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Historic Structure Report – Architectural Data Section

ADVANCED REDOUBT OF FORT BARRANCAS

Gulf Islands, National Seashore, Pensacola, Florida

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SOUTHEAST REGIONAL OFFICE – NATIONAL PARK SERVICE
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I. ADMINISTRATIVE DATA SECTION

A. Name and Number of Structure

Advanced Redoubt of Fort Barrancas, Structure No. B-3, Gulf Islands National Seashore, Florida Section, Pensacola Naval Air Station, Pensacola, Florida. The Advanced Redoubt is classified as a structure of 1st Order of Significance.

B. Proposed Treatment of Structure

The Advanced Redoubt will be stabilized and partially restored, to interpret the construction, occupation, and defense, of a Third System masonry fort. A secondary theme will be the defense of Pensacola Bay and the Pensacola Navy Yard (now Pensacola Naval Air Station).

C. Justification for Such Treatment as Shown in the Master Plan

The Master Plan, currently in draft stage, states as a Management Objective to "Stabilize or reverse deterioration of natural and historical resources consistent with budgetary constraints and ecological limitations.

D. Provision for Operating the Structure

The Advanced Redoubt will be used as a historic structure museum and exhibit in place.

E. Cooperative Agreement, if any, Executed or Proposed for Operating the Structure

None

II. HISTORY DATA SECTION

A. The Advanced Redoubt is Planned

1. Board of Engineers for Fortification

In 1816, the first Board of Engineers for Fortifications was established for the purpose of coordinating all national defense works. Prior to this time, military fortifications in the United States were erected without a uniform system and usually in a crisis situation in response to a foreign threat, direct or implied. These works were carried out by engineers working independently of each other often with only general instructions from the Secretary of War or the Chief Engineer. The constructed components of such a system were therefore neither uniform nor, due to the general use of log and earth materials, durable.

The concept of "system" has been applied to the evolution of American coastal fortifications. The first "system" consisted of those works erected primarily during the 1790's. A second "system"was developed in the first decade of the 19th Century. Neither, however, constituted a cohesive nor mutually supporting body of defense. It was to remedy this defect that the Board of Engineers for Fortifications was established in 1816 to develop the concept of national coastal defense that is now refered to as the Third System.

2. Pensacola Selected as Site for Navy Yard

In 1822, the Board, directed to assess the attributes of Pensacola Harbor for a naval base, concluded that it was well suited for this purpose. Subsequently, a Bill signed by President Monroe, March 3, 1825 established a navy yard and depot at Pensacola.(1)

3. Pensacola Navy Yard Defensive System

Simon Bernard, the French Military Engineer and Chief Engineer of the Board of Engineers for Fortifications from 1816 to 1831, reported that the projected Navy Yard would require "two sorts of defensive works," those to defend the entrance of the bay and those to protect the facilities from land attack. The Navy Yard would have to be protected by an expensive "chain of detached and advanced works, the object of which is to keep out of range the incendiary batteries of the invader, and prevent him from burning the establishment within the first days of his landing; and besides that chain, a line of fortifications around the perimeter of the navy yard to resist a regular attack."

The site selected for the Navy Yard was a peninsula running east and west, bounded on the north by Bayou Grande, and on the east and south by Pensacola Bay. The eastern extremity of the peninsula was

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known as Tartar's Point. The Bay was sheltered by offshore islands, Santa Rosa Island, to the east and Perdido Key (then called Foster's Island), to the west, forming a pass from the Gulf of Mexico into Pensacola Bay southwest of the Navy Yard peninsula. This peninsula of land had a high elevation and was an important fortification site dating back to the late 18th Century Spanish occupation at which time it was referred to as "the Barrancas," meaning the heights. The Spanish in 1784 had projected a fortified town located on the bluff to be defended in part by a detached water battery, Bateria de San Antonio, which commanded the channel.

The Bateria was protected from land attack by Fort San Carlos. This fortified city was not built, however, Fort San Carlos and Bateria San Antonio were.

The fortification system determined upon by the Board of Engineers was developed solely for protection of the Navy Yard located on the Barrancas peninsula. The plans called for a truly integrated system consisting of works to guard the entrance into Pensacola Bay and works to protect the Yard against land attack.

In describing the system, Bernard, wrote in January, 1830:

> "Indeed, the chart of the bay of pensacola will show, at a glance, that the defence of the entrance through the main channel rests on the occupation of three points, viz: the western end or point of Santa Rosa Island; the northern (eastern) end of Foster's Island or a convenient sand bank in its vicinity; the bluff called the Barrancas.

A fort at Santa Rosa Point, besides co-operating with the two other points in the defence of the main channel, will prevent vessels drawing less than 15 feet from passing over the middle ground. It will also occupy a point from which an enemy might bombard the naval establishment at Tartar's Point /the Navy Yard/, and insure to his small armed vessels an entrance into the bay. In fine, it will secure a place of arms from which, according to circumstances, temporary works or military operations might receive their main support, with a view to prevent an enemy from making any establishment on Santa Rosa Island. With regard to such an establishment, the degree of importance which the Government will hereafter assign to the Navy Yard at Tartar's Point can only decide as to the probability of a temporary occupation, by an enemy, of some point of Santa Rosa Island. Indeed, should the Navy Yard become an Arsenal for extensive constructions (which is to me improbable) an enemy might deem its destruction an object worth an expensive attempt, but should Tartar's Point receive but a storing naval establishment, it is not probable that any operation of consequence will be attempted against such an establishment,...

With respect to the bluff at the Barrancas, it lies 1 3/4 miles northeast of Foster's Bank, and 1 1/4 miles northwest of Santa Rosa Point, its elevation above the sea is 40 feet. This commanding position can co-operate advantageously with the two former /forts, ie, on the eastern extremity of Foster's Island and on the western extremity of Santa Rosa Island/, but being in rear of them, and 1,200 yards distant from the main channel, it might be deemed but an auxiliary to both in the defence of this channel. But, in relation to the Navy Yard, this bluff is an essential protecting point inasmuch as possessing also a command on the land side, it can be assumed as the right of a line formed of two or three small detached works and destined to shelter the Navy Yard from a land attack directed between the Barrancas and Bayou Grande. The extent and importance of the Navy Yard will decide as to the nature of the work to be erected at the Barrancas. Should Tartar's Point receive a depot like Gosport, Charleston, which I am far from anticipating, the bluff ought to be fortified permanently, and an open sea battery located under its protection; but should Tartar's Point be destined to receive a naval establishment of inferior order, a temporary battery, or, at the most, an open sea battery, secured by a small permanent reduit, would, in my opinion, be sufficient. Therefore, the further arrangements adopted by the naval department

will determine what, ultimately, is to be done at the Barrancas; and the defensive project in relation to it must, for the present be postponed."(2)

Fortification works to protect the Navy Yard from a land attack were initially postponed as Bernard had suggested, and all efforts were directed to building Fort Pickens and Fort McRee to command the entrance channel to Pensacola Bay. By 1839, however, as these works neared completion, additional thought was given to the land works. A study was made in that year by Lt. Col. Silvanes Thayer, a member of the Board of Engineers, "for the portion north of the Barrancas and at the head of the ravine." This work, an elongated pentagon, was sited near the crest of the 40 ft. high hill that crowned the north side of the peninsula, and in line with a southwesterly trending ravin extending from the Cove and Bayou Grande. Although this work was not carried out it apparently served as an antecedent concept for the plan that was finally determined upon four years later.

By 1843 the design concept for the Navy Yard's land defenses, oringinally projected by Bernard in 1830, was settled upon. The concept finally adopted proposed to revamp the old Spanish water battery, Bateria de San Antonio, then to erect a masonry fort to defend the water battery on the rise just to north and rear of the work on the site of the provisional Fort San Carlos, then to extend a line of earthworks north,

Memoir on the defence of Pensacola Bay, January 1830

(2) "A study made in 1839 by Lt. Col. Silvanes Thayer a member Board of Engineers, for the portion of the Barrancas and at the head of the ravine." NA, RG 77, Drawing 79, Sheet 6

cutting across the peninsula toward the ravine which terminated at the Cove of Bayou Grande. At that point an advanced redoubt would be constructed to anchor the north end of the line.

B. Construction Begins on Advanced Redoubt

1. First Appropriation Request - 1843

Late in 1843, the Chief Engineer, Joseph G. Totten requested an appropriation of $25,000 to fund construction for the Advanced Redoubt of Fort Barrancas.

2. Major William H. Chase Appointed First Project Engineer

On September 3, 1844, Totten forwarded four drawings to the Pensacola Project Engineer, Major William H. Chase, to enable him to locate the site and begin prepatory operations as a prelude to construction activities. Chase, a West Point graduate, had been assigned his position at Pensacola on August 1, 1828. Between that time and 1844 he had been principally engaged in the erection of Fort Pickens on Santa Rosa Island and Fort McRee on Foster's Bank.(3)

3. Siting and Prepatory Construction

Totten cautioned Chase to be careful in siting the Redoubt - To locate it, Chase was to project the line of the gorge (the north face)

(3) Serial 431, Vol. 1, page 110

of the Water Battery eastward and from a point in the center of the gorge measure eastward along the projected line a distance of 680 ft. From that point he was to project a line north 18 degrees 30 minutes west. The Redoubt was to be sited so that the salients of its north and south bastions touched this line. The gorge as well as the principle face of the Redoubt had to parallel this line unless the subject line when projected passed the western shore of the Bay before reaching the Cove. If the line, as thus determind passed too near the shore, its direction was to have been changed toward the east, until this condition was fulfilled. This was a vital requirement in the siting of the Redoubt as it precluded the possibility of enfilading the east curtain with ricochet fire from the Cove. Totten warned Chase that if he found it necessary to make such a siting adjustment that the face be pivoted "the least possible in that direction, since such a change would be turning the face from its proper command." To aid him in securing the proper alignment of the Redoubt, Chase was instructed to clear a line through the woods and underbrush, so he could see the Cove from the point 680 feet east of the Water Battery.

Once Chase established the proper alignment of the Redoubt he was to use drawing "B," "No. 2 sketch of Advanced Redoubt of Fort Barrancas showing the position on the site" to locate on the ground the "exact place" of the Redoubt. (4) The general site was a very tortuous landscape consisting of hills and low places on the north edge of the Barrancas adjacent to a low, marshy, southerly projecting, finger of the cove. Because of the complex topography Totten warned Chase that he must use

(4) NA RG 77, Sheet 23

great care, for if the work were shifted only a small distance in "certain directions a considerable difference of expense" would be involved. Totten was refering to a difference in balance between fill and excavation required by the Redoubt as designed which owing to the great expense of earth moving operations could unduly inflate the final cost of the work.

Totten pointed out also that care had to be exercised in constructing the glacis. The plans called for a reverse slope which would be an obstacle to siege operations and would afford cover for an abatis as well as provide for drainage. If the Redoubt was favorably sited Totten was confident that the amount of earth excavated would nearly equal the amount required to build up the low areas.

4. Drainage and Counter Mine

Totten felt that the sand constituting the soil of the Redoubt site would absorb any excess rain water and a drainage system would not be required. If Chase determined that Totten was in error on this point, he was instructed to build a drain or cunnette with its outlet under the reverse fire of the northwest salient. From its mouth in the ditch, the cunnette was to pass under the floor of the reverse fire casemate as a drain, the bottom being at reference 12'. From the rear of the casemate the drain would parallel the ridge formed by the intersection of the north and the west glacis for a distance of 160 feet as a small countermine gallery. The descent was to be gradual with the reference of the

bottom at the lower extremity being 10½'. From that point the drain gallery was to bear northeast at a 75 degree angle and then be carried a distance of 100 yards terminating at reference 9½'. There the drain would resume its original dimensions and be carried as far as necessary.

In building the walls of the drain galleries, Chase was to leave openings 2'-3" wide and 2'-8" high at 30 foot intervals on the sides towards the enemy. These were to serve as places for mines if required when attacked. Similar openings 3' wide by 4' - 6" high were to be left in the outside walls of the counterscarp galleries and reverse fire casemates, also for countermines. The openings were to be closed by brick walls.

5. Construction Materials: Brick and Concrete

As for materials, Totten advised Chase to substitute concrete for brick work wherever possible. He pointed out that there was "material economy in mixing lime with concrete; and for works out of water, it is not necessary that the mortar should be very hydraulic; but there must be some concrete in all mortar." The principle, Chase was instructed, was to produce a mass of coarse materials that possessed the least amount of voids. Totten was of opinion that it mattered little what the material was; shells, whole, or broken, coarsely or finely; or fragments of stone or brick, coarse or fine; or coarse or fine gravel; or all of these mixed together.

The object of Totten's advice was to save money and his previous experiences had proved that concrete resulted in a masonry structure the equal of traditionally constructed brick or stone work and that it was indeed cheaper. Additional savings were projected if Chase were to lay a 6 or 8 inch thick layer of broken stone or brick on each layer of cement and consolidate the mass with a rammer.

Foundations, walls, and piers were to be concrete with only a thin veneer of brick; and all roofing above the brick arches or vaults was to be of the same material. Totten stated he could see no reason why even half of the arches or vaults might not be similarly constituted.

6. Additional Construction Instructions

There were many similarities in construction details between the Redoubt and Fort Barrancas both apparently designed by Totten. The counterscarp galleries were similar and Chase was instructed to construct the ventilators and loop holes in the same manner. The reverse-fire casemates were also similar. They were higher in the rear, however, consequently the embrasures had to be shaped differently and the loopholes and ventilators made oblique. The reverse-fire magazines were also similar to those at Fort Barrancas, however, Totten cautioned Chase not to begin the superstructure of those casemates until he received additional drawings.

Other parts of the Redoubt could be completed without the necessity of further drawings, Totten stated. Chase was advised that he could complete the gallery of the counterscarp except at the debauch of the

ditch and the stairs. He could also construct the low counterscarp wall of the gorge up to the points where it adjoined the flight of steps at the ditch gallery. The scarp walls of the north, west and south faces could be raised high enough to include the lower relieving arch. The breast-height wall of the covered way could also be finished except where the roads passed and in the re-entering place of arms.

In all of the work with the exception of the glacis, all embanked sand or earth was to be laid in horizontal beds in thicknesses not to exceed 6 inches, each layer to be rammed before laying the next.

The north and south branches of the covered way were subject to enfilade and were to be provided with small gabionades and crotchets, the latter with a three foot banquette. The west and east branches were not subject to enfilade and were not provided with traverses, reliance placed instead on gabions placed when and where needed at the time of attack. The banquette of the covered way, except the crotchets, would be palisaded in time of war.

Totten advised Chase that the place of arms of the gorge was to be larger than shown on the drawings submitted. Further, the line of communication with the advanced positions of the covered way in event of siege would be by the pas de souris, /small steps in permanent works/

between the ditch and the covered way, under cover of the half caponniere, thence along the ditch of the gorge to a temporary flight of wooden steps to the bridge at the extremity of the draw.

The only access to the counterscarp galleries and reverse-fire casemates would be from the interior of the Redoubt. For purposes of placing ordnance in the reverse-fire casemates, a single door opening onto the ditch at ground level was to be provided centered on the east facade of the west counterscarp.

7. Proposed Armament

The ramparts of the Redoubt would mount eight guns in barbette, capable of being converted into embrasured pieces on short notice. Their pintles and traverse circles would be permanently established, however, the former within 1'-3" of the face of the breast-height wall, which had to be provided with a recess for the carriage wheels. In each flank of the gorge and in each small casemate beneath would be embrasures for a carronade howitzer.

8. Structural System Related to Defense of the Work

On the three outer faces (north, west, and south) there was to be a double tier of relieving arches. There were to be no outside openings at the lower vault level but passage between casemates was provided.

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These lower arches not only relieved the walls from pressure but afforded an opportunity of countermining a breach. In the second tier there would be free passage around the faces and, as at Fort Barrancas, loopholes for musketry would pierce the scarp. The small casemates on the flanks and faces of the gorge and near the salients would shelter the garrison from mortar fire.

There was to be a draw bridge, similar to the one at Fort Barrancas, an interior gate 8 feet wide, and two lateral doors 4 feet wide. The draw bridge space would not be arched.(5)

9. Chase Protests Use of Concrete

Two weeks later Chase acknowledged receipt of Totten's letter "enclosing four sheets of drawings on thin paper relating to Plan; some details; and portions of advanced redoubt of Fort Barrancas." Chase promised to give the drawings his careful study; however, in response to Totten's letter, he raised objection to the use of concrete:

> I notice your remarks in respect of materials. I am aware of the use of the concrete in construction at Fort Leighton; but I bear also in mind the great facility that Captain Banace /?/ has in obtaining shells from the neighboring islands and of the best quality. I doubt if these shells can be obtained in this harbor; those used at Fort Pickens in the parade, terreplein, etc, were mixed with a rich mould inadvisable in concrete mixtures. I will make inquiry for pure shells; but I think if we determine on concrete, that the Red Sand Stone would afford the best matrix. This by being taken in small

(5) Chase to Totten, September 15, 1844, NA, RG 77, Ltrs. Rec'd., Chief Engineer

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pieces; could be delivered for $2 per perch. It is easy of breakage; tenacious of cement, itself affording excellent ingredients for the same ___/?/ in sites. ___/?/ and oxides of iron. I will look further into this, and other things relative, that those, most economical, with equal durability, may be prudently adopted. In connection with the subject it is proper to state that, in the construction of Fort Barrancas, concrete was used to that extent that I believe not 1,000 Bus. in value of their payment were not ___/?/, having raked and dug into the sand further in all directions. ((6))

Chase was also apparently a little nettled by Totten's strong admonition to take great care in planning for the earth work related to the Redoubt for he responded:

> Notice your remarks on distribution and application of earth in excavation and embankment, this is so important an item in economy that it would be inexcusable in the Engineer or worker not to observe it. In respect of such operation at Fort Barrancas, the greatest care was taken to avoid unnecessary repetition of removal. ((7))

C. Fiscal Year 1846

1. The First Appropriation

Colonel Totten notified Major Chase on March 7, 1845 that President Tyler had signed into law the Fortification Bill appropriating $30,000 for Fort Barrancas. ((8))

((6)) Ibid. Note, this passage unclear in the original
((7))
((8))

2. Totten's First On-Site Inspection

In May of 1845, Totten inspected the Pensacola fortifications and later wrote Chase that he was gratified by what he had seen, concluding that he "could not take my departure without leaving this brief expression of my opinion."(9)

Following his visit, Totten wrote to Chase enumerating a long list of work items that could be undertaken on the Pensacola forts. The Reduit /the "keep" of the water battery/ was to be coated with asphalt, after which the masonry parapets, terreplein, banquette, and steps were to be given a waterproofing treatment with a composition that Chase had developed.

3. Totten's Recommendations for Waterproofing Water Battery

Repairs at the Water Battery were to be made to the earthen parapet. All sod was to be removed to the top of the breast-height wall. Next, a rammed surface of sand, parallel with the superior slope, would be put down and covered with a coat of asphalt. The sod would then be relaid. To prevent rainwater from entering the 3-foot wall forming the surface of the subject parapet, its back, above the layer of asphalt, was to be smeared with a soft mixture of 6 pounds of mineral tar to 33 pounds of calcareous stone. In covering the tops of steps, banquettes, etc., Chase was to take care to insert the

(9)

edge well into a joint of the adjoining vertical masonry, otherwise there would be seepage.

4. Totten Continues to Press for Use of Concrete

As for the Redoubt, Totten counseled Chase that those portions of the foundations exposed to the weather must be faced with hard brick. The embrasures and loopholes could be of concrete, but the brick facing surrounding them was to be arranged to allow them to be rebuilt if necessary. The inside facings of the galleries and casemates could also be of concrete "with economy and without disadvantage."

Chase was instructed that the best bond for uniting concrete with brick work was to build up the brick facing, stepped on the inside face: the first layer was to consist of three courses laid two bricks wide, the next layer was to be three courses one and one half bricks wide, the third layer was to be three courses one brick wide. Concrete was to be placed in layers, three courses deep, and thoroughly rammed. The advantage of this system, Totten advised, was that a total of nine courses of brick could be laid before placing any concrete and that the concrete, although laid in three strata, would bond to form one stratum.(10)

(10) Totten to Chase, May 30, 1845, NA, RG 77, Ltrs. Sent, Chief Engineer

Totten on June 3, authorized Chase to procure shells for aggregate wherever they could be secured with greatest ease and least cost, even if taken from public land.(11)

5. Progress of Work for Construction Year 1846 and Second Appropriation Request

General Totten, on November 1, 1845, notified the Secretary of War that works on the Redoubt were underway, and the excavation for the foundation was partially completed. A railroad, 4,000 feet in length had been built to transport building materials from the wharf to the site. To continue construction activity on the Redoubt, an appropriation of $50,000 for Fiscal Year 1846 was requested.(12)

6. Chase Continues to Resist Use of Concrete

Chase reported that he attempted to use concrete as Totten had advised only to find the procurement of materials to be a problem and the expense to total more than solid brick masonry.

"Under the circumstances related, I shall not be able to use the concrete as extensively as I desire. I shall use every bit of brick breakage about the work; also rubble from the brick yards whenever it can be procured and Sand Stone if the owner will deliver at $3 or $3.50 per cubic yard."

(11) Totten to Chase, June 3, 1845, NA, RG 77, Ltrs. Sent, Chief Engineer
(12) Serial 470, Vol. 1, page 260

7. Chase Objects to Instructions to Build Drain

Chase also countered Totten's order to build a drain.

> "I am of the opinion that no drainage is necessary to the ditch of the advanced Redoubt. When we dig down to reference (13'-6") water is exhibited which is supplied from springs at the depth, the issues of which are exhibited at various points when the surface of the ground runs down to reference (10). Since we have gone down with the excavation of ditch to (13'-6") we have had very heavy rain falling into the ditch which only temporarily raises the water a few inches above (13'-6") when it subsides. There is no doubt that the heaviest rain falling will never raise the water to the level of the ditch; it will be rapidly carried off in different directions at the reference of (13'-6") at no time rising above the reference (10')."(13)

8. Totten Provides Additional Construction Drawings

On April 23, 1846, Totten mailed Chase five additional drawings:

1. "Plans and Sections of the Advanced Redoubt. Pensacola Harbor," (14)
2. "Sections and Elevations of the Advanced Redoubt, Pensacola Harbor" ... (15)
3. "Details of a Draw-bridge for Advanced Redoubt, Pensacola Harbor." (16)
4. "Details of a Draw-bridge for Advanced Redoubt Pensacola Harbor. (17)

(13) Chase to Totten, December 23, 1845, NA, RG 77, Ltrs., Rec'd., Chief Engineer
(14) NA, RG 77, Dr. 79 Sh. 35
(15) NA, RG 77, Dr. 79 Sh. 36
(16) NA, RG 77, Dr. 79 Sh 32
(17) NA, RG 77, Dr. 79 Sh. 33

5. "Sketch showing the mode of securing pintle centers and forming earthen banquettes for the Advanced Redoubt, Pensacola, Harbor. (18)

These supplementary drawings were to enable Chase to proceed with the completion of those parts of the Redoubt that he had been instructed to hold in abeyance in September, 1844.

Water from the top of the vaults was to be carried through conduits constructed for that purpose in the piers and flow from the scarp toward the rear of the sustaining arches, to disperse in the earth fill behind. (19)

D. Fiscal Year 1847

1. The Second Appropriation

On May 21, 1846, the Department notified Chase that the Fortifications Bill for the fiscal year ending June 30, 1847, appropriated $50,000 for Fort Barrancas. On June 26, Chase was notified that $25,000 of that was to be spent on the Redoubt. (20)

2. Progress of Work for Construction Year 1846

General Totten on November 10, 1846, advised the Secretary of War that the excavation for the foundations had been "very heavy."

(18) NA, RG 77, Dr. 79, Sh. 34
(19) Totten to Chase, April 23, 1846, NA, RG 77, Ltrs. Sent, Chief Engineer
(20) Totten to Chase, May 21, 1846 and June 26, 1846, NA, RG 77, Ltrs. Sent, Chief Engineer

The masonry of the foundations had kept pace with "the excavations, following them closely,...to prevent the caving in of the sides."

By this date about two-thirds of the counterscarp and its galleries had been completed. Also, in spite of Chase's contrary notations, the drains and the connected countermine gallery had been built.

3. Work Remaining and Fiscal Year 1848 Request

Totten informed the Secretary that to complete the masonry of the work (leaving only the formation of embankments, and the completion of details, to be provided for by subsequent appropriations) would require a substantial sum but being aware of the budget limitations imposed by the Mexican War, he was paring his request to $40,000 for fiscal year 1848. (21)

E. Fiscal Year 1848

1. Appropriation Not Forthcoming

Because of the Mexican War and the need to effect economics in nonessential spending, the 2nd. Session of the 29th Congress failed to pass a fortifications Bill. (22)

(21) Serial 493, Vol. 1, p. 128
(22) Welcher to Chase, March 8, 1847, NA, RG 77, Ltrs. Rec'd, Chief Engineer

2. Progress of Work

Chase's request that the balance of the previous year's appropriation, $18,500, be applied to the Redoubt, was rejected by Totten. Chase proposed pushing construction of the Redoubt, but Totten reasoned that if Congress had intended this then an appropriation would have been passed. Totten left up to Chase the "mode and time of arresting expenditures on the Redoubt"(23)

3. Annual Report - 1847

At the end of June 1847 Chase submitted his annual report on the status of the work at the Redoubt:

> The Principle Fort remains in the condition reported on the 30th June last.
>
> The counterscarp of the advanced Redoubt is completed, with the exception of the cordon, together with its gallery and flank defense casemates. The roofing of the Arches has been very carefully attended to and has been arranged after the method of Lieut. Scarrit of the Engineer /sic/ and which has been used with entire success at Fort Barrancas.
>
> Nearly all the earth necessary to the formation of the Glacis has been placed in position. This part of the work as well as the banquette and breast high walls, traverses, will be very soon completed.
>
> The gallery of communication falling under the caponnier of N.W. angle is completed and all the adjacent wall of counter-scarp carried up.

(23) Totten to Chase, June 1, 1847, NA, RG 77, Ltrs., Sent, Chief Engineer

The face flank and part of the side of the N.W. demi-bastion is carried up to the reference of (39'). The foundation of Curtain of Gorge is laid.

The gallery falling under the caponnier is nearly completed and the adjacent parts of the counterscarp are under construction.

The work of excavation of the foundation owing to the numerous springs of water together with the limited space for operations has been rendered difficult and expensive.

This part of the work being nearly completed we shall have only the scarp wall and retaining arches to raise together with the construction of the parapets in order to exhibit the completion of the Redoubt in one year after the 1st October next.

The materials used are of the best quality and the workmanship, it is thought, will compare in quality with the most favorable specimens. (24)

4. Progress of Work for Construction Year 1847

On September 30, 1847, Chase submitted an updated report with a plan drawing "Showing the Condition of Advanced Redoubt of Fort Barrancas." In his report accompanying the drawing, Chase related:

There is but little to state concerning this work ... beyond what was given in the memorandum for 30 June 1847.

The drawings illustrative of the conditions of these works show, that not as much progress has been made as was anticipated in June.

A fair amount of work however, considering the force and means at Command, has been done.

....no operations are carried on at the Redoubt, but in the excavation of the ditch and foundations of scarp.

The Railway has been extended into the ditch in front of gorge. A ramp has been carried into the main ditch by which the heavy work of excavation is done principally by carts.

(24) Chase to Totten, June 30, 1847, NA, RG 77, Ltrs., Rec'd., Chief Engineer

The passage-under-the-ditch gallery to the NE has been completed. The right demi-bastion of gorge has been raised to the reference of (26') and the piers of casemates of curtain and left demi-bastion of gorge, carried up to the required height.

There remains no great amount of work to do to complete the Redoubt, and the estimates are made to that end.

The materials used in construction are of excellent quality and obtained at reasonable prices. No concrete has been used, save that made from the rubble arising from the breakage and cutting of bricks about the works, and some obtained from the brick yards. Shells cannot be procured sufficiently free from dirt.

The principal fort remains in good condition.

The estimate for the next Fiscal Year is a large one, for it embraces present and future arrearages and a sum necessary to complete the Redoubt .... (25)

General Totten, in mid-November 1847, advised Secretary of War Marcy, that during the year work had continued, "and much of the more difficult and expensive parts of this construction have been executed."

The counterscarp of the Redoubt had been completed (except the coping), along with its gallery, and casemates of reverse fire. Nearly all the earth necessary for the glacis had been positioned; the galleries of communication (Caponniers) under the ditch had been completed; the scarp of the northeast bastion raised to the height of the cordon; the scarp of the right bastion about one-third built; the foundations of the curtain laid; and the piers of the scarp casemates along the curtain, and in the northeast bastion, carried to their full height.

(25) Serial 503, Vol. 1, page 617

F. Fiscal Year 1849

1. Appropriation

The appropriation of $40,000 for Fiscal Year 1849 would enable the construction crew to complete the masonry.(26)

For the fiscal year ending June 30, 1849, the total sum of $40,000 for Fort Barrancas was appropriated. Of that the Department instructed Chase that he was to consider one half of the sum, $20,000, as exclusively applicable to the Redoubt. He was to submit an operating program for expenditure of this sum.(27)

2. Progress of Work for Construction Year 1848

During the year the sand for the glacis was positioned, and a surplus accumulated for the main rampart. Only 1,300 cubic yards still remained to be removed from the ditch. Sand had also been piled on the terreplein of the covert way in readiness "to be formed into the proper planes."

The counterscarp and underlaying counterscarp gallery, and casemates of reverse fire had been completed, except for the coping of the former and the pavement of the latter.

(26) Totten to Chase, July 21, 1848, NA, RG 77, Ltrs., Sent, Chief Engineer
(27)

The communication tunnels under the caponniers were completed, and sand sufficient to finish the caponniers stockpiled.

The scarp of the south front had been raised to reference 22¼', and the piers of the first tier sustaining arches raised to their planned height. The scarp of the west Front had been raised to reference 33'; the piers and arches of the lower tier were completed, and the piers of the second tier raised to their proper height. The scarp of the face and flank of the northeast bastion had been raised to the reference of the curtain; the southeast bastion had been raised to reference 33', and the piers of same raised to their desired height. The scarp of the east front had been raised to the reference 26' - 8". The piers and arches of the first tier were completed, and the piers of the second tier had been raised to their proper height.

The ditch of the gorge and part of the foundations of the counter-scarp of gorge had been excavated. (28)

3. Estimate to Complete the Work

On September 30, 1848, Chase submitted an estimate to complete the Redoubt totalling $47,000.

(28) Serial 537, Vol. 1, page 267

ESTIMATE TO COMPLETE REDOUBT MADE 30TH SEPTEMBER 1848

1,300 cubic yards sand in ditch at 20¢		$ 260
4,000 cubic yards rampart filling in arches, parade, etc. with tamping etc. at 50¢		2,000
Forming slopes of rampart, glacis, terreplein, banquetts, planting grass, placing shingles to support exterior slopes of rampart etc, etc.		2,000
Making good earth to Caponneires		250
Making culvert through ditch		500
44 stonesteps communication with covert way		176
1,600 cubic yards Scarp wall		
90 " " " "		
80 " " piers of arches		
800 " " arches & roofs		
160 " " DO.		
600 " " breast high wall glacis		
170 " " of main work		
55 " " traverses		
400 " " C. Scarp of Gorge		
3955 " " Say 4000 cubic yards		
Which require 1,800,000 Bricks at $10	$18,000	
1,500 Casks Lime at $1.50	2,250	
500 Casks of Cement at $2	1,000	
3,000 days work of Mason at $2.50	7,000	
6,000 days work of laborers at $1	6,000	
	34,250	- Say 35,000
		$40,186

Amount brought up	$40,186
10 Sets traverse stones & irons at $50	500
Bridge & Machinery	500
Gates etc.	200
2 sets embrasure stones and traverse /?/	100
Fence around work	1,000
Pavement of Counterscarp gallery	300
Fitting magazine	500
	$43,286
Sundry Contingencies of Clerk, Superintendence, Barge crew, etc.	3,914
	$47,000 (29)

(29) Chase to Totten, October 4, 1848, NA, RG 77, Letters Received, Chief Engineer

Redoubt" and the barracks with the largest portion to be allotted to the barracks. (30)

2. Lieutenant John Newton Appointed Second Project Egineer

Chase was ordered relieved of duties as the Project supervisor in the fall of 1854 and continuing work at the Redoubt was placed under the supervision of Lieutenant John Newton. (31)

3. Construction Resumes

Construction resumed in 1855, and the workmen proceeded "as rapidly as the warm season and high prices would allow." By the end of September, the counterscarp gallery had been paved, the wall coped, the scarp of the west face raised six feet, some work done on the gorge, counterscarp, covered way, terreplein, and glacis of west face; and large quantities of materials collected. (32)

4. Questions Regarding Glacis

On August 21, Newton wrote to Totten requesting advice regarding the completion of the glacis.

(30) Totten to Chase, August 26, 1854, NA, RG 77, Ltrs., Sent, Chief Engineer
(31) Serial 811, Vol. 1, pt. 2, page 202
(32)

As there exists a descrepancy between Department's Instructions to Major Chase dated September 3, 1844, and a plan of the advanced redoubt in my possession, in regard to the form of the crest of the covert way of the S. Front of the redoubt of Fort Barrancas - The former specifiying a crest en cremaillere /indented/, while the latter represents a straight line. I would request precise instructions on this point.

Also, on the face of the redoubt as there is already roughly distributed, much more earth than would be necessary for Constructing the slope of the glacis of 1/10. (33)

Newton requested permission to make the slope "more gentle," stating that:

The former will be the most economical while the latter would prove more disadvantageous to the enemy's sap.

The same difficulty would exist in regard to the glacis of the other fronts, though my attention has been directed more particularly to the W. face. (34)

He concluded:

May I request the earliest consideration of the Department about breaking ground on the SE portions of the work. (35)

5. Appropriation For Fiscal Year 1856

Congress appropriated $30,000 for Fort Barrancas for Fiscal Year 1856. (36)

(33) Newton to Totten, August 21, 1855, NA, RG 77, Ltrs., Rec'd, Chief Engineer
(34) Ibid
(35) Ibid
(36) Totten to Newton, March 24, 1855, NA, RG 77, Ltrs., Sent, Chief Engineer

6. Armament Approved for Advanced Redoubt

On April 4, 1855, Lt. Newton was notified by the Department that the Board of Officers convened by Secretary of War Davis had established the armament of the works under his superintendence. Redoubt was to have eight 24-pounder guns mounted in barbette and eight 24-pounder howitzers mounted in casemate. (37)

7. Totten's Second Field Inspection of Advanced Redoubt - 1855

General Totten visited the Pensacola fortifications April 17, 1855. Since his last visit to Redoubt in 1848, the work accomplished had consisted of carrying up the front scarp to the "springing of the lower arches;" the turning of the arches of both tiers on the flanks; and the raising of the scarp of the two flanks to nearly their planned height. (38)

8. Totten's Instructions for Completing Covered Way and Glacis

General Totten, on responding to Lt. Newton's letter of August 21, advised him that he found no inconsistencies in the official drawings and the directions contained in his letter to Major Chase of September 3, 1844. Both north and south branches of the covered way were to be prepared in the same way for traverses, etc.

(37) Totten to Newton, April 4, 1855, NA, RG 77, Ltrs. Sent, Chief Engineer
(38) Totten to Newton, April 17, 1855, NA, RG 77, Ltrs. Sent, Chief Engineer

In regulating the surfaces of the glacis, it was important that the extension of the planes below the natural surface insured a considerable reverse slope. If the quantity of earth permitted, the glacis slopes were to be formed as shown on Sheet 2, with no part less steep than 1 to 10 until a cover of several feet was secured. If 6 or 8 or more feet could be secured so much the better, from whence the glacis "may run off into the natural slope as will be fully commanded from the parapet." The reverse slope was to be 1 to 3; such an arrangement would be an obstacle to sapping.(39)

In laying out the place of arms, the salient was to present an angle of 60 degrees, with each face having a lenght of 100 feet.(40)

K. Fiscal Year 1856

1. Progress of the Work

On October 1 Newton submitted his annual report on the status of the work at Redoubt.

> I have the honor to submitt the following memoir of the progress and condition of the redoubt of Fort Barrancas, for the year ending 30 September 1855.

(39) Totten to Newton, September 4, 1855, NA, RG 77, Ltrs. Sent, Chief Engineer
(40) Ibid

Progress - In April last, proposals were invited for supply of bricks, but the bids were rejected as too high. In the harbor the bid was $13.50 - As there was no prospect of obtaining brick in quantity from the yards of the harbor until September or October, I purchased 200,000 in New Orleans for $13 and commenced work in July. Since which time the whole counterscarp gallery has been paved, the Counterscarp wall coped, the Scarp wall of the west face carried upwards 6 feet, the Counterscarp wall of gorge has had its foundation and part of superstructure laid. The terreplein of Covert Way is in part graded, and the glacis of S. face is partly formed.

A wharf and railroad has been constructed anew and Stable, Barn, Storehouse, Boathouse and Toolhouse built - and large quantities of brick, lime cement, lumber, etc. purchased.

As soon as hands can be procured, in which great difficulty has been experienced, the breast-height walls of terreplein will be undertaken, and the Glacis quickly formed.

The Department will understand the cause of the little progress made to have been with great difficulty of obtaining materials in quantity for a reasonable rate, and also the present scarcity of laborers.

I have great satisfaction in stating that I have succeeded since in purchasing brick for $12 and that Jules Blanc Esq. of New Orleans is now engaged to deliver 700,000 for $11.50.

Condition of the Work - The work is in good state so far as constructed. The Counterscarp Galleries alone are serviceable as defences. About 3,632 cubic yards of Masonry, distributed over the Redoubt itself, the breast-height wall of Covert Way, and the Counterscarp wall of gorge, are to be put up. The Glacis are unfinished, the terreplein of Covert Way, in great part untouched, the ramparts etc. of the redoubt are to be embanked, and the ditch of the gorge behind the Caponniers is yet to be arranged.

It may be estimated that nearly twice as much earth as is necessary for the Glacis is now put up in position, I state this that the Department may understand the large estimate submitted for this part of the work, I wish it likewise to be understood, that if the Glacis is to be formed into a reverse slope, a very large amount of grading and sodding will necessarily result therefrom and from the large amount of earth now disposable.

Concrete is used wherever it can be applied, Viz; in the foundations, backing and filling of all walls and upon the roofs of arches. I have succeeded heretofore, in making concrete at a mean cost of $4.34 while brick masonry costs $10 per yard. Bats costs us $6 per M and the cost of concrete made from them has been somewhat diminished by the mixture of a cargo of shells accidentally obtained at a very reduced price. Should it be impossible to obtain further shells, it is not likely that concrete will cost more than $4.60.

Pointing has been added as a separate item because it has been found by experience, that the pointing heretofore executed, with the mortar used in building, and during the progress thereof will not indure the climate.

Note: From the experience derived from the inspection of Fort Barrancas, any appearance of deficient strength in the portions of the redoubt now finished will be noticed and for the future in what remains undone, alterations of the plan judged necessary will be reported.

Newton appended his estimate for the completion of the work totalling $38,215.(41)

On October 30, the Department approved the contract Newton had made with Jules A. Blanc for delivery of brick at Barrancas.(42)

2. Instructions for Casement Ventilators

The Department on January 22, 1856, advised Newton that there ought to be ventilators in all casemates. Those in the upper tier of the north, west, and south fronts to be about 2" x 12" in cross section and to "open out just under the cordon." Where the cordon was further above the arch keys, the ventilators were to be continued up on the inside of the wall until they obtained the height necessary, for

(41) Newton to Totten, October 1, 1855, NA, RG 77, Ltrs. Rec'd, Chief Eng.
(42) Totten to Newton, October 30, 1855, NA, RG 77, Ltrs. Sent, Chief Eng.

passing out just under the cordon. Where the key of the arch was above the cordon, the ventilators, opening into the scarp from under the key, could be carried up vertically in the body of the scarp wall, with its outlet in the superior slope, or if it would not be thick enough for a flue of 8" x _" or 6" x 24", it could be carried directly through the scarp (12" x 12"). The ventilator over the flank casemate gun would escape just under the cordon (12" x 36").

The ventilator openings from arches running along the scarp and openings above the loopholes were to be 3" x 18".

3. Drawbridge Revisions

The axis of the motion of the drawbridge would not be on the underside as shown in the drawing but in the middle thickness. (43)

When he forwarded a list of drawings on file at the Department for the Redoubt, General Totten advised of additional corrections to be made to the one depicting the drawbridge. The thickness of the iron axis in its flat part was too great and its correct dimensions were to be 1" x 6", rather than 2" x 6".

(43) Totten to Newton, January 23, 1856, NA, RG 77, Letters Sent, Chief Engineer

4. Additional Modifications and Construction Drawings

If the embrasures in the reverse casemates had not been constructed, Newton was to hold work on them in abeyance until he received amended drawings of such embrasures to be prepared by the Department and incorporating modifications necesitated by recent tests at West Point.

Numbered among the Redoubt drawings were:

A. No. 1 "Sketch of the ground between Fort Barrancas and Bayou Grande, showing the position of the advanced redoubt."

B. No. 2 "Sketch of advanced Redoubt of Fort Barrancas, showing the position on the site."

C. No. 3 "Sketch of Advanced Redoubt of Fort Barrancas, showing in part the masonry and in part the finished work."

D. No. 4 "Profiles, sections etc., of Advanced Redoubt of Fort Barrancas."

E. Sheet 1 "Plans and sections of the advanced Redoubt, Pensacola harbor, showing the arrangement of the masonry and roofing of the arches, and showing the arrangement of the earthen slopes."

F. Sheet II "Sections and elevations of the advanced Redoubt."

G. No. 1 "Details of a drawbridge for advanced Redoubt, Pensacola harbor; scale of plan 2" to 5' scale of sections 2" to 1'."

H. No. 2 "Details of a drawbridge for advanced Redoubt, Pensacola harbor, Scale 2" to 1'. (44)

(44) Totten to Newton, February 22, 1856, NA, RG 77, Ltrs. Sent Chief Engineer

5. Newton Requests Clarification Regarding Casement Ventilators

Newton responded to Totten's letter the 2nd of March as follows:

Dept.'s letter of 23rd -in relation to completing my list of drawings for the Redoubt of Fort Barrancas is received and the instructions therein given will receive my earliest attention.

The roll of drawings noted in the letter has also been received.

In regard to the casemates for reverse fires: the embrasures for the N. and W. fronts were completed prior to my taking charge, except the raised outer sole, which is a small reversed flat arch - Those for the flanking of the ditch of the S. front are yet unformed except the upper arched portions, and appear to have been left in that condition for the purpose of receiving some modification of their former plan.

In regard to ventilators - the instructions given by the Dept. will be carried out; and in doing this a ventilator for the embrasure of the left flank of the E. front, must be cut through the scarp wall which is here already constructed to the ref. (39').

In the scarp of the left face of the same front, no openings or indications of ventilators are to be seen, though the wall is finished to same ref. (39'), and several of the casemates of this half bastion have already been arched.

It has appeared to me that this was a designed omission; it being considered that the arched communications, leading from the terreplein of the redoubt to the counterscarp galleries which fan through, the entire extent of the two half bastions, were two large flues through which the smoke, etc. would freely escape.

The other half bastion has not yet been raised sufficiently high to commence the ventilators.

The question which I now ask is, whether the ventilators for the left flank & face should now be cut.(45)

(45) Newton to Totten, March 2, 1856, NA, RG 77, Letters, Rec'd, Chief Engineer

After reviewing Newton's report, General Totten concluded that the subject embrasures "should be completed according to the original design." As the scarp of the left face of the east front had been finished without ventilators, he need not open them, "but in the left flank, one should be opened for the embrasure by cutting through the wall."(46)

6. Newton Requests Instructions on Waterproofing

On August 6, 1856, Newton wrote to the Acting Chief Engineer submitting an estimate for the completion of the Redoubt totalling $42,144.49. In his letter he requested advice on the method for water proofing the roof surfaces. He noted that he felt a mastic covering "to be the most reliable."

> You will observe that the arch when fully loaded, must undergo a change of form, to which the thin concrete roof will adapt themselves by cracking - the motion will communicate itself to the brick covering, rigidly laid in cement, which must likewise crack, along a line perpendicular to the scarp, and a leak will probably be the result. I have not herein taken into consideration the settlement of the piers which at certain changes of direction in the work, must be unequal, owing to different surcharge weights. This will necessarily aggravate the objection before urged.
>
> In the case of the mastic, should this be applied upon the cement plaster commonly finishing off the concrete roofs, it would be as bad as the brick in the event of a sharp crack in the concrete - for the effects would probably be the same as suddenly, striking a layer of mastic with a sharp blade.

(46) Totten to Newton, March 11, 1856, NA, RG 77, Letters, Sent, Chief Engineer

But on the other hand, if a friable material say poor lime mortar, be inserted between the mastic and roof, the effects of a rupture in the roof would not be so directly communicated to the mastic, and the elasticity of this material, being gradually brought into play, would probably be sufficient to enable it to undergo a change of form without rupture.

I would like soon to be informed of the wishes of the Department on this head, the counterscarp galleries were roofed and finished before I assumed charge of the work and the benefit to be derived from the use of mastic, would be the protection of the masonry of the main work only, from the percolation of water.(47)

L. Fiscal Year 1857

1. Appropriation and Proposed Construction Program

Captain Wright on August 20, 1856, notified Lieutenant Newton that the fortifications bill recently signed into law by President Pierce appropriated $25,000 for Fort Barrancas in Fiscal Year 1857. Newton, in accordance with regulations, would prepare and forward for approval by the Department a program for expenditures of this sum, and his projected monthly rate of disbursements.(48)

Newton responded to Wright's letter with a proposal for "operations recommended commencing July 1, 1856," for the Redoubt:

Finishing coping of Counterscarp walls, laying coping of scarp, finishing upper tier of relieving arches, casemate arches of interior of work and concrete roofing of the same (the brick

(47) Newton to Wright, August 6, 1856, NA, RG 77, Ltrs. Rec'd, Chief Eng.
(48) Wright to Newton, August 20, 1856, NA, RG 77, Ltrs. Sent, Chief Eng.

or mastic covering of these not being included herein) - Raising scarp wall of E. front to ref (37') - Finishing Breast height wall of covered way, except a small gap for Railway - Taking up and replacing drain in ditch. - Finishing embrasures in counter-scarp gallery and constructing the same in flanks of half bastions. Finishing Gateway, Viz: 1,700 Cubic yards of Brick Masonry at $13 22,490.00
955 Cubic yards of Concrete at $7 6,685.00
Stone for steps of pas de souris and for arches communicating from interior of work to Counterscarp galleries - for Embrasures, for Barbette Pintle and Traverse stones, and for Gateway 1,483.00
Earth work of interior of Redoubt 182.00
One Master Mason 1,200.00
One clerk 480.00
Care of work from June 30, 1857 to June 30, 1858 400.00
32,920.00

The application just made being expended, there will probably remain to be done, the following, Viz - Pointing generally. - Breast height wall of interior of Redoubt- Laying barbette pintles and traverse stones. Filling in interior of work with earth and construction of parapet, banquettes, ramps and slopes of the same. Finishing off roofs of arches with brick or mastic - Purchase of iron machinery for drawbridge and putting up the same. - Construction of Drawbridge and Bridge, - Construction of traverse of covered way and banquettes, - Building profile walls of traverses - Excavation and filling in the glacis, - and grading, sodding and enriching all of the slopes.

After the expenditure therefore of the present available fund /$25,000 appropriation plus $7,920 carryover/, this work will still be in an unserviceable state.(49)

Newton followed up his proposed program with a financial report on operations for the month of November at Redoubt, concluding with these "Remarks,"

Redoubt of Fort Barrancas, Relieving arches of E. Front finished - Finishing soles of loopholes, etc. Arched Communications to half bastions under progress-

(49) Newton to Wright, August 28, 1856, NA, RG 77, Ltrs. Rec'd, Chief Eng.

Probable operations of the month of December Redoubt of Fort Barrancas, Arches of half bastions to be undertaken...(50)

2. Summary of Work Completed in 1856

In his annual report to the Secretary, the Chief Engineer related that in 1856 the artisans and laborers spent most of their time on the masonry, "earth-work being only undertaken when indispensable in itself, or when made necessary by the progress of the masonry. During the year there was laid 1,554 cubic yards of brick masonry and 863 yards of concrete. The scarp wall at all points had been raised to reference 39', and the upper casemate arches of the scarp galleries completed." The counterscarp of the gorge was finished, and all the breast-height wall of the covered way, except a gap of 193 feet, necessarily left open until completion of the project.(51)

3. Newton Continues to Press for Instructions for Waterproofing

In the middle of January, 1857, Newton wrote to Totten complaining of the Department's negligence in not responding to his questions regarding the method to be used to waterproof the roofs.

> In a former letter, August 8, 1856, transmitting estimates for the Redoubt of Fort Barrancas, I requested the views of the Department, in relation to covering the

(50) Newton to Wright, December 1, 1856, NA, RG 77, Ltrs. Rec'd, Chief Eng.
(51) Serial 876, Vol. 3, page 285

roofs of the arches with brick or mastic, recommending the latter, if laid upon a foundation of friable material, as preferable to a brick covering.

The last I suggested as liable to crack from the settlement of the arches and the unequal settlement of piers, when the weight of the parapet should be imposed.

The joint between the heads of the casemates and the scarp wall, can never perhaps be made tight, except by uncovering it after several years settlement /___/ the full wall, and repointing with mastic. A continuance may however, in the first instance be made effective, by covering the joint with a layer of bricks, projecting a distance equal to half a brick beyond the joint, as per sketch.

Experience has proved here that the brick covering, of the roofs has not achieved its purpose, owing to cracks caused by settlements: and it is a matter of importance to determine whether a material like mastic, can be so applied as to obviate this difficulty.

Another method would be, to lower the arches with the parapet and remove the wall after an interval of a few years, for the purpose of covering the roofs permanently. This would demand the foundations of the Breast height wall, to be level as such, as not to be affected by the after removal of the parapet.

It is now necessary, for the method of roof covering to be finally determined and I hope the Department may be able soon to give its attention to this point.(52)

4. Totten Sends Instruction for Waterproofing

Replying to Newton's letter of January 17, General Totten pointed out that policy was to protect roofs of casemates, where feasible, with a layer of asphaltic mastic. Whenever possible, two layers of brick laid endwise, in a bed of shells, would be placed upon the mastic.

(52) Newton to Totten, January 17, 1856, NA, RG 77, Ltrs. Rec'd, Chief Eng.

This principle would be applied to all roof surfaces of the Redoubt, including coverings of galleries and sloping tops of walls. An applicateur would be sent on call from the New York depot to execute this work if requested. A requisition for mastic would also be addressed to this agency.(53)

5. Repairs and Modifications in East Front

Newton was called on for a report on the condition of the piers of the left and right flanks of the east front at the time of their temporary repair and the nature of the repairs.(54)

General Totten on February 19, approved a change order for the roofs of the half bastions of the Redoubt, subject to certain restrictions as to protecting the backs of walls and piers from dampness of adjoining earthen enbankments. To guard against this, Newton would build, from the bottom of the foundations, a half brick wall at a distance of half a brick from the back of the wall with frequent headers bearing at one end against the back to keep this thin wall from being pressed against the thicker one. Where the height of this wall was insignificant, it could be laid without mortar, but where it was more than three or four feet high, it was to be laid in good mortar. The top of this wall was to be covered with two layers of

(53) Totten to Newton, February 13, 1857, NA, RG 77, Ltrs. Sent, Chief Eng.
(54) Totten to Newton, February 19, 1857, NA, RG 77, Ltrs. Sent, Chief Eng.

bricks. In the case of the back walls of the magazines and perhaps the adjoining casemates there should be applied first a coat of mastic to the back surfaces.

Lieutenant Newton was to indicate on his drawings the authorized changes, and forward a copy thereof to the Department.(55)

6. Modifications to Covered Way Traverses

Totten believed a simpler and less costly method of strengthing the profile wall (next to the ditch) of the traverse of the Redoubt would be to carry up the four-foot wall next to the ditch to the top of the traverse. The upper foot, confirming to the several slopes of the traverse, was to be laid in independent blocks, constituting the coping. Next, a wall vertically over the rear wall of the gallery and of the same thickness should be raised so that its top would be everywhere about 2 1/2 feet below the top surface of the traverse. The breast-height wall was to be built at the same time, and so much of it as lay between these two parallel walls would be begun on the roof of the gallery - the rest to be commenced on reference (31). The parallel walls were to be tied together by this breast-height wall, and by three other cross walls, each two bricks thick - these also to be begun on the roof surface of the gallery. The spaces formed by these exterior, interior, and cross walls were to be filled with sand, thoroughly rammed.

(55) Totten to Newton February 19, 1857, NA, RG 77, Ltrs. Sent, Chief Eng.

The tops of the interior wall, of the cross walls, and of the coffers filled with sand, were to be so regulated as to form roof slopes conducting water from the bottom of the coping course backward and downward: the subject roof surfaces were to be finished by a course of brick laid in mortar flatwise over the sand coffers as well as the walls; and on the surface thus prepared, would be laid a coat of mastic, to be covered by two courses of brick.

To firmly tie together the two parallel walls, three tie rods, one inch square, 10 feet long and with each end turned up about four inches, would be buried in the brickwork of the breast-height wall and of the cross wall located under the exterior of the traverse. A piece of boiler iron placed in front of the turned-up end would prevent the ties from being drawn out. The two lower ties were to be embedded at reference (30) and the upper ones a little below the roof, and the others at the mid-point.(56)

7. Totten Issues Further Instructions for Waterproofing Casement Roofs

Replying to Newton's letter of March 26th, General Totten admitted that a "change of figure in the roofs, owing to motion in the masonry below," was the chief cause of leakage. But for this, there would be no need of mastic covering, as a cemented surface should be made water-tight. The reason for using mastic was because it was flexiable

(56) Totten to Newton, February 24, 1857, NA, RG 77, Ltrs. Sent, Chief Eng.

enough to yield without breaking. In applying mastic at the junction of heads of arches with the scarp, these were, without reference to the span of the arches, such changes of openings that provisions must be made for motion by "separation or by difference of subsidence." Totten believed that the procedures here-to-fore recommended would suffice to answer Newton's problem.

If plates of mastic were laid in shingle fashion as suggested by Newton, water would be drawn through by capillary action. Even if the plates could be closely fitted, the motion that cracks cement would "break any such nice adjustment; and here will be no gain over a roof surface formed of cement." If the plates were fused, they would be no better than a single stratum of mastic, while being more expensive. Consequently, Totten preferred a single coat of mastic properly applied by a professional applicateur.

Experienced satisfied Totten that the depth of impressions in the mastic caused by the covering bricks would do no harm to a layer of mastic well tempered, and especially in a sub-tropical climate, where it was unnecessary to guard against shrinkage caused by sub-freezing temperatures.

He was agreable, however, to first put down a layer of slates face downward, and edge to edge. Upon the slates would be laid the

bricks, these rows half an inch rather than two inches apart, and upon them a cross layer of bricks.( )

8. Progress of Work in Summer of 1857

Newton's men by the late summer of 1857 had "carried up" the scarp wall to the corridor; and had completed the galleries of the reverse fire, the scarp galleries, the casemates of the half bastions, the stone steps therein, the masonry of the traverses, and the paving of one of the subterranean galleries. The covered way, except for a little grading and "the grassing" of the terreplein, was finished as far as it could be, pending construction of the parapets. The interior roofs were ready for the application of asphaltic mastic.(57)

9. Newton Expresses Concern About Stability of Traverses

Writing in August, 1857, Newton expressed concern for the stability of the traverses of the Redoubt.

> All of my calculations of the stability of the Counterscarp gallery, previous and since the plan of the Department was sent me, have been predicated upon the separation of the back wall from the C. scarp wall. As has recently taken place at Fort Barrancas and Redoubt. This was so explicity stated in my communication to the Department and hence its plan, if brick, to be defeated in its effect by such circumstances did not present a probable stability sufficient to guarantee safety.

(57) Serial 920, Vol. 3, page 182

In every case of settlement in these galleries, it has been the back wall which had gone down. I was fortified in believing that when the additional load of the traverse should have been placed upon the gallery, that the same settlement would be experienced. What would be the effect of such upon the construction of the plan sent me from the Department? The back wall going down, would carry with it the superincumbent load and something must yield - in this the iron ties would stretch and bend to accommodate themselves to this change, or they would be torn from their fastings. If in this case, the fastings would be loosened, and the crack shown on the sketch developed. Now let it be considered that the effort to overturn the wall would be by revolution around the foot of the back wall, and also around the foot of the C. scarp wall and what adequate resistence would be exhibited from a superstructure already cracked and disintegrated by settlement. A slight motion would in the first place be manifested and be arrested, for a time only, by the iron ties, and such motion by the continued splintering and /?/ of the face of the crack, must take place again until large cracks and dislocations from such cracks would make an ugly appearance on the counterscarp wall. What the actual effect /would?/ be, no one could with certainity predict, but I think the wall would be left in a dangerous predicament.

I have inperfectly discounted the forces alone, but it is in its nature difficult to convey the exact idea except with /?/ words and sketches.

Supposing no iron ties to be inserted, the resistance of the plan /?/ words and sketches.

Supposing no iron ties to be inserted, the resistance of the plan /?/ would by calculation be 1.2 times the estimate.

The actual construction was a modification of the above, furnishing a resistance of 1.96.(58)

10. Newton Argues with Totten About Waterproofing Roof Surfaces

Newton again wrote to Totten on September 24, 1857 raising the unresolved issue of water proofing the roof surfaces at Redoubt.

(58) Newton to Totten, August 13, 1857, NA, RG 77, Ltrs. Rec'd, Chief Eng.

In your instructions upon the subject of asphalting at the Redoubt of Fort Barrancas, dated February 13, 1857, having a sketch attached as below-you prescribe as follows:

The layer of mastic will be extended 3 or 4 inches over from the roof surface of the casemates upon the top of the Scarp Wall, and a separate piece of mastic covering the top of the scarp, will lap about as much upon the roof-these sheets of mastic should be smoothly and closely in contact, but not melted into one.

Is not capillary action to be apprehended in such case-when it is considered that the tendency to settle, is by the piers sinking more towards the rear than towards the scarp and thereby separating the head of the arch from the latter.

The effect of this would be to rupture the plate of mastic starting from the roofs and overlying the scarp, which being accomplished the water might flow by capillary action under the upper, and finding a fissure or separation in the lower sheet of mastic would penatrate down the head of the arch into the gallery.

Would not Sheetlead as arranged as above, answer a better purpose? I have lately given a full description of the method of connecting the lead with the mastic-and lightwood spikes might be used with advantage to fasten the lead more securely to the masonry and thereby assist in preventing a drawing out or separation from the mastic. I have confidence that the connection between Mastic & Lead will be sufficient to prevent capillary action.

At the S.W. and N.W. angles, precisely alike in plan, the oblique pier having already settled the most, has caused a separation along a.b. As the future load of the parapet may cause an aggravation of this defect, would it not be well to treat this case with lead as recommended above.

In Dept.'s letter of April 8th, you state "when a line of casemates changes direction, especially around a salient, then is as you state reason to provide against motion of a different kind, perhaps considerable in amount...in all such cases too much pains can hardly be taken; but for the same reason that extraordinary precautions are necessary, only such as have been approved, or from their nature cannot fail, should be resorted to "and further on," it is important besides I should state that asphaltic mastic cannot be used in contact with or quite near to clay which as it appears very promptly destroys the former...if you should think a stratum of sand,

upon the proper roof surface would afford the best security against leaks in any particular spot (I certainly do not think the course heretofore indicated by the Department should be departed from, except in some special cases) you should after making sure the compactness of the sand, lay thereon, a single course of bricks for the mastic to rest upon."

I certainly am not in favor of the use of sand unless it can be confined by some substance sufficient to ensure its non-disturbance after being once compacted, and a single course of bricks, would not in my opinion, afford such guaranty, even against the necessary trampling of the persons engaged in the work of supplying and applying mastic. In recommending the use of sand it was protected from the danger of such accident by a layer of clay or rather a clay of mortar. In all my suggestions upon this subject, the starting point has been to provide a foundation for the mastic which should adapt itself very gradually to changes of form, and I can conceive of nothing superior to clay mortar, laid directly upon the roofs from 4" to 8" thick. I should never use sand except in deep valleys and steep roofs, where a large space at the bottom might be advantageously filled with it. The ease, with which mastic may be separated from the clay by a layer of lime mortar upon a previous coating of cement mortar, should not prescribe in view of its advantages the use of this material. In connection, I fear much the effect of a change of figure and unequal settlements in the arches of the bastion upon the tenacity of the mastic covering. (59)

14. Annual Report for Fiscal Year 1857

On the first of October, 1857, Newton submitted a report on the status of the work at Redoubt.

Condition of the Redoubt, July 30, 1857. Scarp wall all around up to reference 39, (coping yet to be put on) - and its height on E. Front raised to reference (51') - galleries of reverse fire finished. Scarp /?/ and casemates of half bastions finished, except the high arches of the N.E. half bastion. 3 traverses of concrete (masonry) finished-the fourth about half completed. The covered way is generally finished except the earth on top the traverses, and a little grading and the planting of the terreplein. The glacis of the W, N and S. Fronts, completed as far as possible until

(59) Newton to Totten, September 24, 1857, NA, RG 77, Ltrs. Rec'd, Chief Eng.

the parapets of the interior work can be put on. The roofs of the interior, with the exception before stated, are ready for the applicateur. The parapet and terreplein together with the B.H. wall and gun platforms yet remain to be done, also the gateway, bridge, and draw. The woodwork of the magazines, main gate, gate of interior passage, and postern done. Also pointing in / ? / the pavement of subterranean galleries to counterscarp gallery, grading, sodding, and enriching the entire slopes, and carrying a fence around the work.

Operations during the fiscal year. 1,310 cubic yards of brick masonry and 900 cubic yards of concrete masonry together with an expenditure of 1,422 days labor on earthwork. Brick masonry $30 per M including all expenses, except superintendence, and office expenses.

Concrete $5,56 per cubic yard with the same limitations as above. 420 bricks to one cubic yard. Expenditures for all services during the year $26,905.70.

I enclose herewith an estimate in duplicate, by which it will be perceived that the amount in hand and deductions being made for work on Barracks and Fort Barrancas will probably be sufficient to finish the Redoubt-with the exception of the pointing not estimated for on account of the difficulty of determining a method by which this important finish of the work can be considered durable. (60)

12. Totten Responds to Newton's Arguments on Waterproofing Roof Surfaces

Replying to Captain Newton's letter of September 24, General Totten referred him to the Department's letter of February 13. But as Newton was unwilling to proceed under these instructions, Totten directed that the roof surfaces of the Redoubt be covered "with mastic, and with slates, and with bricks, etc., as here-to-fore directed." Where the wall in front of the roof surfaces or against which they abut, rose high enough above the surface, the scheme outlined in his

(60) Newton to Totten, October 1, 1857, NA, RG 77, Ltrs. Rec'd, Chief Engineer

letter of April 8 would be carried out, with these modifications: a little prism was to superimposed where feasible, the edge of the roof mastic being turned up whether there was a prism or not, and supported by a strip of lead underlying the mastic about 6 inches and folded, the upper edge to be inserted in the wall several courses above the edge of the mastic. To keep the lower edge of the lead strip from collapsing upon the mastic bits of bricks or shells would be placed between them. The fold of the lead was to be rather sharp to serve as a drip.

In building the wall above the roofs, there should be inserted a strip of wood (1/2" x 1/3") to be afterward removed, leaving a clean joint for insertion of the edge of the lead. The lead would be secured in the subject joint, by driving in about it, loosely twisted cotten or hemp rope supersaturated with asphaltic tar, and wooden wedges.

To the top of the scarp of the west face, and the greater part of the northwest and southwest faces, additional masonry would be added, carrying up the back of the wall vertically until it intersected the exterior slope of the parapet. The front of the portion rising above the cordon to be built in offsets, the lower course overlapping by a few inches, the rear joint of the cordon. In the joint next the top of this portion, there was to inserted the edge of a strip of lead which, being folded, would underline the turned up edge of the mastic, all being fitted and protected as previously detailed.

Prime was authorized by telegram to construct the recesses in the Redoubt, "as shown on the lithographic sheet for guns on land fronts."(61)

Confirming his telegraphic message, Captain Wright wrote to Prime the following day that the "new recess" was applicable only to guns on water fronts, and all guns exposed to the fire of land batteries were to have their pintles 1' - 3" from the face of the breast-height wall. Accordingly the recesses, rectangular in design, would be formed in the wall in front of the pintle to admit the corners of the chassis in extreme traverses on taking off the large wheels of the carriage. Such guns could be changed into embrasure pieces by the addition of merlons.(62)

3. Progress of Work by March 1858

At the end of the month Prime submitted the following "Report of Operations at the Advanced Redoubt of Fort Barrancas, for the month of March 1858.":

Stonecutter	has been employed fitting pintlestones for magazine doors.
Masons	finishing Embrasures, Laying stone steps to counterscarp wall, building steps to scarp gallery, fitting copper bars in ventilators, laying pintle stones for magazine doors and shutters, fitting up pudlock holes in Scarp wall and building second roof to Scarp gallery.

(61) Wright to Prime, April 23, 1858, NA, RG 77, Ltrs. Sent, Chief Eng.
(62) Wright to Prime, April 24, 1854, NA, RG 77, Ltrs. Sent, Chief Eng.

Carpenters	repairing wheelbarrows and mason's tools, erecting staging for excavatiors, making wood shutters for embrasures, building magazines and magazine doors and making rammers for ramming sand.
Blacksmith	making copper grating for magazines, repairing carts and mason's tools, and repairing rail road.
Rigger	transporting slate from Fort Pickens.
Laborers	have been assisting Masons, Stonecutters, Blacksmith and Rigger, and wheeling sand, wheeling brick from R.R., planting grass on terreplein and covered way, transporting brick on R.R., attending stable, carrying mail, and general work.

Probable Operations of the Month of April

Building B.H. Wall, placing pintle and traverse stones, filling up rampart and parapet, removing earth from covered way, building piers for bridge etc. etc. (63)

4. Annual Report for Fiscal Year 1858

By June 30, Prime was able to report the following additional progress:

Report of Operations under the Appropriations for Fort Barrancas during the Fiscal Year Ending 30th June 1858.

Advanced Redoubt

During the fiscal year the scarp has been completed, the small mass of brickwork on the coping to sustain the foot of the exterior slope has been built, the open joints of the coping and of this mass have been caulked with bitumen, the four high arches of the N.E. half bastion have been finished, also the stone staircase of both half bastions. In accordance

(63) Prime to Totten, April 1, 1858, NA, RG 77, Ltrs. Rec'd, Chief Eng.

with the detailed instructions received from the Department the arches of the main work have been all asphalted and covered with three layers of dry brick and the counterscarping and the connecting lead flashing between the roof surfaces and vertical surfaces has been put in place, the concrete of the foundation of the B.H. Wall has all been put in, the B.H. Wall in great measure built, the banquettes and paving of the small space above in the bastions devoted to musketry fire have been completed, and the adjoining traverse circles for flankfire have been laid, the parapet has been embanked to reference (46) and the greatest part of the terreplein has been embanked, one subterranean passage leading to the counterscarp gallery has been paved. The embrasures in the counterscarp gallery have been finished. The copper gratings in the corresponding ventalitors have been put in place, also those of the magazine ventilators. The masonry of the fourth and last traverse has been completed, the earthwork and grading of the four traverses and the whole covert way have been completed: the piers of the bridge have been built: the cunette has been demolished previous to rebuilding it: the magazines are all lined and the doors and window shutters hung, the glacis has been roughly graded excepting on the N. side, the earth having been employed in embanking the terreplein and parapet of the work, the caponniers have been graded.

1,040 cubic yards of brick masonry have been built (a part of this has been laid dry on the asphalted roof surfaces). 728 ½ cubic yards of concrete have been made and put in place.

Amount required to complete redoubt in addition to funds on hand 1st July 1858, and application thereof:

Finishing one subterranean passage	$150.00
Masonry of gateway	350.00
Drawbridge, making and hanging gates	600.00
Masonry of cunette	350.00
grading, claying, and grassing all the ditch	1,000.00
enriching covert way	250.00
embanking and grassing terreplein and parapet	1,250.00
grading and grassing glacis	800.00
Erecting and painting fence	600.00
laying traverse circles, and drilling pintle holes etc,	800.00
finishing asphalted joints	300.00
pointing new work and repointing	3,000.00
substituting new iron embrasures for old ones	1,200.00
	$10,650.00

Add for contingencies, superintendence, and incidental expenses such as repairs of railway, wharf, buildings etc. to suspension of work. 2,350.00

$13,000.00 (64)

5. Totten's Summary of Work Completed in Fiscal Year 1858

During the year ending September 30, Totten was able to report the Secretary of War, that all masonry "without the ditch," was completed, and also "within the ditch, except a part of the breast-height wall, the main entrance and the platform for barbette guns. All joints of coping in the main work had been caulked with bitumen, the covered way and traverse put in grass, the tereplein and parapet of the main work largely embanked, the glacis graded, and the magazines finished. (65)

N. Fiscal Year 1859

1. Prime Submitts Annual Report

By the end of June 1859, Prime submitted the following status report:

Report of Operations at Fort Barrancas during Fiscal Year ending 30th June 1859.

The operations during this fiscal year have been confined to the redoubt, and to the months of August and September 1859. The B.H. Wall has been completed. The cunette rebuilt for about

(64) Prime to Totten, 1858, NA, RG 77, Ltrs. Rec'd, Chief Engineer
(65) Serial 976, Vol. 3 page 826

half its length; the concrete foundations of the balance put in place, considerable earth wheeled into parapet and terreplein. Masonry of gateway nearly completed, lumber got out for gates, doors and drawbridge. 35,000 bricks were laid. In the spring of 1859 the Barrancas Wharf which was in very bad condition was repaired by Lieut. Beckwith the A.A.Q.M. of the Fort. An appropriation of $20,000 is asked for Fiscal Year ending 30th June 1859.

Redoubt of Fort Barrancas	$13,500
Purchase of Appraised Buildings	10,500
	$24,000
Application of funds asked for redoubt	
Completing masonry of gateway and Cunette	$1,683.81
Laying barbette pintle and traverse stones and irons	1,276.05
Altering Flanks and counterscarp embrasures by introducing check irons and shutters	1,261.51
Pointing new and old masonry	1,100.70
Asphalting joints	198.52
Embanking terreplein and parapet	729.12
Grading, claying, and enriching terreplein, Parapet, Glacis, and Ditch	4,714.08
Drawbridge and Gates	687.53
Fence	429.81
Repairs Rail Road	168.20
Embanking Glacis	297.60
Contingencies	253.07
	$13,500.00

The redoubt can mount its guns in flanks and casemates, counterscarp galleries. Magazines in good condition and ready for use.

The Appropriation asked for will complete the redoubt and allow whole armament to be mounted.

Recapitulation.

Operations confined to redoubt, B.H. Wall completed, cunnette rebuilt for half its length, concrete foundations for the balance in place. Considerable earth embanked in parapet and terreplein. Masonry of gateway nearly completed, lumber got out for gates, doors and drawbridge. (60)

(60) Prime to Totten, August 4, 1859, NA, RG 77, Ltrs. Rec'd, Chief Engineer

2. Totten's Summation to the Secretary of Defense

Totten sumed up the program in his year end report to the Secretary. The breast-height wall was completed, the cunette finished for half its length, and the concrete foundation of the remaining one half laid. Considerable earth had been embanked in the terreplein and parapet, the masonry of the gateway nearly completed, and the lumber for doors, gates, and drawbridge purchased and on hand.

Totten stated that $13,500 in construction funds would be required to complete the Redoubt. (67)

3. Construction Halter - 1859

Construction was stopped in 1859 and in accordance with orders, Lt. Prime placed the Redoubt in charge of a fort keeper.

Reporting on its condition, Prime announced that the flanking howitzers of the scarp and counterscarp could be mounted, if and when the traverse irons were laid. Stones for the barbette traverse circles were on hand, and could be set in short order. (68)

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(67) Serial 1024, Vol. 2, page 650
(68) Serial 1079, Vol. 2, page 267

0. Fiscal Year 1868

1. Condition of the Advanced Redoubt after Civil War

In 1867, Frederick S. Prime, the last Federal project supervisor prior to the outbreak of the Civil War, submitted the first assessment of the Pensacola works since their occupancy by the Confederates. In this report he recorded:

> At the Redoubt the breast-height wall of the covered way needs repairs in some places - a fence is needed around the work, the old fence having entirely disappeared. The bridge planking needs renewing - gates for the entrance should be provided as part of the composition gratings of the magazine windows have been stolen, there being no means of closing the work - the pintle stones and much of the traverse stones for this work are on hand and can be laid if so desired by the Engineer Department, in place of the present wooden platforms. The traverse stones are of the old circular pattern 12 inches square in cross section.
>
> The parapet of this work has been raised higher than originally intended so as to form embrasures for the barbette guns and I would recommend the removal of this additional embankment especially where the scarp wall has commenced to give way. The earth can be used to complete the glacis slopes, which should be planted with Bermuda grass, as soon as the fence is erected. (69)

2. Prime Submittes Work Program to Complete Construction

Ten days later Prime's proposal for repairs at the Advanced Redoubt were approved. He was instructed to lay the small traverse stones as specified since the guns were not the same as for water batteries. The

(69) Prime to Humphreys, Dec. 14, 1867, NA, RG 77, Ltrs. Rec'd, Chief Eng.

surplus earth removed from the parapets was to be used as Prime had proposed. Finally, Prime was requested to submitt a cost estimate for the proposed work.(70)

On March 3, 1868, Prime submitted his estimate of the repairs consisting of the following work items:

Fence	1277.07
Laying 8 sets barbette platforms at $300 each (8 braces, 6 pintles stones, 40 peices traverse stone on hand)	
Irons for same (supposed to be old irons on hand)	xx
Renewing upper part of parapet and glacis	1000.00
Repairs bh of covered way & main work	200.00
Repairing side arch of entrance, turning inner large arch of entrance and roofing in same----	500.00
1 main gate, 2 side doors for entrance, hinges, etc.	300.00
Planking & repairing bridge	150.00
Completing cunette (about ½ still incomplete)	1000.00
Regrading ditch	400.00
Filling in & grading & grassing glacis	1000.00
	8227.07
Add for contingencies	772.93
Total	9000.00

Not included in the proposed work was repair of any of the cracks in the scarps or counterscarps.(71)

3. Department Approves Primes Proposal

On March 11, the Department approved Prime's proposals for the completion of the Redoubt, except for the eight sets of barbette

(70) Humphreys to Prime, Dec. 24, 1867, NA, RG 77, Ltrs. Sent, Chief Eng.
(71) Prime to Humphreys, March 3, 1868, NA, RG 77, Ltrs. Rec'd Chief Eng.

platforms. This project was to be held in abeyance until "the sufficiency" of the existing platform's, structure was determined by tests then in progress. (92)

4. Annual Report for Fiscal Year 1868

At the end of the year Prime submitted his annual report.

Report of Operations at Advanced Redoubt, Barrancas, Pensacola Harbor, Fla. for the fiscal year ending 30th June 1868

Operations under authority form Executive Department were commenced on 11th of March under the immediate supervision of Bvt. Major Suter. The parapet of the work had been raised some four feet by merlons to form embrasures & the exterior slopes deepened so as to procure a greater thickness, thus throwing from this mass of earth a greater thrust on the scarp of the work than had been intended. The cracks in the scarp rendered the removal of this earth desirable, which with the surplus earth, was all removed and used to grade the ditch, and the interior of the work brought to the original design.

The /breast/ height wall of the work was repaired except at the recesses for the guns, which were not touched though cracked in places, as the building of gun platforms had been postponed by instructions until the coming fall - The masons have in addition to these repairs, completed the masonry of main entrance & half of the cunette of which the foundation of concrete had been laid before the war, such other repairs of scarps, counterscarp & breast-height of covered way were made as were needed, but nothing has been done to the cracks which have been developed in the scarp wall.

Shutters have been provided to close the flank embrasures, gates of main entrance made, hung & painted; standing portion of bridge & the drawbridge rebuilt; machinery of draw put in order---- Grading & sodding of ditch & two single caponniers completed--- Glacis graded & sodded as far as it was found necessary---- Fence built except entrance gates & about 1/5 of top rails.

During the present fiscal year, the fence will be completed - also wood work etc. of magazines which only require the

(92) Humphreys to Prime, March 11, 1868, NA, RG 77, Ltrs. Sent, Chief Eng.

work progress made during the year. He reported that at the Redoubt,

> "Arches of three gun recesses given away. Great deal of the brick work needs repointing. Slopes in very good condition but contains a good deal of rubbish---- Two of the angles of the scarp wall cracked same as those of Barrancas." (73)

Progress at the Redoubt consisted of

> "Wood work of magazine repaired---- Bridge repaired---- Ventilators & Gratings put in Magazine - Masonrey /sic/ repaired." (74)

3. Termination of Construction

Official reports for the years from 1870 to present do not mention any substantive further work at the Advanced Redoubt from which it is to be concluded that from 1870 on the fort was allowed to deteriorate to its present condition.

(73) Damrell to _____?_____, June 30, 1869, NA, RG 77
(74) Ibid,

A. Summary of Documentary Information - Chronological History of the Advanced Redoubt of Fort Barrancas

1843 - To fund construction of the Redoubt, necessary for affording protection to the Navy Yard, an appropriation of $25,000 was requested by Chief Engineer Totten on November 2, 1843.

1844 - In 1844 the site for the Redoubt was located and approved, and prepatory operations looking toward its early construction commenced.

1845 - General Totten on November 1, 1845, notified the Secretary of War that work on the Redoubt was underway, and the excavation for the Foundation partially completed. A railroad, 4,000 feet in length, had been built to transport building materials from the wharf to the site. The wharf had been extended and repaired.

To fund the project, an appropriation of $50,000 for Fiscal Year 1846 was requested.

1846 - General Totten on November 10, 1846, advised the Secretary of War that the excavation for the foundations had been "very heavy." The masonry of the foundations had kept pace with "the excavations, following them closely,... to prevent the caving in of the sides." About two-thirds of the counterscarp and galleries had been completed. The drains and connected countermine gallery had been built.

To complete the masonry, leaving only the formation of embankments, and the completion of details, to be provided for by subsequent appropriations, would require a liberal appropriation, but budgetary limitations imposed because of the Mexican War caused the Chief Engineer to pare his request to $40,000.

1847 - General Totten in mid-November 1847, advised Secretary of War Marcy that during the year work had continued, "and much of the more difficult and expensive parts of this construction have been executed." The counterscarp of the Redoubt had been completed, except the coping, along with its gallery, and casemates of reverse fire. Nearly all the earth necessary for the glacis had been positioned; the galleries of communication under the ditch had been completed; the scarp of the northwest bastion raised to the height of the cordon; the scarp of the right bastion about one-third built; the foundations of the curtain laid; and the piers of the scarp casemates along the curtain, and in the northwest bastion, carried to the full height.

The appropriation of $40,000 for Fiscal Year 1849 would enable the construction crew to complete the masonry.

1848 - During the year the sand for the glacis was positioned, and a surplus accumulated for the main rampart. Only 1,300 cubic yards still remained to be removed from the ditch. Sand had also been piled on the terreplein of the covered way in readiness "to be formed into the proper planes."

The counterscarp and underlaying gallery, and casemates of reverse fire had been completed, except for the coping of the former and the pavement of the latter.

The communication tunnels under the caponniers were completed, and sand sufficient to finish the caponniers stockpiled.

The scarp of the south front had been raised to reference 22¼', and the piers of the first tier sustaining arches raised to their planned height. The scarp of the west front had been raised to reference 33'; the piers and arches of the lower tier completed, and the piers of the second tier raised to their proper height. The scarp of face and flank of northwest bastion had been raised to the reference of curtain and southeast bastion raised to reference 33' and the piers of same raised to their desired height. The scarp of east front had been raised to reference 26' - 8", and the piers and arches of first tier completed, and the piers of the second tier raised to their proper height.

The ditch of gorge and part of the foundations of counterscarp of gorge had been excavated.

1849 - Due to the small amount of money available to him Chase was unable to accomplish much during the year.

During this year, a drain was laid, the ditch excavated and planted

1850 - with grass, and the embankment of the two capponiers completed and covered with grass.

1851 - 1854 - No work undertaken in these years.

1855 - Construction resumed in 1855, and the workmen proceeded "as rapidly as the warm season and high prices would allow." By the end of September the counterscarp gallery had been paved, the wall coped, the scarp of the west face raised six feet; some work done on the gorge, counterscarp, covered way, terreplein, and glacis of west face; and large quantities of materials collected.

1856 - The artisans and laborers spent most of their time on the masonry, "earthwork being only undertaken when indispensable in itself, or when made necessary by the progress of the masonry. During the year there was laid 1,554 cubic yards of brick masonry and 863 yards of concrete. The scarp wall at all points had been raised to reference 39', and the upper casemate arches of the scarp galleries completed."

The counterscarp of the gorge was finished, and all the breast-height wall of the covered way, except a gap of 193 feet, necessarily left open until completion of the project.

Newton's men by the late summer of 1857 had "carried up" the scarp wall to the corridor; and completed the galleries of reverse fire, the

scarp galleries, the casemates of half bastions, the stone steps therein, the masonry of the traverses, and the paving of one of the subterranean galleries. The covered way, except for a little grading and "the grassing" of the terreplein, was finished as it could be, pending construction of the parapets. The interior roofs were ready for application of asphaltic mastic.

1858 - Lt. F. E. Prime replaced Captain Newton as project engineer at Pensacola on March 4, 1858.

During the year ending September 30, 1858, all masonry "without the ditch," was completed, and also "within the ditch, except a part of the breast-height wall, the main entrance and the platform for barbette guns. All joints of coping in the main work had been caulked with bitumen, the covered way and traverse put in grass, the terreplein and parapet of the main work largely embanked, the glacis graded, and the magazines finished.

1859 - Fiscal Year 1859 found the breast-height wall completed, the cunette finished for half its lenght, and the concrete foundation of the remaining one half laid. Considerable earth had been embanked in the terreplein and parapet, the masonry of the gateway nearly completed, and the lumber for doors, gates and drawbridge purchased and on hand.

To complete the project $24,000 was needed, $13,500 in construction funds and $10,500 for acquisition of several private buildings near the barracks.

1867 - During these years the fort was completed except for laying the traverse stones.

1868 - Excess earth added to the parapets during the Civil War was removed; the breast-height wall was repaired; the masonry of the main entrance was completed; half of the cunette was built, using the concrete foundations completed before the war; flank embrasures were shuttered; main entrance gates made, hung, and painted; the standing portion of the bridge and draw-bridge rebuilt and the draw machinery put in order; grading and sodding of glacis, ditch and caponniers completed; and glacis fence nearly completed.

1869 - During the year the wood work of the magazines was repaired; ventilators and gratings put in magazines; magazine doors completed including locks and nettings; and repairs were made to the bridge and masonry.

B. GENERAL DESCRIPTION

The consideration of terrain and military functions that dictated the placement of the Advanced Redoubt of Fort Barrancas also dictated its design. It is trapizoidal in shape, laid out symmetrically around an east-west axis. The main work supports the terreplein and parapets of the ramparts and a parade. It is surrounded by a dry ditch, a covered way, and beyond that a glacis. The fortification faces north, west and south and access to Redoubt was from the east by a bridge from the covered way across the ditch to the level of the parade.

In essence the main work of the Redoubt is a raised mound held in place by a masonry structural system of interconnected sustaining arches devised to retain the loose sand that is the natural soil of the area. The interior construction contains galleries and casemates and is protected by a scarp wall. The counterscarp, which also contains small arms galleries and casemates, is more conventional in design and supports the covered way.

The west face of Redoubt is 12^{o} off true north, facing slightly southerly. On the exterior, it measures 185 feet. The north and south faces form 105^{o} angles with the west face. Both measure 140 feet and terminate towards the east in half bastions. The salient angles of these are 80^{o} and their east faces and flanks measure 60 feet and 15 feet respectively. The curtain between the half bastions is 130

feet wide on the west and south while on the north it is 30 feet wide. Towards the east the ditch varies in width from 25 feet to a maximum 37 feet at the recess of the half bastion.

The covered way along the outer side of Redoubt has a general width of 30 feet. North and south covered ways have two traverses each with crotchets and banquettes. Towards the east the covered way measures 25 feet and opposite the sally port of the main work expands into an equilateral triangular Place of Arms. Throughout it is defined by the coping of the counterscarp and the 4 feet 6 inch high breast-height wall that defines the inner limits of the glacis. Due to the irregularities of the terrain, the glacis varies considerably in width from a 70 feet minimum towards the north to a 220 feet maximum towards the southeast.

The arched sustaining structure of the main work is one story on the east and two stories on the north, west and south. On the latter three sides it is topped by the earth embankment of the parapet.

The upper "roof" level contains the parade. It is defined by the curtain wall on the east and on the other three sides the raised embankment of the gun positions of the terreplein. Fronting the latter, a breast wall 4 feet 6 inches high and 31 feet back from the face of the scarps retains the sand parapet. This parapet slopes down 10½ feet to the top of the cordon of the scarp along the west face and for

approximately 3/5 of the length of the north and south faces. On the eastern 2/5's of these faces, the scarp wall has been built up on an incline above the cordon to meet the top level of the masonry parapet, the masonry breastwalls of the terreplein, the breastwalls of the half bastions and the top of the curtain all of which have the same elevation.

From the parade, staircases in the north and southwest corners lead down to the second story of the main work. In each half bastion there is a magazine and 5 moderately sized casemates. Four casemates served as garrison quarters and one, behind the flank face of the half bastion, held a howitzer positioned for sweeping the ditch. Continuous small arms galleries along the outer sides of Redoubt connect the two casemate areas. Loopholes through the scarpwall allowed for small arms coverage of the covered way. On the east, inside the scarpwall, there is a pit for the drawbridge flanked by 3 vaulted bays. These are interconnected but walled off from the casemates on the same level under the half bastion.

The lower story along the outer faces of Redoubt served a structural function mainly. It was designated as a mining gallery but was not used for communication purposes.

Under the salient angle of both half bastions staircases lead down to a vaulted corridor or caponnier that passes under the ditch and leads to the small arms gallery of the counterscarp. The counterscarp gallery runs along the north, south and west ditches and connects the

casemates and magazines located under the north and south corner of the west covered way with the casemates of the main works. The function of the counterscarp gallery was to cover the ditches with small arms fire. The casemates and their magazines provided the facilities for howitzer positions directed to sweep the outer ditches of Redoubt. A doorway centered in the west counterscarp wall provided a secondary access to the interior in order to move ordnance in and out of the counterscarp galleries.

The primary access to the main work, as mentioned previously, was by a bridge system across the east ditch to the sally port centered in the east curtain. For about 2/5 of the width of the ditch the bridge was stationary and rested on the east counterscarp and bridge piers. A draw extended from the stairway section then the sally port and across the 9 foot underpit that is located behind the sally port. The draw was pivoted around a horizontal axis set in the jambs of the sally port. It was designed and so _____ that the outer section of the draw closed the sally port opening _____ pivoted in to a vertical position while the inner section tipped into the pit. Above the pit the walls that define it are carried up to _____ of the coping of the scarp.

They are pierced by _____ openings to the south, west and north that _____ access process the drawbridge when down to the parade level. The walls also provide _____ for the housting mechanism. Although the bridge is now no longer in existence, of the masonry piers of the bridge are still extant and all other masonry parts of its construction still stand.

The parade, which was intended to have (and for its greatest extent still has) the same elevation as the top of the cordon, is 14 feet and 3 inches above the east ditch, in front of the curtain. At the flanks of the half bastions, the ditch slopes gradually down 5 feet toward the north and south. At the salient angles a 5 foot high extension of the scarp forming a caponniere connects the salients with the counterscarp walls of the north and south ditch and provided a protected cover from the two staircases (pas de souris) that connect the moat level with the covered way. The top of the caponneire wall is 15 feet 2 inches below the top of the cordon. The ditches to the north and south slope gently downward from the top of the caponniere wall to a level that varies from 23 feet to 24 feet below the top of the cordon, and continues across the west face of the main work at this level. The caponniere wall is the highest and only exposed part of the construction of the corridor that passes below and across the ditch. The passage-way of the caponniere has the lowest elevation of any accessible part of the fort and is drained by a masonry duct that opens into a cunnette in the lower section of the ditch. The cunette is centered in the north, west and south ditches and from its northwest corner leads out under the covered way and the glacis in a northwesterly direction.

The continuous counterscarp wall defines the outer edges of the ditch and retains the covered way. By design the counterscarp varies considerably in height from 6 to 16 feet and through the partial destruction of its upper portion and the consequent displacement of

fill, from a low point in the east ditch of 1 foot 8 inches to 15 feet 7 inches at the northwest corner of the ditch. The covered way above the counterscarp was by intent to be on the same level on all sides of Redoubt except where it was interrupted by the previously mentioned traverses. From the coping of the counterscarp the covered way sloped gently upwards to a continuous banquette fronting the breast wall. The banquette was an earthwork construction except within the crochets where it was built of masonry. The top of the breast wall that stood 4 feet 6 inches out of the ground was 1 foot below the top of the cordon of the scarp and 8 feet above the coping of the counterscarp. Its height provided ample protection against enemy fire for movements on the covered way and still allowed for sweeping the glacis from the higher elevation of the main work. As mentioned previously, the glacis was of varied depth due to the irregularities of the terrain and for the same reason had a reverse slope only towards the east and west.

C. CONSTRUCTION MATERIALS

Redoubt is a brick and concrete construction. The latter material was not employed extensively in masonry forts prior to the period of construction of the Redoubt and therefore, represents an innovation. It is not much in evidence as it was used below ground in footings, under earth fill in covering brick vaulting and behind brick as a core for walls. Where it does appear on the surface in the bottom of the cunnette and in some of the loopholes it appears to have been composed of cement, sand, crushed bricks and oyster shells.

The brick varies in color but is generally a medium reddish buff, fairly soft, uneven in texture, and very porous. The brick masonry is laid in common bond with every 4th course a header course. Cordons, coping and parapets have roller, runner and header courses, laid up in 3 foot segments, interrupted by expansion joints. The mortar is a pale gray near white lime mortar. The exposed joints are tooled. On the exterior, the masonry was left unpainted while the interiors in the small arms galleries were whitewashed. A light gray granite is sparingly employed for steps exposed to weather, for outer corners of the cordon and at the sally port for the masonry that took the stresses of the drawbridge and of its hoisting mechanism. The building is completely free of architectural embelishment and for its effect relies upon bulk, logic and workmanship. In Redoubt the latter is of a high order.

D. STRUCTURAL SYSTEM

Although the use of concrete was innovative, the structural systems employed throughout in the arches, vaults, and the retaining walls of Redoubt are conventional. The application of these masonry structural systems to the special and difficult conditions of the site however, is ingenious and of considerable interest.

The soil of the area is a fine sand. It has a good bearing capacity when compacted and confined, but when not restricted it is very unstable in both its dry and drenched condition. It drains easily and

where it is not exposed to wind and weather quickly reaches a state of equilibrium. It absorps direct impact well but is sufficiently fine grained to be wind blown under normal weather conditions. Exposed surfaces require vegetation cover to hold them in place. There is considerable variance in weight between the dry and wet stages of the sand.

To hold the 30 foot high mound of the main work with this unstable material in place, the military engineer Joseph Totten devised a structural design that relied upon the sand's tendency to seek its own equilibrium when undisturbed. It consisted of a double tier of open ended interconnected vaulted bays along the outer three sides of Redoubt and a single tier toward the east. The height of the vaults and the depth of the bays were established from the slope of the sand when it was at rest.

The bays on both levels are interconnected by arched openings to allow a perimetor passage through the structure. In the lower tier the passage way was thought of as a mining gallery and used only in case of emergencies or for inspection of the structure. Here the sand was allowed to flow unrestrictively and reaches the perimeter of the bay leaving only a crawl space between the bays. The upper tier served both as a small arms gallery and as a covered communication way between the casemates of the half bastions. Here the concept of the design was modified by building a 5 foot high retaining wall transversely across the center of

each bay to keep the sand from flowing into the outer half of the bay. The roof surfaces of the vaults were covered with concrete and waterproofed. The concrete was laid with a pitch towards the interior of the main work and water was allowed to drain into the uniform sand fill of the interior without any attempt to channel or duct it. In the original plans, leaders were built into the piers of the casemates of the half bastions as part of a channelled drainage system. This was determined to be impractical as sand would clog the drains and change the valleys between the vaults into small reservoirs. To escape, water would have to seek its way down through the masonry of the work. This was not desirable so a modification was made to the vault surfaces of the half bastions to discharge the water into the sand fill on the interior of the work.

The 20-odd feet high scarp wall enclosing the interior structure of vaulted tiers is not bonded to it and is structurally independent of the sustaining vaults. The sole function of the scarp was to provide protection to the interior structure and sand fill against weather and, of course, arms fire. With its retaining wall function diminshed, the scarps stability could be insured with a lesser use of material than otherwise would have been required.

The structural system of the counterscarp with its galleries and casemates is more conventional in its approach. The lesser height of the counterscarp walls as well as the relatively small amount of fill it had to support, compared to the scarp wall of the main works,

allowed it to be designed along more conventional principles. The vaulting, backwalls of galleries, casemates, piers, and counterscarp wall are constructed as an integral structural system, bonded together and self-supporting.

The breast wall of the covered way and of the terreplein of the main work were designed as retaining walls. They are structurally independent of the scarp, the interior structure of the main work, and the counterscarp.

E. EXISTING CONDITIONS

Redoubt is still in a fairly good condition considering its age and its many years of exposure to neglect and vandalism. It exhibits several instances of masonry failure most notably in the north scarp walls and in the northwest corners of the main works. Although similar conditions, if less consequential, can be observed along the south scarp and in the counterscarp.

It appears the pressure of the sand fill within the main work of Redoubt combined with unequal thermal expansion and the deterioration of the masonry fabric caused by leakage and aging of the mortar has produced a thrusting outward movement and a corresponding lateral expansion action on the interior structure, which like a harmonica fold held in place at the lower end tends to fold out. It is exerting

pressure on the exterior scarp walls. These in turn have cracked and moved out from their rearward leaning position to one near vertical and in case of the north scarp wall, has bulged in a horizontal plane. The cracks vary in width from hairline to 2 1/2 inches at the most serious condition of the northwest corner. Settlement can be observed in both the horizontal and vertical plane. On the interior structure the movement has produced a flattening of several of the vaults as well as a lateral crack at the weakest point of the interior structure, the arch passage interconnecting its tiers. Caused by this movement, or possibly causing it, the retaining walls of the upper tiers have in several instances failed allowing a free flow of the sand fill. There is also evidence of failure of the waterproofing and of leakage through the masonry fabric of the structure. It is notable that the 9 existing sink holes in the sand parapet of the rampart correspond to failures of the retaining walls and evidence of leakage in the vaulting below and the size of the sink holes is relative to the seriousness of these conditions. The settlements have also cracked the masonry of the outer tiers that support the arches of the passage way at both the northwest and southwest corner of the main works. The crack is hairline towards the interior and from 1/16 to 1/4 of an inch toward the scarp wall.

In the galleries and the casemates of the counterscarp construction there is a cracking of the vaulting parallel with the outer face of the wall. It is not continuous and unlike the failures of the main

work does not show appreciable settlement. The cracks in the counterscarp wall proper are all hairline and in its upper courses. They can be attributed to thermal expansion and weathering of the joints.

With two exceptions in the main work, the cracks are all weathered and from current observation there is no indication of recent movement of the structure. In contemporary accounts of the construction there are references to settlement of footings of the inner structure of the main works, pressure on the scarp wall, and a failure of counterscarp construction. They are identical to the conditions that can be observed today, and from these accounts and present appearance it can be assumed that the structure of Redoubt has reached a state of equilibrium. Under normal soil conditions this certainly would be the case.

However, the fill, a loose fine-grained and unstable sand, has flowed into and filled cracks as they opened from thermal expansion and prevented their contraction. Although it can be said with certainity that Redoubt at present is not in danger of serious structural failure, whether or not the continual wedging effect of the sand fill will endanger the stability of the structure in the future cannot be determined through brief field observations. It is necessary to monitor the structure over a long period with accurate and detailed measurements of the masonry failure cracks to determine what additional measures may need to be taken to preserve the continued integrity of the structure.

Although Redoubt was completed, the fortification at present has some of the appearance of an unfinished building project. During the

past several decades, the site and surrounding area was allowed to go into bush and supported until the late summer of 1974, when all but the glacis was cleared, a dense woody growth with several sizable trees. Through deterioration caused by this vegetation, weathering, vandalism and lack of any sort of maintenance, parts of the original fabric have been lost. The coping of the counterscarp has been preserved in its entirety on the north side of the fort only, fragmentarily towards the south and not at all toward the west and east. Additionally, on the latter side the top 30 inches of the wall is missing. The breast-height wall and the traverses of the covered way are similarly preserved in fragments only. With the loss of these walls there has been a shifting of the fill and considerable changes to the original grade. The cordon of the coping of the scarp walls has a number of areas where the weakening of the mortar through the action of weather and vegetation has caused the bricks to be dislodged. In one area alone, as many as 36 bricks are missing considerably reducing the weathering capability of the walls. Many of the loopholes and other openings in both interior and exterior walls have been damaged by weathering and vandalism and now lack structural integrity.

Similar conditions have resulted from the systematic mining of Redoubt for all metals and woodwork of its interior and exterior. With the single exception of the hoisting mechanism for the bridge, the structure is bereft of all hardward, shields, grills, shutters, gates, magazine liners and of the bridge proper. The stripping has

in most cases left ajoining masonry badly damaged or destroyed as is the case of the magazines and the bridge piers.

In two areas of the east moat thoughtless burning of trash during the recent brush clearing operation against the masonry walls has produced spalling brickwork and has insured preservation problems.

For a period, in recent decades, target shooting was practiced against the east face of Redoubt and the curtain still exhibits the pitted brickwork that resulted from this use.

In all magazines there is severe spalling of the interior brickwork. The spalling process appears now to have been arrested. Its cause may have been a Civil War. The burning out of the magazine is possibly the effect of trapping moisture in the masonry by a complete waterproofing of the walls and vaults surrounding the magazine.

More recently in an effort to prevent unauthorized entry into the fort, 10 openings in the exterior walls of the counterscarp have been bricked in. The new brickwork is set in cement mortar and in addition to marring the ajoining original brickwork it will also be difficult to remove without causing further damage to the original fabric.

All exterior walls are badly weathered and the deterioration of mortar unchecked by any maintenance since initial construction can be observed throughout Redoubt. Pointing has been lost and the joints

in some areas eroded as much as three inches. This deterioration, the disintegration of cordons and copings and the failure of the water-proofing over interior construction is producing a gradual weakening of the masonry fabric. That is a threat to the integrity of the structure and more adverse to its preservation than the previously mentioned structural failures.

In recent years, probably during the 30's, some effort was made to stabilize the fortification. It was not completed and in some instances had an adverse effect. Where copings and parapets were rebuilt, expansion joints were omitted and a hard brick was used, set in cement mortar. Subsequent thermal expansion caused cracks that in a number of cases were carried through the new work and into the original fabric. Besides faultiness of workmanship this construction activity also produced instances of reconstruction, such as the traverse walls, in variance with the original condition.

F. RECOMMENDATIONS

A field and documentary source study of the Advanced Redoubt of Fort Barrancas has established that the fortification was completed and a loss of historic fabric now evident in the standing structure is largely contributal to neglect and vandalism. From field observations, paired with analysis of detailed historical accounts of the building's construction, it has been concluded that Redoubt is structurely stable. The existing flaws of the construction are essentially the same as those

noted during the course on initial construciton and do not show an appreciable change from that time. To halt further loss of fabric and to diminish the rate of deterioration, proposed work can, with a few exceptions, be limited to masonry stabilization, waterproofing, improvement of drainage and vegetation control.

To facilitate supervision, routine maintenance and eliminate the effect of destructive vegetation the glacis is to be cleared of woody growth and movable ground cover established on all soil slopes within and around the fortification. In order to reduce the possibility of vandalism, controled assess and better security closure of Redoubt is also necessary.

Controlled access and security closure will be limited to the reconstruction of the bridge across the east ditch, replacement of the masonry fill of the entrance to the counterscarp gallery of the west moat with wooden gates and the removal of the modern walls that currently block free passage through the counterscarp gallery.

Following the stabilization it is recommended that a long term monitoring system be devised of all structural failures of Redoubt. It shall include "Tell Tales" of all cracks and careful and accurate measurements of any possible changes to the structure so that guidelines

can be established for future preservation efforts should they be necessary. The work proposed accordingly is:

1. Clean areas of deteriorated masonry joints of exterior walls and repoint same. Grout all cracks with a plastic lime filler.

2. Repair of all copings, cordons, and other horizontal masonry surfaces exposed to weather. The work will include reseting of loose and replacing of missing bricks, repointing of joints, grouting of expansion joints and the dampproofing of all the horizontal masonry surfaces of cordons, copings and walls.

3. Repair damaged loopholes, archways, and piers to prevent loss of structural integrity. Replace missing and damaged bricks of arches, and sills and repair the slits of 35 loopholes throughout Redoubt. It will also include the repair of arches and piers of the interior structure.

4. Waterproofing of galleries and casemates of both sides of north ditch. The work will require the excavation of the masonry structures that are to receive the waterproofing, their repair and their plastering. After the waterproofing the fill will be returned to its original grades.

5. Repair walls and pavements of the interior of the main work to revitalize the sustaining structural system. Repair 16 retaining

walls of the upper tier of the interior of the main works, and re-establish pavements of 15 of the bays, and in the casemates under the half bastion, spot repair to steps and pavements.

6. Reconstruct bridge and provide gates for access and security. Work on the bridge will include rebuilding the demolished piers, the wood structure of the bridge proper as well as the mechanism for hoisting and lowering the bridge. The gateway centered in the counterscarp of the west ditch will be opened and wood doors installed. All other blocked openings in the exterior walls will remain as they are.

7. Clear glacis of woody growth and restablish the historic grades of counterscarp and ditch.

8. Establish grass over on all soil slopes within and around the fortification.