BATTERY ELON FARNSWORTH
AND ADJACENT COAST DEFENSE STRUCTURES

Fort Point, New Castle, New Hampshire

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AND ADJACENT COAST DEFENSE STRUCTURES

Join us on a virtual tour of Battery Elon Farnsworth and adjacent coast defense structures located on Fort Point in New Castle, New Hampshire, at the mouth of Portsmouth Harbor.

Situated 100 yards southwest of Fort Constitution, Battery Farnsworth is a concrete battery dating back to the Spanish-American War era. Constructed in 1897-1899 and armed in 1898, this low profile concrete battery was fitted with two eight-inch guns mounted on disappearing carriages. Due to structural inadequacies and moisture problems, both of which plagued the battery from the outset, Battery Farnsworth was not subsequently modernized for use during World War I, thereby making it somewhat unique. In 1917, Battery Farnsworth was stripped of its guns, which were shipped overseas for use in the Great War, and never rearmed.

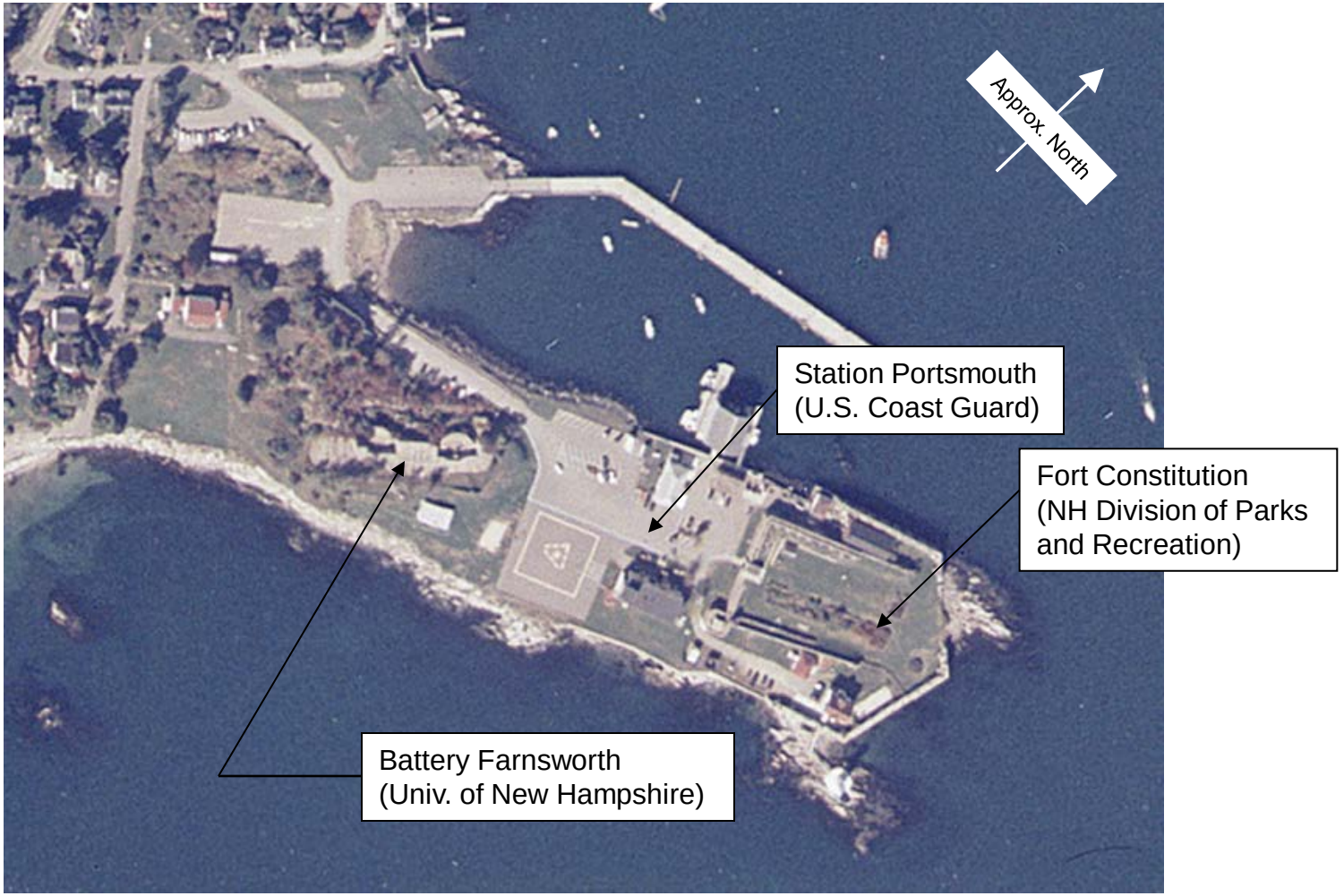
Battery Farnsworth is located on former U.S. government property that is now owned by the University of New Hampshire. As it is not open for public visitation, it is our hope that this tour will give you a general feel for the battery, how it functioned, and its current condition.

So, put on your virtual boots and bug spray and let's go. Oh . . . don't forget your virtual flashlight because Battery Farnsworth was never electrified.

(Unless indicated otherwise, all photos taken by Rich Rouleau, UNH Facilities Design & Construction)

Fort Point

New Castle, New Hampshire



(Aerial photograph courtesy of the National Atmospheric and Oceanic Administration)

Fort Point – Property Lines, Historical Resources, etc.

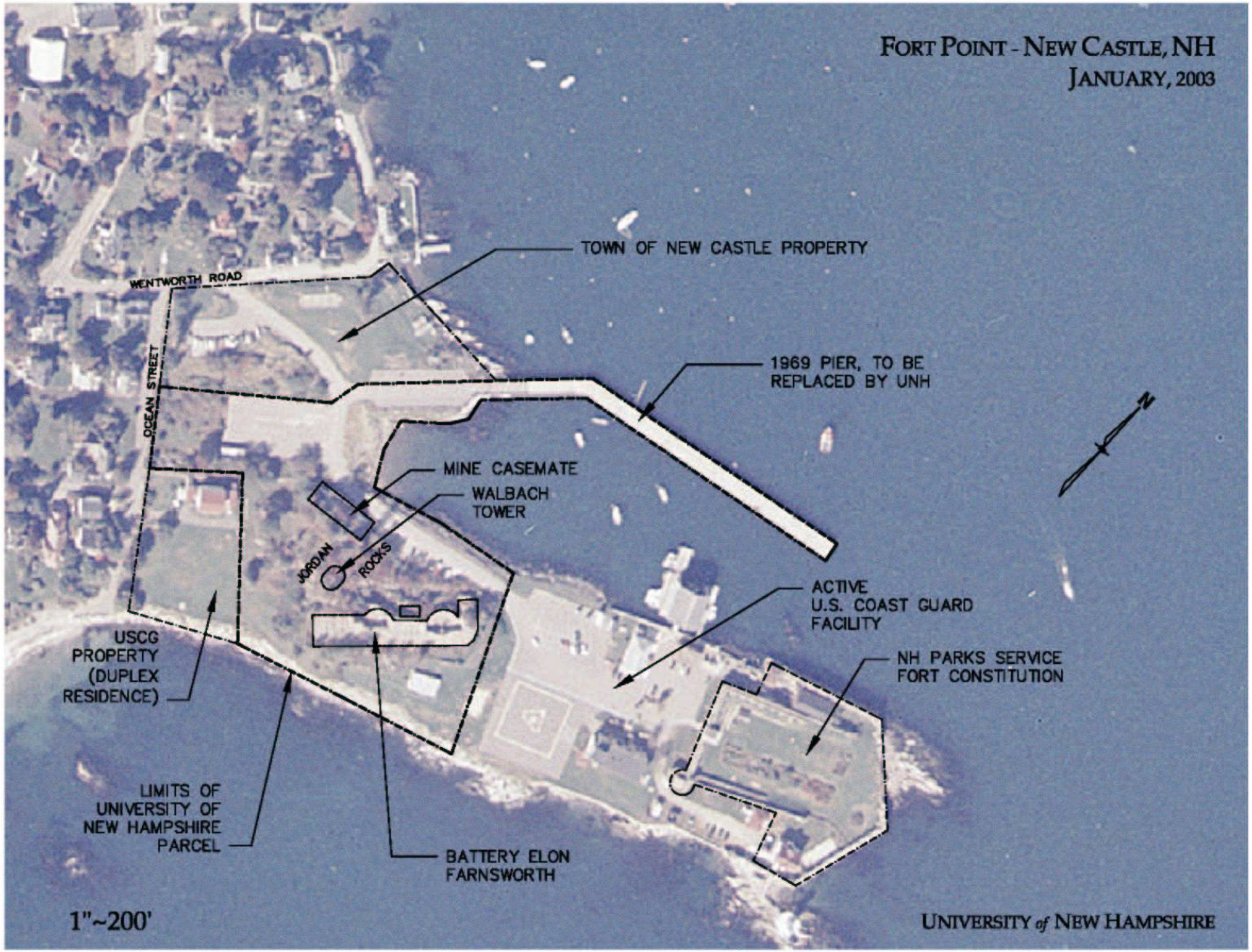


photo by Perry Smith, University of New Hampshire Photographic Services

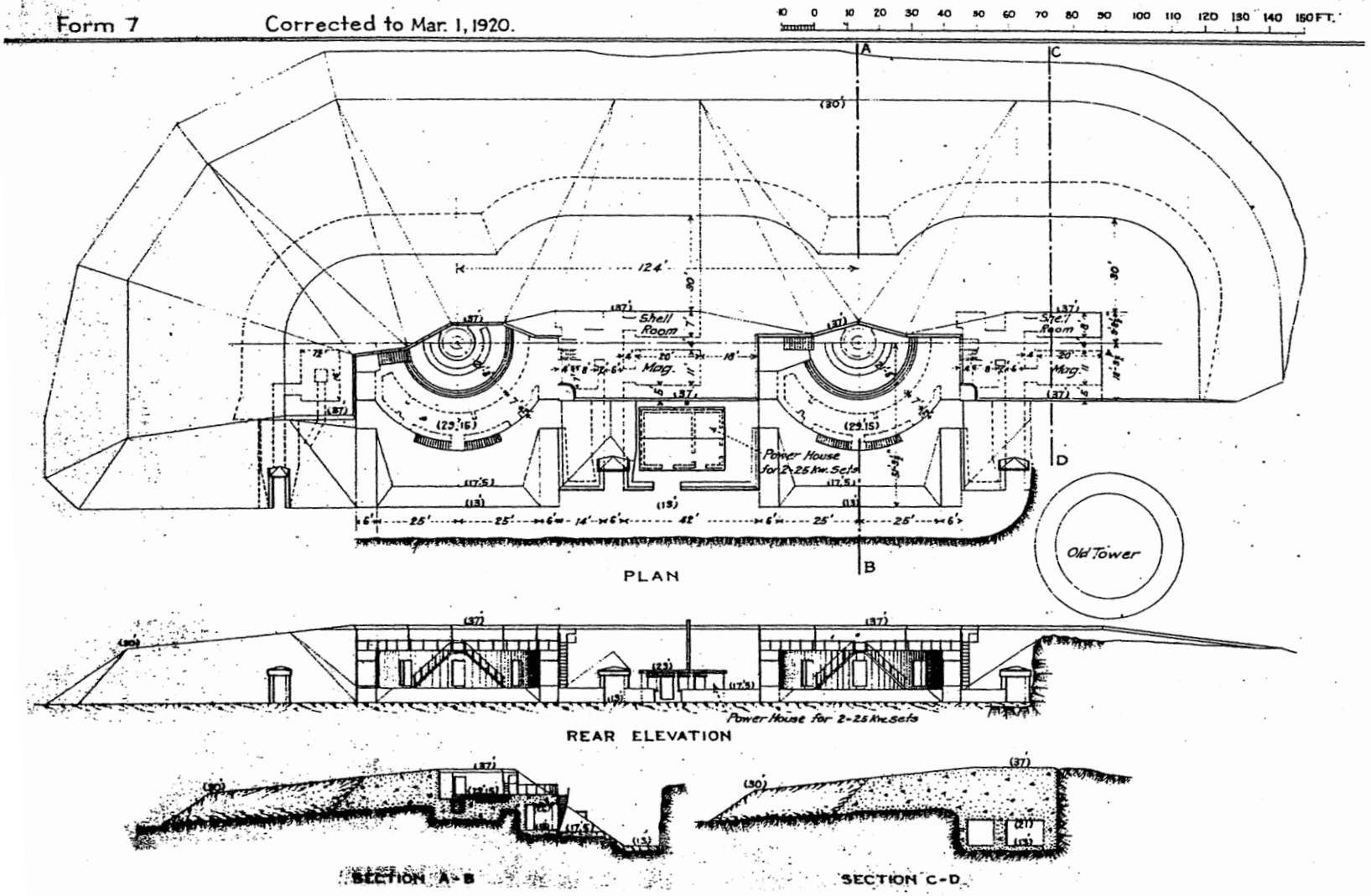
photo by Perry Smith, University of New Hampshire Photographic Services

Battery Farnsworth – as Viewed from the Ocean

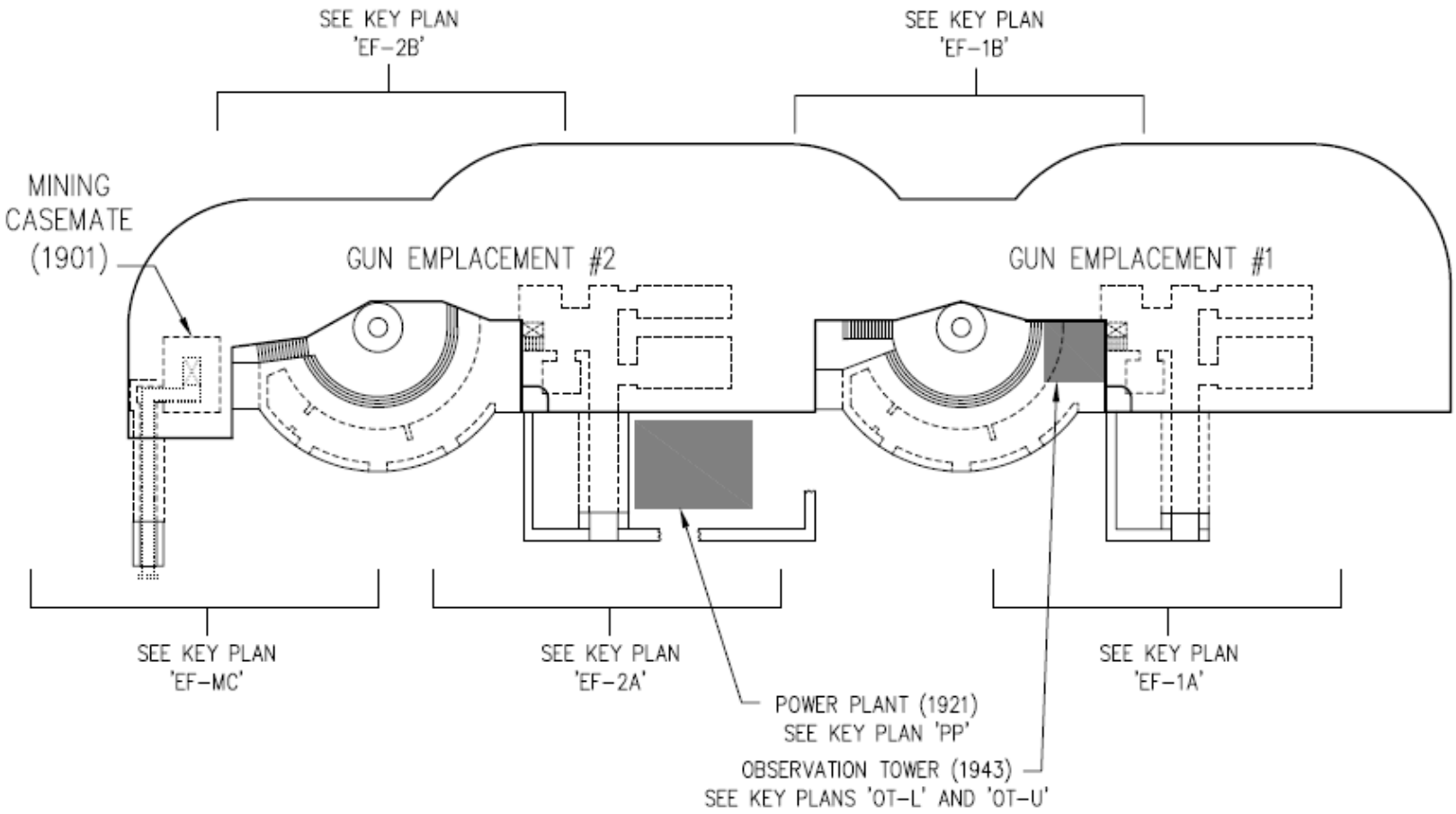
REPORT OF COMPLETED WORKS ~~for~~ SEACOAST FORTIFICATIONS
(Battery Plan)

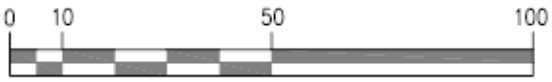
COAST DEFENSES OF PORTSMOUTH, N.H.
FORT CONSTITUTION
BATTERY FARNSWORTH (No Armament)
No of guns, 2. Caliber 8" Carriage Dis. L.F.

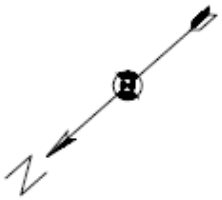
Form 7 Corrected to Mar. 1, 1920.



Report of Completed Works, Form 7, Mar. 1, 1920. *NARA*







Battery Elon Farnsworth (1898)

Fort Point, New Castle, New Hampshire

Key Plan

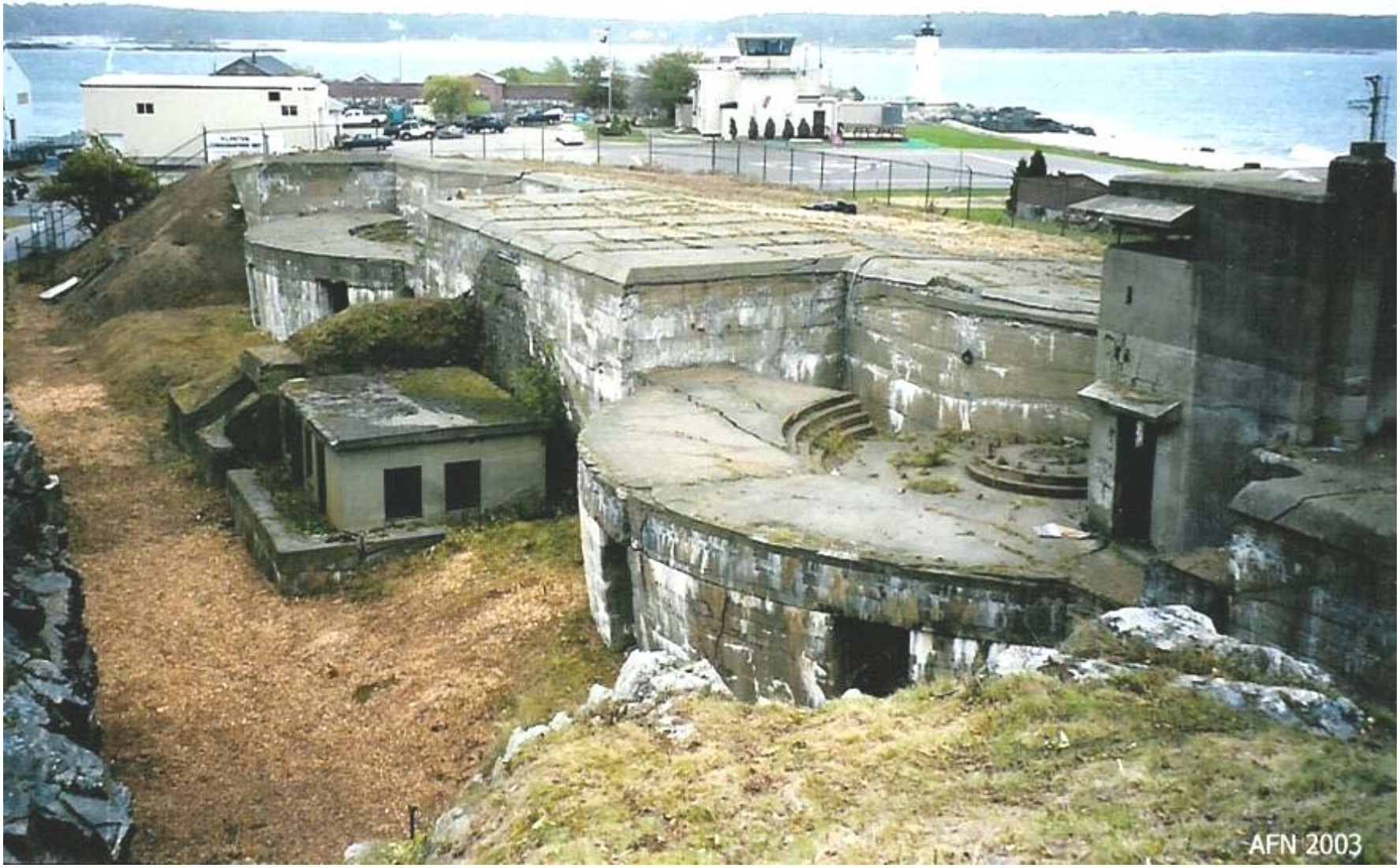
EF

Photographed May 2004 for the University of New Hampshire

Battery Farnsworth, with the foundation of Walbach Tower in the right foreground. The battery has just been completed, except for the iron railings along the stairs and parapet. The two guns are 8-inch breech-loading rifles, mounted on disappearing-type carriages. The west wall and gate of Fort Constitution can just be made out in the left background through the fog. (from Bolling Smith Collection, via American Forts Network web site)

Battery Elon Farnsworth - 1915

From the Kenneth Maxam collection, from a copy by Douglas Armsden via Pete Payette & American Forts Network



Courtesy of Pete Payette and American Forts Network.

View from Hart's Cove (located to the north of Fort Point)

Seen at the left in this photo, the berm wraps around the entire ocean face of the battery. Obscuring much of the battery from the harbor side (as viewed here) is "Jordans Rock", a natural ledge formation that starts near the east end of the battery and rises to a point of prominence. In fact, Walbach Tower, a coast defense structure from the War of 1812 era, was constructed atop Jordans Rock to take advantage of the clear view in all directions.

Okay, let's head in to take a closer look. We will enter the fenced area through the gate at the east end of the battery. The first thing we will see when we enter is a first generation mining casemate that was constructed on the east flank of Battery Farnsworth.

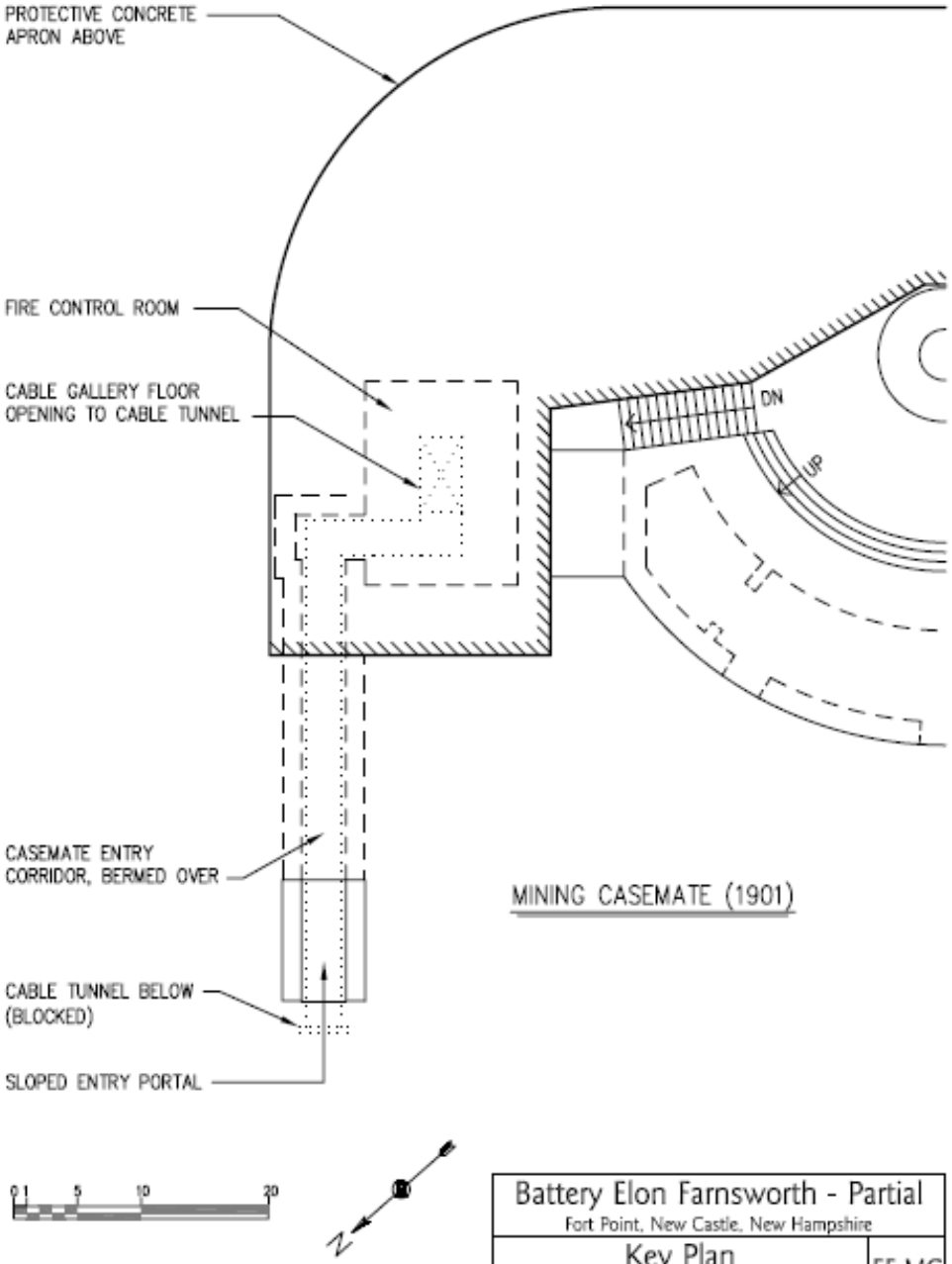
First Generation Mining Casemate

A “casemate” is a fortified position or chamber or an armored enclosure on a warship from which guns are fired through embrasures.

From this, a “mining casemate” can be described as a fortified position or chamber from which (harbor) mines are detonated.

In 1899, construction commenced on a mining casemate at the east end of the only just recently completed Battery Farnsworth. It was turned over to the Army in 1901.

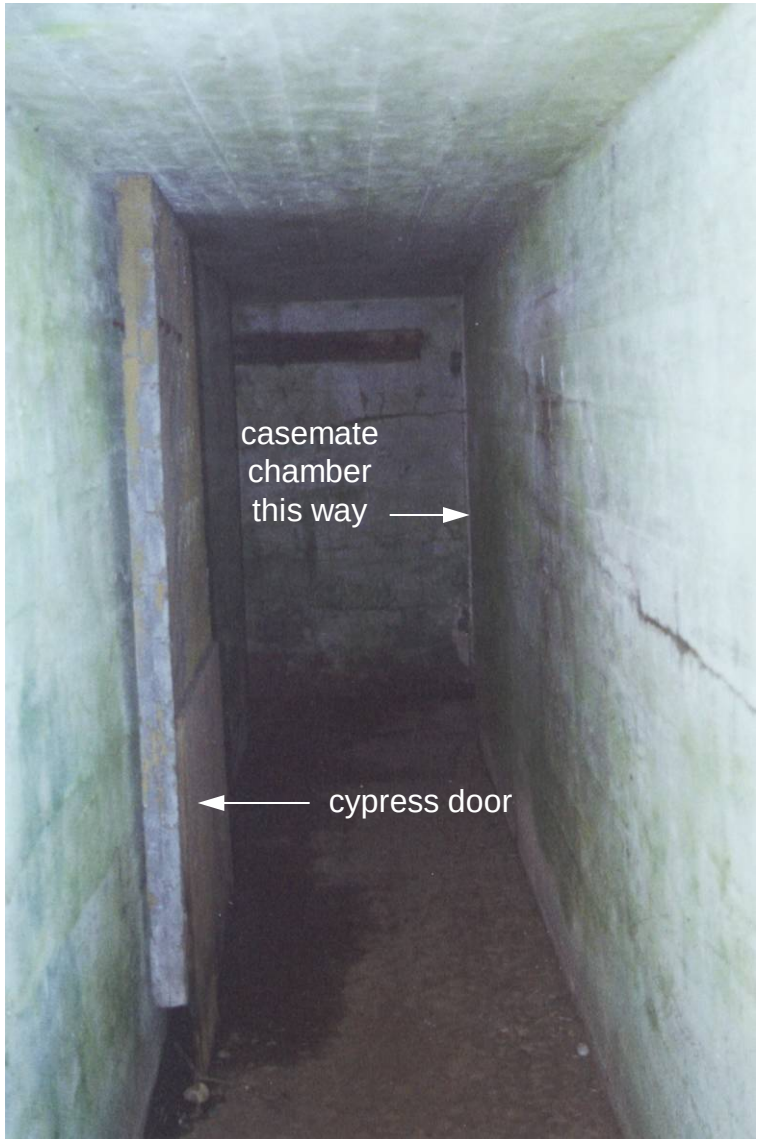
It is thought that this mining casemate may have never been used; possibly due to structural problems, or because it was an uncomfortable and potentially dangerous place to work. It was uncomfortable in that it was cold and damp and potentially dangerous in that the equipment being used put off noxious and potentially explosive fumes.



Battery Elon Farnsworth - Partial	
Fort Point, New Castle, New Hampshire	
Key Plan	EF-MC
Photographed May 2004 for the University of New Hampshire	

photo by James Rosenthal, National Park Service Historic American Building Survey

This is the entry portal into the 1901 mining casemate. It is located at the east end of the battery, north side, and is the first thing seen upon entry into the fenced enclosure around the battery.



This is the entry corridor into the 1901 mining casemate.

At the far end of this corridor, there is an opening to the right that brings you into the casemate chamber.

Directly under this corridor is a tunnel, or cable gallery, intended for the routing of mine detonation cables. The tunnel, you will see, originates in the casemate chamber, runs under this corridor and out to Hart's Cove on the north side of Fort Point. It has since been blocked at a location under the entry portal shown on the previous slide.

On the left side of the corridor against the wall is one of the cypress doors from the original construction, still in reasonably good shape.

photos by James Rosenthal, National Park Service Historic American Building Survey

On the left is the casemate chamber looking toward the entry corridor. It shows the arched concrete ceiling, the concrete walls, and the cast-in wood nailers that were presumably intended for the mounting of fire control boards for the harbor mines. Leaning against the wall is another cypress door. On the right is the floor opening into the cable gallery.

photos by Prof. David Gress, University of New Hampshire, Department of Civil Engineering

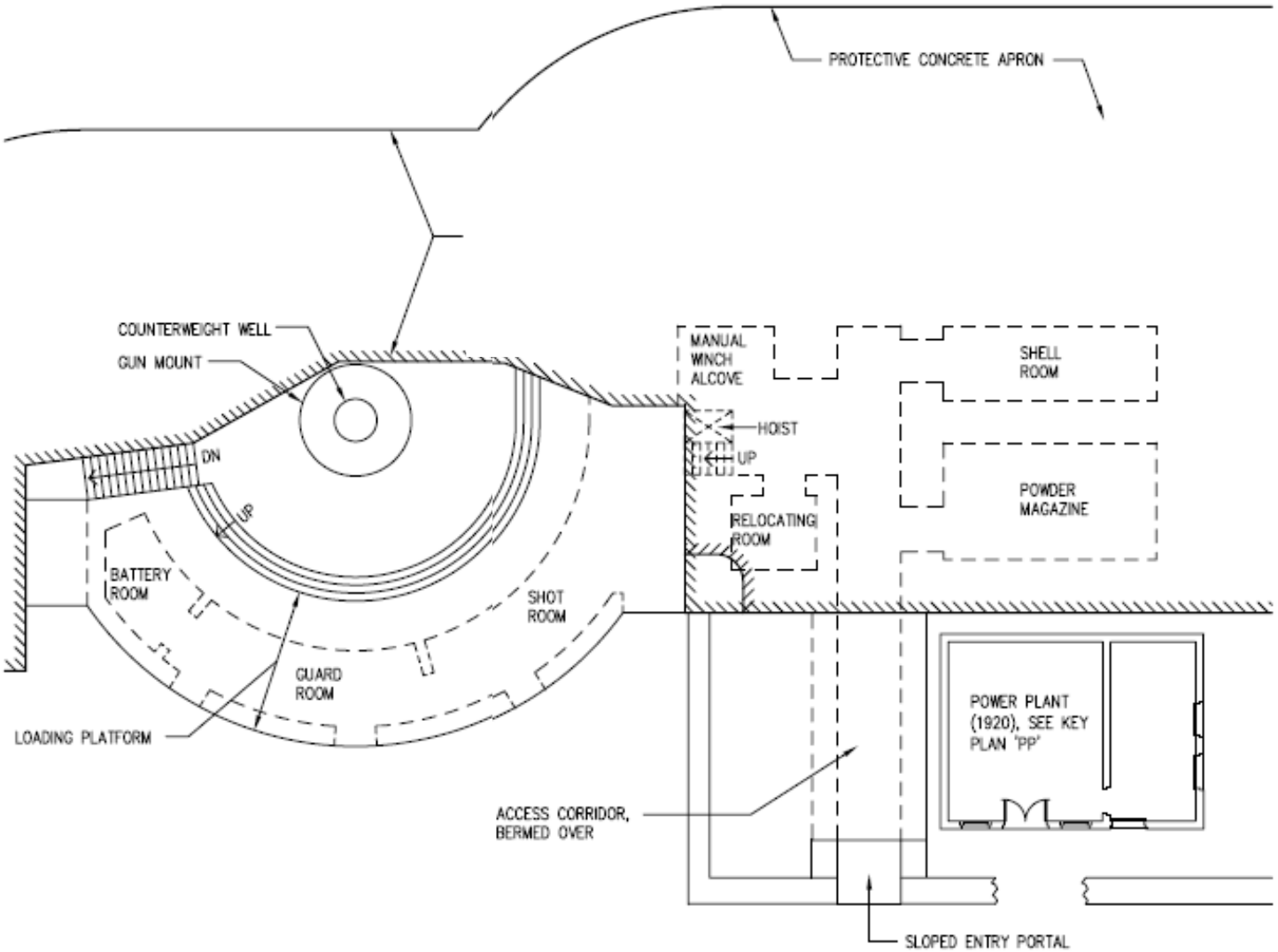
Gun Emplacements

Battery Elon Farnsworth consists of two identical and essentially independent gun emplacements. Each was fitted with a model 1888 8-inch caliber breechloading rifle mounted on a Buffington-Crozier model 1894 disappearing carriage. At each gun was an elevated loading platform serviced by a hand-operated munitions hoist. There were also two davit cranes at each loading platform and, along the north side of the battery, there were curved iron stairs and a similarly constructed catwalk running between the two gun emplacements, all of which were removed during WWII for a massive ship building effort. Below each of the curved loading platforms are a shot storage room, a guard room and a battery room. Near the hoistway at the west end of the shot storage room, there is a half-flight of stairs that lead down to a small plotting room, a shell storage room, a powder magazine, and a corridor that provides a separate route to the exterior. A ceiling-mounted trolley system transported shells and shot to the munitions hoist, where they were manually winched up to the loading platform. For safety purposes, gunpowder was hand carried up to the gun.

photo by Rich Rouleau, University of New Hampshire Facilities Design & Construction

Gun Emplacement #2

As the gun emplacements were numbered from the ocean side, we first encounter Gun Emplacement #2. Of the two, this gun emplacement is in slightly better condition.



GUN EMPLACEMENT #2

0 5 10 20

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Battery Elon Farnsworth - Partial

Fort Point, New Castle, New Hampshire

Key Plan

EF-2A

Photographed May 2004 for the University of New Hampshire

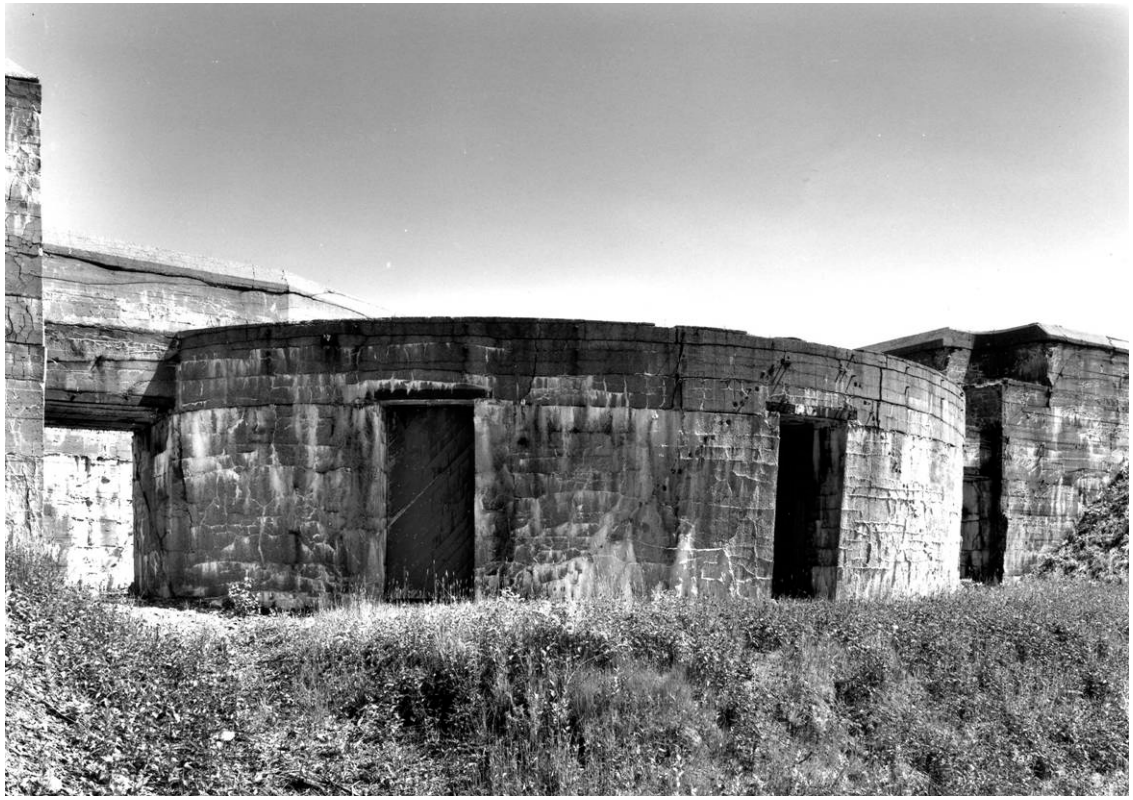


photo by James Rosenthal, National Park Service Historic American Building Survey

At the left of this shot is a covered entry leading to the base of an open stair that leads up to the gun mount and loading platform for Gun Emplacement #2. Before us are the loading platform (above) and the battery room, guard room and shot storage room (behind the curved walls).

This photo is taken facing south from the access path that runs along the rear of the battery. The 1901 mining casemate is out of the frame to the left.

Having walked through the covered entry (shown in the previous photo) and turned right, we are now at the base of the open stairs that lead up to the gun mount and loading platform.

Okay . . . follow me up. Please watch your step. These stairs are in rough shape.

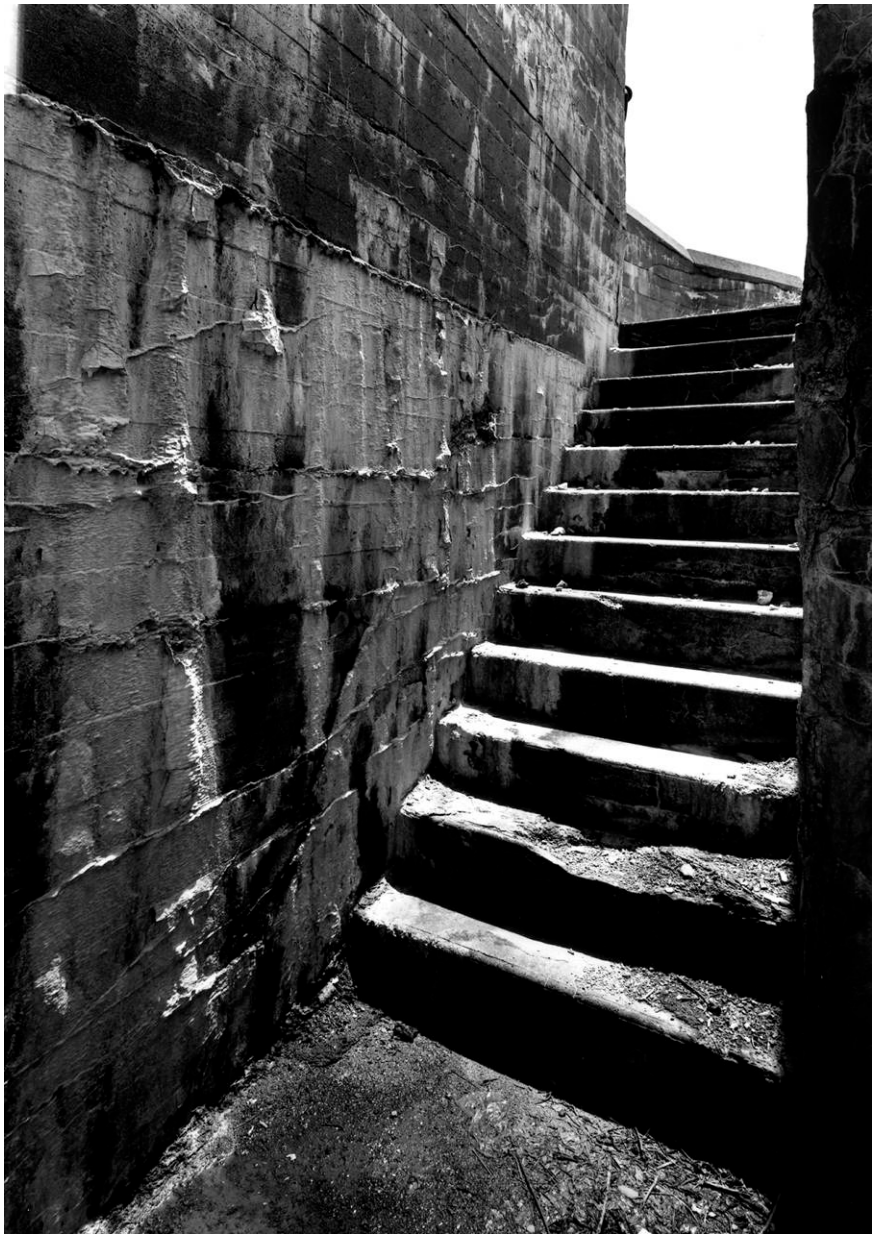


photo by James Rosenthal, National Park Service Historic American Building Survey

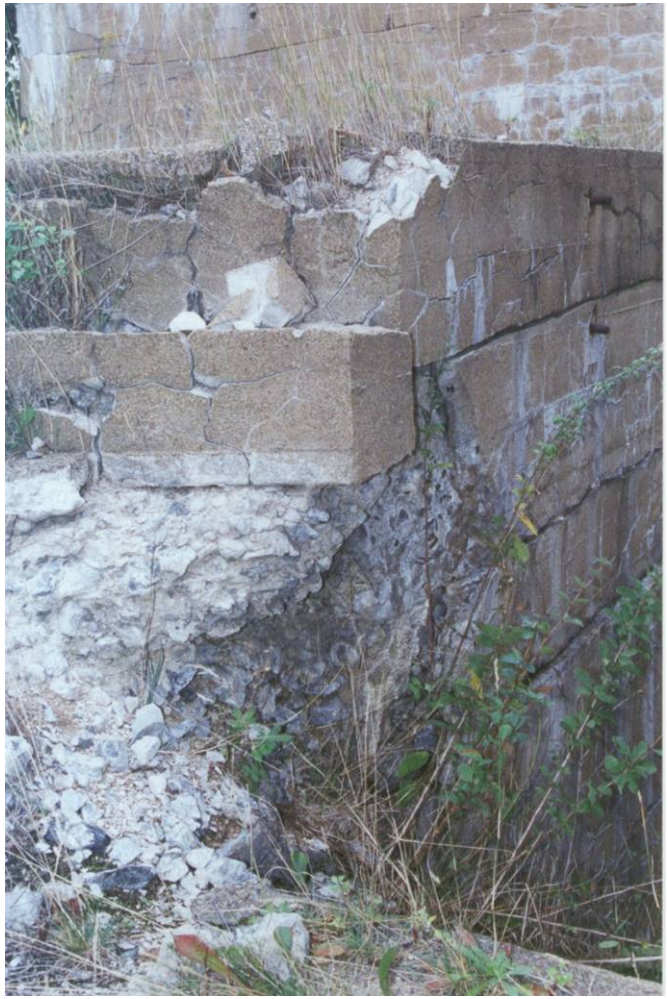
In front of us at the top of the stairs is the central mounting base for the rotating gun carriage. The trees are a nice touch, don't you think. Beyond that are four steps up to the loading platform and munitions hoist.

No . . . that thing on the wall to the left is not a door knocker. It is a heavy steel ring and eyebolt assembly. There are several of these rings spaced around each gun well. From historical photos, it appears these may have been "hard points" to which winches or cables could be attached for the occasional handling of materials. When the gun was in place, this particular ring was essentially inaccessible.

Now, turning around, this photo shows the open stair down. To the left are the steps up to the loading platform.

Let’s take a closer look at those crumbling steps . . .

Here is a good example of the condition of Battery Farnsworth's concrete. The main reasons why the concrete is in such bad shape and among the reasons why the battery was plagued with structural problems from the outset are:



1. Use of natural Rosendale cement from New York State, which produced concrete with relatively low frost resistance, rather than imported higher quality, manufactured portland cement from Europe ,
2. Use of local aggregate including beach sand,
3. Combined, the alkali in the Rosendale cement and the silica in the local aggregates have experienced Alkali-Silica Reaction, an expansive chemical process that causes massive micro- and macro-cracking throughout the concrete,
4. Low volume on-site concrete batching resulted in countless "cold joints", which invite water penetration and associated freeze/thaw action,
5. Poor quality control (at the time, rapid construction was vastly more important).

Gun Emplacement #2

Looking approx. west, toward WWII triangulation tower

Looking approx. east, toward Fort Constitution and the Coast Guard Station with Kittery, Maine, and the mouth of the Piscataqua River beyond.

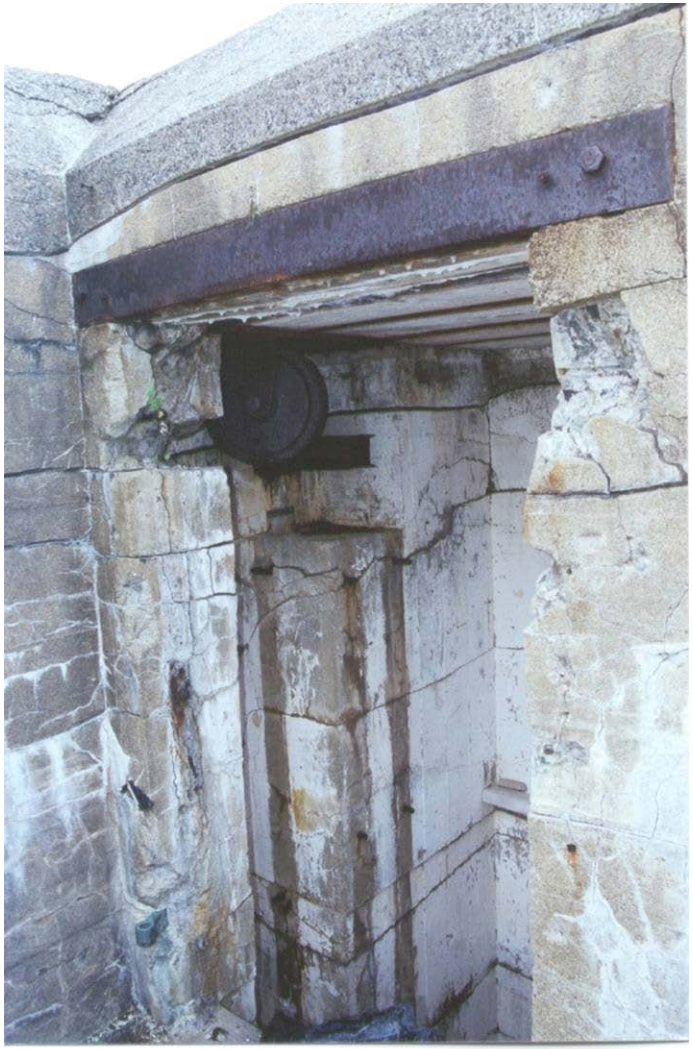
We are now standing on the loading platform, again looking toward the stairway. Here, more of the gun mount can be seen; “imagined” may be a better word. As previously mentioned, the inner bolt circle establishes the central pivot point of the gun carriage. The outer circle of bolts provided anchorage for the curved track along which the back of the gun carriage traveled.

Okay, let’s take a closer look at the cracking in the walls.

This is a close-up shot of the south wall, seen in the previous photo. Note the cracks in the wall. The larger, more defined cracks are “cold joints”, which are formed when fresh concrete is placed against set or partially set concrete. The finer cracks are the result of Alkali-Silica Reaction (ASR) and years of freeze/thaw action. The white stains on the walls are efflorescence (salts leaching out of the concrete), while the gray expulsion is the product of ASR.

Turning to the right now and looking toward the southwest corner of the loading platform, we can see the munitions hoistway.

Note the change in coloration of the concrete at the top of the walls. We are of the understanding that the concrete used in the protective apron, which is shown here to also cap the tops of the battery walls, was different from the other concrete used in the battery, in that it contains the more durable and more frost resistant portland cement. Hence the differing color.



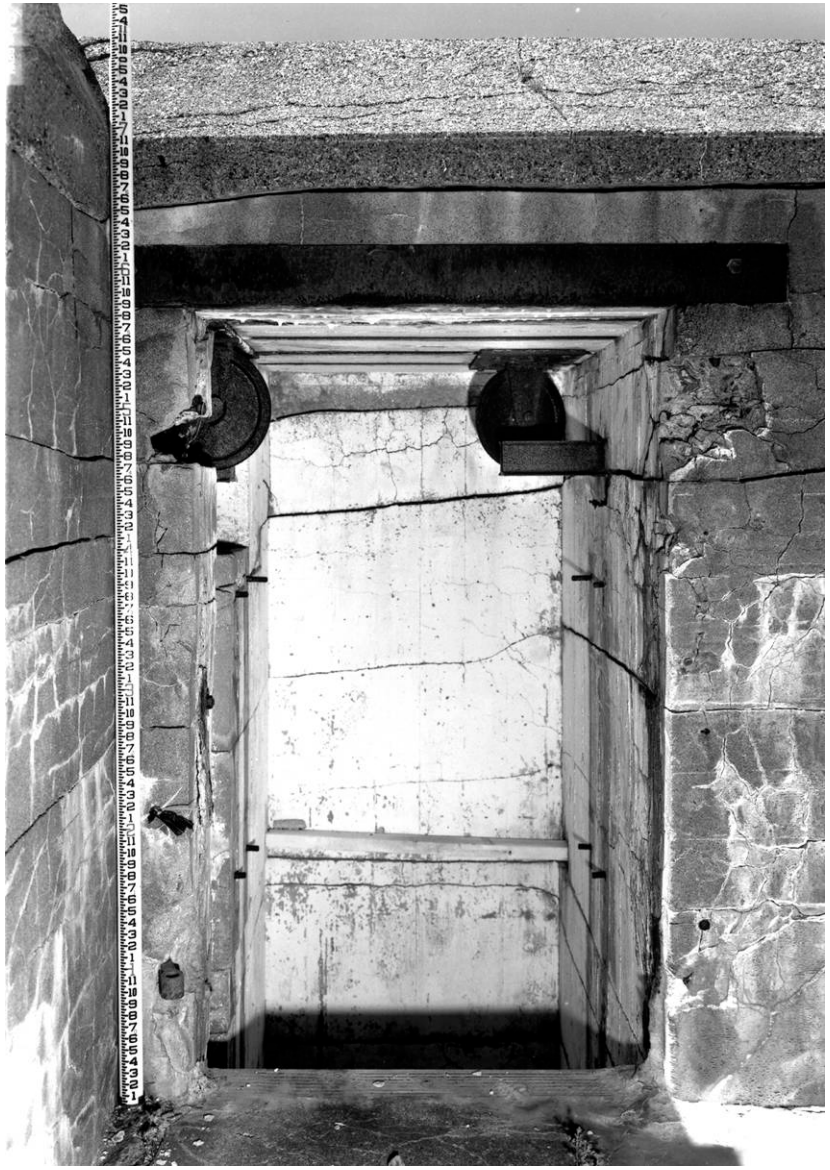
Okay, now let’s take a closer look at the hoistway.

A steel angle appears to have been used as a lintel over the hoistway opening.

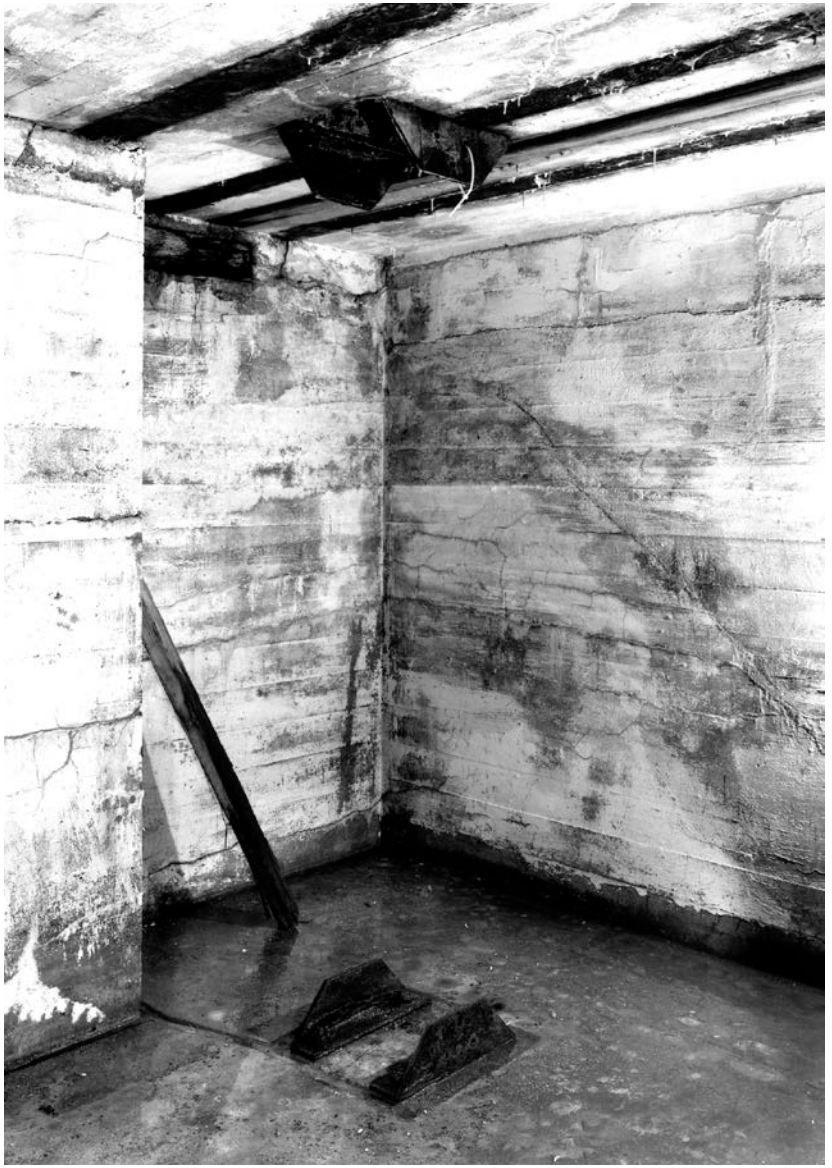
The hoistway once held a cable and pulley “balanced platform hoist”, later determined to be inherently unsafe and unreliable, although I am not entire sure as to the underlying issues.

At the base of the hoistway is a small alcove with a concrete equipment base on the floor, which provided mounting for a hand cranked winch (remember . . . no electricity) used for hoisting the shells and shot up to the loading platform. For safety reasons, powder was hand carried up from below in a wooden litter.

Hoistway – Gun Emplacement #2



Winch Alcove – Gun Emplacement #2



photos by James Rosenthal, National Park Service Historic American Building Survey

Turning right again, we see a somewhat primitive crow's nest, which would have been the battery commander's station during battle. It was accessible both from the loading platform and by way of an external ladder up from below, mounted to the north face of the battery.

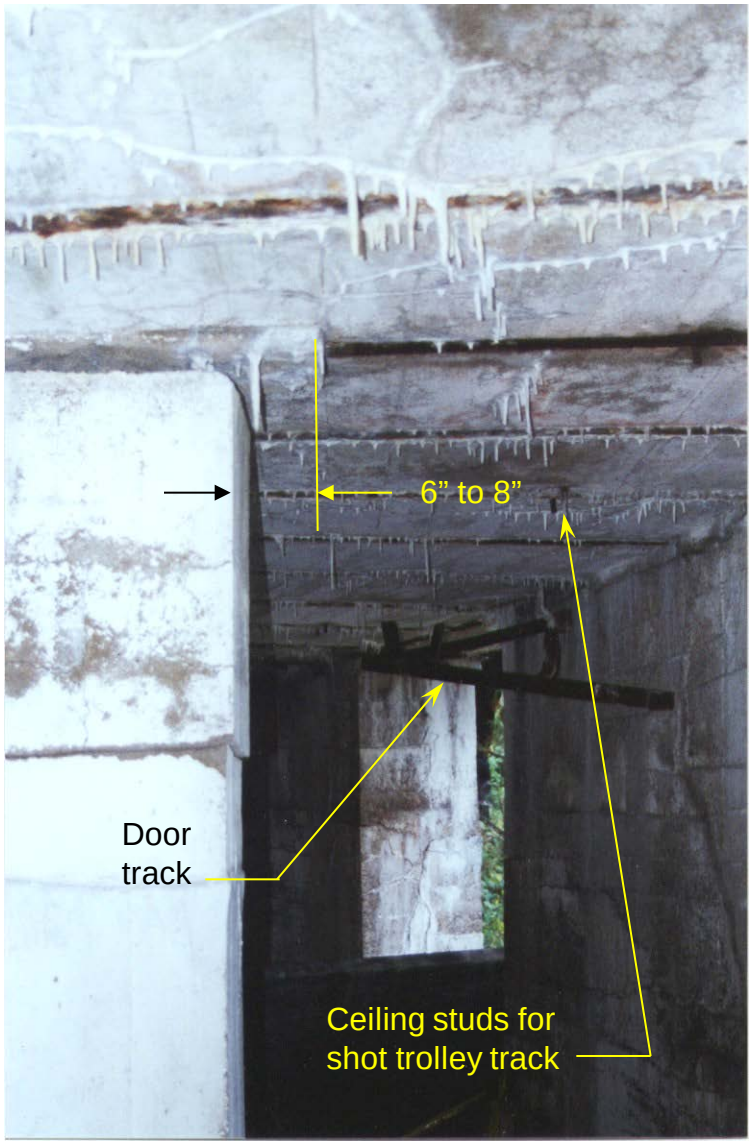
Here also, we get our first good look at the loading platform. Notice the radial cracking propagating out from the top of the steps.

This is more of the loading platform at Gun Emplacement #2.

Again, notice the cracks.

Also, check out the gap developing between the top step and the loading platform. This indicates that the loading platform is bulging to the right (northward). The extent of the movement is more obvious from below and far worse at Gun Emplacement #1, as you will see.

Okay, let's head down now . . . But, keep this image in mind because the next thing we look at will be the shot storage corridor, immediately beneath our current position.



As promised, we are now in the guard room under the loading platform of Gun Emplacement #2, looking into the shot storage corridor.

Most important to note is the extent to which the loading platform has moved. Basically, what is happening is that, because the loading platforms are effectively pinned at the ends, the ASR-induced expansion is being expressed as an outward/radial bulging.

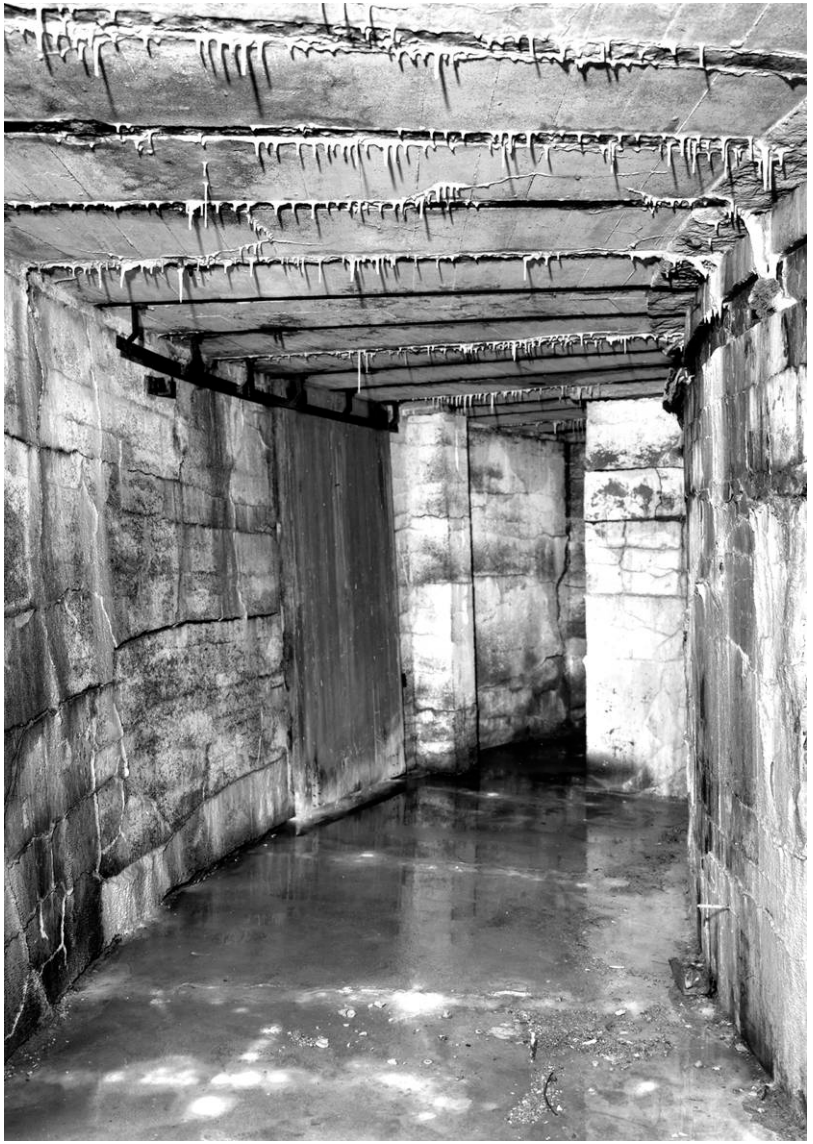
Also, note the stalactites. Normally seen in caves, these stalactites are the comprised of natural salts leaching out of the concrete.

Turning to the right, we see part of a steel track system associated with exterior cypress doors, which once slid along the tracks to seal the portals that lead into the shot storage corridor. Most of the doors remain on the premises, many still in reasonably good condition.

Note the steel beam that is cast into the concrete ceiling, to which the door track is attached. Beams such as this are typical throughout the battery ceilings. It is thought that they were intended primarily to support the fresh concrete as it cured. As the concrete is not otherwise reinforced, it may also be that these beams were intended to provide long-term strengthening to the 39” thick concrete ceiling/loading platform.

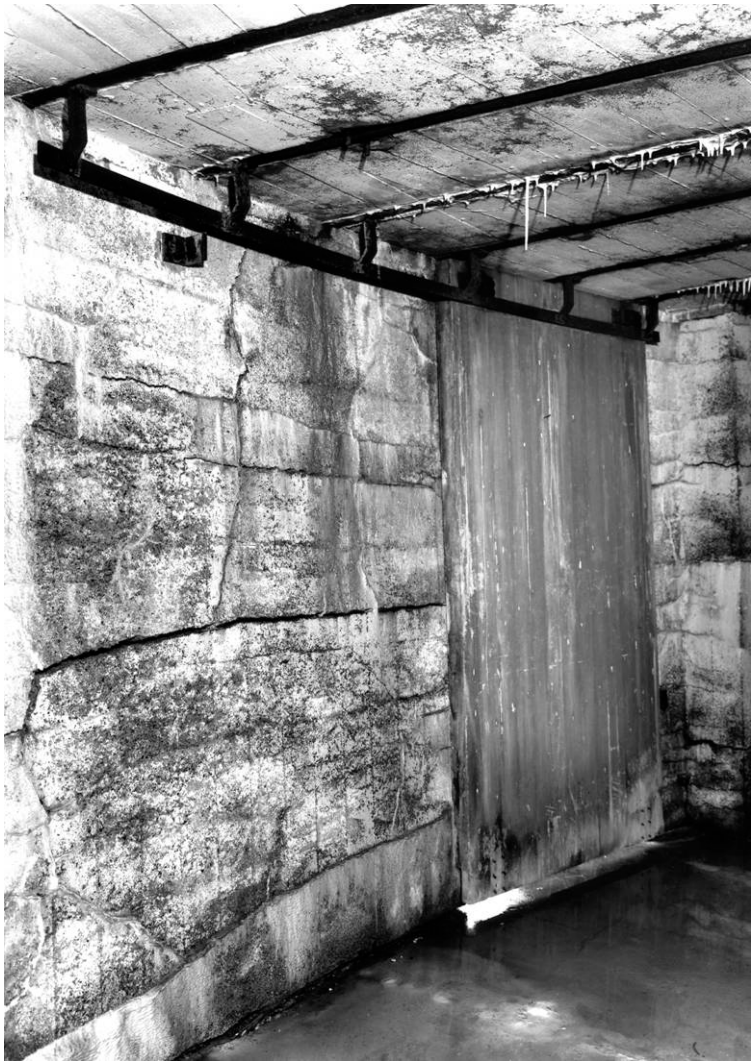
Shot Corridor – Gun Emplacement #2

Guard Room – Gun Emplacement #2

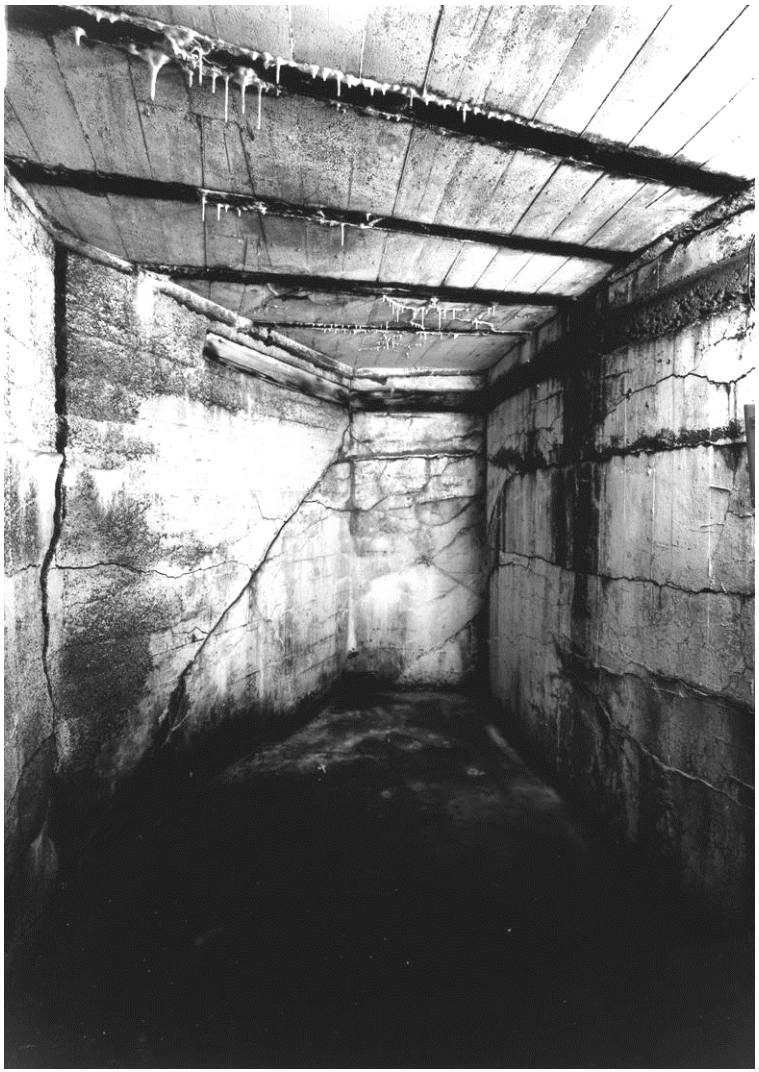


photos by James Rosenthal, National Park Service Historic American Building Survey

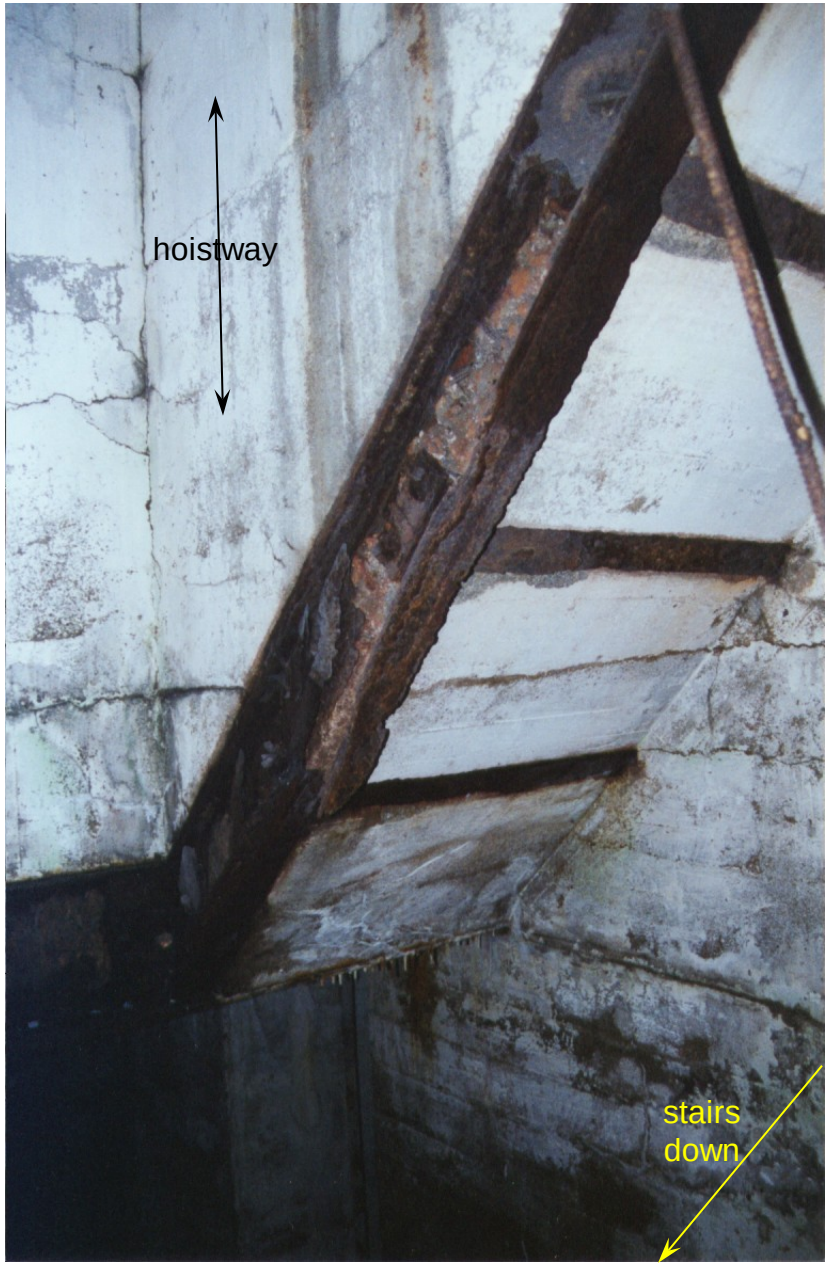
Guard Room Door – Gun Emplacement #2



Battery Room – Gun Emplacement #2



photos by James Rosenthal, National Park Service Historic American Building Survey

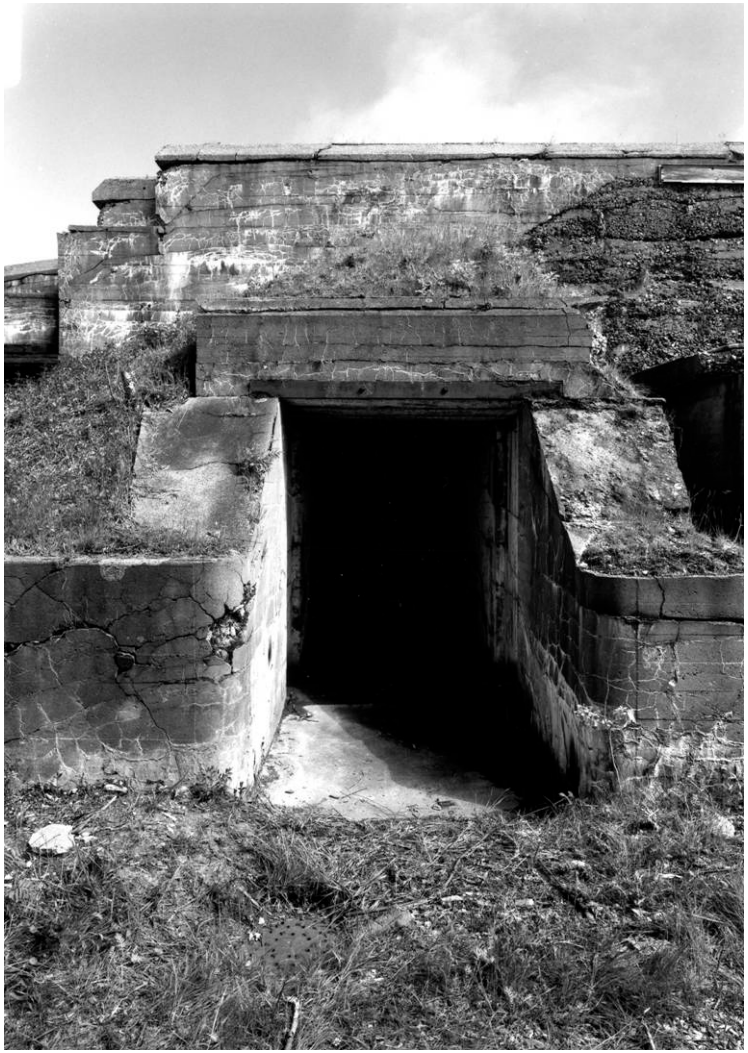


We are now at the far west end of the curved shot storage corridor. We are standing essentially at the landing area for the hoist. There is a half-flight of stairs immediately beside the hoistway that lead down to the powder magazine, shell storage room and relocating room.

Note more of the same in terms of the poor condition of the concrete. Also note the degree of deterioration on the steel elements that has been hastened, I am sure, by the salts leaching out of the concrete.

Rear of Gun Emplacement #2

photos by James Rosenthal, National Park Service Historic American Building Survey



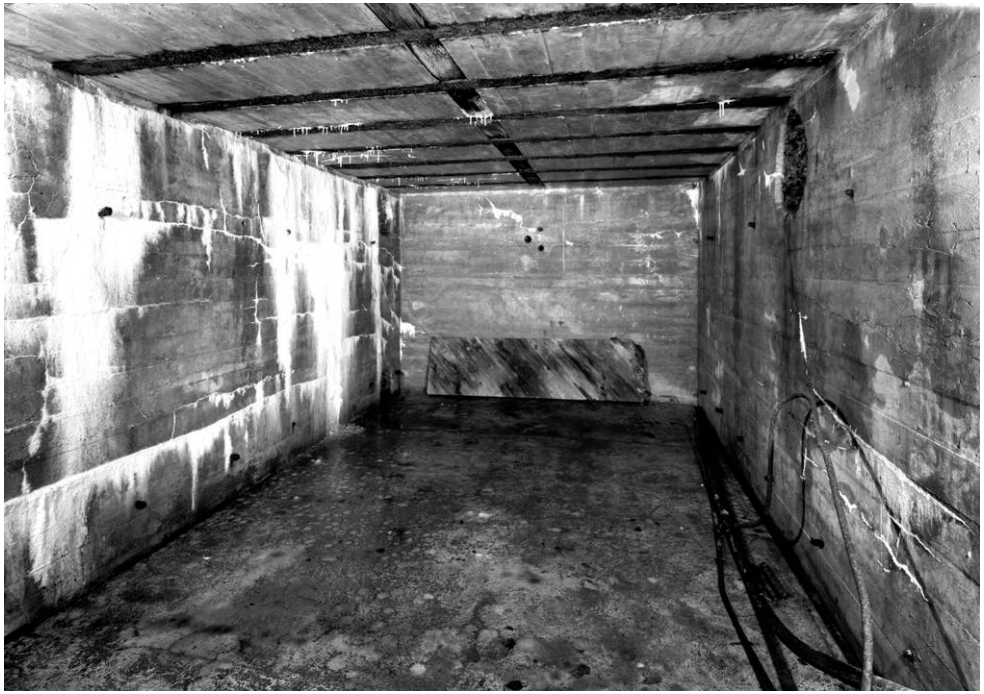
Lower Level Entry Corridor
Gun Emplacement #2

We are now in the main corridor into the lower level of Gun Emplacement #2. The first room on our right is the powder magazine. At the end of this corridor on the right is the shell room and on the left are the relocating room, hoistway, winch alcove, and half flight of stairs up to the shot corridor. The lower level for Gun Emplacement #1 is identical.

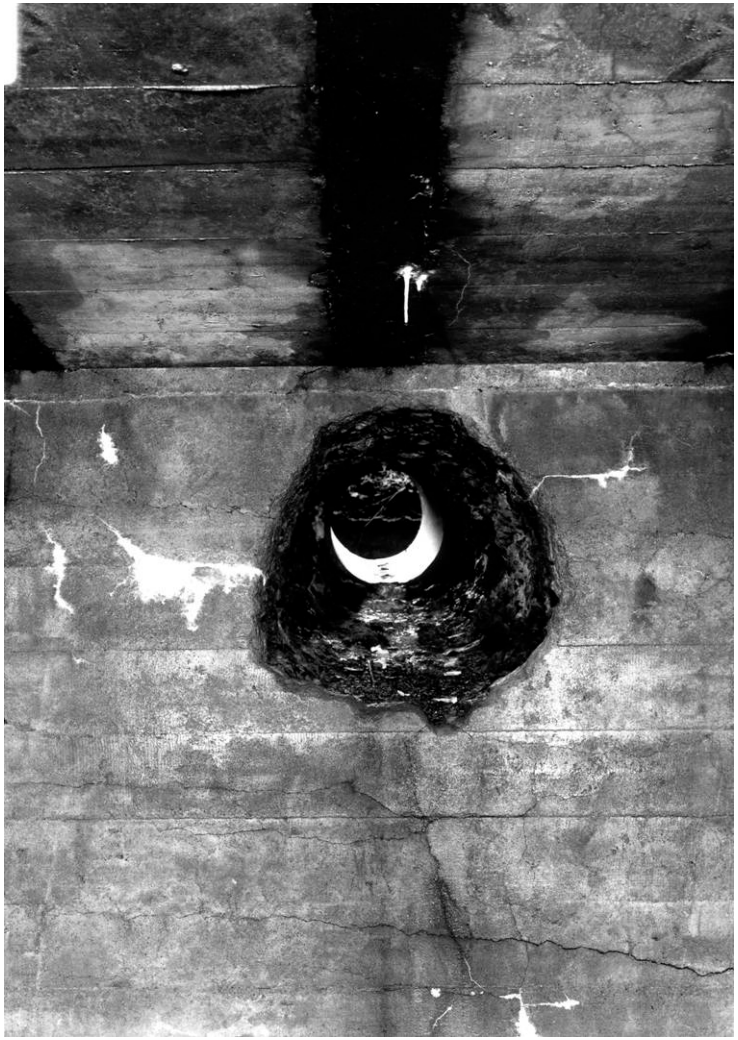
The lower portion of the gun emplacements were plagued with water intrusion problems. Much effort was expended to correct these problems, including tearing up and replacing the concrete floors in order to add an underdrain system, busting high and low ventilation holes between the shell room and the powder magazine and to the exterior hoping to dry things out, and lining of the powder magazine ceiling with copper and walls with multiple thicknesses of waterproofing roofing materials. All of this was to little avail and this ongoing problem was a significant factor in the eventual decision to abandon Battery Farnsworth rather than upgrade it for World War I.

photo by James Rosenthal, National Park Service Historic American Building Survey

Powder Magazine – Gun Emplacement #2



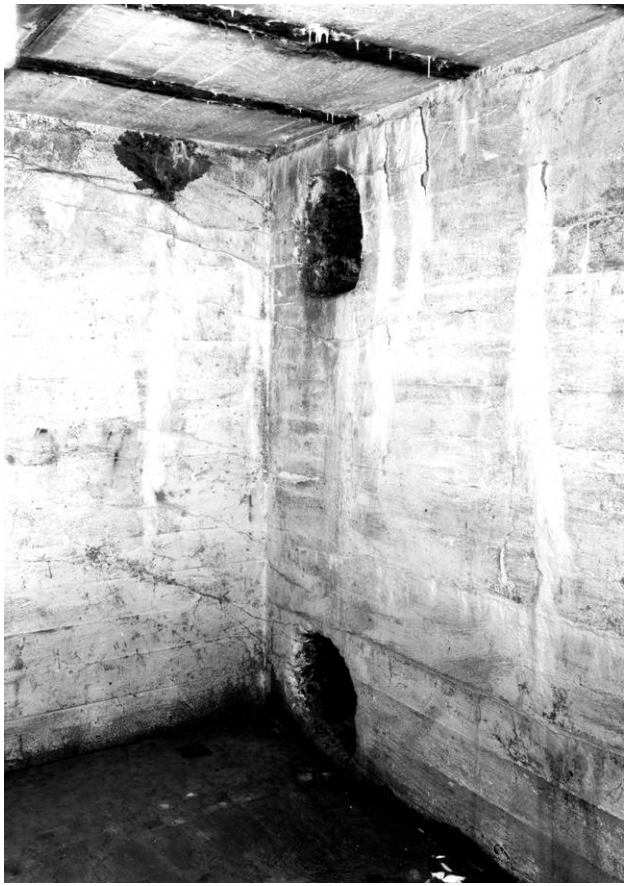
photos by James Rosenthal, National Park Service Historic American Building Survey



Vent Hole to Exterior

Shell Storage Room – Gun Emplacement #2

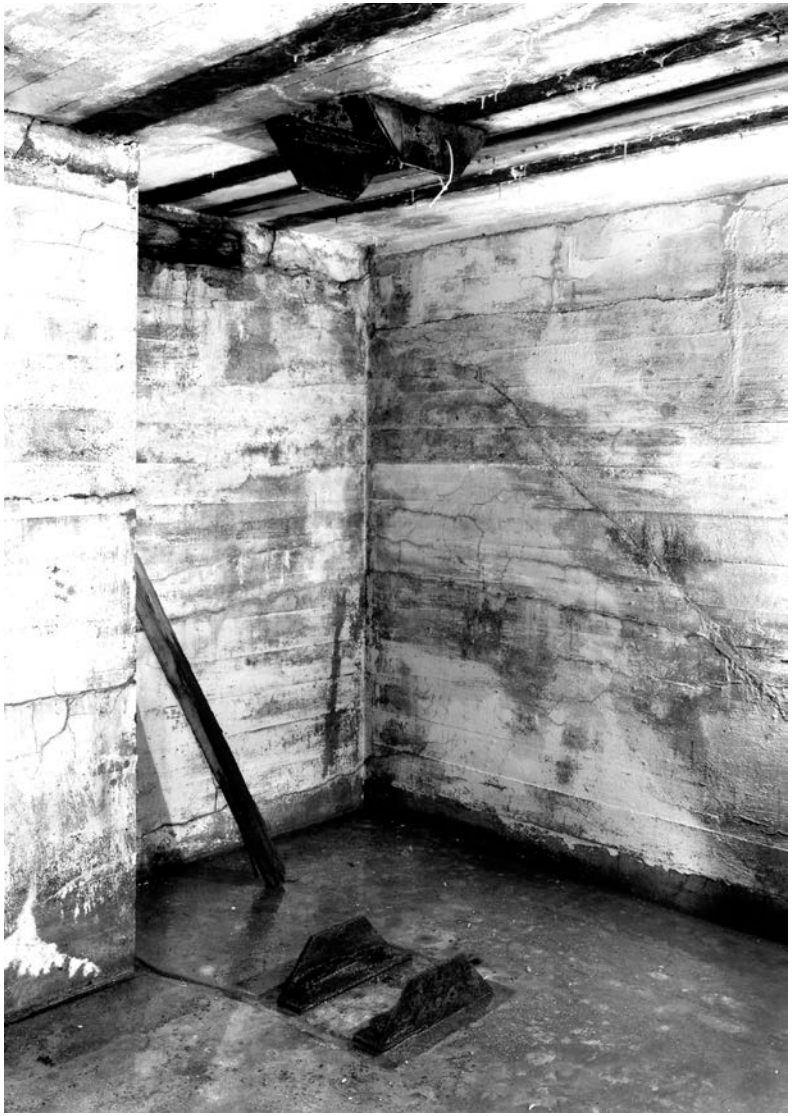
Vent Holes to Powder Magazine



photos by James Rosenthal, National Park Service
Historic American Building Survey

Relocating Room and Stair to Shot Corridor
Gun Emplacement #2

Winch Alcove – Gun Emplacement #2



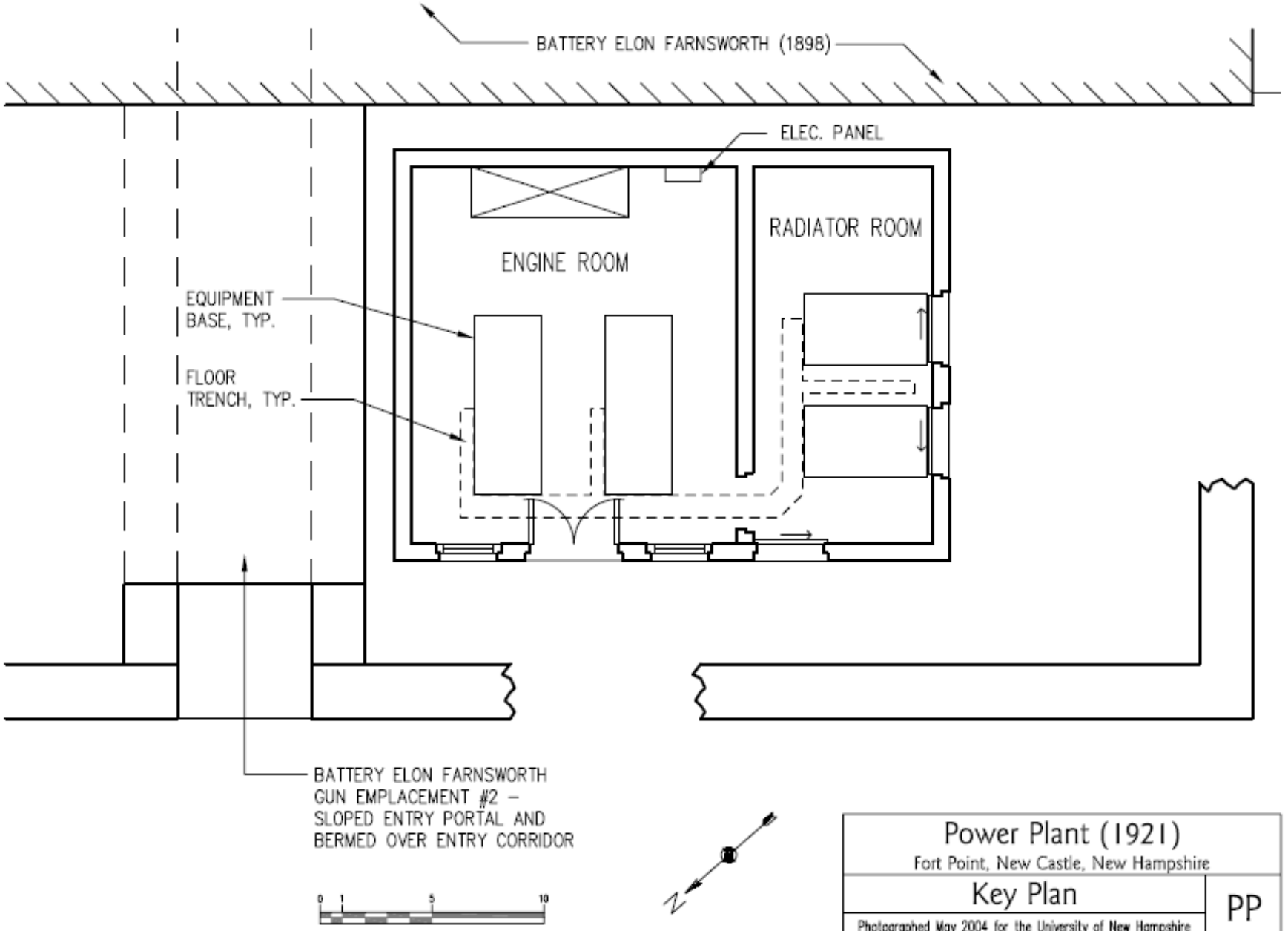
photos by James Rosenthal, National Park Service Historic American Building Survey

1921 Power Plant

Line of original earthen berm, placed against the wall early enough in the Rosendale cement's slow cure period to damage the surface. Shortly after its original placement, the top portion of the berm was removed to allow the installation of a catwalk between the two gun emplacements. In 1920, the remainder of the berm was removed to allow construction of the power plant.

Courtesy of Pete Payette and American Forts Network.

Nestled at the rear of Battery Farnsworth, between Gun Emplacements #1 and #2, is the 1921 power plant. It contained two generators, each with an associated radiator.



Power Plant (1921)

Fort Point, New Castle, New Hampshire

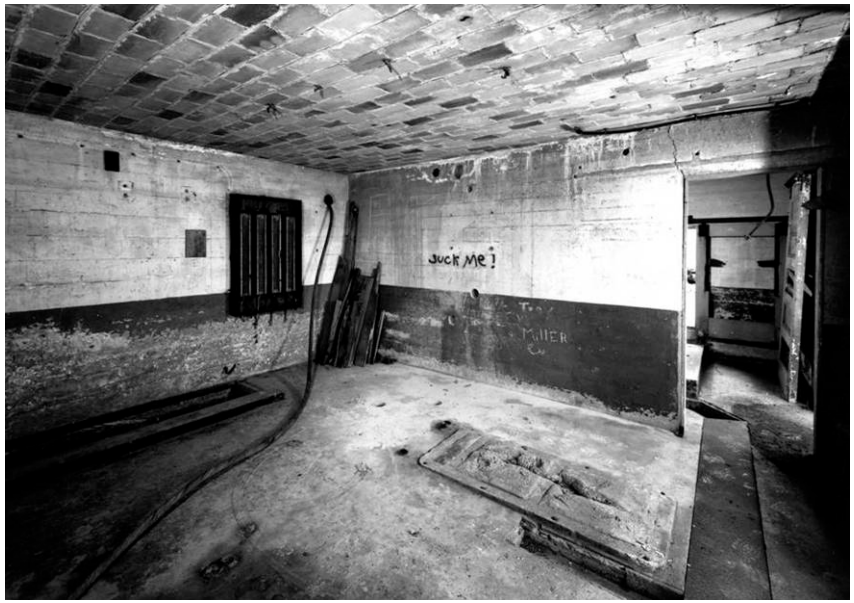
Key Plan

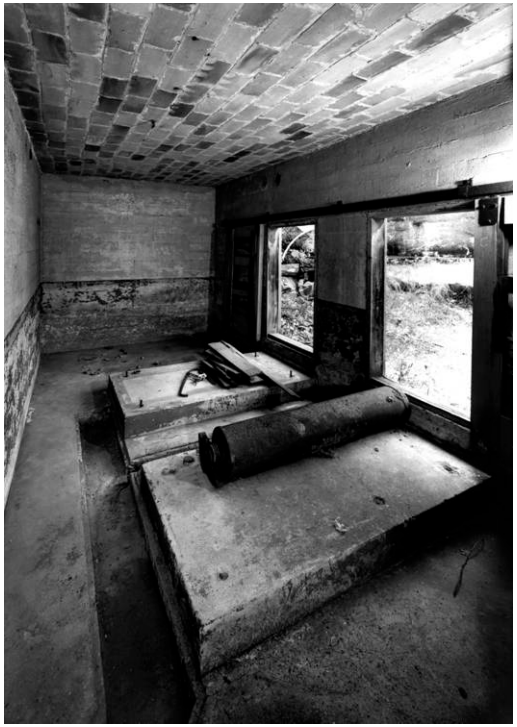
PP

Photographed May 2004 for the University of New Hampshire

Generator Room – 1921 Power Plant

Radiator Room – 1921 Power Plant



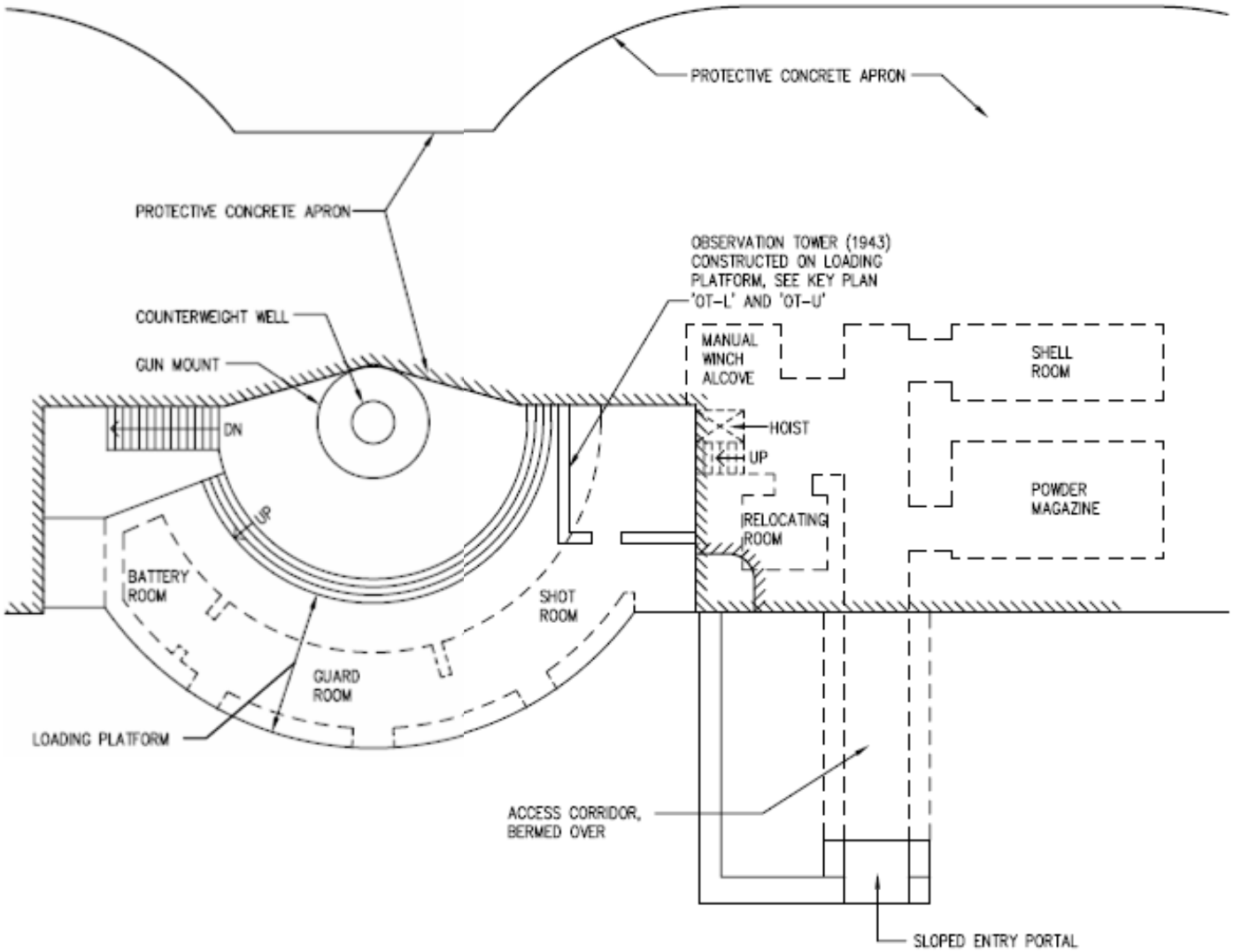


photos by James Rosenthal, National Park Service Historic American Building Survey

Gun Emplacement #1

We will now move on to Gun Emplacement #1, which is essentially identical to Gun Emplacement #2. The primary differences are:

1. the addition of the WWII Base-End Triangulation Tower that we saw previously from a distance, and
2. the significant extent to which the loading platform is bulging outward.



Battery Elon Farnsworth - Partial

Fort Point, New Castle, New Hampshire

Key Plan

EF-1

Photographed May 2004 for the University of New Hampshire

Approaching Gun Emplacement #1, we immediately see that something looks a bit “out of kilter”. And, it is certainly more than just a case of holding the camera crooked. In fact, the curved walls that support the loading platform are leaning to the extent that they appear ready to collapse.

Atop the gun emplacement we see the WWII Base-End Triangulation Tower.

Okay . . . Let’s take a closer look.

Note the degree of lean associated with the curved loading platform support wall to our immediate right. What is happening, as we will see shortly, is that the loading platform above is bulging northward away from the fixed gun base and pushing the outer curved support walls with it. The wall in front of us, however, is braced by another wall that returns to the right. As such, instead of the wall leaning, the landing platform is sliding over the top of the wall

In fact, this is occurring at both gun emplacements, with the condition at Gun Emplacement #1 having progressed to the point of near collapse.

Before we go topside, let's take a look at the movement of the Gun Emplacement #1 loading platform, from below in the shot corridor.

Everyone *has* turned in their signed liability waiver . . . right?

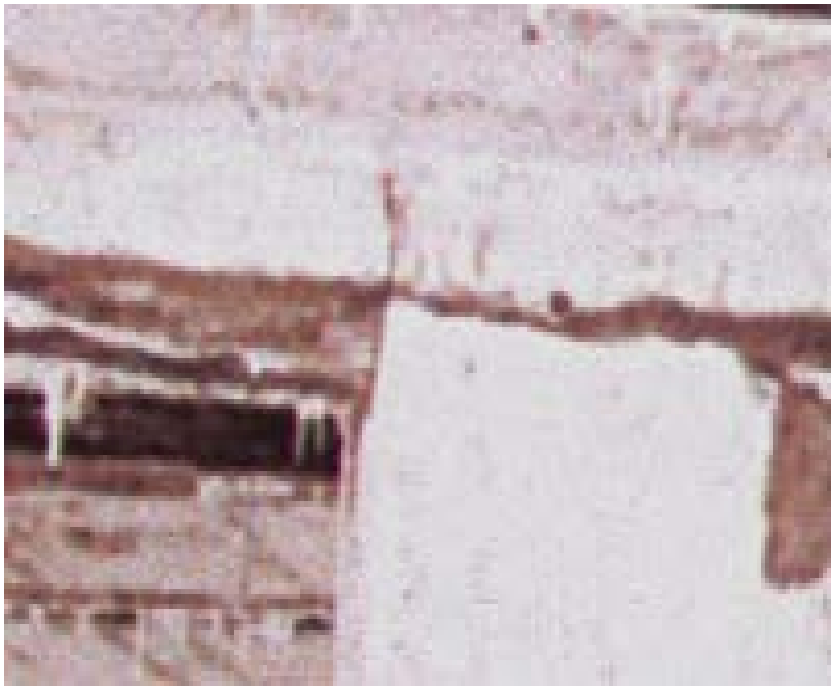
No . . . really . . . Has everyone turned in their liability waiver?

Okay, I've seen enough already. Let's get out of here and head up to the gun emplacement.

Although tough to see in this photo, the approximately 2 foot thick concrete walls are leaning so much that the inside edge has lifted about 3½" off the floor slab, putting significant pressure on the outside edge of the wall and on the edge of the floor slab. The 3½" lift corresponds to the top of the wall having migrated out about 15", which is consistent with what we saw earlier.

Battery Farnsworth, Gun Emplacement #1 – Close-up photos showing progressive movement

2001 (Wastrom Report)



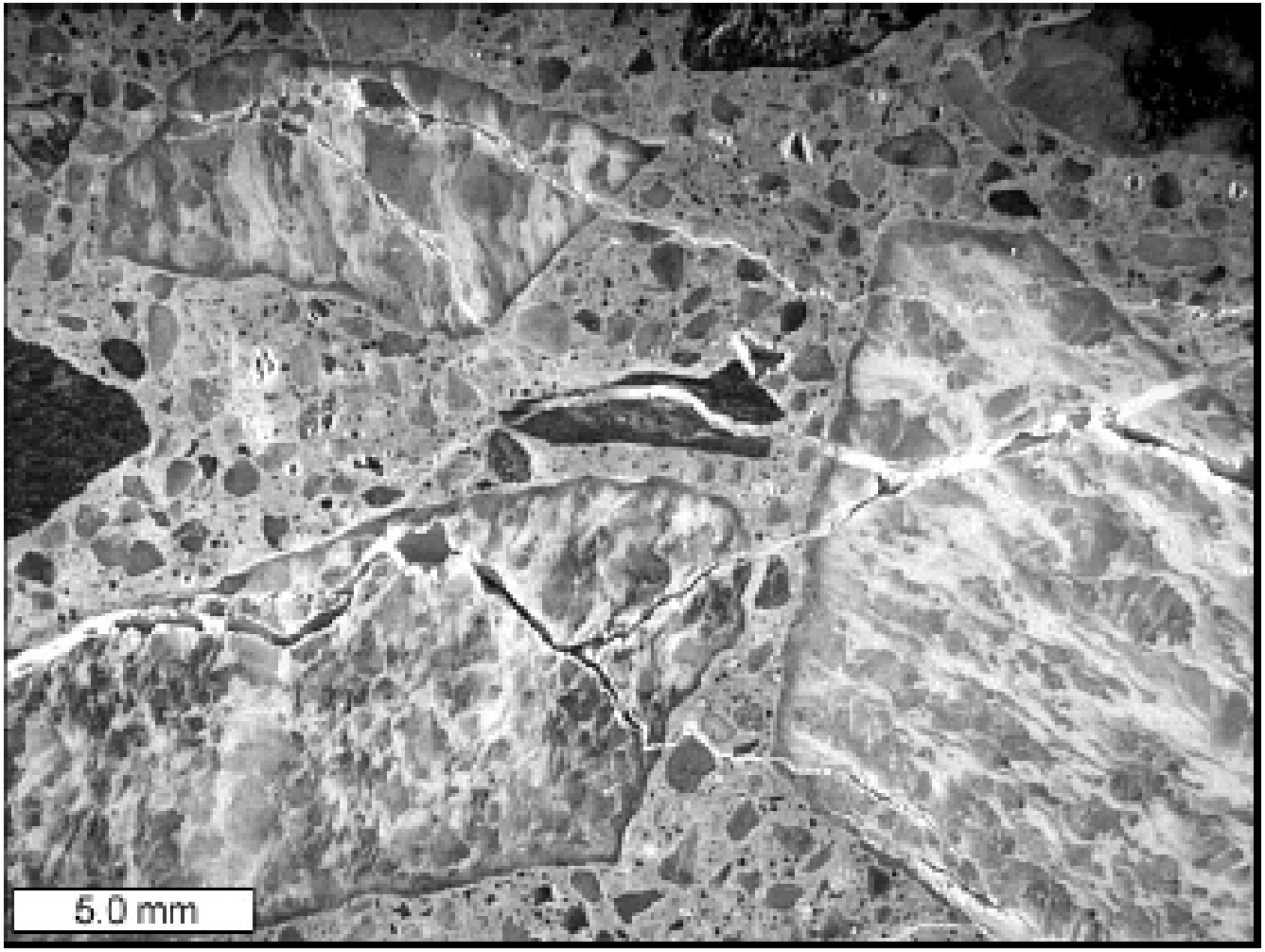
2004

Courtesy of Prof. David Gress, University of New Hampshire, Department of Civil Engineering

Battery Farnsworth, Gun Emplacement #1 – Lintel crack, exterior and interior views

Courtesy of Prof. David Gress, University of New Hampshire, Department of Civil Engineering

Stereo microscope image of 13-1 showing cracks and ASR gel



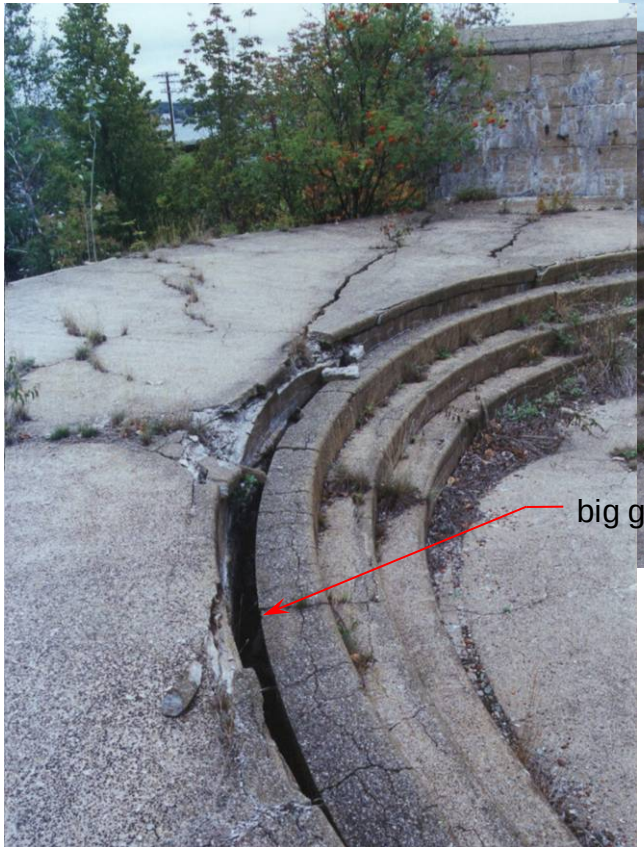
Courtesy of Prof. David Gress, University of New Hampshire, Department of Civil Engineering

Polished core 6-2 showing gel deposits and internal fractures

Courtesy of Prof. David Gress, University of New Hampshire, Department of Civil Engineering

Courtesy of Pete Payette and American Forts Network.

As we get ready to head topside, check out the condition of the concrete. The large crack shows the loading platform tearing itself apart as it bulges northward.



Gun Emplacement #1 is much the same as at Gun Emplacement #2 (sans tree in the gun carriage mount), except the concrete here appears to be even more distressed and, of course, there's the matter of the loading platform bulging outward 15" or more.

This vantage point also provides a good look at the condition of the loading platform.

WWII Base-End Triangulation Tower

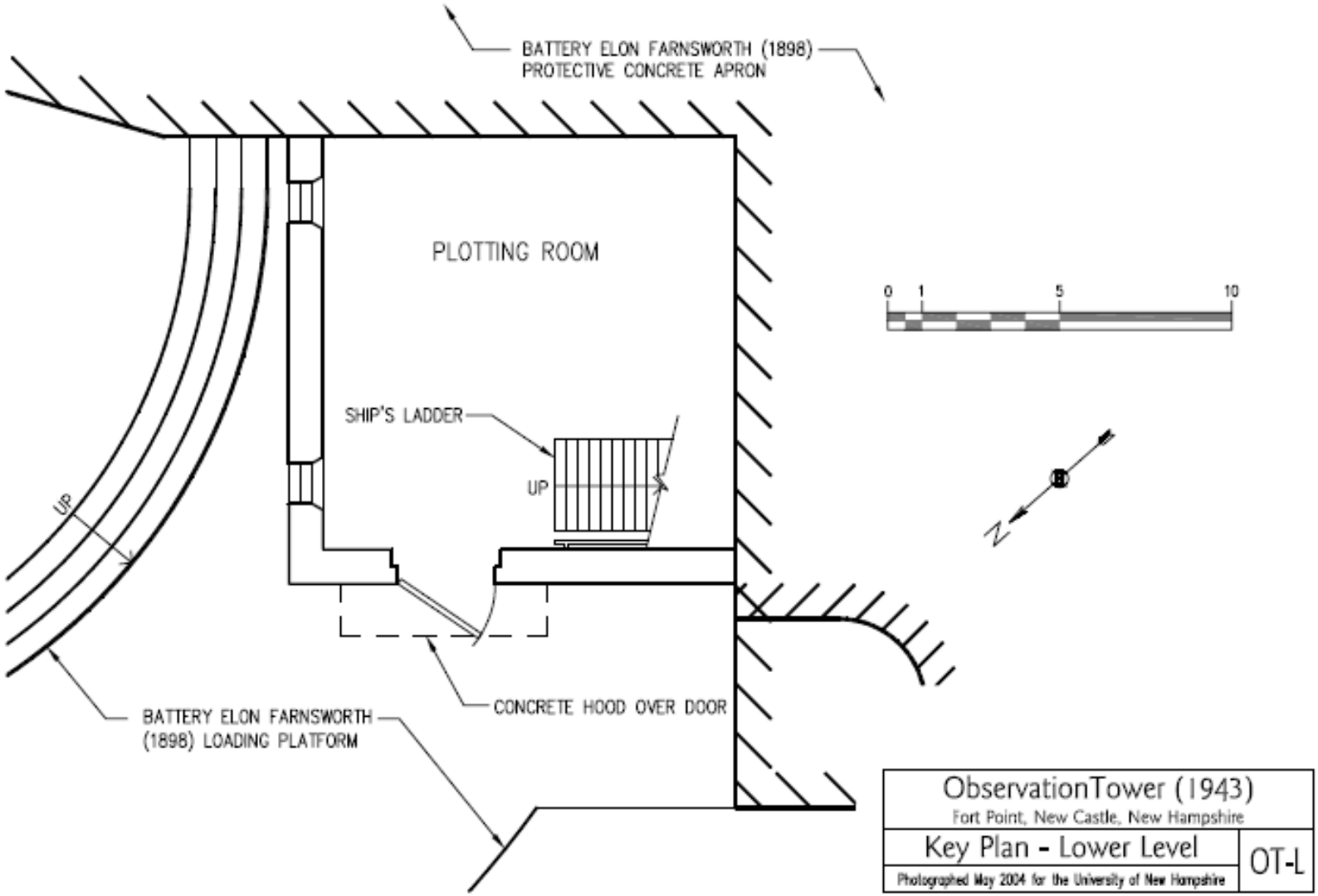
Added in 1943 atop Battery Farnsworth, soldiers in this base-end triangulation tower were able to provide enemy vessel siting information to mine control personnel. In combination with siting information from a sister tower at Fort Foster on Gerrish Island in Kittery, Maine, the position of approaching vessels could be plotted relative to that of harbor mines, thereby allowing remote detonation of mines nearest to the target. Prior to the addition of this tower, Battery Farnsworth was effectively hidden from approaching vessels.

The 1943 base-end triangulation tower (a.k.a. observation tower) consists of two levels . . .

The lower level held a work table for plotting vessel sightings as well as communications equipment linked to the mine control personnel, who were located within the protection of the 1920 mining casemate.

The upper level, accessible only by way of a wooden “ship’s ladder” from the plotting room, contained a manned sighting instrument and a sentry.

Observation slits wrapped around 70% of the tower perimeter . . . pretty much wherever there was water to see.



ObservationTower (1943)

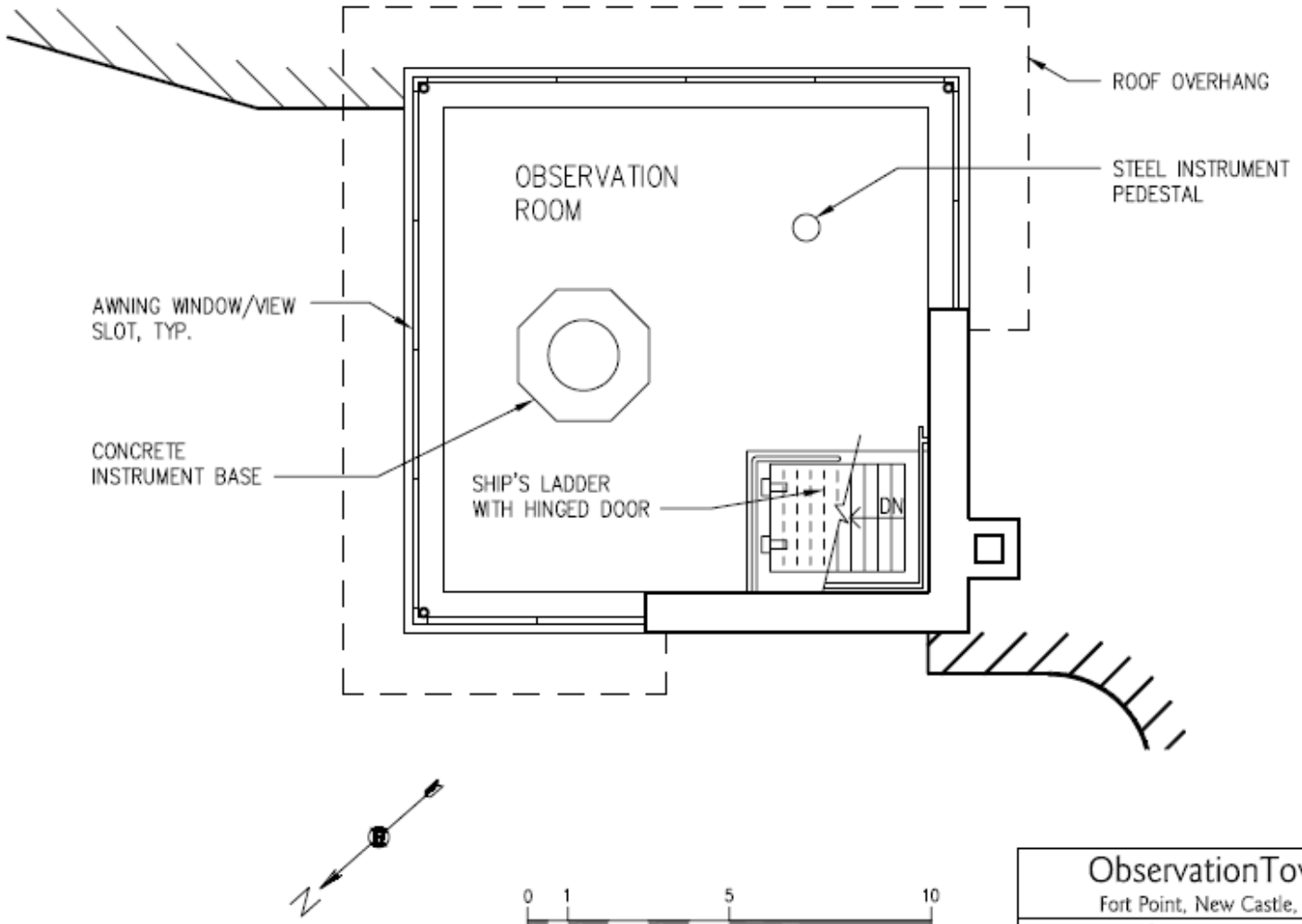
Fort Point, New Castle, New Hampshire

Key Plan - Lower Level

OT-L

Photographed May 2004 for the University of New Hampshire

photo by James Rosenthal, National Park Service Historic American Building Survey



ObservationTower (1943)

Fort Point, New Castle, New Hampshire

Key Plan - Upper Level

OT-U

Photographed May 2004 for the University of New Hampshire

1943 Observation Tower

Upper Level

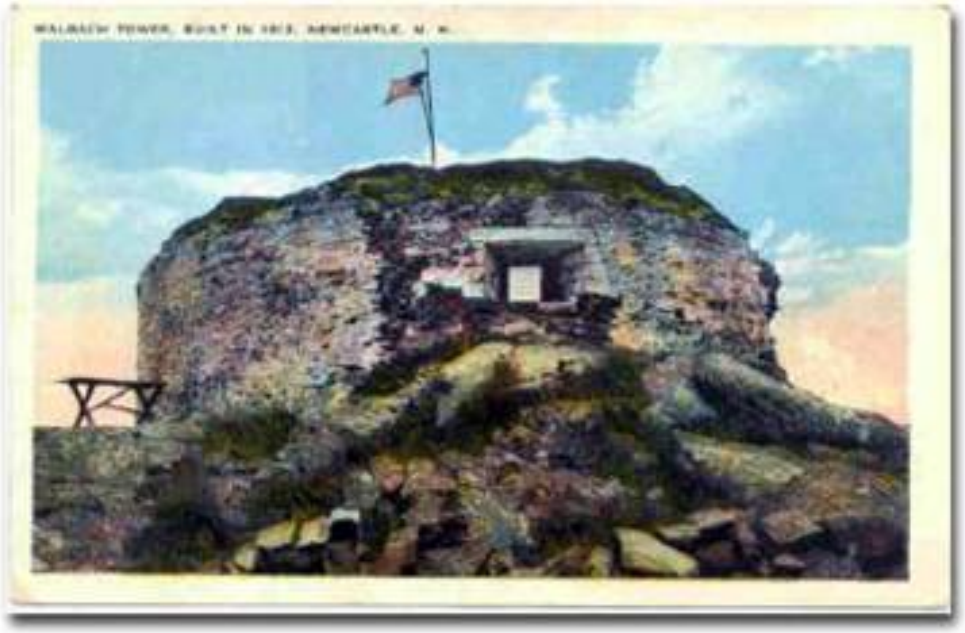
photo by James Rosenthal, National Park Service Historic American Building Survey

Courtesy of Pete Payette and American Forts Network

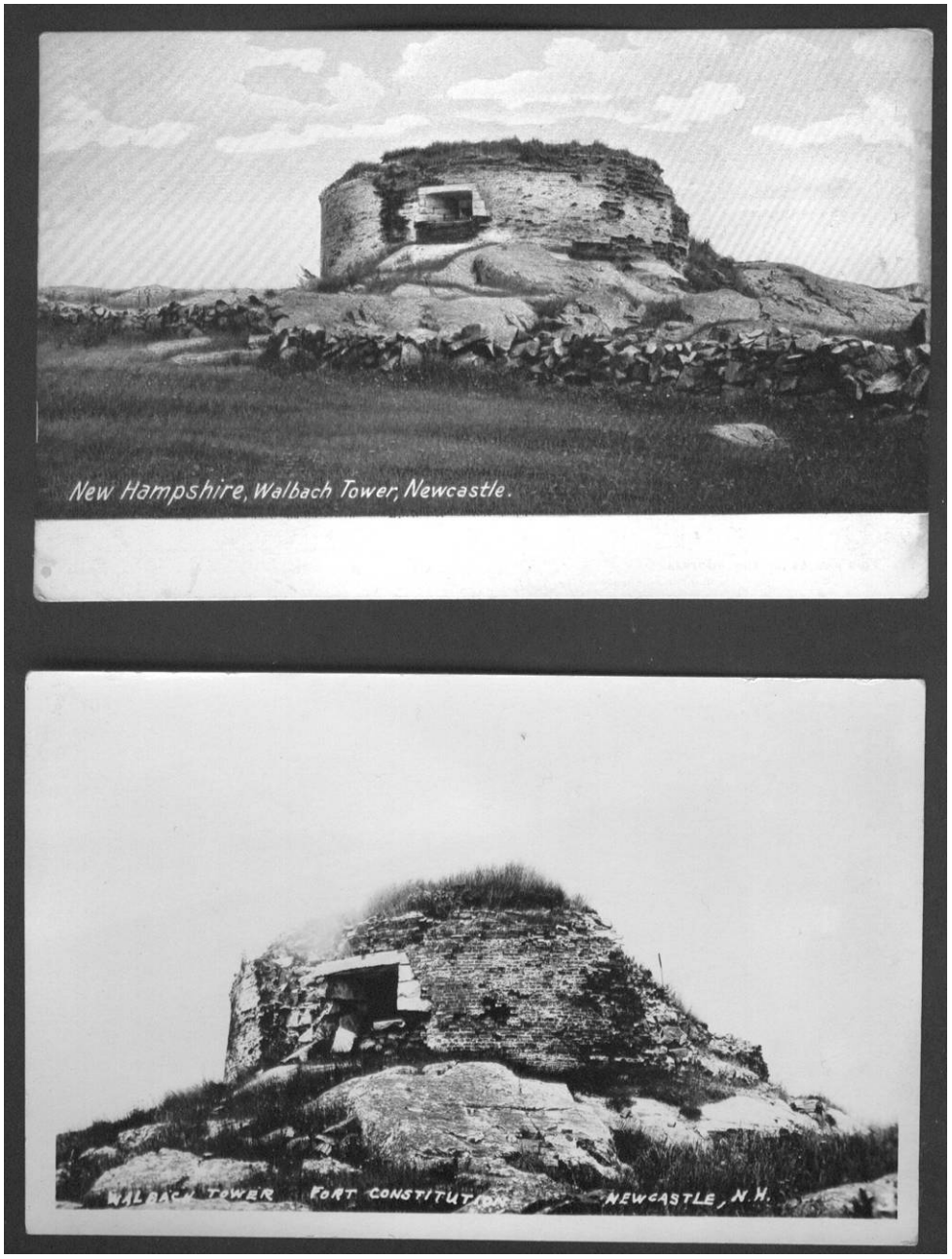
Walbach Tower

Well, it looks like we have a few minutes to take a quick look at Walbach Tower. Watch your step . . . the rocks can be slippery. Okay, follow me . . . single file now.

Courtesy of Pete Payette and American Forts Network



Early postcarad of Walbach Tower built at the Fort in 1812

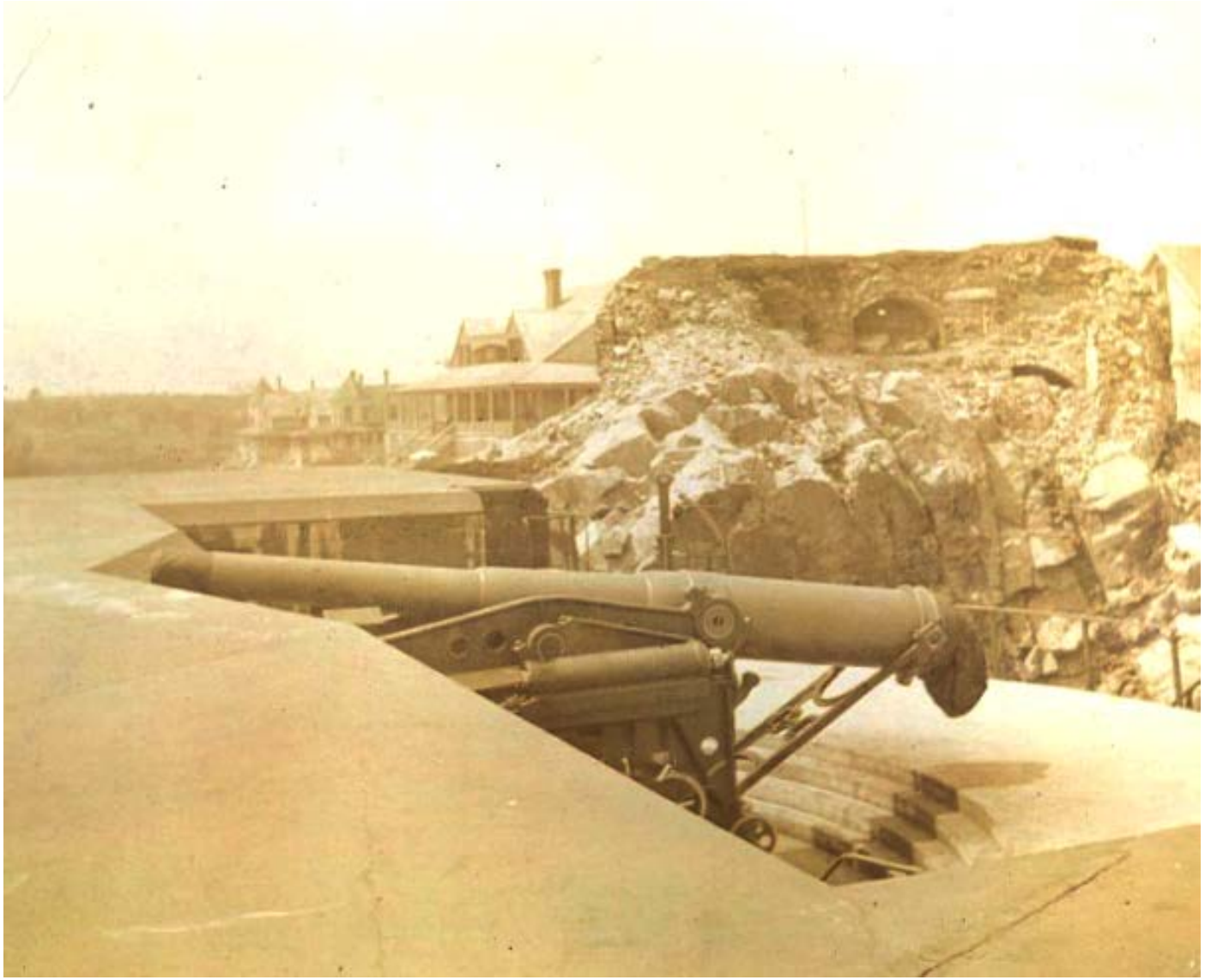


Walbach Tower

Before & After 1897-1899 Construction of Battery Elon Farnsworth

From Town of New Castle Historic Archives

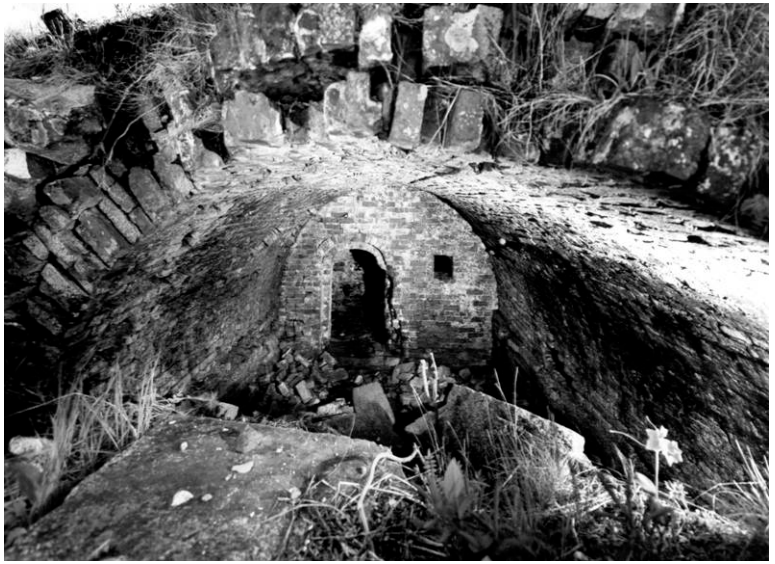
Courtesy of Library of Congress, via Pete Payette and American Forts Network web site



Obtained during National Park Service research for Historic Structures Report

Walbach Tower Ruins (from northwest)

Walbach Tower is now in ruins as a result of the passage of time as well as due to damage associated with the construction of Farnsworth Battery, and thought to have been further demolished during World War II to reduce its prominence. Walbach Tower was a three-level Martello-type cylindrical stone and brick masonry structure, which supported a heavy cannon on its top level and had rooms beneath serving as barracks and a magazine. It is said to have been constructed in the course of only a couple of weeks in 1814 under the cover of dark.



Black & white photos by James Rosenthal, National Park Service Historic American Building Survey

Walbach Tower - Magazine

The entrance to the lower level magazine has been somewhat blocked by falling debris from the tower above and by rocks displaced by blasting operations associated with the construction of Battery Farnsworth. To get into the magazine, it is now pretty much necessary to do the army crawl.

The magazine interior is in surprisingly good condition considering its age. While some of the bricks littering the floor have fallen from the arched ceiling, most appear to have tumbled in from the walls of the tower above, as they either collapsed or were knocked down.

Photograph by Beth Muzzey, NH Division of Historical Resources

Views from top of Walbach Tower

East

South

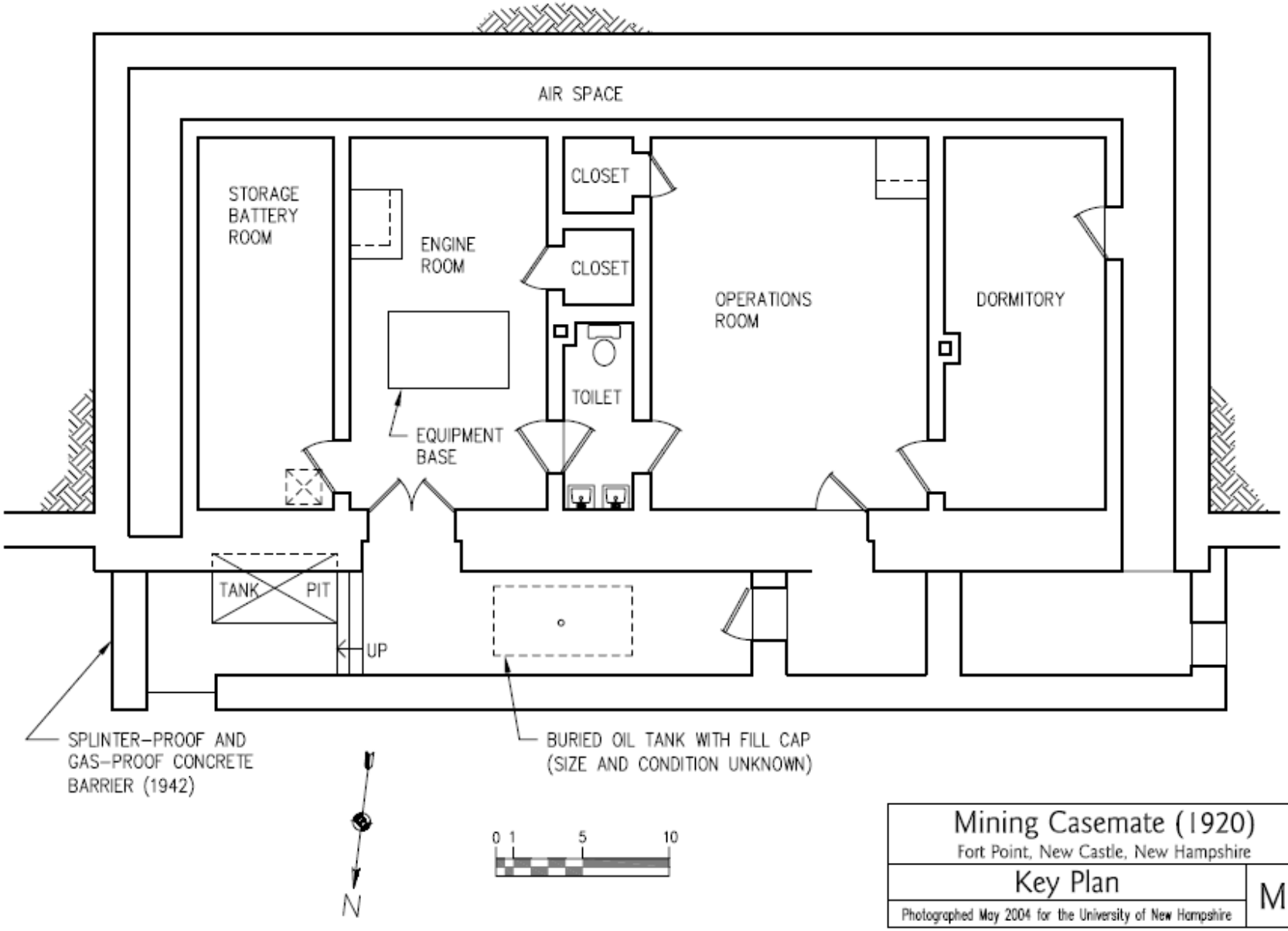
West

North

East Again

1920 Mining Casemate

Also seen from Hart's Cove is the 1920 Mining Casemate. Actually, all we see of the original structure are the flanking wingwalls. At the center, we see a rather stark concrete facade that was constructed as part of WWII efforts to offer protection against attack from the north.



Mining Casemate (1920)

Fort Point, New Castle, New Hampshire

Key Plan

MC

Photographed May 2004 for the University of New Hampshire

1920 Mining Casemate
(from the north)

Entrance

Blast-Proof / Gas-Proof Entry Corridor (1942)

photos by James Rosenthal, National Park Service Historic American Building Survey

Battery Room

photo by James Rosenthal, National Park Service Historic American Building Survey

Boiler / Generator Room

photo by James Rosenthal, National Park Service Historic American Building Survey

Boiler / Generator Room

photo by James Rosenthal, National Park Service Historic American Building Survey

Toilet Room

photo by Rich Rouleau,
University of New Hampshire
Facilities Design & Construction

Operations / Mine Control Room

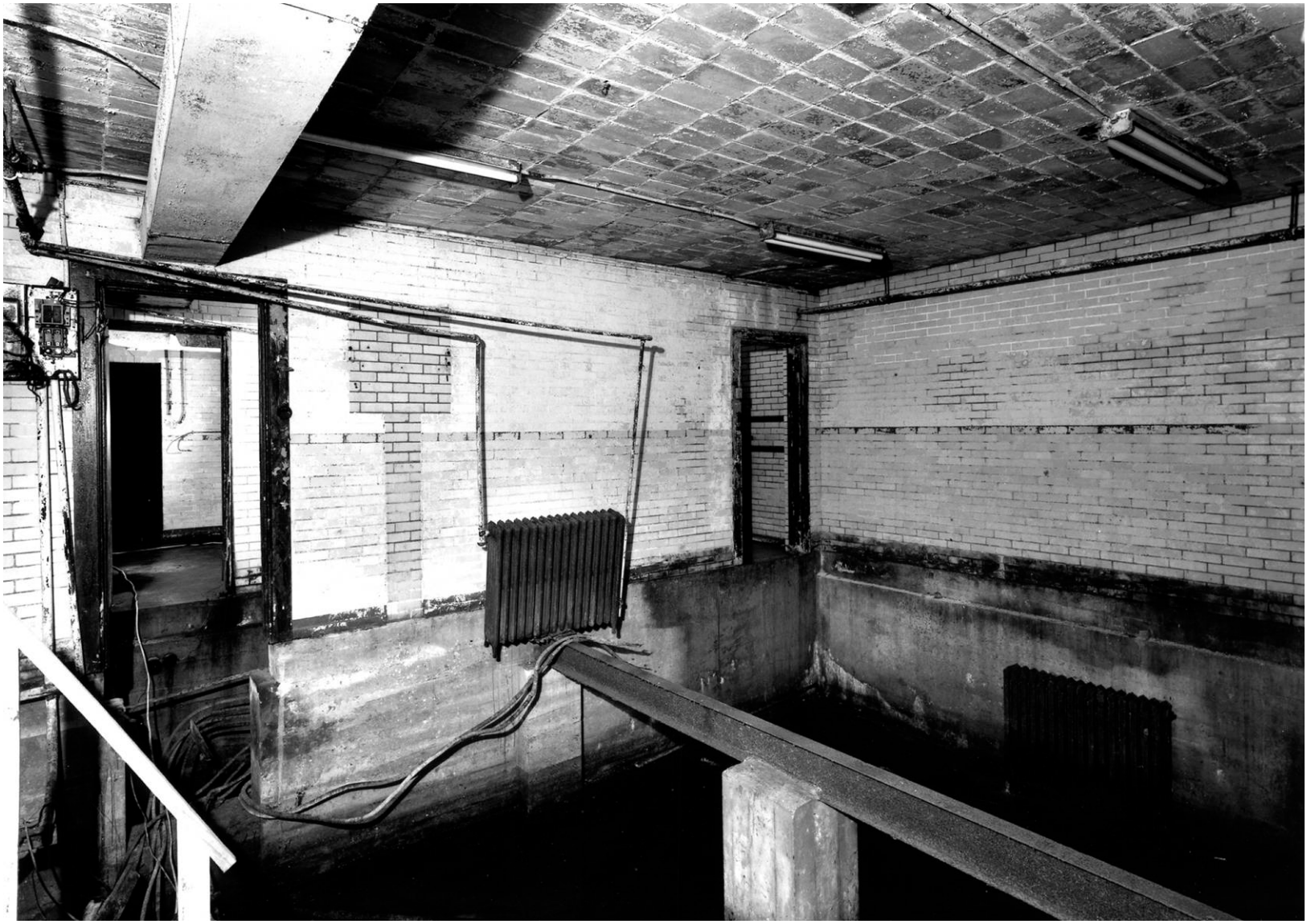


photo by James Rosenthal, National Park Service Historic American Building Survey

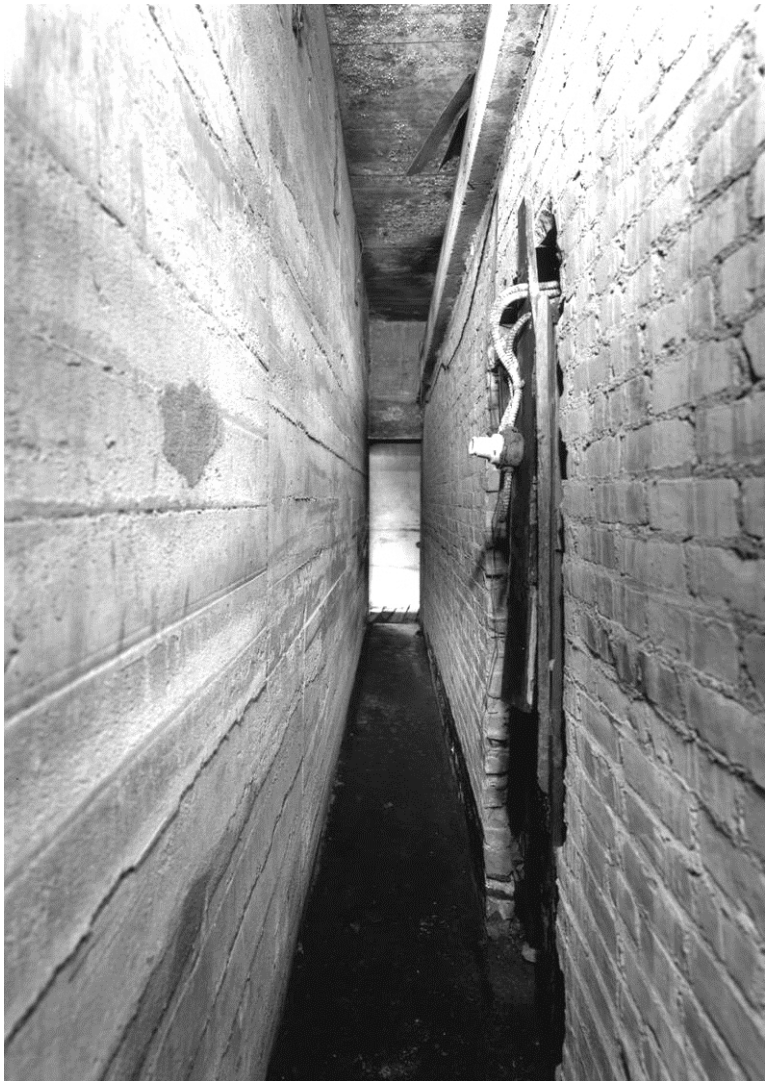
Operations / Mine Control Room

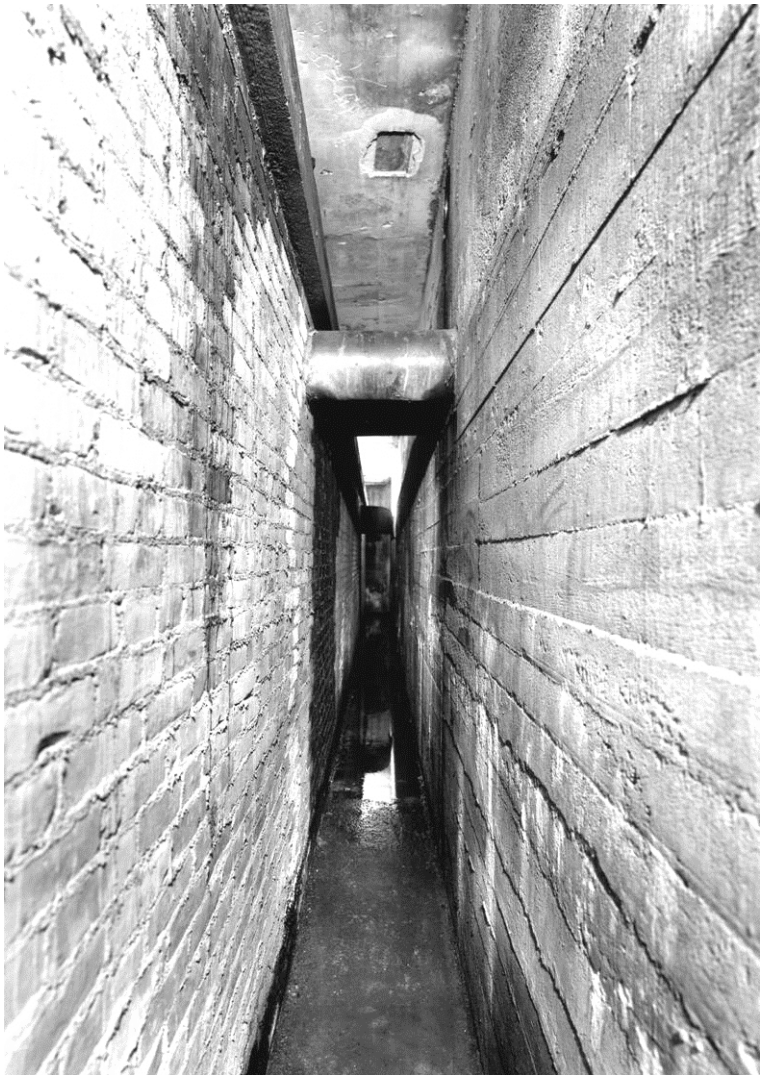
photo by James Rosenthal, National Park Service Historic American Building Survey

Bunk Room

photo by James Rosenthal, National Park Service Historic American Building Survey

Air Space





photos by James Rosenthal, National Park Service Historic American Building Survey

Air Space

photo by James Rosenthal, National Park Service Historic American Building Survey

Air Space

photo by Rich Rouleau, University of New Hampshire Facilities Design & Construction

More Information?

If your are interested in the history associated with Fort Point, at the mouth of Portsmouth Harbor, consider checking out "Fort Constitution." It is a fantastic web site produced by American Forts Network, which includes a thorough history of New Castle's Fort Point.

Or, check out "Seacoast Forts of Portsmouth Harbor", also by American Forts Network, for information about all of the numerous forts of Portsmouth Harbor.

Other sources include your local and state libraries and special collections, Portsmouth's Strawbery Banke, and local historical societies.

And, of course, internet searches for terms such as Fort William and Mary, Fort Constitution, Walbach Tower, War of 1812, Elon J. Farnsworth, Battery Farnsworth, Spanish-American War, Portsmouth Harbor, mines casemate, and the like will yield a plethora of information.

This slideshow presentation was developed by Rich Rouleau, Project Manager
for the University of New Hampshire's pier facility,
currently under construction on Fort Point in New Castle, New Hampshire.