

FORT GORGES CASEMATE STABILIZATION AND WESTERN VIEWING AREA ACCESS IMPROVEMENTS

ASSESSMENT REPORT AND COST OPINIONS

PERFORMED FOR
CITY OF PORTLAND, MAINE PLANNING DEPARTMENT
389 CONGRESS STREET
PORTLAND, ME 04101

R.F.Q. #4817

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1.0 EXECUTIVE SUMMARY

Fort Gorges on Hog Island Ledge in Portland, Maine is a city-owned space in transition. The City of Portland and the renewed and reinvigorated Friends of Fort Gorges (FoFG) are now imagining the potential and possibilities of this under-used historic site and park asset. The site is an iconic figure in Portland Harbor, and is a draw for boaters, kayakers, history enthusiasts, birders, artists and, occasionally, vandals. Its potential as a city park and tourist attraction has remained largely untapped, as it has remained as an “enter at your own risk” facility. Actively encouraging its increased use requires some practical structural and safety improvements. Assessment and safety improvement designs to the casemates and western viewing access area, including two short pedestrian bridges and rooftop pathways, is the first step in a Master Planning project to fully determine the condition and understand the potential of the site.

This project, funded by grants provided by the Maine Historic Preservation Commission and the National Trust for Historic Preservation, with matching funds provided by the City of Portland and the Friends of Fort Gorges, has been a collaborative effort involving the City of Portland Historic Preservation Office (Deb Andrews), the Portland Parks, Recreation and Facilities Department (Ethan Hipple and Joe Dumais), the Friends of Fort Gorges (Paul Drinan), Resurgence Engineering (Alfred Hodson, P.E., and John Turk, AIA) and, through consultation, the Maine Historic Preservation Commission. A publicly-advertised workshop to discuss the project drew approximately 70 attendees to listen to and engage with the project team described above.

The project scope focuses on two primary areas within the fort:

1. The casemates, which have both settled and shifted due to water infiltration, tidal erosion, freeze-thaw forces, and thermal expansion, and;
2. The western viewing area, which requires improved access, pedestrian bridges, safety, wayfinding, and interpretation.

While not specifically in our project scope, we spent additional time considering initial improvements to public access at the fort, including minor wharf improvements, on-site storage and temporary restroom facilities, and Officers' Quarters cleanup and protection against vandalism. These important considerations will be included in further discussions with the project participants, and in a separate report.

Concurrently, the United States Army Corps of Engineers (USACE) is providing safety improvements to the fort under a separate agreement with the City of Portland, part of a decades-old program that the Army Corp has administered to military sites closed and handed over to state and local owners and stewards.

Casemates Condition Summary, Recommendations, and Stabilization Cost Opinion:

The casemates within Fort Gorges are in fair condition, but their condition is declining rapidly. Lack of maintenance since the military permanently left Fort Gorges decades ago, as well as the natural forces of soil overburden, settlement, tidal erosion, unabated roof plant growth, and freeze-thaw action has induced significant bearing pressures on masonry, clogged internal drainage systems, cracked internal cast-iron drain pipes, and eroded soil beneath the parade ground and casemates. Specific casemate condition varies, but the slipping arch stones, cracked brick, falling brick and fracturing granite require stabilization and rehabilitation.

We reviewed the casemate condition against previous preliminary assessment review performed in 2001. We observed instances of increased casemate floor settlement, arch slip, and brick masonry cracking. Anecdotally, Paul Drinan has also observed these worsening conditions over the last several years.

As part of the casemate stabilization project, we recommend geotechnical assessment to try to confirm bearing conditions beneath the parade ground walls. Geotechnical assessment could include a combination of soil borings and non-invasive sidescan-sonar type investigation. This work could either be included in the actual stabilization project, or included as a lump-sum fee for separate investigation coordinated by Resurgence Engineering and a selected geotechnical consultant. We recommend that you include a \$20,000.00 allowance for this geotechnical work. Additionally, a formal site survey could establish grade elevations and benchmarks within the Fort, and provide a baseline to monitor future settlement. As we understand it, FoFG has already been in discussion with a surveying company about providing some of this information. Depending upon the complexity and comprehensive nature of the survey, costs would vary between \$10,000.00 for a simple survey and \$20,000 for a more comprehensive cloud-point data survey.

Our prescribed casemate stabilization program includes installation of pressure-treated timber cribbing and inexpensive precast concrete post bases, painted with intumescent paint to discourage vandalism-by-fire. We suggest installing a series of these cribbing frames, along with temporary heavy-duty neoprene or granite bearing shims at the second tier granite arch stones. We also recommend removing areas of significantly loose brick at arch intersections and at the perimeters of cracks. We recommend holding off on wholesale arch intersection rehabilitation and restoration until after the geotechnical information has been gathered and the tidal erosion of soil fines through the exterior walls has been mitigated. The purpose of these stabilizations is to arrest settlement, not to correct it.

We anticipate the casemate shoring project to cost approximately \$223,000, which includes the lump-sum fees for future engineering coordination, geotechnical assessment, and surveying. Casemate shoring will likely require periodic adjustment while fundraising occurs to perform more permanent repairs.

Western Viewing Area Access Condition Summary, Recommendations, and Cost Opinion:

Short timber pedestrian bridges spanning from the south tower to the second tier and barrette tier are in fair condition and generally safe from a gravity-loading perspective, but railings are in poor condition and need significant safety improvements and/or replacement. However, the bridge beams and flooring may likely deteriorate and become unsafe within a few years. The access path to the Western Viewing Area is overgrown, uneven, and eroding, and in fair to poor condition. The “urban wilderness” aspect of the Fort allows visitors to travel to locations that could endanger themselves and responders, especially in wet and windy conditions. New bridges, railings, wayfinding signage, and improved path width and grading will help mitigate these safety concerns, improve public access, and, in turn, spark further interest in visiting the fort.

Our design improvements include bridge replacement with a galvanized steel structure with railings designed to resemble those recently installed by the Army Corps, and galvanized steel railings, timber cribbing erosion control, and a stone-dust and gravel surface finish. The pathways in particular will require routine maintenance. The City will have an opportunity to determine how the designs implemented by the Army Corps will hold up against weather, wear, and vandalism, and some modifications of these designs can be made as necessary when it is time for construction of the Western Viewing Area improvements.

The Parrot Rifle at the Western Viewing Area could be lifted and mounted on an appropriate carriage mount in the future. Currently, Maine hosts some of the most skilled Parrot Rifle conservators in the world, in Ron Harvey of Tuckerbrook Conservation, Jonathan Taggart (the conservator currently under contract with the city of Portland), Matthew St. Cyr of Cumberland Ironworks (a fabricator who has worked extensively on historic cannon and Third System Fortifications). Resurgence Engineering has worked with these craftsmen on previous cannon and Parrot Rifle lifting mechanism and carriage design, fabrication, and conservation at Fort Jefferson in the Dry Tortugas National Park. We recommend that you include discussions with these experienced professionals as part of the ongoing Master Plan.

Access improvements can also be made to allow those who cannot conveniently or conceivably climb the stairs to the Western Viewing Area or gain access to the fort for lack of transportation or physical capability. Interpretive signage, and vandalproof remote video cameras, and could provide experiential opportunities to those who are physically unable to access the fort. The Friends of Fort Gorges already has placed drone footage and a film about the fort on its website.

We anticipate that construction costs for the Western Viewing Area improvements will be approximately \$195,000. Bridge replacement with a timber structure, though not as durable, might cost approximately \$19,000 less than the galvanized steel option, and conceivably be constructed by a small carpentry crew with minimal difficulty as part of a public-awareness campaign to spark further interest in Fort Gorges.

We estimate that total construction costs, excluding soft costs and G.C. Overhead and Profit for the two projects to be approximately \$418,000, but combining the projects under one general contract could significantly reduce mobilization costs and allow the two projects to proceed simultaneously for approximately \$378,000.

2.0 INTRODUCTION

In March 2017, the City of Portland Planning Department solicited qualification submittals to provide engineering consulting services for casemate repairs and access improvements at Fort Gorges under Request for Qualifications Number 4817 (RFQ #4817). The qualified team was asked to:

1. assess the existing condition of interior casemates and prepare construction documents to address necessary repairs; and,
2. prepare plans and specifications for improved access to the Fort's western viewing area, incorporating existing details developed as part of a recently approved Army Corps of Engineers project for other areas of the Fort.

Alfred H. Hodson III, P.E. of Resurgence Engineering and Preservation, Inc. (RE&P) and John Turk, AIA performed this assessment. The work scope did not include evaluation of any mechanical or electrical systems, accessibility issues, or egress requirements.

PROJECT SCOPE

1. Documentation/Assessment of Existing Conditions

a. Preparation of Base Drawings for Casemate Analysis

Resurgence Engineering will prepare as-built drawings of Fort Areas within the project scope to serve as base drawings for the condition assessment and construction documents.

We will prepare ceiling plans for the first and second level casemates. The footprints, ~~elevation drawings~~ and ceiling plans will be developed in an AutoCAD R2013 dimensionally accurate drawing with each being uniquely identified.

b. Documentation/Assessment of Structural Condition of Casemates

Resurgence Engineering will assess the structural conditions in the casemates, using information from the 2001 CME assessment for comparison. Our assessment will consider structural requirements for safety and increased access within the fort, as well as the long-term preservation of the historic structure. Our assessment will include detailed study of areas of loose overhead brick masonry and casemate crack mapping.

Deliverables (for a and b):

- Base drawings (ceiling plans of first and second level casemates).
- Illustrated summary of existing structural conditions within casemates.

c. Documentation/Assessment of Existing Path of Access to Western (Parrot Rifle) Viewing Area

Resurgence Engineering will evaluate the existing travel path(s) to the western viewing area and identify measures necessary to provide safe access. Evaluation to include the two wooden bridges which lead to the area, as well as the path of travel at the top of the Fort structure.

Deliverables:

- Illustrated summary of existing condition of wooden bridges and access path.

Presentation of Preliminary Recommendations

a. Recommendations for Casemate Repairs/Stabilization

Resurgence Engineering will make recommendations for repairs and improvements to address deficiencies identified in the casemate structural condition assessment. We will develop a scope of work and associated budget estimate for the repair/stabilization of casements and the access improvements. We will rank recommended casemate repairs according to their urgency or sequencing, and we will note those which are most efficiently and economically carried out together. We will provide Opinions of Probable Rehabilitation for the repair work, and we will present preliminary recommendations to City Project Team prior to preparation of final report and construction documents.

Deliverables:

- Recommendations for casemate repairs and/or stabilization measures, including prioritization of areas needing attention
- Budget estimate for the above.

b. Recommendations for Access to Parrot Rife viewing area

Resurgence Engineering will make recommendations for providing safe access to the parrot rifle viewing area. Recommended access system shall incorporate railing/guardrail details already developed in conjunction with the Army Corps' fall hazard mitigation project and will be consistent in approach with that general program. (Construction details from Army Corps project will be provided to consultant.) We will also include recommendations for pathway itself and bridge repairs.

Deliverables:

- Recommendations for access improvements
- Budget estimates for the above

Note: Prior to finalizing specific recommendations, Resurgence Engineering will consult with staff of the Maine Historic Preservation Commission (MHPC) to ensure that proposed measures respect significant features of the site and meet Secretary of the Interior's Standards for the Treatment of Historic Properties. If necessary, recommendations shall be adjusted to reflect input from MHPC.

2. Final Reports and Construction Documents

Deliverables:

- a. Casemate Stabilization/Repairs: Resurgence Engineering will assemble our summary of findings and recommendations in an illustrated report suitable for reproduction and ongoing use, together with *Construction Documents* for proposed cribbing/stabilization/repair of masonry casemate ceilings
- b. Access to Western Viewing area: Resurgence Engineering will assemble our summary of findings and recommendations in an illustrated report suitable for reproduction and ongoing use, together with *Construction Documents* for 1) proposed repairs and/or replacement of existing wooden bridges to western viewing area; and 2) proposed pathway improvements to western viewing area, including guardrail system along the path and at the viewing area.

Note: Construction documents to be sufficient for bidding purposes.

Assessment of the fort occurred over the spring and summer of 2017.

Appendix A of this report provides Preliminary Opinions of Probable Rehabilitation Cost for casemate stabilization, bridge replacement, and west parapet viewing access improvements.

Appendix B of this report provides plans and details for casemate and access improvements, which are part of a separate set of construction documents detailing initial stabilization and rehabilitation work, while Appendix C contains a partial bibliography of sources and resources used during this project.

We did not consider specific building code requirements, egress, flooding, ventilation, hazardous materials, fire safety and energy code. We did not perform invasive testing or formal structural analysis. We understand that more comprehensive structural and envelope assessment, including invasive and nondestructive geotechnical testing, is necessary to perform long-term rehabilitation strategies and to develop more refined cost opinions. Other conditions may exist beneath concealed surfaces that appeared sound or in areas that were not visible during the inspection.

For purposes of this report, Face VI, the fort entrance, faces north-northwest (NNW). The “West Viewing Area” located at the approximate corner of Face V and Face VI, actually faces west-southwest (WSW). This orientation and nomenclature is in keeping with the historic maps and with the USACE construction documents.

Also for purposes of this report it is assumed that the fort would be rehabilitated according to the *Secretary of the Interior’s Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*. These Rehabilitation standards allow considerable leeway to perform replacement, rather than strict restoration or conservation, of deteriorated structural elements, thereby making projects more economically feasible.

3.0 DOCUMENT REVIEW

3.1 ORIGINAL CONSTRUCTION DOCUMENTS

Joel Eastman, of the original Friends of Fort Gorges group, has studied Fort Gorges and fortification structures around the world for decades. He provided Paul Drinan with a large number of construction plans of the fort, obtained at the National archives, detailing proposed and completed construction over a 50-year period from 1858 to the turn of the twentieth century. These documents contained many iterations of design and construction progress. These documents are critical, as they detail original design intent, completed work, and technological advancement in fortification design. Occasionally, archived drawings include notes made during construction to document specific construction changes and to provide insight into why those changes occurred.

3.2 PREVIOUS STUDIES AND HISTORIC RESEARCH

In accordance with the Request for Qualifications, we were provided access to two previous reports about the structural condition and history of the buildings in question, including the following:

- By Criterium-Mooney Engineers (prepared by this author in 2001) against current observations;
- Historic American Buildings Survey, HABS ME-134, circa 1965;
- Construction plans and Documents, drawn for the Board of Engineers, 1858 through 1897

We also performed a review of several publications related to Third System Fortification in the United States. Appendix C lists a bibliography of materials researched or reviewed for this report, including site surveys and maps available on the Maine Memory Network.

We viewed several historic maps online to view general conditions and layouts of the site, understanding that such maps included some artistic license and potential inaccuracies not found in formal survey maps or photographic images.

OBSERVATION, EVALUATION, RECOMMENDATIONS

4.0 GENERAL OBSERVATIONS AND EVALUATIONS

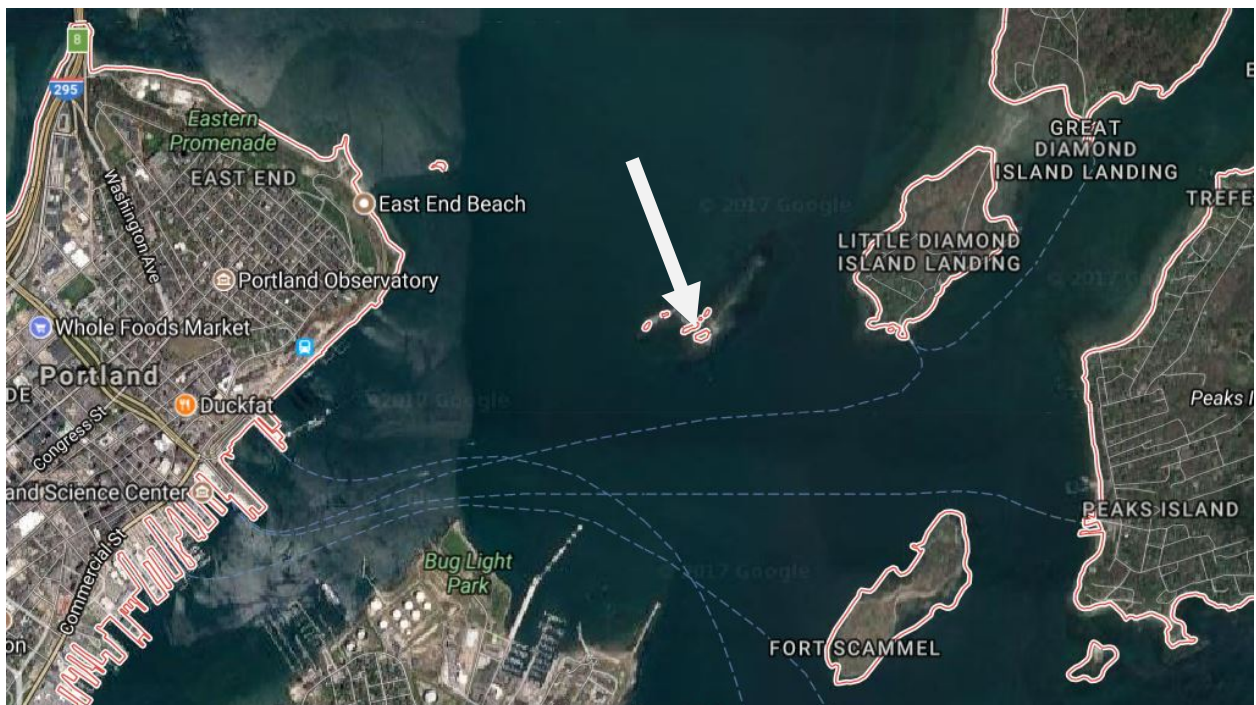
Site Considerations and Conditions:

Hog Island Ledge lies in Portland Harbor approximately 1.1 miles east of the boat landing at East End Beach and 0.6 miles west of the landing at Little Diamond Island, and 0.8 miles north of the Spring Point Lighthouse.

The Army constructed the exterior fort perimeter to primarily bear directly on the ledge that creates Hog Island. Based upon construction documents reviewed in our study, some of the Parade Ground walls and some of the Wharf walls rested upon on fill.

A complex system of drainage pipes and cisterns run through the casemate walls and under the casemates and parade ground. In the officers' quarters, waste pipes and drains built within the exterior wall of Face VI transported sewerage and gray water directly into the ocean, to be flushed away twice daily by the tides.

At this site with construction that predates largely available commercial photography, historic maps and existing plans are often a key resource to determining site conditions. However, one must take into consideration any "artistic license" taken by the cartographer and/or draftsman. An aerial view places the fort in context with the peninsula and surrounding islands:



Fort Gorges, located in Portland Harbor, strategically constructed to defend the Fore river from attacks through various island passages.

Wharf Structure (Not in Scope):



Wharf Structure, ravaged by tides: Top Photo HABS No. ME-134-23; Bottom Photo, Google Earth

Brick Masonry Casemate Construction:

The brick masonry casemates in Fort Gorges are typical of Third System Fortifications, comprised of unreinforced multi-wythe brick construction primarily bonded by natural cement. As masonry construction changed in the early 20th century, stronger mortar mixes using Portland cement became a preferred construction material. While the granite masonry provides the “columns” of the fort, the brick masonry casemate arches provide “beams and girders” to support the granite floor of the second tier and the roof and fill on the barbette tier.



Barbette Tier Construction:

Work proceeded on the fort itself from 1858 through 1877. Advancements in military equipment required that larger rifled cannon, capable of longer range, be installed on the Barbette Tier. Resisting larger and more powerful rifled cannon required more safety, in the form of earthen fill, on the Barbette Tier, to protect smaller powder magazines that were easily accessible to troops and only a short distance from the rifles.

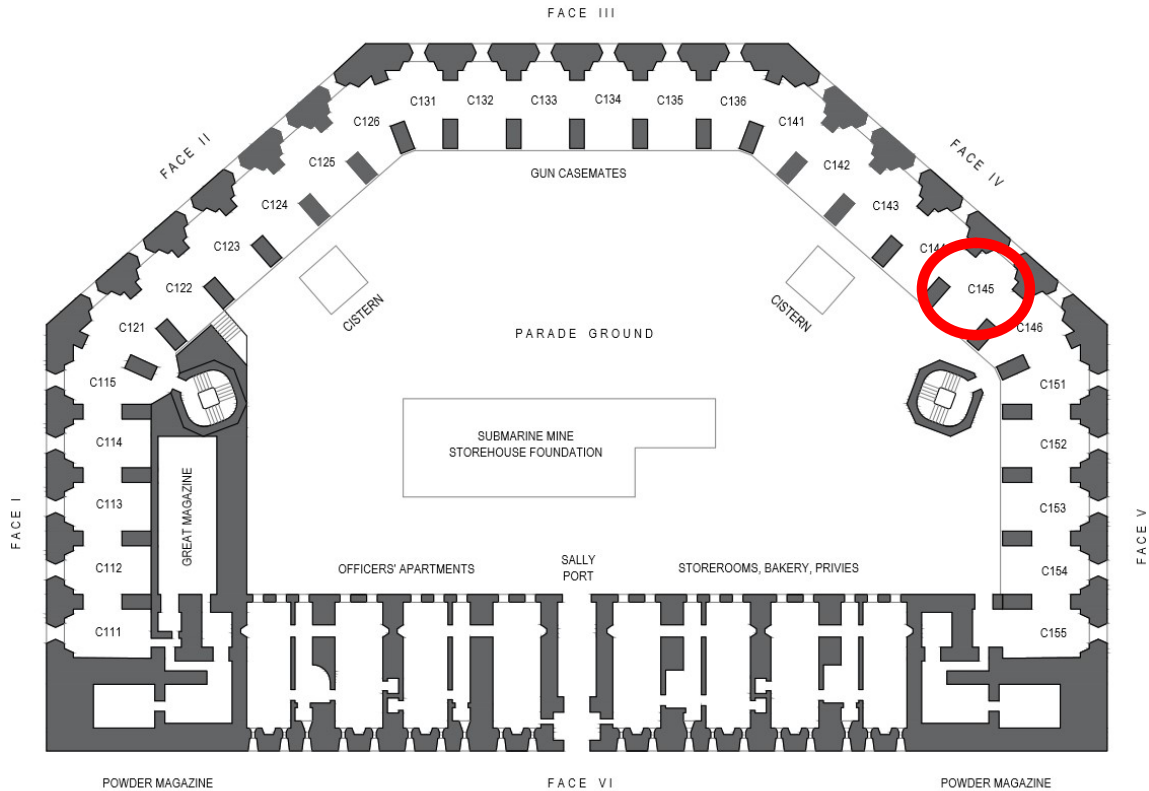


Above: Barbette Tier, Built-up berms (parados) over passageways to Barbette Tier powder magazines.
Below: Scrub foliage reduces and obscures the visibility of parados (left), an important historical feature of the fort. More visible contours are viewed from parade ground (right)



4.1 CASEMATES

Structural Description:



1
A1.1 FIRST TIER - KEY PLAN
1" = 30'-0"

Key Plan showing Parade Tier Casemates at Fort Gorges, on Faces I through V.

For purposes of this report, the casemates include the vaulted arch structures that housed cannon on the parade level (Tier 1), the second level (Tier 2), and the Barbette Tier (roof tier). Casemates extend clockwise from Face I around to Face VI, with Face VI housing the officers' quarters and ancillary spaces such as the bakery, storerooms, and powder magazines. To best coordinate future communication about the casemate locations, we have developed a logical three-digit numbering system that considers the location, face, and number of the individual casemates as follows:

C TFN, where

C = Designation as Casemate

First digit:

T = Tier, or Level of the Fort

1 = Parade Ground level, or Tier 1

2 = Second level, or Tier 2

3 = Barbette (roof) Tier

Second digit:

F = Face of the Fort, I through V, clockwise from the Parade Ground Entrance;

Third digit:

N = Casemate Number within the face, clockwise from the Parade Ground Entrance;

As an example, Casemate 145 (circled) is on the First Tier, Face IV, fifth casemate in that face.

Observations and Evaluation:

- In many places, the parade level (Tier 1) floor has subsided and is uneven, most likely a result of initial imperfect subgrade compaction and erosion of fine soil particles through the exterior masonry walls on Faces 1 through 5, and through any failures in the fort drainage system. A site survey should be planned to determine elevations of floor stones at specific locations, to determine settlement and movement patterns.
- Some of the granite Parade Wall piers have cracked, presumably because of frost action or settlement. Technology has improved significantly, and it may allow for a drain camera inspection to determine the condition of the drain pipes that travel downward through the Parade Wall piers.



Crack in First Floor Casemate Pier on Parade Ground Wall

- We suggest that a more comprehensive survey be performed to verify grades in the casemate floors on both the first and second levels. As we understand it, the Friends of Fort Gorges are working with an engineering consultant to provide them with survey work at the fort. If too extensive an amount of fines are lost beneath the casemate floors, the granite slabs will crack under the induced bending stresses as the floors begin to sag. Some cracking has begun in casemates along Face II.
- Settlement beneath the parade walls is also contributing to movement in the first and second tier casemates. In 1873, the fort was “modernized” by placing fill on top of passages and small powder magazines on the Barbette Tier. The added weight of the fill may have contributed to greater pressures at the Parade Walls, which may have not extended to ledge below, as indicated on existing construction documents. The added soil likely compromised the drainage system by clogging it with soil fines, accelerating freeze-thaw damage.

- Iron arc-shaped cannon carriage mounting plates have largely been removed and scrapped, leaving nothing but their rust shadows and protruding bolts extending from the granite floor (Photo #). While we recognize that the extending bolts constitute a tripping hazard, we do not believe that they should be further cut back, despite the fact many visitors enter the fort wearing little more than water shoes, flip flops, or sandals for foot protection. The iron bolts remain as an important engineering element germane to the fort's intended use.



- A series of primarily circumferential cracks traverse the casemate roof arches on both the parade level (Tier 1) and the second level (Tier 2). The cracks appear to begin near the intersection of Faces I-II and wrap around to the intersection of Faces IV-V. We believe that a combination of factors caused these cracks, which we have also seen and stabilized at Fort Popham in Phippsburg, a “sister fort” that guards the mouth of the Kennebec River.



Top photo: First Tier circumferential crack; bottom photo: Second Tier circumferential crack.

- In many locations, brick masonry has been damaged and is loose or already fallen out. Sound loose bricks should be removed, labeled, and stored as necessary in a secure casemate or officers' quarters location for re-use in repairs.



Typical First-Tier Casemate Damage along circumferential cracks and arch intersections.

Adaptive Use Potential:

- Other Third System Fortifications, such as Fort Jefferson in the Dry Tortugas, have used selected Casemates to house park staff, visiting consultants, and craftspeople, due to the extreme remote location (an island 70 miles due west of Key West, Florida). Other forts, such as Popham in Phippsburg, Maine use casemate space to house interpretive signage. Fort Knox houses a Rodman Cannon in one of its casemates.
- One or two casemates could potentially house a secure small (8' x 8' x 20') shipping container that can house needed equipment and materials onsite. We believe that Casemate 154 could house such a shipping container with the least amount of visual disruption possible. The City and Friends of Fort Gorges could share the container store tools, lights, a generator, portable bleachers, first aid equipment, hoists, grass trimmers and other gear that may become desirable in the future.

Recommended Stabilization and Short-term Rehabilitation Scope:

- Perform a site survey and geotechnical investigation at the Fort, performing angled soil borings at locations indicated on plans to determine if footings extend down to assumed ledge.
- Stabilize the first tier casemates in Faces 2 through 4 by installing temporary shoring towers in the general configuration as shown on Drawing A1.7.
- Stabilize the second tier casemates in Faces 2 through 4 by installing temporary shims in the general configuration as shown on Drawing A1.8.
- Remove and store loose brick from archways. Place brick in a secure location for later re-use.
- Depending upon outcome of the soil borings and subgrade investigation, develop a program to stitch casemate cracks as indicated on Sheet A1.6. It is paramount to allow water to drain through the cracks, particularly during winter, to relieve ice pressures.

4.2 WESTERN VIEWING AREA ACCESS IMPROVEMENTS

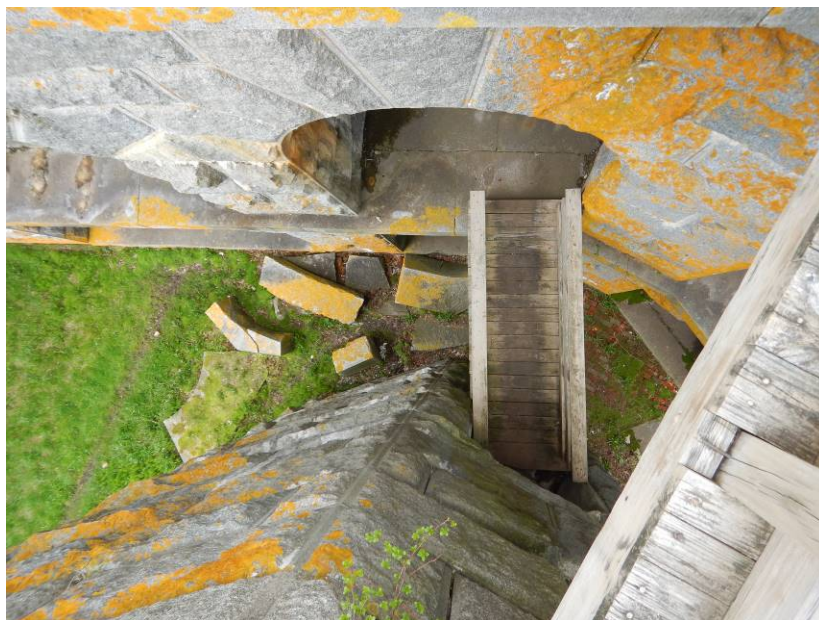
South Tower Bridge Structures



Photo 4.1 and Photo 4.2: Tier 2 (left) and Barbette Tier (right) bridges



Photo 4.3 and Photo 4.4: Tier 2 (left) and Barbette Tier (right) bridges viewed from below.
Photo 4.5 (below): Note skew where Tier 2 bridge spans from casemate 246 to tower.



Structural Description:

- Existing bridges consist of pressure-treated lumber beams, decking, and handrails. The Tier 2 bridge spans from casemate 246 and lands at a skew to the south tower. The Barbette Tier bridge spans orthogonally between the tower and the parade wall intersection of Face IV and V. Both bridges bear directly on granite at each end.
- The Drawing labeled Drawer 13, Sheet 3 indicates that iron bridges with iron railings may have been intended originally. We have observed the type of "X" railing pattern on other Third System Fort railings, such as at Fort Warren on Georges Island in Boston Harbor.

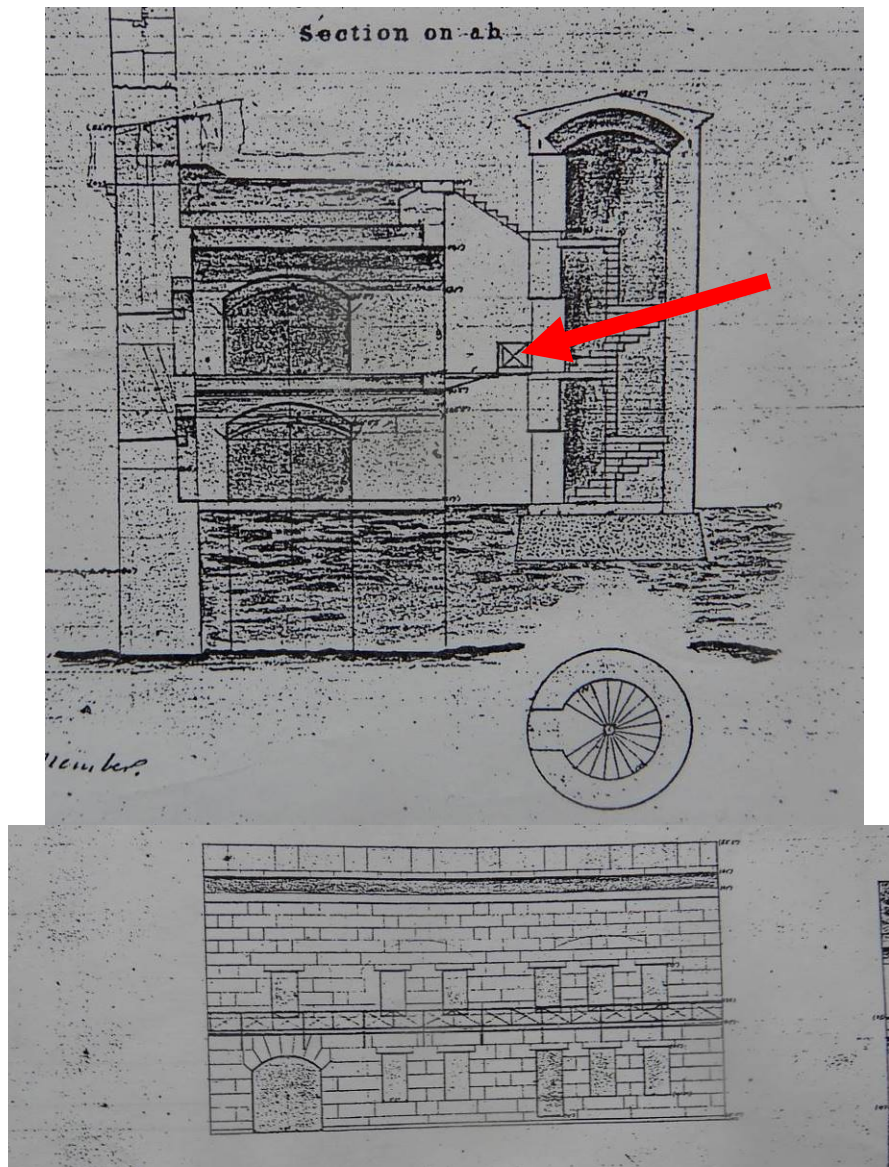


Photo 4.6: Iron bridge suggested on design drawings (arrow). Note also that the tower was originally conceived to be a cylindrical structure, and that the finished Barbette Tier elevation was to be several feet higher! Early design drawings also show three towers, located at the centers of faces I, III, and IV. It appears that the later addition of the massive powder magazine inboard of Face I required the reduction to two towers. Further research is necessary to determine if any evidence exists of towers at different locations.

Observations and Evaluation:

- Bridge bearing beams are not significantly rotted, but the notches in the bearing ends, created to lower the step height onto the bridge, are subject to stress concentrations and could fail under unplanned heavy loads or construction loads.



Photo 4.7 Bearing end of Tier 2 Bridge at Casemate 246.

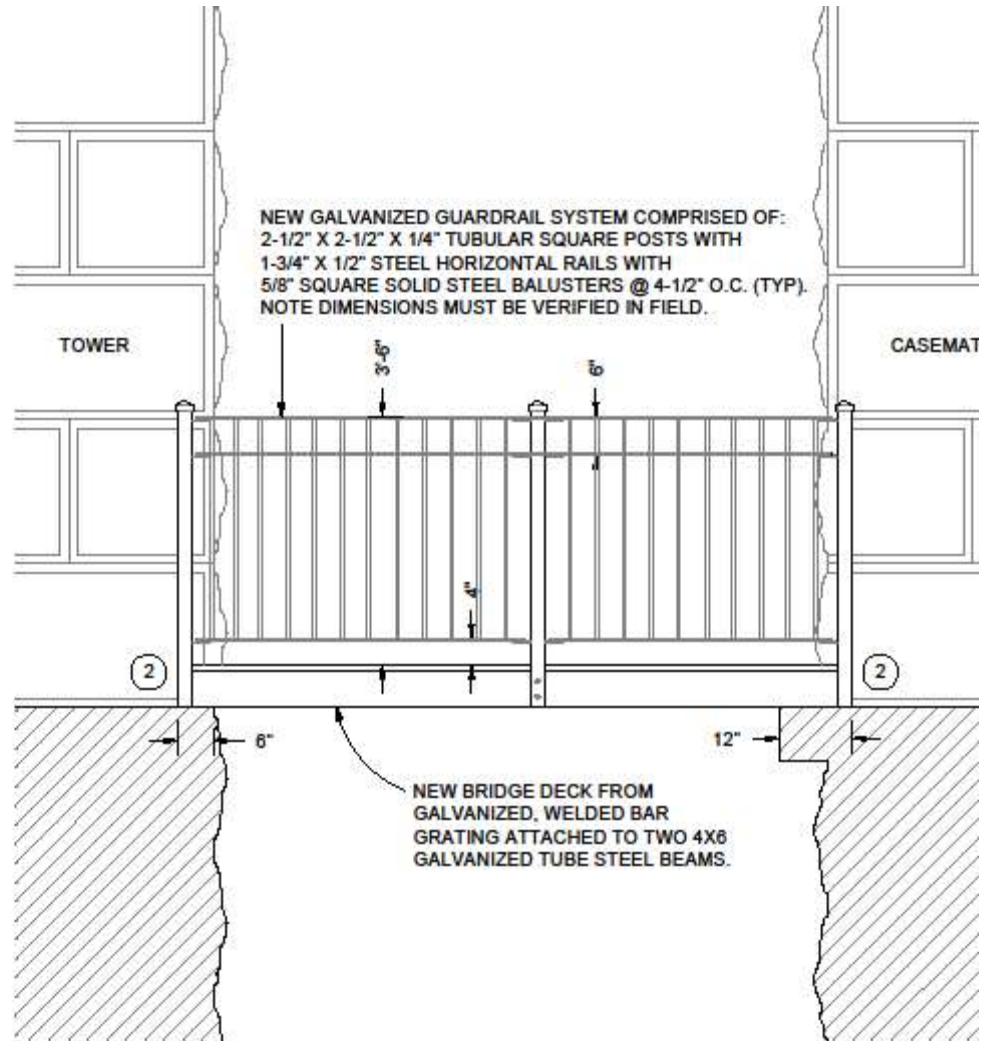
- Bridge railings are not expected to have a significant lifetime, and present significant falling risk. Although the fort is a “pass at your own risk” structure, the weak railings create unnecessary safety concerns due to their lack of code required (but not necessarily applicable) and remaining strength. Weathering, vandalism, and routine use have weakened the railing structures, and increased fort use only highlights the need for railing and bridge replacement.



Photo 4.8 Unsafe Railing System at Barbette Tier Bridge and Path

Recommended Structural Rehabilitation Scope:

- Replace the bridges. While general replication of the existing bridges, with improved wooden railings, is feasible, we recommend replacement with galvanized steel structures with galvanized floor grating and rails to generally match the Army Corps Work.



1 ELEVATION AT SECOND TIER BRIDGE
A2.6 1/2" = 1'-0"

Photo 4.9: Elevation of Second Tier Bridge, showing rail system similar to that installed by the Army Corps of Engineers in summer 2017.

4.3 WEST VIEWING AREA AND PARROT RIFLE ACCESS



Photo 3.1 and 3.2: West Viewing Area in winter and summer. Barbette Tier explodes in dense, mostly invasive foliage.

Structural Description:

- The West Viewing Area extends from the Barbette Tier bridge landing at the intersection of Faces IV and V, and extends to the Parrot Rifle area and glacis at the corner of faces V and VI. Two tunnels linked to small Barbette Tier Powder Magazines on Face V form part of the access path to the Parrot Rifle.

Observations and Evaluation:

- Dense overgrowth regenerates annually, providing the overgrown fort roof so well known today. When the fort was occupied by a caretaker as late as 1910, the roof vegetation was much shorter and more manicured.
- Existing railings consist of pressure-treated railings installed several years ago. The railings suffer from weathering, vandalism, and normal wear and tear, and currently provide a false sense of security to visitors.



Bridge and Barbette Tier Railings

- On Face V, two passage structures provide protected access to small powder magazines located on the barbette tier. These structures, in turn, are covered with several feet of earth, creating high-points that visitors regularly climb to get better views of the surrounding harbor. The steep slopes falling toward the exterior fort walls present a safety hazard that realistically cannot be mitigated without full-time staff working on the barbette tier.



Steep slopes (parados) atop Barbette Powder Magazine passages

Adaptive reuse potential:

- The 300-pounder Parrott Rifle is a rare example of its type. Improving access to the western viewing area and Parrott Rifle will be a major draw for military historians and other visitors. The project could spur significant interest and funding opportunities.

Recommended Building Envelope and Structural Rehabilitation Scope:

- Remove overgrowth in areas along Face V where small retaining structures are planned to improve travel between the staircase and the western viewing area. Install pressure-treated timber retaining structures, with native plants planted where vegetation has been stripped.
- Install railings as detailed on the Construction Documents to provide a safe and continuous path from the staircase to the western viewing area.
- Re-grade the Barbette Tier at the corner of Faces V and VI, the Western Viewing Area. Provide filter fabric and stone dust viewing areas.
- Construct protective rails at the western viewing area as shown on Construction Documents.
- Provide improved and more durable signage and interpretive panels in the Western Viewing Area. Provide economical interpretive panels in select areas to highlight the Parrott Rifle, views of the city, and the technological improvements that occurred during the fort's construction. Include language instructing visitors to stay within the confined viewing areas.

5.0 RECOMMENDATIONS AND CONCLUSION

Fort Gorges provides remarkable opportunity to the City of Portland, to develop a nearly unique park facility in Casco Bay. Other fortification structures in Casco Bay are privately owned, with limited access.

We recommend that you undertake geotechnical investigation to better understand Parade Ground wall settlement locations and extents, as well as a detailed site topographical survey that can be referenced later to monitor vertical and horizontal displacement. It may be economical to have geotechnical and site surveys performed on the wharf structure at the same time, to save on mobilization costs for consultants, drilling rigs, and other equipment

Casemate stabilization should include, at a minimum, temporary shoring in discrete areas between Casemates 131 and 145, and Casemates 231 and 245. Our design documents detail aesthetically unobtrusive shoring systems that are relatively inexpensive, and painted with intumescent coatings to deter vandalism. Loose bricks should be removed from casemates, particularly near crack locations, and stored in one of the powder magazines for potential re-use. Crack stitching should only occur once a thorough understanding of subgrade conditions is determined, pending the results of the site survey and geotechnical assessment.

Western viewing Area access improvements include replacement bridges, timber retaining structures, galvanized steel railings and stone dust paths on the Barbette Tier between the west tower and the Parrot Rifle located near the intersection of Faces V and VI.

Casemate Stabilization construction costs are approximately \$223,000. Western Access Area Improvement Costs are approximately \$195,000. If funds become available, these two projects could be combined to save on mobilization and general conditions costs, which are a significant portion of this work. We believe that combining the projects could save as much as \$40,000.

It has been a pleasure to assist you with this project. If you have any further questions about the content of this report, please feel free to contact me at your convenience.

Sincerely,

A handwritten signature in blue ink that reads "Alfred H. Hodson III, P.E." The signature is written in a cursive style with a prominent "H" and "III".

Alfred H. Hodson III, P.E.
Resurgence Engineering and Preservation, Inc.

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APPENDIX A

OPINION OF PROBABLE REHABILITATION COSTS

APPENDIX B

**EXISTING CONDITIONS AND REHABILITATION
DOCUMENTS**

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APPENDIX C

PARTIAL BIBLIOGRAPHY

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