon glow lamp in a lock-tight globe guard. This low wattage and the choice of argon, which glows blue, were probably designed not to attract attention to a shelter during an attack. Only one such light fixture (but no argon bulb) remains, at Fac. S 51 (Mason Architects 2004: 2.2-12). A few original interior light fixtures remain in some of the Pearl Harbor air raid shelters.

The most typical alterations in the arched category of air raid shelters over the years have been the removal of the toilets, interior doors, and other interior fixtures or finishes, since most were converted to storage use. In many, the original entry units have been altered or removed. When an entry unit with the opening on the side wall is removed, the previous vestibule wall and opening become the end wall and entry. Where entry units remain, the original doors have generally been replaced.

CAST-IN-PLACE RECTANGULAR-SECTION SPLINTERPROOF SHELTERS

Splinterproof shelters in the second category were rectangular in section and cast in place, rather than built of arched, pre-cast units. These were typically built underground, with an entrance at each end, at right angles to the long, narrow shelter space. In 2001 there were only six examples remaining at Pearl Harbor. It is not known how many of this kind of shelter were built at the base during WWII, since maps only indicate shelter locations, and shelters were not given facility numbers or included on building lists until after WWII. Three shelters in this category are at Submarine Base (Fac. S 937, S 936 and S 938); the latter two are entered at grade, without stairs, due to the topography of the hill in which they are excavated. Facility S 936 is U-shaped in plan, with two entrances on Nimitz Street. Facility S 938 is L-shaped in plan with one entrance on Nimitz Street and the other at a paved area near the large BEQ. Facility S 937 is below grade and can be entered via a stair at each entry, which runs at right angles to the length of the shelter. The shelters at Kuahua (Fac. S 721) and at Shipyard (Fac. S 1115) were also built below grade and entered by a stair at each end. The shelter near Bloch Arena (Fac. S 897) is only partially below grade, but earth was mounded over it for additional protection and for camouflage reasons. No drawings were listed in the Plan Files index of Naval Facilities Engineering Command, Pacific for these facilities. The Navy database indicates that all are approximately 10' high and 10' wide and a little more than 100' long, except Fac. S 1115, which is about 13' high and approximately 14' x 179' in plan.

Only the entries and the ventilation stacks of this category of shelter are visible on the exterior. The two remaining examples at the Submarine Base have entrances essentially at grade. One door of Fac. S 938 and the two doors to Fac. S 936 are in the wall along Nimitz Street. The two doors to the latter are set into a concrete retaining wall, while the entrance to the former is carved into the natural rock of the hill. These three doors are made of boards and are less than 6' tall. There is a concrete lintel above the Fac. S 938 door that is about 8" thick. However, above the passage leading to the other entrance to Fac. S 938 the concrete roof is about 2' thick. A sheet-metal door on a metal frame has recently been installed at that entry. There are no ventilators above these two shelters. The entrances to the other four shelters in this category are narrow stairways between concrete walls. Metal doors were installed above ground (like outside cellar doors) on Fac. S 721, but may not be original. The openings to Fac. S 1115 have been blocked up with panels of corrugated metal since at least 1977. The ventilation stacks to Fac. S 1115 have been removed, but photographs show there were three metal cylinders about 6' tall, with conical caps. Fac. S 721 retained its two ventilators until this structure was demolished around 2002.

The floors, walls, and ceilings of these shelters are entirely concrete, except for Facility S 1115 which has some wall portions simply excavated from the bedrock. Also, wooden partitions for the toilet rooms remain in some of them. The wooden forms used for containing the concrete are evident, since the concrete was left unfinished. Some of the shelters in this category, including Fac. S 721, had concrete beams spanning the width, spaced about 8' on center. A historic photo of the dismantling of an underground shelter shows the roof was made by placing pre-cast concrete panels, measuring approximately 4' x 14', across and overhanging the width of the shelter. Two types of wooden benches were found in the shelters in this category. Facility S 721 was lined with high-backed benches prior to its demolition. These measured about 8' in length, and were built with three boards on the seating planes and three on the back planes. Facility S 1115 has one backless bench.

Although no drawings were found for the extant facilities in this category, one drawing was found for rectangular-section splinterproof shelters. This was listed under "Standard Definitives" on the Plan Files database, but is a drawing for two specific shelters that were located in

Honolulu, near Punchbowl Street and Ala Moana Boulevard. These rectangular shelters, unlike the ones at Pearl Harbor, were designed to be built above ground and then covered with earth, rather than constructed below grade. The drawings show the floors in these shelters were 4" thick, the walls were 8" thick, and the ceilings were 10" thick, with a mounded earth cover, measuring at least 3'-0" at center. The toilet enclosures are shown on this drawing as being built of plywood on 2x4 studs, with two toilets for men and three for women, with the two sinks against the opposite wall.

In addition to those six underground, rectangular-section shelters which had similar shapes and dimensions, there was at least one other underground shelter type built at Pearl Harbor during WWII. Facility S 96, on Ford Island, is the only known underground bombproof command center and shelter at Pearl Harbor. Built in 1942, this facility is referred to on a 1945 map (Fourteenth Naval District 1945), as a "bombproof shelter" and on the Navy's 1945 building list as a "command center" constructed at a cost of $70,000 (U.S. Navy, Bureau of Yards and Docks 1945: 1083). This structure was apparently built as a command center from which air operations could be directed in the case of another attack. By the time its construction was finished there was little fear of a repeat attack, so it is not known if this building was maintained as a standby command center or regularly used. In any case, it was available as an emergency shelter for the numerous officers living nearby. The building is no longer listed on the Navy's facility data base. The entrances to the building have been mostly blocked off, but a concrete shaft, approximately 3' square, projects slightly above the earth mound over this structure. This was probably the emergency exit. A metal plate covers the shaft opening and a metal ladder provides access down to the generator room. This building was partially accessed and surveyed in 2004 by Jeffrey Dodge, Historic Preservation Specialist at Naval Facilities Engineering Command, Pacific. He measured the ceiling height as 14'. The dimensions given in the 1945 building list are 98' in length, 34' in width, and 17' in height. That height dimension may include the thickness of the concrete roof.

CASUALTY STATIONS AND GAS DECONTAMINATION STATIONS

The third category of splinterproof shelters at Pearl Harbor was the casualty station, which was designed to treat, and temporarily shelter, victims of an attack. There were at least three different types of casualty station designs. (Note that this is not counting Fac. 4 at Bishop Point which is in the arched shelter category, but, unlike the others, was adapted for use as a small casualty station). The basic casualty station design was essentially rectangular in plan, with some slight projections from the main rectangle. Seven casualty stations are extant at Pearl Harbor: Facilities 207 and 213 at the Shipyard, 210 and 216 at Naval Station, 212 at Marine Barracks, 681 at Submarine Base, and 43 at West Loch. Only two other casualty stations at Pearl Harbor were noted in the 1945 buildings list (U.S. Navy, Bureau of Yards and Docks 1945: 1004 & 1067); these were of wood construction, which is part of the reason they did not last. One was in the Aiea Naval Receiving Barracks area and listed as Facility 104, with dimensions of 85' x 22' x 10'. The other, Facility 304, was in the Hospital Point area and had dimensions of 84' x 31' x 11'. Most of the extant casualty stations were built according to the Type A design, but Facility 207 was Type B, and Facility 43 was Type D. It appears that gas decontamination was usually incorporated into the function of the casualty stations, but in at least five instances, separate buildings were erected as "Gas Decontamination Stations," including Facilities 192 (demolished) and 305 on Ford Island, Facility 44 (demolished) at West Loch, Facility 44 in the Shipyard, and a building now used by the Boy Scouts on Red Hill. Facility 441 (demolished) was located near Facility S 721 and was called a Decontamination Building for Clothing on 1943 and 1944 maps of Pearl Harbor.

It appears that all the Casualty Stations were built in 1942, in response to the Pearl Harbor attack, although 1941-1944 dates are listed in the Navy facilities database. Although built in 1942, these buildings were not equipped and ready for operation until early 1943, according to an undated typewritten report on the WWII activities of the Yard Medical Department (Pearl Harbor Navy Yard n.d). Seven of the "Casualty Dressing and Gas Decontamination Stations" were under the cognizance of the Yard Medical Officer, but only for a year or so, since in late 1944 and early 1945 five of these stations were decommissioned, and "made available for uses other than Medical" (Pearl Harbor Navy Yard n.d.). Two stations (Fac. 213 and 207) were kept by the Medical Department.

Type A Casualty Stations

Each of the three entrances/exits to a casualty station had an airlock room between the entry/exit room and the main part of the building. There was also an internal airlock between the undressing room and washing & bleach treatment room. One of the entrance airlocks was much larger than the other two and had doors into either the receiving ward or the undressing room. The airlock that led only into the receiving ward had two storage cabinets along its side. There were 32 to 36 beds plus a wash-off pit in the receiving ward, according to the drawings for the various Type A casualty stations. The next largest space after the receiving ward was the operating room, with two operating tables and an operating set-up table. A large boiler room was also part of the facility, but this room was accessed only from the outside, through large double doors that were not specially protected. The smaller rooms in the casualty station were the doctors' room with adjacent private toilet and shower room, sterilizing room, nurses' station, clothes storage room, dark room, and several other toilets. This building type was essentially rectangular in plan, with projections for one entrance and one exit. The Type A Casualty Stations are listed with floor areas slightly over 5,000 square feet. The shape is irregular, but the rectangle which could enclose the stations of this type measures about 120' x 55'. The roofs of the entrance/exit projections are 8'-6' high, while the roof of the main building is 10'-6" high. There were originally five concrete-covered ventilation openings on the roof. These were 12" x 12" in plan and 12" thick; air flowed through 6" openings, between the 6" overhang of the covers and the 6" curbs around the vent opening. Historic photos and drawings show that the boiler stack was a metal cylinder 18" in diameter and 40'-0" tall.

The walls of all the casualty stations are 1'-1" thick and the roofs are 1'-0" thick concrete, on a concrete slab foundation, with concrete footings under the structural columns. Some of the Type A casualty station's elevation drawings show windowless walls, while others show planned future window openings, with a note that they are to be filled in with "concrete bricks." Air conditioning and ventilating equipment provided for these buildings was relatively complicated compared to the standard naturally ventilated buildings at the base. Originally all the doors on both sides of the airlocks were 1 ¾" thick metal-covered gasproof doors. The door schedule notes that each of these doors had hardware by Jamison: three "ajustoflex" hinges, a "wedgetight" fastener, an improved door closer, plus rubber gaskets and seals all around. No detailed drawing of these doors was located, but they are probably similar to those used in the bombproof buildings (see HABS No. HI-391).

The original doors have generally been replaced in the casualty stations. The original wall and window opening designs have been altered in some of these buildings, with openings partially unbricked or by cutting new openings in the walls. In Facility 212 the openings shown in a 1945 drawing are larger than the current fixed windows, so the most recent renovation may have entailed bricking back up part of the openings The Type A casualty stations have been adapted

for a variety of uses, from offices (Fac. 681 and 216), to retail outlet (Fac. 210), to industrial shops (Fac. 212).

Facility 213 is the only casualty stations with an added wooden second floor. Construction started in late 1943, and in January 1944 the Industrial Health Center was established here. This addition housed "Chemical, Clinical and Micro-laboratories, Medical Examining rooms, Storerooms, Quarters for Enlisted Personnel attached, and offices for the Industrial Health Officer and Staff" (Pearl Harbor Navy Yard n.d.). This Industrial Health Center served not only the Shipyard, but also the entire 14th Naval District, by conducting surveys that evaluated health hazards, and by performing any chemical or clinical tests necessary. By 1945 the casualty station on the first floor of Facility 213 was not needed for that purpose anymore, and part of it was used as "a storeroom for surplus Medical equipment and supplies from various decommissioned Casualty and Decontamination Stations. The other part of this station was made available to the Safety Engineer for use as a storeroom and an issue room for safety devices" (Pearl Harbor Navy Yard n.d.).

Type B Casualty Station

There is only one remaining casualty and decontamination station of this type, Facility 207 in the Shipyard. Although some historic photos label Facility 681 at the Submarine Base as a "Type B" station, the original drawings label it as Type A, and that facility matches the plan of other Type A casualty stations. Facility 207 is larger and the plan is more complex than the Type A casualty stations. The overall rectangle enclosing the irregular shape is 128'-0" x 70'-6", and the building's total area is 8,038 square feet. This Type B casualty station had five airlocks at entrances and exits, compared to three for Type A. Facility 207 had two undressing rooms, two "washing and bleach treatment rooms," two internal airlocks between those rooms, two dressing rooms, and three storage rooms, rather than one each of these rooms in Type A casualty stations. The operating room was about the same size as in Type A, with only two operating tables, but the receiving ward held 65 beds, compared to the 32 to 36 beds in the Type A casualty stations. Facility 207 also had six rectangular concrete ventilators projecting above the roof line.

Facility 207 was used as a Civilian Dispensary, starting in June 1943. No major changes were made at first, so that it could be ready to function as a casualty station, if required. In January 1945, however, the concrete masonry units in the window openings were knocked out, windows installed, and the building was extensively altered to accommodate a "Civilian Dispensary for male Civil Service Employees with a separate clinic for female Civil Service Employees, female Naval Personnel and for Naval Dependents in the Navy Yard" (Pearl Harbor Navy Yard n.d.). It was remodeled again about 1984 and became the Shipyard Security Office (Orlowski 2003:3).

Type D Casualty Station

Pearl Harbor's only remaining Type D Casualty Station is Facility 43 at West Loch. There is also a similar building (Facility 22) in Wahiawa at the Naval Computer and Telecommunications Area Master Station (NCTAMS). Only drawings for the latter building were found in the Plan Files at Makalapa. Late 1940s maps for both West Loch and Wahiawa showed that a "Decontamination Unit" was in a separate adjacent building for each of these casualty stations. This was in contrast to the Type A and B Casualty Stations which had decontamination rooms within the building. The Type D Casualty Station is very different from Types A and B, especially in the roof design. The flat roof has built-up roofing on boards with a framing of large

timber (12" x 16") beams, which are tapered under the wide eaves. Another major difference from most other splinterproof buildings is that this structure has a concrete frame but infill walls of concrete masonry units (CMU). A historic photo of a Type D Casualty Station at Puuloa Rifle Range shows the walls were built with a row of narrow CMU between every two rows of standard CMU. This type of casualty station was "splinterproofed" by filling the CMU with sand, and its other protective features consisted of the extra CMU walls outside one end and outside a portion of one side of the building. These extra walls protect the ambulance drive and an entrance into the operating room. The CMU walls (main building and protective sections) are about 7' tall; above the walls concrete columns rise about another 3' to support the roof. Originally the narrow band between the columns was filled with metal light-proof louvers. The openings are now largely blocked up with plywood. The original layout included a 16'-0" wide ambulance drive at one end of the building. From this space there were doors into both the waiting room and the ward room. Casualties could be taken directly to the operating room by passing along the exterior, but protected, passage along part of one side. A doctor's office was off the operating room. A corridor between the ward and operating rooms connected the lab and pharmacy room, duty officer's room, kitchen, nurses' station, stores, and linen rooms. A heater room was accessed from the exterior. The toilet and shower facilities and another large room were at one end of the ward, and together these three rooms occupied about half the building. Both remaining examples of this type have been altered.

Gas Decontamination Stations

There were at least three types of Gas Decontamination Stations. Only two Gas Decontamination Stations are extant, but there is one photograph of the demolished Fac. 192 station on Ford Island. That one has a wood exterior, presumably lined with sand bags or some other protective material on the interior. Facility 44 at the Shipyard has a concrete frame with CMU infill. Drawings were found only for this building, which is labeled a "Type K Temporary Decontamination Station." The concrete Decontamination Station now used by the Boy Scouts at Red Hill is no longer owned by the Navy,

SHELTER IN BASEMENT OF SHIPYARD FACILITY 1

In May 1941 the eastern wing of Facility 1 in the Shipyard was designed to have a splinterproof basement (the only part of this building to have a basement, and the only known splinterproof basement at Pearl Harbor). The ceiling and walls of this basement are 12" thick concrete. About one-third of the L-shaped basement was designated on the plan as a bomb shelter, with a telephone equipment room in the short part of the L, and an intelligence vault and intelligence room in the remaining space. There were small toilet rooms in a corner of the three largest rooms. There were no air locks or special gas protection ventilation for these basement rooms, although there was an air conditioning machinery room.

TEMPORARY AIR RAID SHELTERS

Temporary air raid/bomb shelter types are another related category of splinterproof construction. Numerous types of temporary shelters were erected at Pearl Harbor during WWII, but none are extant. One historic photograph (National Archives II, RG 71 CB, Box 103, Folder J) shows box-like structures on the seaplane ramps of Ford Island, which are called splinterproof shelters. Their wood exteriors are presumably lined with sand bags or some other protective material on the interior. A contractor's report also stated that "an enormous amount

of splinterproofing [and] sandbagging" was undertaken after the December 7, 1941 attack (Contractors Pacific Naval Air Bases n.d.: A-1168).

On Midway atoll, and perhaps also at certain areas around Pearl Harbor, timber shelters were built underground, protected typically by an earth or sand cover. At least six hundred of these splinterproof shelters were erected on Oahu by the Office of Civilian Defense. Zig-zag trenches were also dug to provide temporary air raid shelters. Most of the open spaces at schools throughout the territory formerly used for play and open-air classes were taken up by air raid shelters to serve people in the neighborhood as well as school children (Hawaii War Records Depository WR#100 to #105).

OTHER SPLINTERPROOFING DURING WORLD WAR II

Some of the splinterproofing added to buildings during WWII, such as sandbagging, was removed after the war. Power Plant No. 2 (Fac. 149), however, received a more substantial concrete wall enclosure, probably after the December 7, 1941 attack. The steel-framed building was completed late in 1940, and a historic photo shows it had numerous bands of windows and a paneled siding material. The protective concrete walls that were added as splinterproofing required tall, narrow, triangular buttressing, since they were not part of the original building.

Five "Fire and Rescue Stations" were built on Ford Island in 1943 (Facilities 219 through 223, see HABS No. HI-330 and 331). These were apparently built in anticipation of fighting fires created by an incendiary attack (Carlson 1941) and perhaps for rescue of plane crashes and other disasters. They have a splinterproof design, with 12" thick walls and roof slabs and recessed entries.

Many electrical substations and transformer stations at Pearl Harbor were built or enclosed with splinterproof construction, not to shelter people but to help ensure the continuity of power during an attack. There were several different types of splinterproof buildings for these electrical facilities. The most important electrical substations (in Drydock No. 1 pumphouse, Fac. 170 and Fac. S 246, near Drydock No. 4) were protected by bombproof construction.

AIR RAID SHELTERS AFTER WORLD WAR II

After WWII, with the threat of nuclear bombs, further plans for bomb shelters were developed. Some of these just involved re-use of the existing arched shelters, but there was also a new shell design, which differed from the WWII type "only in the distribution of reinforcing steel" (District Public Works Office 1952). It is not known if any of these more heavily reinforced arched shelters were constructed, or if any remain. The 1952 sketch plan also showed two variations of rectangular-section underground shelters, one with ceilings and floors measuring 1'-4" thick and another where they measured 2'-0" thick. The walls in each variation were 1'-1" and 1'-6", respectively, and each had a dividing wall down the center and 2'-0" of fill on top of the structure. There are no known examples of these 1952 underground, rectangular-section bomb shelters at Pearl Harbor.

Those WWII arched and rectangular-section air raid shelters that had not been demolished immediately after the war were listed as bomb shelters in the 1966 Navy list of facilities (U.S. Navy 1966). Most that survived until 2000 are now used for storage. Many of the removed arched shelters have been placed in the Public Works Center compound and function either as

fill or as a retaining wall, in an area used in WWII for personnel staging and Construction Battalions (Dodge 2002).

The casualty stations, with more usable space than in the linear splinterproof types, have been adapted to a variety of uses in the last half of the twentieth century. Each of them has undergone a unique set of alterations. Currently, most are administrative buildings, but Facility 210 is a retail shop and Facility 213 was first converted into a brig workshop and now serves as a hazardous waste facility.

SOURCES

A. DRAWINGS

Most of the splinterproof shelters did not have any drawings listed under their facility numbers in the Plan Files database of the Naval Facilities Engineering Command, Pacific (NAVFAC PAC). However, a few microfiche cards for some original and alteration drawings were located in the NAVFAC PAC Plan Files. Only one Navy drawing was found for rectangular-section splinterproof shelters, and this was for shelters in Honolulu, not at Pearl Harbor. This sheet is reproduced in this report, along with a standard drawing for an arched splinterproof shelter. Drawings for three types of casualty stations are also included. Other useful drawings and maps are listed below in the Bibliography.

B. EARLY VIEWS

There are numerous aerial and facility-specific photographs of Pearl Harbor in the Still Photo section of National Archives II, College Park, Maryland. Only a few historic photos of splinterproof facilities were found; and most of those were of the casualty stations. A small number of historic photos of shelters were also found at the Hawaii State Archives, Admiral Furlong collection, in the 14th Naval District collection of the USS *Arizona* Memorial Association, and at the Naval Facilities Engineering Command Archives at Port Hueneme, CA.

C. BIBLIOGRAPHY

Carlson, H. F.
1941 Memorandum for Naval Air Station Commanding Officer, Subject: Air Raid Attack by Japanese – report on, dated December 18, 1941. In binder of individual reports of December 7, 1941 attack, provided by Jeffrey Dodge of Naval Facilities Engineering Command, Pacific.

Contractors Pacific Naval Air Bases
n.d. *Technical Report and Project History, Contracts Noy-3550 and Noy-4173, Pacific Naval Air Bases.* Microfiche of report at Library of Naval Facilities Engineering Command, Pacific.

District Public Works Office
1952 Preliminary Bomb Shelter Types. 14th N.D. Drawing no. SK-2066 at Plan Files of Naval Facilities Engineering Command, Pacific.

Dodge, Jeffrey
2002 Comments on report draft by Historic Preservation Specialist, Naval Facilities Engineering Command, Pacific.

Fourteenth Naval District
1942 Splinterproof Shelter. [Rectangular Section Type.] Drawing no. OA-N4-515 at Plan Files of Naval Facilities Engineering Command, Pacific.

1942a Bishop Point Naval Reservation, Oahu, T.H., Air Raid Shelters Location Plan, Approved May 12, 1942. 14th N.D. Drawing no. OA-N4-908 at Plan Files of Naval Facilities Engineering Command, Pacific.

1942b Bishop Point, Oahu, T.H., Section Base, Dispensary & Casualty Dressing Station, Approved June 23, 1942. 14th N.D. Drawing no. OA-N9-552, filed under Y&D Drawing No. 204154 at Plan Files of Naval Facilities Engineering Command, Pacific.

1942c Bishop Point Naval Reservation, Reinf. Conc. Arch Type Dispensary & Casualty Station, Location Plan & Services, Approved June 23, 1942. 14th N.D. Drawing no. OA-N9-551 at Plan Files of Naval Facilities Engineering Command, Pacific.

1942d Drawings of Air Raid Shelters for Naval Air Station Barbers Point, dated October 1942. Drawings on sepia, located in Staff Civil Engineer's office there. 14th N.D. Drawing nos. OA-N4-1188 and OA-N4-1189.

1942e Navy Housing, Precast Reinforced Concrete, Arch Type, Air Raid Shelter, dated 10/10/42. 14th N.D. Drawing no. OA-N4-586 at Plan Files of Naval Facilities Engineering Command, Pacific.

1942f Bishop Point Naval Reservation, Precast Conc. Arch Type Splinter-proof Armory, Location Plan, dated 12-12-1942. 14th N.D. Drawing no. OA-N6-441 at Plan Files of Naval Facilities Engineering Command, Pacific.

1942g Bishop Point, Pearl Harbor, Splinterproof Armory, Precast Concrete Arch Type, Approved October 2, 1942. 14th N.D. Drawing no. OA-N6-443 at Plan Files of Naval Facilities Engineering Command, Pacific.

1945 Naval Air Station, Pearl Harbor, T.H., Showing Conditions on June 30, 1945. Drawing no. V-N1-136, filed as 1400-3-142 on microfilm roll R-1042, RG 71, cartographic section of National Archives II.

1947 Bishop Point, Oahu, T.H., U.S. Naval Shipyard Annex, Road Paving and Drainage, Approved 3/14/47. P.W. Drawing no. OA-N2-398 at Plan Files of Naval Facilities Engineering Command, Pacific.

1952 Map of Pearl Harbor Naval Shipyard Annex, Bishop Point, Halawa, Oahu, T.H., Showing Conditions on 30 June 1952. Drawing no. OA-N1-2192H, filed under Y&D Drawing No. 3843 at Plan Files of Naval Facilities Engineering Command, Pacific.

Hawaii War Records Depository
var. Photographs and other records of Hawaii's experience during World War II (civilian orientation). At University of Hawaii, Hamilton Library, Hawaii and Pacific Room.

Historical Section, Fourteenth Naval District
[1945] *U.S. Naval Administration in World War II, Administrative History of the Fourteenth Naval District and the Hawaiian Sea Frontier.* Microfilmed typed report purchased from the Naval History Center and donated to Library of Naval Facilities Engineering Command, Pacific.

Mason Architects, Inc.
2004 *Historic Context Report and Historic Preservation Plan for World War II Defensive Accessory Facilities: Building Types Assessment: Splinterproof Shelters and Gun Emplacements.* Prepared with Helber Hastert & Fee Planners for Commander, Navy Region Hawaii, under contract to Naval Facilities Engineering Command, Pacific.

National Archives II
1942 Historic photos in Still Photo section of National Archives II, College Park, Maryland.

Orlowski, Joanmarie N.
2003 U.S. Naval Base, Pearl Harbor, Type B Casualty Dressing and Decontamination Station (Facility 207). Draft Historic American Buildings Survey report, prepared for Pacific Division, Naval Facilities Engineering Command.

Pearl Harbor Navy Yard
n.d. Typescript manuscript with 8 chapters, including a 14-page one by "Medical Department," reporting on WWII activities of the Navy Yard's departments. From Robert F. Walden Collection, University of Hawaii Hamilton Library, Hawaii & Pacific Room.

Smith, Bolling W.
1999 "Note, Gas!" *The Coast Defense Study Group Journal,* Vol. 13, Issue 3, p. 80-82.

U.S. Navy
1966 Detailed Inventory of Naval Shore Facilities – Real Property, Station CNO, Pearl Harbor Hawaii. In Library of Naval Facilities Engineering Command, Pacific.

U.S. Navy, Bureau of Yards and Docks
1945 *Public Works of the Navy Data Book: Buildings, NAVDOCKS P-164, July 1945 Edition.* Copy provided by Jeffrey Dodge, Naval Facilities Engineering Command, Pacific.

1947 *Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corps, 1940-1946.* United States Printing Office: Washington, D.C.

Yoklavich, Ann
1995 Naval Air Station Barbers Point, Air Raid Shelter, Facility 87, HABS No. HI-279-D. Prepared for Pacific Division, Naval Facilities Engineering Command.

D. LIKELY SOURCES NOT YET INVESTIGATED

National Archives II, Text section, 8601 Adelphi Road, College Park, Maryland 20740, ph. (301) 713-6625.

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

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

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

PROJECT INFORMATION

Commander Navy Region (COMNAVREG) Hawaii has embarked on a program of documentation of historic properties within its area of responsibility, with the goal of recording historic information about each property or set of facilities. In order to establish the context of significance for this facility group, this overview report was prepared. This information will assist COMNAVREG Hawaii in the appropriate management of these properties, be it routine repair and maintenance for continuing use, rehabilitation for continuing use / adaptive reuse, or demolition. This report was prepared under a Historic Preservation Services contract (N62742-97-D-3502) awarded to AMEC Earth and Environmental, the prime contractor, by the U.S. Navy, Naval Facilities Engineering Command, Pacific. The contract was funded through the Cultural Resources Program of COMNAVREG Hawaii. This report was researched and written by Ann Yoklavich, Architectural Historian at Mason Architects, Inc. The Oahu map was made by Nestor Beltran of NAB Graphics. The location maps were made by Angela Stiber and Ming Wong, Architects at Mason Architects, Inc. Erika Webb, Architectural Historian at Mason Architects, Inc., enhanced the historic map of Ford Island to highlight the locations of extant and demolished shelters.

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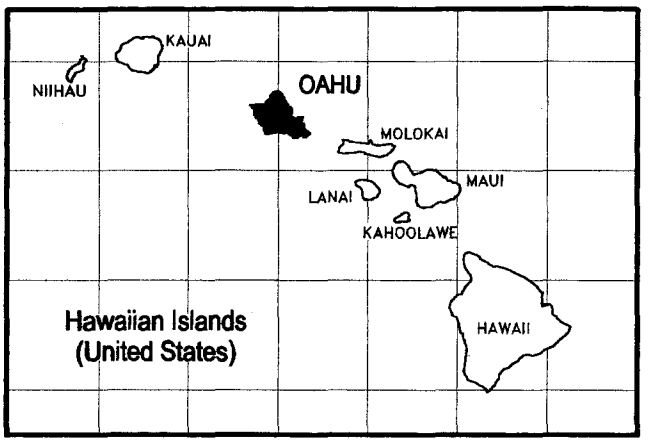
Date of Final Report: September 2004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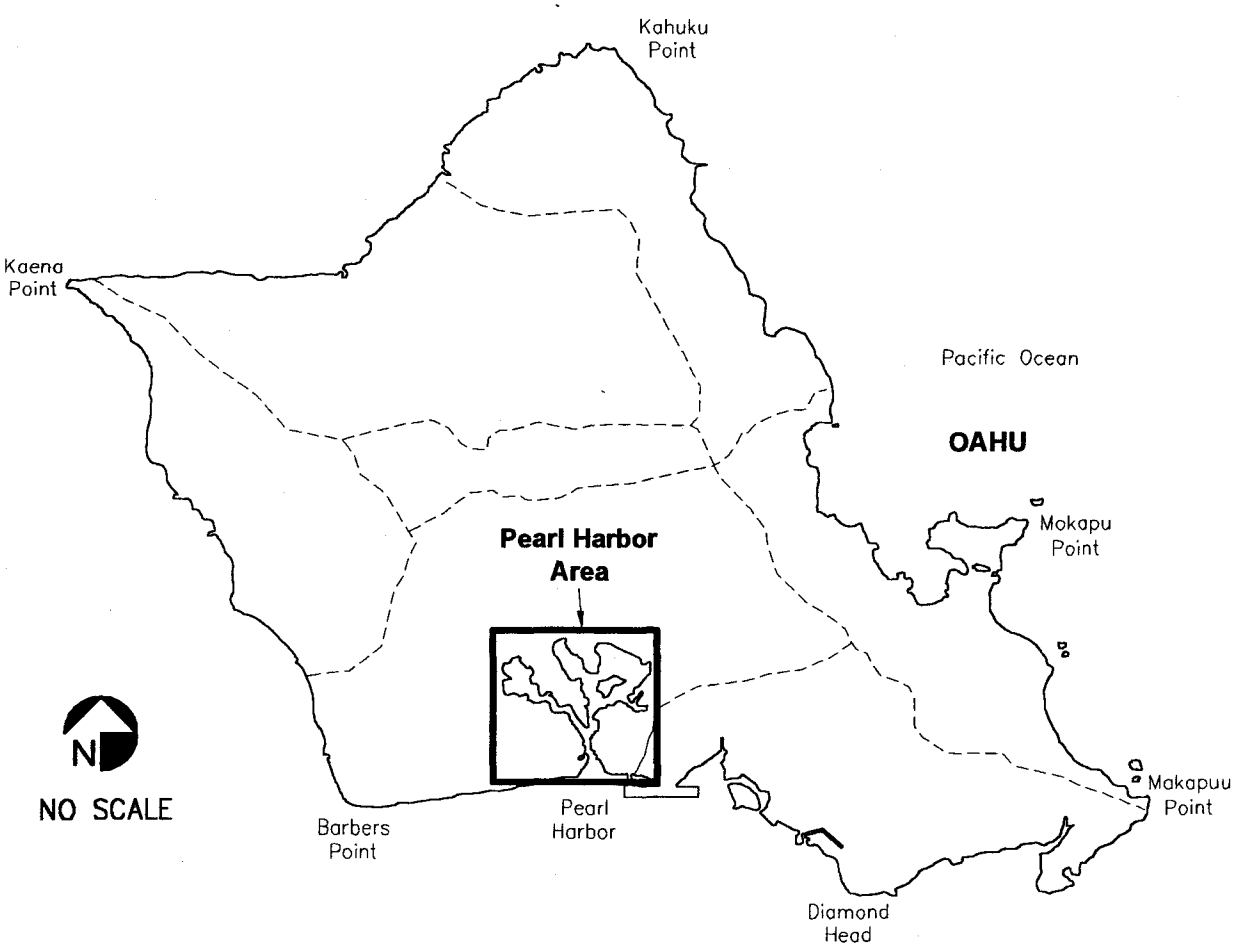
(United States)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Kaena
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OAHU
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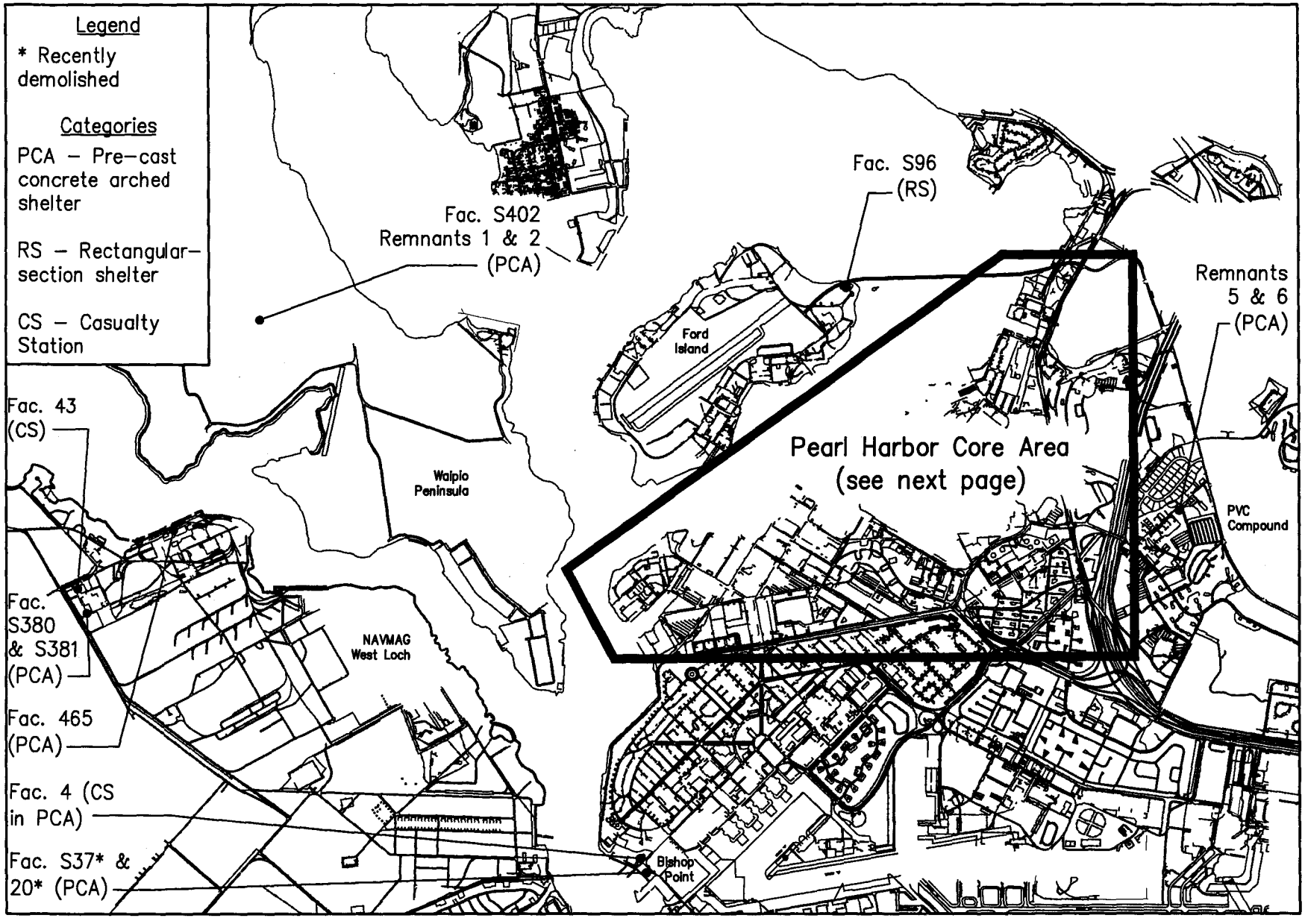
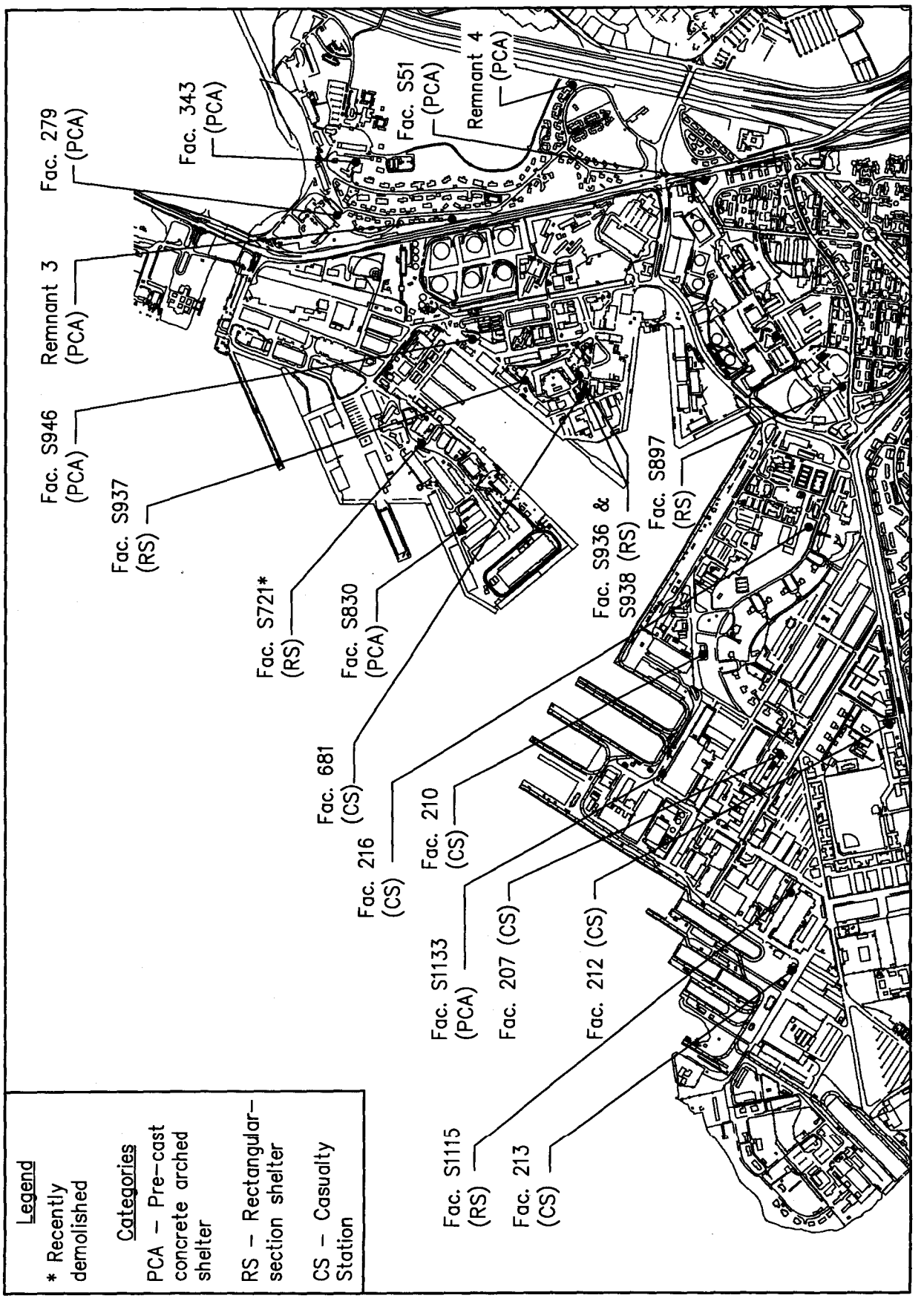
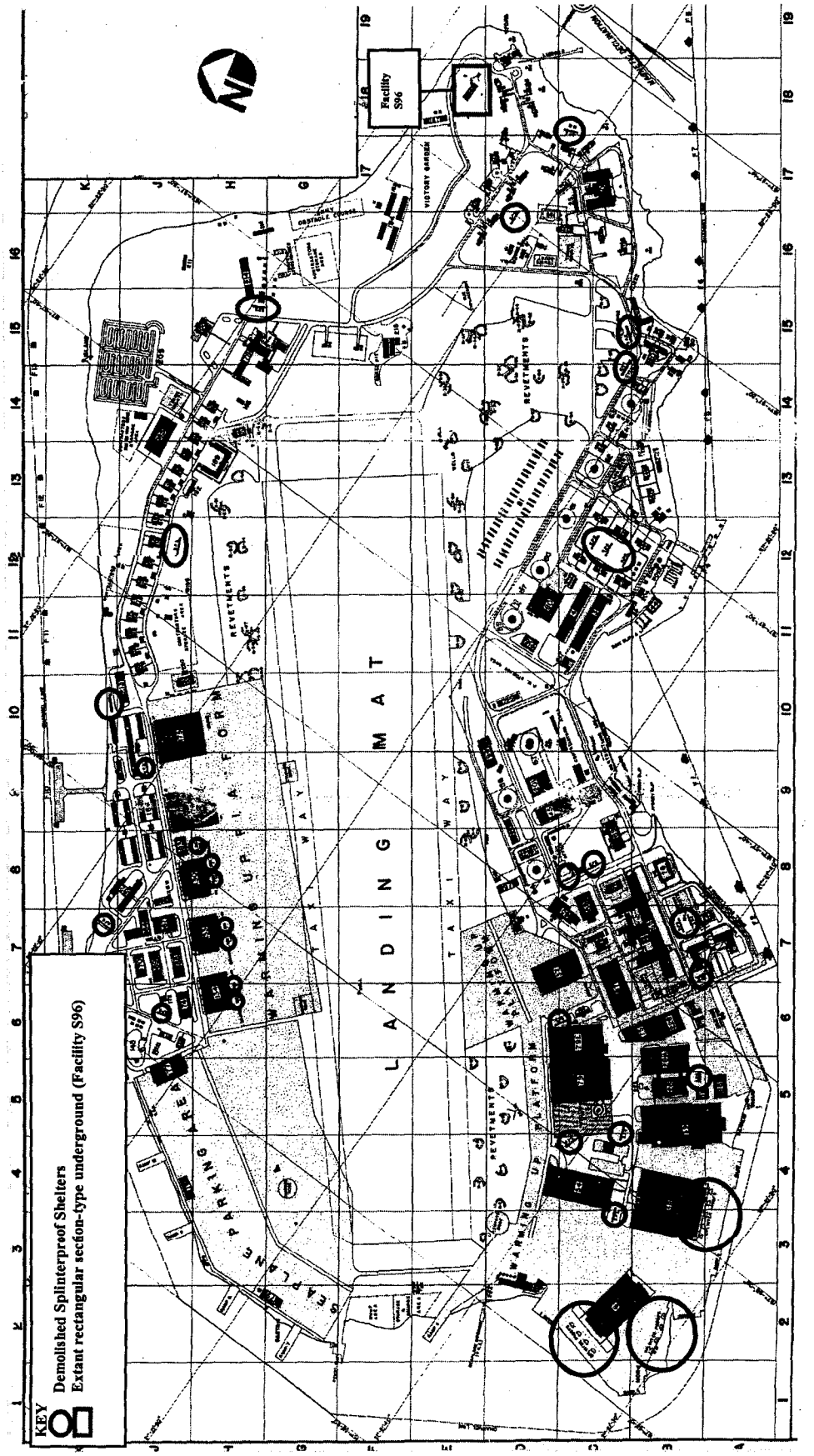


No Scale

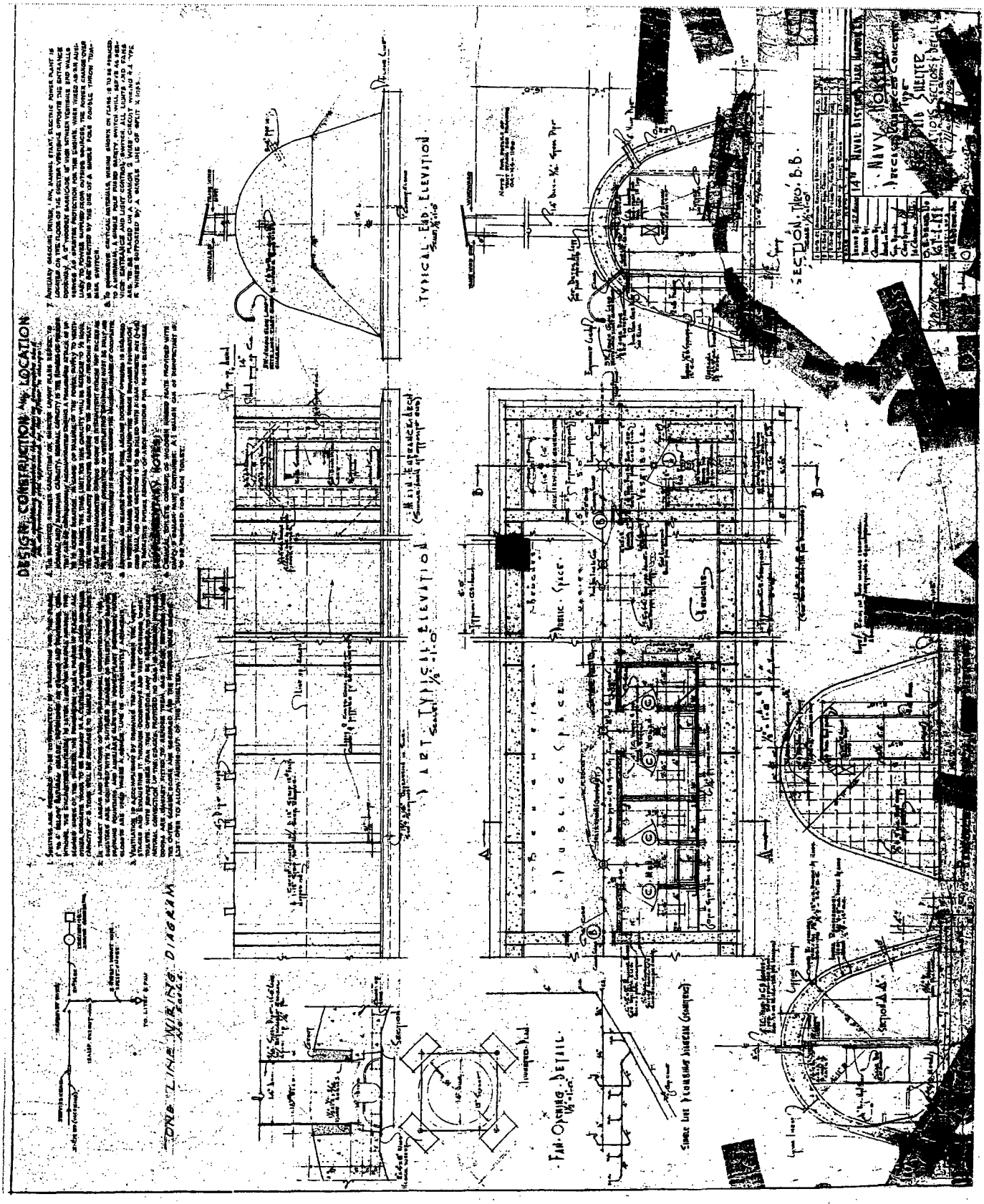
Locations & Categories of Extant or Recently Demolished Splinterproof Shelters


Legend
* Recently demolished
Categories
PCA – Pre-cast concrete arched shelter
RS – Rectangular-section shelter
CS – Casualty Station
Fac. 279 (PCA)
Fac. 343 (PCA)
Fac. S51 (PCA)
Remnant 4 (PCA)
Remnant 3 (PCA)
Fac. S946 (PCA)
Fac. S937 (RS)
Fac. S721* (RS)
Fac. S830 (PCA)
Fac. 681 (CS)
Fac. 216 (CS)
Fac. 210 (CS)
Fac. S936 & S938 (RS)
Fac. S897 (RS)
Fac. S1133 (PCA)
Fac. 207 (CS)
Fac. S1115 (RS)
Fac. 213 (CS)
Fac. 212 (CS)
N
Feet
0
1500
Pearl Harbor Core Area
Locations & Categories of Extant or Recently Demolished Splinterproof Shelters

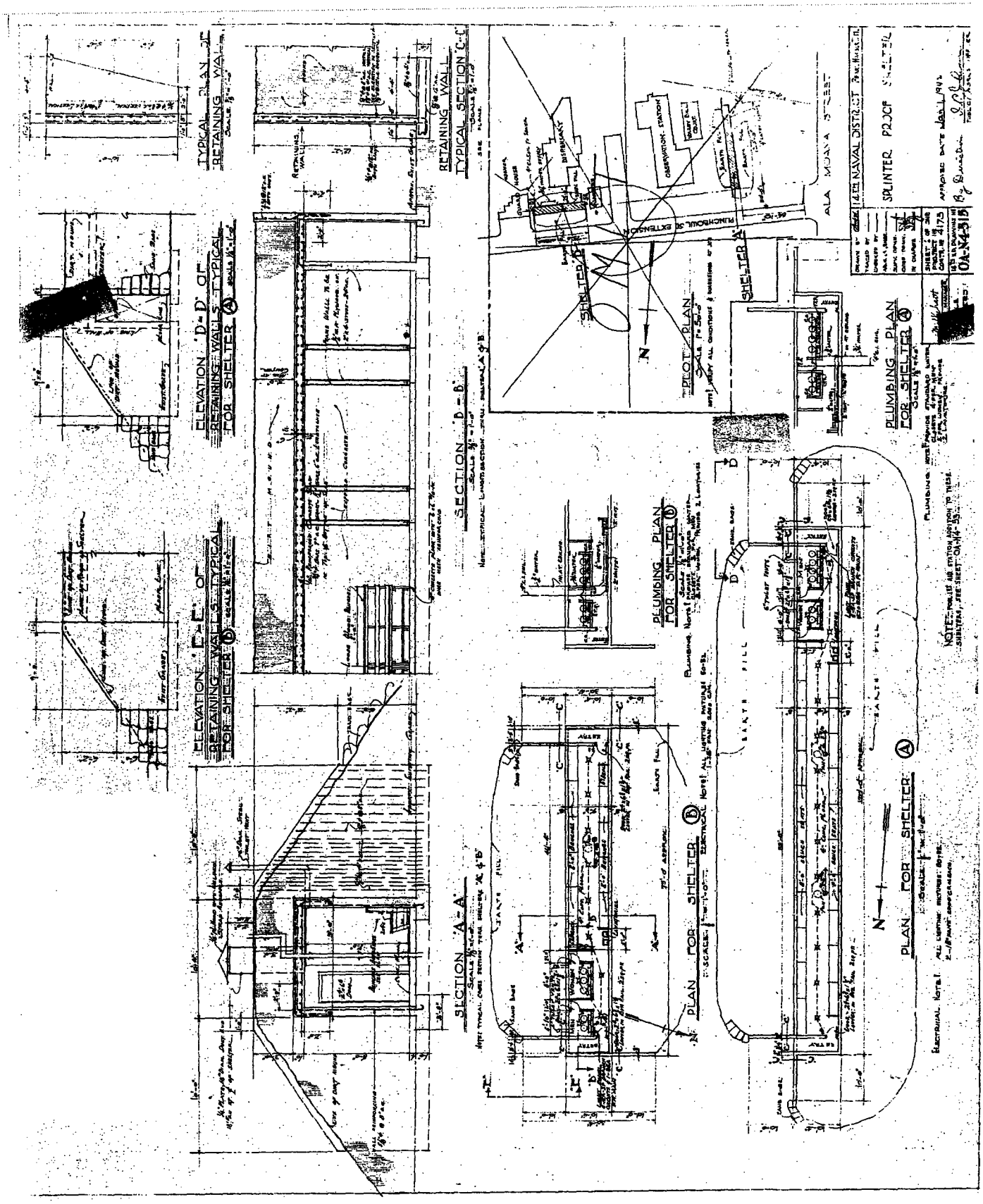
Map of Ford Island dated June 30, 1943 showing shelter locations (only one extant) – Drawing no. V-NI-129



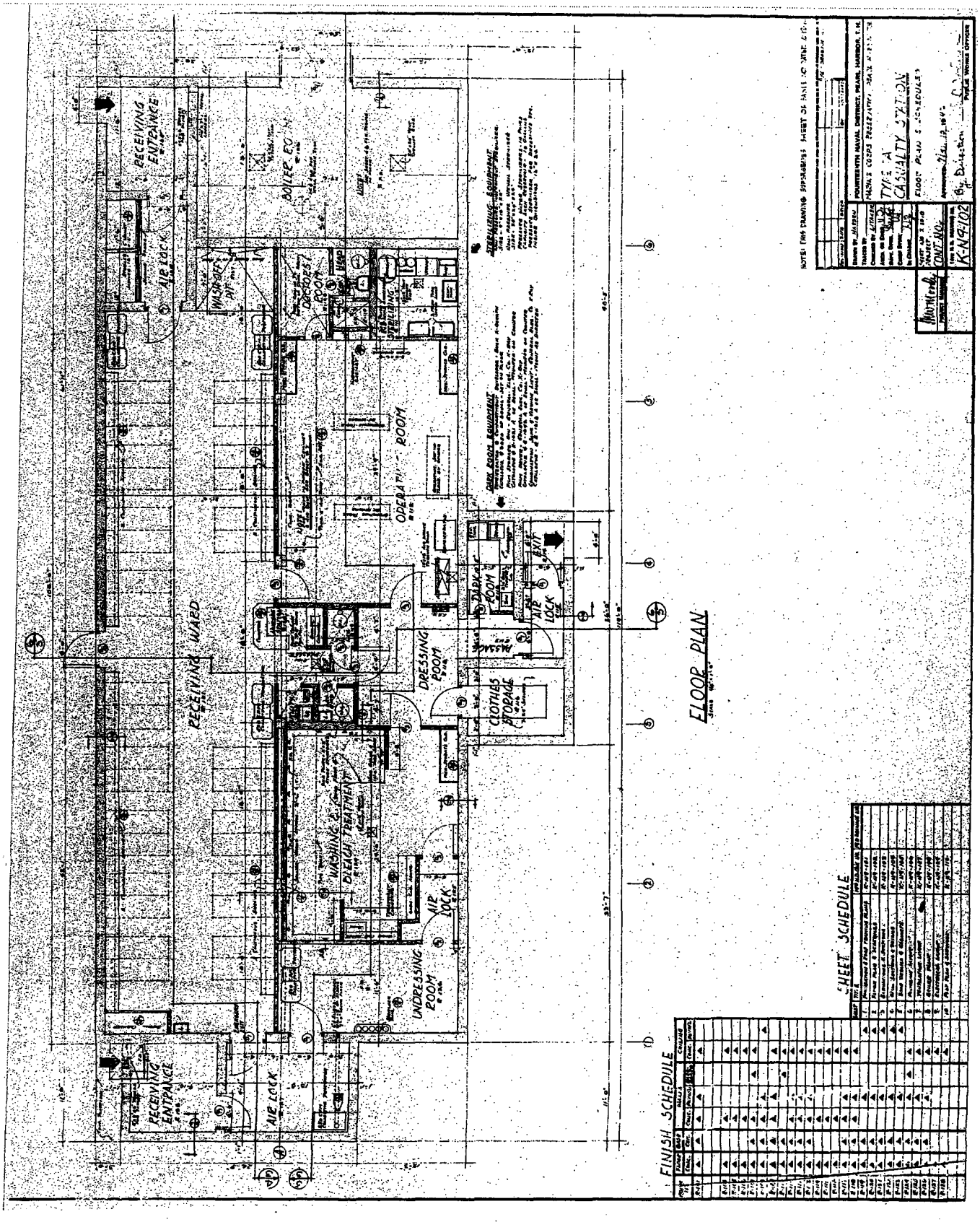
1942 Drawing of Pre-Cast, Arched Splinterproof Shelter –
14th N.D. Drawing no. OA-N4-586



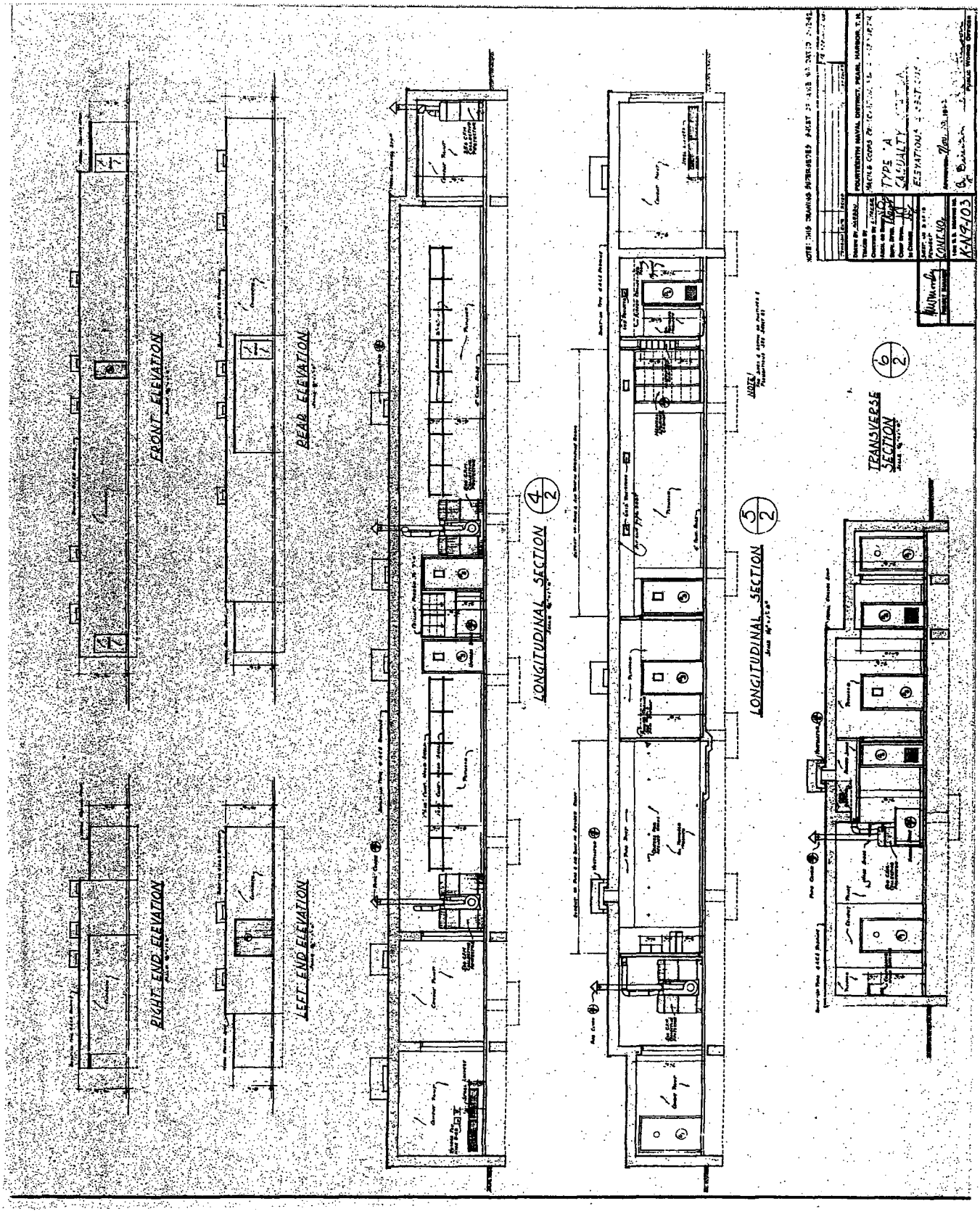
1942 Drawing of Rectangular-Section Splinterproof Shelter –
14th N.D. Drawing no. OA-N4-515



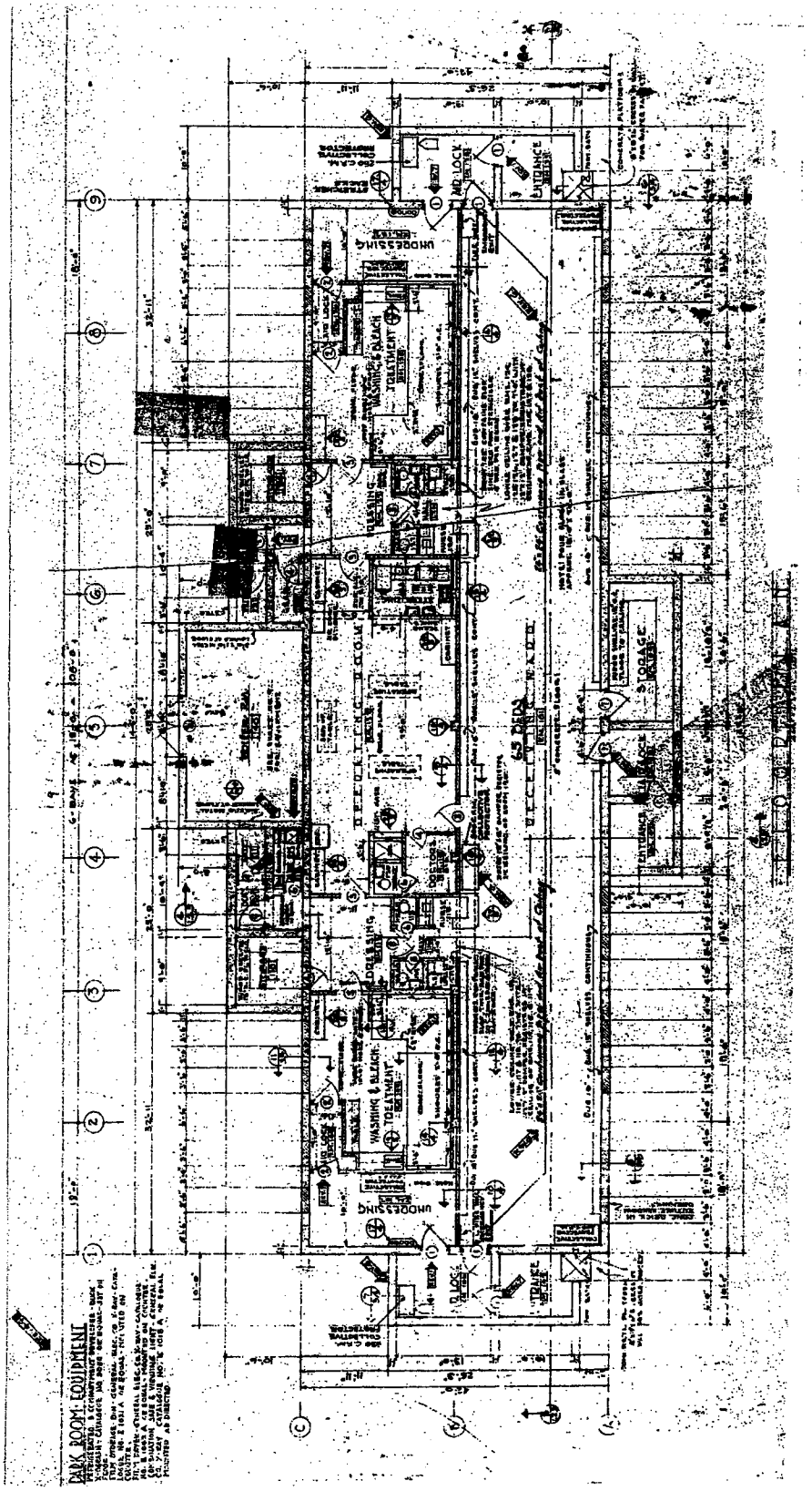
1942 Drawing of Type A Casualty Station, Plan –
14th N.D. Drawing no. K-N9-102



**1942 Drawing of Type A Casualty Station, Elevations and Sections –
14th N.D. Drawing no. K-N9-103**



**1942 Drawing of Type B Casualty Station, Plan –
Portion of Y&D Drawing no. 199698**



1942 Drawings of Type D Casualty Station, Plan and Elevation
Portions of Y&D Drawing nos. 199651 & 199652