The Halifax Citadel, 1825-60:
A Narrative and Structural History,
by John Joseph Greenough
September 1974

Part 2
Volume 2
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Introduction

The structural chapters of this report are intended to provide the reader with the most important documents, plans and photographs associated with the construction of each of the major features of the fort. The documents and plans mostly cover the period 1828-56, although, in some instances, more modern plans are included to throw some light on the subsequent evolution of the individual building or feature.

The structural chapters are, with two exceptions, set in a standard format. Each is provided with a brief introduction describing the construction of the feature under consideration. These introductions assume a familiarity with the narrative part of the report. The remainder of each chapter is given over to texts having some bearing on the subject. The four most common sources for the texts are the 1836 estimate for completing the Citadel, the 1843 estimate for alterations and renewals, the 1846 supplementary estimate, and the 1856 committee report. At the end of each chapter is a selection of plans and photographs, as well as a bibliography of the major plans in the National Historic Parks and Sites Branch collection bearing on the subject of the chapter. Further information about these plans may be found in the general plan bibliography.
following this part of the report. Each chapter is interiorly cross-referenced as an aid to the reader.

Two chapters - those on the trace and the glacis - deviate from this format. The first is intended as a general introduction to the building of the fortress and recapitulates briefly the material treated at length in the first part of the report. It also includes a summary of the major features of the Citadel, giving the dates of construction of each and a short bibliography of ground, surface and block plans and sections (1825-1950) which illustrate the evolution of the entire fort. The chapter on the glacis is necessarily brief because there is little detailed information on the subject.

Despite the enormous amount of primary material on the subject of the Citadel, the structural chapters contain a surprisingly large amount of conjecture on my part. The reason for this is that the documentary material, though extensive, is almost all of the wrong sort for the purposes of structural history. The entire absence of annual estimates before the late 1850s and of structural progress reports is much bemoaned in the following pages. In all instances I have indicated clearly what conclusions are conjectural. Comparison of the evidence presented in this report with the Citadel itself as it now stands might, in some instances, lead to the formulation of more certain conclusions.

This part of the report is intended to deal almost exclusively with the structure of the Citadel. There is a minimum
of material on subjects such as the use of the buildings and casemates, the way the casemates appeared when they were occupied by troops, or the day-to-day routine of the fortress. These subjects, and many others, will need more research and will require an additional report.

**Editor's Note:** We have tried, in preparing this report for publication, to keep as close a correspondence between quotations and their manuscript sources as the vagaries of 19th-century clerks, the exigencies of type, and human error would permit. In the case of the estimates quoted below, we have altered the format to one which will, hopefully, be simpler to read than the original, but we have made no intentional changes in content.

It should be noted that, in 19th century reports and estimates, "9.6" (or any number similarly expressed) is likely to mean 9 ft. 6 in. rather than 9.6 feet.
1 General Discussion

The evolution of the trace can be divided into three periods. In the first, Colonel Nicolls formulated his initial design, and, after some experience with the construction, altered parts of it. In the second, Colonels Boteler and Jones and Captain Peake re-designed much of the work, and after a lengthy and complicated series of events, succeeded in settling the general outline of the fort as it now stands. In the third period, Colonels Calder and Savage made suggestions to improve the design still further, and succeeded in making many alterations.

Nicolls's original design was for a fort in which the opposite fronts were identical. There were four demi-bastions of the same dimensions; two curtains (east and west) and four ravelins, one opposite each front. The whole was surrounded by a ditch bounded by a counterscarp and by a gallery containing casemates of reverse fire, opposite the four bastion salients. Countermines were placed at regular intervals along the gallery.

The interior of the fort, because of its shape, was cramped. A large portion of the available space was taken
up by two cavaliers and the powder magazine. The latter, a survival from the previous fort, was located at the southern end of the east curtain. The two cavaliers were both to be in the north end of the fort. They were to be of identical size, each containing seven two-storey casemates, and were to face west and north.

Beneath the ramparts, Nicolls placed 16 casemates of defence in pairs, two flanking each of the ravelin ditches. These were intended primarily for defensive purposes, although they could also be used for accommodation and storage.

The western ditch was flanked by a caponier which led from the west curtain to the guardhouse in the gorge of the ravelin opposite. This ravelin was flanked by two rudimentary places d'armes, one above each counterscarp re-entrant.

Nicolls proposed three major alterations to this basic scheme. On a suggestion from the Assistant Inspector General of Fortifications, he rearranged the cavaliers, placing three of the casemates intended for the north cavalier in the south end of the fort, and leaving the remaining four in their original location. He altered the trace of the northern front slightly to allow the inclusion of an old well within the bounds of the fort. This was the origin of the asymmetrical shape of that front and the off-centre re-entrant angle of both the front and the ravelin opposite.

Nicolls's most radical alteration was his proposal for
a redan on the eastern front. This was also at least partly out of consideration of the water supply, since it allowed yet another old well to be included in the body of the fort.

The disasters of the early 1830s led to a re-examination of the whole design. When the controversy was finally settled in 1838, fundamental changes had been made. The north and south cavaliers, the caponier and the places d'armes were all discarded. The counterscarp gallery and the ravelin guardhouses were redesigned. The casemates of reverse fire were abandoned and only half the countermines (those on the north and west fronts) were retained. The old magazine was judged unfit, owing to its location and height, and replacement magazines were designed for the gorges of the western bastions.

The most fundamental change was the introduction of dwelling casemates. Of Nicolls's original 16 casemates of defence, 4 had disappeared with the introduction of the redan. To the 12 remaining were added an additional 26, including 12 two-storey dwelling casemates in the redan. The west cavalier was retained, but was slightly re-designed to include cooking casemates at each end.

After 1838 there were no essential alterations to the shape of the fort. In 1843 Colonel Calder added a number of features, including 19 casemates, storage cellars (under the redan), the magazine porches and the rooms over the cavalier cooking casemates. He also re-designed the roofs of the
magazines and ravelin guardhouses.

In a later estimate (1846) Calder attempted to provide for the services needed for the proper functioning of the fort, including tanks and drains for the water supply, lightning conductors for the magazines, and flagging for the magazine areas. These proposals were, in the end, all altered to meet changing conditions. The whole of the water supply system, for example, was changed several times before the final version, a complicated system of drains and storage tanks, was installed in the early 1850s.

Calder's final contribution to the site was a major redesigning of the west ravelin, which, because of earlier collapses, had to be rebuilt. At this time (1846) the final form of all three ravelins was settled. The guardhouse ditch was the most important addition Calder made to the two existing ravelins.

After 1850, all changes were made in response to the needs of the moment. The final version of the cavalier roof and chimneys, for example, was arrived at in a desperate attempt to keep the barrack space in the building dry.

2 Summary of the major features of the Citadel

I have included the date in which each was designed and the subsequent fate of each.
Casemates: 16 provided in 1825 estimate, of which 12 were built and the remainder abandoned because of changes in the shape of the work; 28 additional casemates provided in 1836 and 19 in 1843-46; no record of the remaining two casemates. There was a total of 60. (For further comments on the number of casemates, see "Casemates," below.)

Caponier: Provided in 1825 and deleted in 1835. Not built.

Cavalier (north): Provided in 1825 and deleted in 1835. Not built.

Cavalier (south): Provided in 1828 and deleted in 1835. Not built.

Cavalier (west): Provided in 1825; built, 1830-31; altered twice in the 1840s and again in 1856.

Cellars (off redan area): Provided in 1843 and built before 1848.

Countermines: Provided around the whole of the ditch in 1825; those on the east and south fronts deleted in 1835; remainder built in late 1830s.

Counterscarp and gallery: Provided, along with casemates of reverse fire, in 1825; design altered and casemates deleted, 1836; the whole built in stages, partly to the original design and partly to the altered design, between 1829 and 1848.

Curtain (east): Provided in 1825; deleted upon the introduction of the redan, 1831.

Curtain (west): Provided, 1825; built, 1830-31.

Demi-bastion (northeast): Provided, 1825; altered into a salient by the introduction of the redan in 1831; constructed in stages
between 1830 and 1846.

**Demi-bastion (northwest):** Provided in 1825; constructed in 1828-30; partly reconstructed subsequently.

**Demi-bastion (southeast):** Provided in 1825; altered into a salient by the introduction of the redan, 1831; constructed 1830-42.

**Demi-bastion (southwest):** Provided in 1825; constructed in 1828-30; partially reconstructed subsequently.

**Magazine (1812):** Constructed in 1812; judged unsuitable in 1832; demolished, 1847.

**Magazines (north and south):** Provided in 1836; built in 1842-44; altered subsequently.

**Ravelin (east):** Provided in 1825; deleted in 1831-32. Not built.

**Ravelin (north):** Provided in 1825, begun in 1831; altered and completed subsequently.

**Ravelin (south):** Provided in 1825; built in late 1830s.

**Ravelin (west):** Provided in 1825; built in 1829; redesigned in 1846; torn down and rebuilt, 1848-49.

**Redan:** Proposed in 1831; provided in 1836; built in 1839-43.

**Retaining wall:** Provided in the 1836 estimate; built between 1841 and 1848; top and coping altered, 1851-53.
Ground plan of the Citadel in October 1828 (plan 01-1828-10-1). This plan shows Colonel Nicolls's original design. It was drawn at the end of the first working season and shows the progress of the work. It also shows the proposal to split the north cavalier. The original north cavalier (marked "A" and "I" on the plan) was to be divided into the two sections marked "A" and "K". (Public Archives of Canada.)
Ground plan of the Citadel, September 1831 (plan 01-1831-9-1A). This plan shows Colonel Nicolls's original proposal for the redan. It also shows the north front as redesigned and the two asymmetrical re-entrants. (Public Record Office.)
"Citadel Halifax N.S. to accompany Return Shewing the proposed Appropriation...", 1849 (plan 01-1849-1-1).

The Citadel in its final form. Owing to the difficulties encountered in keeping the casemates from leaking, another seven years were to pass before the work was considered complete. (Public Archives of Canada.)
**Plan Bibliography**

Note: Because of the subject of this chapter, the entries in the following bibliography are confined to general, block and ground plans and sections of the Citadel which shed some light on the evolution of the work, building usage, etc.

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<td>01-1825-12-5</td>
<td>Similar to No. 1 above, with some variation in individual features. No. 1 is closer to Nicoll's intentions.</td>
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12 04-1843-5-1: General plan of the north end of the fort, showing the casemates added by Calder in 1843 (Part 1, Fig. 8).
13 01-1846-3-1 and 3-1A: Two versions of a block plan illustrating the services provided in the 1846 estimate.
14 01-1847-12-1: A ground plan. The modern re-drawing of this plan (12-1A) has made it the most familiar of all the Citadel plans. It is also one of the best.
15 01-1848-12-1: A ground plan showing the casemate numbering system in use at the time, and an early proposal for the water system.
16 01-1849-1-1: Ground plan showing the contemporary casemate numbering system (Fig. 3).
17 01-1849-4-1: Ground plan showing drains and casemate numbering system (Fig. 45).
18 01-1849-4-2: Surface plan, cut away to show the casemate dos d'anís (Fig. 34).
19 01-1849-4-5: Surface plan showing drains (Fig. 46).
20 01-1852-4-1: Record plan of the ramparts (Fig. 90).
21 02-1852-4-2: Eight sections and elevations keyed to No. 20.
22 01-1856-5-1: Ground plan to illustrate the 1856 commission report (Part 1, Fig. 12).
23 01-1858-8-3: Surface plan showing the water system as constructed (Fig. 47).
24 01-1862-13-1: Surface plan of ramparts.
25 01-1871-4-1: Surface plan showing armament.
26 01-1874-1-1 and 1-1A: Surface plan showing an armament proposal (Fig. 91).
27 01-1891-10-1: Ground plan detailing casemate allocation.
28 01-1891-11-1: Block plan showing building allocation (Fig. 51).
29 01-1907-13-1: Block plan showing building allocation.
30 01-1908-4-1: Ground plan showing drainage, etc.
31 01-1908-8-1: Ground plan showing building allocation.
32 01-1922-1-1: Ground plan showing space allocation.
33 01-1933-6-1: General plan to accompany report on progress of an unemployment relief project.
34 01-1950-7-1 and 7-1A: Ground plans: 7-1A was drawn for submission to the Massey Commission.
1 General Discussion
The present cavalier is one of three originally planned for the Citadel. It was begun in 1830 and was virtually complete by 1832. In its initial form it consisted of seven two-storey casemates surmounted by a parapet and terreplein, with positions for seven 24-pounder guns on traversing platforms (see Fig. 4 and section 2, below). The front of the building was provided with a two-storey colonnaded verandah, open at both ends.

In the course of the 1830s, several alterations to the original design were proposed. The alterations finally accepted were detailed in Colonel Jones's revised estimate (see section 3, below, and Figs. 5 and 6). These consisted of four small casemates placed in pairs at each end of the building at right angles to the existing casemates. The purpose of these additions was twofold: to provide the cooking facilities needed for the garrison, and to "give the additional support [the cavalier] appears to require before it can be safely loaded with its Terreplein, or guns mounted on it." The verandah was extended to include the additions, and the verandah staircases were moved to each end.
Final approval for the provisions of Colonel Jones's revised estimate was not forthcoming until the summer of 1838, and the additions were not actually constructed until 1840-41. In the meantime, a temporary wooden roof was constructed, apparently to keep the body of the building from being damaged too much by the weather. There exists no documentation whatever for this roof, but it was apparently a hipped shingle roof. (See Part 1, Fig. 10.)

In Jones's plan for the end casemates, the space above the casemates had been left unfinished, apparently for use as storage. In 1846, Colonel Calder proposed to use this area for accommodation and prison cells. The space over the south casemates was to be fitted up as a suite of three rooms (quarters for the Director of Signals and the Regimental Sergeant Major and an orderly room) and the space over the north casemates as cells for solitary confinement. The latter consisted of six arched cells linked by a corridor. Access to both ends of the cavalier was by means of a door leading to the verandah stairwells, (see Fig. 7 and section 4, below.) Calder's proposal was approved, and the additional rooms were constructed around 1847.

As long as the Citadel remained incomplete, no one gave much thought to the problem of preparing the cavalier for its armament. Down to 1846, the only covering of the dos d'anès was the glazed tiles provided for in the original estimate. These were inadequate either to bear the weight
of the terreplein earth and the guns, or to keep the case­mates underneath staunch. As long as the building was covered by a timber roof, no problems arose, but it was obvious that this state of affairs could not continue indefin­itely. When Calder framed his armament proposal in 1846, the problem became urgent, and he inserted an item in the 1846 supplementary estimate for completing the platform and building the curbs for the traversing platforms\(^3\) (see Fig. 8 and section 5, below). The dos d'anès were to be covered with ironstone flagging laid in Roman cement, and the terre­plein filled in with earth and broken stones. (For details on the curb and armaments, see "Ramparts and Armament".)

The cavalier was thus provided with the same type of dos d'ane covering as the rampart casemates, and with the same result: it leaked. In the end, all the expedients tried on the rampart casemates were also used on the cavalier, including counterflagging, alterations in the drainage system, and, ultimately, asphalt (see "Casemates"). At some point, presumably around 1850, the timber roof was removed, making the problem even worse. Exposed to the elements, the cavalier leaked like a sieve, partly as a result of the inadequacy of the staunching expedients, and partly, one supposes, because the masonry of the building had been neglected for almost 20 years. By 1854 the casemates were uninhabitable because of the damp, and serious consideration was being given to a proposal to tear the building down
altogether⁴ (see section 8, below.) The Ordnance department would not, however, allow such a drastic step. In the end, Colonel Stotherd installed a permanent timber roof. As it extended to the edge of the parapet (the earlier temporary roof had apparently only covered the terreplein,) it interfered with the workings of the chimneys and these had to be raised⁵ (see Fig. 9 and section 7, below.)

Stotherd's alterations severely affected the utility of the cavalier as a gun platform. The armament had been mounted in 1853, but the addition of the permanent roof and the raised chimneys made it impossible to fire the guns. Indeed there was some doubt expressed as to whether the guns could be fired safely. Although the 1856 committee claimed that the guns could be worked, no one seems to have had the courage to find out.⁶ The armament remained in place at least until 1860, and possibly until much later.

I have not been able to ascertain when the cavalier was first occupied as a barracks. There are suggestions in the correspondence that there were soldiers quartered there as early as 1845, and it was certainly occupied by 1848. An estimate was submitted in September 1854 for re-positioning the casemate stoves for greater warmth⁷ (see Fig. 10 and section 6, below). Two months later, the casemates were pronounced uninhabitable because of the leakage, but the permanent roof, installed in the summer of 1855, and the repointing of the masonry carried out at the same time
effected a substantial improvement. A second inspectional report, dated June 1856, states that the building was only slightly damp, and anticipates further improvement (see section 8). At this time the cavalier housed 280 NCOs and privates, as well as a staff sergeant in the rooms over the south cooking casemates.

In 1875-77, the top of the cavalier was converted into a barrack (see Figs. 12 and 13). This radically changed the shape of the building. The rooms over the north end casemates were altered to provide access to the new top storey, and the height of the roof was raised. It would seem that the gun platform was altered only by the removal of the guns (if indeed they had not been removed earlier). The tops of the casemates were filled in to provide a level surface which was then floored over. The curbs and pivots were left in place. At least some of them are still there.

2 Summary of structural information

There are no written sources for Nicolls's original design for the cavalier. The only reference to it in Nicolls's general estimate for the Citadel is an entry which reads: "Two Casemated Cavaliers, one to hold 32 men, the other captain, subaltern, with storerooms, mounting on the top 7-24 prs £18,126/17/8". The other cavalier referred to was, of course, the one intended for the north end of the fort.

The only major source of information on Nicolls's
intentions for these buildings is the plans drawn to accompany the estimate. \(^{10}\) A brief digest of the information contained in these plans is included below. It must be noted that there is little evidence of how closely these specifications were followed in the actual construction of the building. Indeed there is every indication that Nicolls altered his design in the course of construction. The specifications given below must therefore be checked against later plans of the building to decide which of them are accurate.

Brief digest of information.

**Overall dimensions** (excluding verandah): 166 ft. x 50 ft.

**Casemate dimensions:** lower story, 41 ft. x 18 ft. x 9 ft. high; upper storey, 41 ft. x 19 ft. x 10 ft. to the crown of the arch and 6 ft. 6 in. to the spring.

**Verandah:** two-storey, colonnaded; each storey 166 ft. x 10 ft. x 9 ft. high. Two staircases between the storeys, located between the second and third casemates from each end. (The verandah was later extended and the staircases moved to the ends.)

**Arches:** seven in number, each 2 ft. 8 in. thick, with a span of 19 ft.

**Dos d'anès:** seven in number, each a maximum of 2 ft. 4 in. thick above the crown of the arch. (They were probably thickened in the course of the waterproofing experiments carried out later.)

**Front wall:** 4 ft. foundation, 3 ft. thick; height not given on plan.
Pier walls: 2 ft. foundation, each 4 ft. thick at the lower storey and 3 ft. at the upper.

The parapet, parapet wall, terreplein and staircases leading to the roof were not constructed as shown on the plan.

3 Report and estimate for the addition of the cooking casemates, 1836

The information contained in this estimate for the cooking casemates, kitchen equipment and colonnade floors is accurate. That for the completion of the platform can, I think, be disregarded.

Mens' Cavalier

Item 15

This provides for completing the present Cavalier as a Soldiers' Barrack according to the original Project and Estimate; as also for adding Cooking houses at the North and South ends, in the manner shown on Plan No. 1, and the annexed Sections.

Two floors to the Colonnade of 2 inch plank laid on inches joists 10 x 4, 200 feet long and 10 feet wide. - The lower floors of the Barrack rooms each 45 feet long by 18 feet wide with 2 inch plank on joists 10 inches x 4. -

A flat roof to Colonnade. Two flights of stairs communicating to the upper story formed in the Colonnade.

28 doors and frames.
Iron work for bars, bolts, hinges &c.—Sheet lead for gutters, and Colonnade roof.—

The Masonry of the two additional Casemates to be as before described; the arches of brick of the dimensions shown in the Section.—

[Section of the additional casemates. Scale 10' = 1". Signed by Lt. Wentworth.]

The platform of the Cavalier to be completed by filling in with earth, broken stone &c.—length 160 feet, and 40 feet wide, and an average depth of about 1 foot 3 ins, to be paved with brick on edge.—

The new rooms over the additional casemates to have shingled roofs, floors of 2 inch plank on joists 8 ins x 4. The Kitchen to be flagged with iron Stone slabs.—

10 four pannel doors and frames.—10 sashes and frames.—Eight common doors and frames.

[East-west section of the new casemates. Scale 10' = 1". Signed by Lt. Wentworth.] The excavation is for the additional Casemates at each end of the Cavalier;—2 end walls 38 x 4 x 3;—4 abutments 18 x 7 x 3 and 2 centre piers 15 x 4 1/2 x 3.—

[Plan of additional casemates.] The Masonry is for the foundation of the above; viz. end walls 2(38 x 3 1/2 x 3);—abutments 4(18 x 6 1/2 x 3);—piers 2(15 x 4 1/2 x 3): and for walls above foundation 2(38 x 3 x 34) — abutments 4(18 x 6 x 21). — wall above abutments
4(18 x 3 x 13).- Piers 2(15 x 4 x 10). Filling in or loading over arches 2(38 x 15 x 1 1/2); 4(15 x 4 x 2) and 2(15 x 10 x 4) This loading is principally to assist as a Counterpoise against the pressure of the arches already built.- The 299 perches of brickwork are for the arches of these additional Casemates, 4(15 x 28 x 2.3) the span of the arch being 17 feet.- The workmanship on face of walls is for the additions at each end of the Cavalier 2(86 x 34).- The facia & Cornice is for the front and end of the Colonnade.- The plastering is for the ceilings of the lower rooms and upper story of Colonnade.- Before the cooking houses can be considered complete there will be required in addition to the above;-

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<th>Weight (cwt)</th>
<th>Unit Price</th>
<th>Total Price</th>
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<tr>
<td>123 perches of brickwork in setting boilers and building chimney flues</td>
<td></td>
<td></td>
<td>30/-</td>
<td>184.0.0</td>
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<td>20 Cast Iron boiler plates 1: 1: 0</td>
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<td></td>
<td>30/-</td>
<td>37.10.0</td>
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<tr>
<td>each; 25 Cwt</td>
<td></td>
<td></td>
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<td>20 large Hoppers 1: 0: 0</td>
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<td></td>
<td></td>
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<tr>
<td>each; 25 Cwt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 small Hoppers 0: 1: 20 each; - 25 cwt</td>
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<td></td>
<td></td>
<td></td>
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<td>8 lbs each 560 lbs</td>
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<td></td>
<td>6d</td>
<td>14.0.0</td>
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<tr>
<td>20 wrought iron ribs and fixtures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Cast iron boilers 1':6&quot; deep,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1':4&quot; wide and 1':10&quot; long</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 feet sup. 13/8 ins thick, 14 lbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>per foot, 30 Cwt</td>
<td></td>
<td></td>
<td>30/-</td>
<td>45.0.0</td>
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*[Numbers in brackets altered in ms. - author's note.]
20 cast iron grates with doors etc. complete for heating boilers 0: 3: 7
each 16 Cwt 1 p 30/- 24.7.6
20 sheet iron covers to boilers 6 lbs
each 120 lbs 3d 1.10.0
40 wrought iron dampers for flues
280 lbs 6d 7.0.0
Total for fitments for Cooking houses £356.4.8 [370.4.8]

Length of brickwork for boilers 2(34 x 5 x 3).-
do - chimney flues 4(10 x 9 x 1.9) & 4(24 x 2 x 2).
280 double cantilivers - 7:14 each 2205.0 -
42 right single do - 6:7 540.12 -
42 left single do 6:7
Pins & nuts 3 to each Man 2:11 a set men
322- 865.6 -
322 curved rails - 4:11 each 1590.6 -
322 open shelves - 15.4 - 4910.8 -
90 Cwt. 10031-0 - 30/- 135.0.0
322 Iron arm bands at 6d each
including fixing.- 6d 8.1.0
14 rooms 23 men each.-
Total for Cantilivers &c. - £143.1.0
[Estimate]

**No. 15, - Men's Cavalier**

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<td>105</td>
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<td>1626</td>
<td>perches of Masonry in foundations and walls</td>
<td>$14/2$</td>
<td>1151.15.0</td>
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<td>37</td>
<td>Squares of Framing and laying sleepers</td>
<td>$13/-$</td>
<td>24.1.0</td>
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<tr>
<td>50</td>
<td>&quot; - of d° to Colonnade</td>
<td>$22/-$</td>
<td>55.0.0</td>
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<tr>
<td>89</td>
<td>&quot; - of 2 inch pine plank Flooring</td>
<td>$32/2$</td>
<td>143.2.10</td>
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<tr>
<td>20</td>
<td>&quot; - of flat Roofing</td>
<td>$104/-$</td>
<td>104.0.0</td>
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<td>200</td>
<td>feet of Facia, headed and moulded</td>
<td>$8^d$</td>
<td>6.13.4</td>
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<tr>
<td>200</td>
<td>&quot; - Cornice -</td>
<td>$1/4$</td>
<td>13.6.8</td>
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<tr>
<td>288</td>
<td>sup. &quot; - &quot; - Stairs -</td>
<td>$11^d$</td>
<td>13.4.0</td>
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<tr>
<td>435</td>
<td>&quot; &quot; - &quot; - Inside and outside doors</td>
<td>$1/6^1_2$</td>
<td>33.10.7^1_2</td>
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<tr>
<td>420</td>
<td>&quot; &quot; - &quot; - door Frames</td>
<td>$7^1_2^d$</td>
<td>13.2.6</td>
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<tr>
<td>976</td>
<td>&quot; &quot; - &quot; - door &amp; window jamb Linings</td>
<td>$2^1_2^d$</td>
<td>10.3.4</td>
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<tr>
<td>754</td>
<td>square yards of lath &amp; plaster, 3 coats</td>
<td>$1/4$</td>
<td>50.5.4</td>
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<tr>
<td>68</td>
<td>squares of Furring for lathing</td>
<td>$7/3$</td>
<td>24.13.0</td>
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</table>
700 feet of pin rack 5d 14.11.8
650 yards of 3[2]* coat oil painting on new Work 8d[7d] 21.13.4
168 ins pans of glass 7 x 9 4d [18.19.2] 2.16.0
168 ins pans of glass 7 x 9 4d [18.19.2] 2.16.0
56 lbs of Putty 4d 0.18.8
336 -"- of wrought Iron 3d 4.4.0
11 Cwt of sheet Lead for Colonnade roof 32/6 17.17.6
5848 sup. feet of Workmanship on face of Walls 1/8 487.6.8
229 perches of Brickwork, in arches 30/- 343.10.0
1005 cubic yards of earth over arches 10d 41.17.6
675 sup. yards of brick on edge Paving 5/6 185.12.6
75 cwt sheet Lead, 10 lbs Per foot for gutters 32/6 121.17.6
15 squares of boarding and shingling 40/- 30.0.0
15 -"- of pine timber roofing 22/- 16.10.0
220 cubic feet of pine timber, in joists 1/1 11.18.4
14 1/2 squares of 2 inch pine plank flooring 32/2 23.6.5
27 tons of stone flagging 6/- 8.2.0
180 sup. feet 4 pannel framed doors 1/6 1/2 13.17.6
Report and estimate for building rooms over the cooking casemates, 1843

The rooms were built according to the specifications of this estimate.

Item 8

This item provides for fitting up six cells for solitary confinement and a convict room agreeably to the desire of the Major General Commanding and plan annexed to item 9. The most eligible place for this purpose appears to be over the cooking casemates.
house at the north end of the Cavalier for the former as each cell can be thoroughly ventilated.

The masonry is in the division walls, each 9.0 x 6.6 x 1.6, - in the front wall 42.0 x 8.3 x 1.9 and filling in between the arches.-

The brickwork is in the arches each 9.0 x 8.0 x 0.9.

A double door to each cell, the inner covered with sheet iron on one side and secured by two bolts on the other, the outer by a lock.-

The guardbed [?] 6 x 3 feet to have a frame of 6 x 4 ins. covered with 2 inch plank, grooved and tongued.-

The guardbed in the convict room or casemate 3.0 x 6.0 to be constructed in the same manner. - An additional 2 inch framed door, covered on the inside with sheet iron, secured with two bolts, and the window with iron bars 1 inch in diameter.-

<table>
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<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
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<tbody>
<tr>
<td>90</td>
<td>perches masonry in division, front walls, and between arches</td>
<td>14/2</td>
<td>63.15.0</td>
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<tr>
<td>19(\frac{2}{3})</td>
<td>perches brickwork in arches</td>
<td>30/-</td>
<td>29.10.0</td>
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<tr>
<td>68</td>
<td>cubic feet of timber in door frames and frames of guard beds</td>
<td>1/6</td>
<td>5.2.0</td>
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<tr>
<td>210</td>
<td>supl. feet of 2 inch pine framed door, flush on both sides</td>
<td>11d</td>
<td>9.12.6</td>
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</tbody>
</table>
3 squares 2 inch pine plank, grooved and tongued in guard beds

12 pairs 18 inch hook & eye hinges with screws and bolts

1 pair 12 inch do. do. do.

14 12 inch bolts on plates

6 12 inch iron rimmed locks

130 lbs. of sheet iron 1\frac{1}{2} lbs per foot to line doors

1 cwt. 1 inch round iron

[Total] £118.12.2

Contingent 1/10 11.17.2

[Total] £130.9.4

**Item 9**

This item provides for fitting up the room over the south cooking house as shewn on the accompanying sketch, namely to divide it so as to be appropriated to the purposes therein stated which were not provided for in the revised estimate.

The partitions to be lath and plastered.

<table>
<thead>
<tr>
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<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
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<tbody>
<tr>
<td>15\frac{1}{2}</td>
<td>perch. brickwork in chimneys</td>
<td>30/-</td>
<td>23.5.0</td>
</tr>
<tr>
<td>116</td>
<td>supl. yards rendering on walls,</td>
<td></td>
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</table>
Report and estimate for completing the cavalier platform,

The curbs and pivots were constructed according to the specifications of this estimate. The flagging may have been, at one time, laid as described here, but the arrangement was altered several times subsequently (see "Casemates").
Item 9 Mens' Cavalier

In Item 15 of the revised Estimate it is proposed to complete the platform of this building [the cavalier] but the only provision made for that purpose is to fill it in with earth, broken stone &. and laying the gutters with lead. The dos d'âne [sic] are at present covered with unglazed tiles which though they have hitherto answered the purpose (a wooden roof having been erected over the building for its preservation) will not bear the weight of the curbs to be laid for the Traversing platforms proposed to be mounted on the work, nor will they long resist the effects of wet should the roof be removed.

This Item is in consequence introduced to provide for covering the arches with strong flags on which the masonry to support the curbs can be placed with safety. see plan N° 10.-

The arches of the dos d'ânes to be covered with Iron stone flagging in roman cement viz 12/.40 x 12 and 2/.40 x 10 and ridges 7/40' x 1'.6" The filling in the formation of the banquette and terre plein was provided for under Item 15 of the revised Estimate of 1st February 1836. Provision is also made for setting 2 circular curbs & pivots for Traversing platforms and 5 segmental ones, as follows -

The foundations to be of Iron stone rubble masonry in lime mortar 2/50 x 3.2.-2/3.6 x 3 x 3: 5/39 x 5 x 2 and 5/- 7 x 5 x 3.
The curbs & flagging to be chiselled, secured with wrought Iron cramps run with lead got out of blocks 2/. 9 9 x feet 3 x 2, 5/4/: 10 x 3 x 1, and the flagging round pivots 5/7' 0"
 x 5'.6" x 1'.0, and 2/- 3'.6" x 3'.6" x 1' 0".-  The pivots to be of cast iron (of the approved pattern) painted, 4 oils, lead colour.

Men's Cavalier Flag covering to Dos d'anés, and curbs

for Traversing platforms

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<th>Cost</th>
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<tr>
<td>cubic feet of</td>
<td>1033</td>
<td>Granite stone set in mortar</td>
<td>1/-</td>
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<td>51.3.0</td>
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<tr>
<td>sup. yards</td>
<td>776</td>
<td>iron stone flagging &amp; counter flagging in cement (over dos d'anés.)</td>
<td>4/6</td>
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<td>174.12.0</td>
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<td>ft. sup. plain</td>
<td>452</td>
<td>chiselled work straight</td>
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<td></td>
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<td>30.2.8</td>
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<td>half plain</td>
<td>574</td>
<td></td>
<td>8d</td>
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<td>19.2.8</td>
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<tr>
<td>circular</td>
<td>673</td>
<td></td>
<td>2/-</td>
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37 holes jumped & shaped, and run with lead in platforms 1/6 2.15.6
14 holes cut in granite for iron pivots 10/- 7.0.0
37 lb wrought Iron in cramps 6d 0.18.6
112 Cwt cast Iron solid pivots 16/8 93.6.8

Add Contingent 1/10th 57.3.0\(\frac{1}{4}\)

\[\text{Total} = 628.13.4\frac{1}{4}\]

6 Report and estimate for altering the position of the stoves in the cavalier barracks, 1854½

The stoves were re-positioned as described here.

Special Service,

Report and Estimate

for altering the position of the stoves in the

Citadel Cavalier Barrack,

Halifax, Nova Scotia.
Amounting to 22.12.10 Sterling.

This estimate provides for the alteration of the Stoves in the Cavalier Barrack in the Citadel Halifax, is brought forward at the request of the officer Commanding the 76th Regiment, at present quartered therein and who represents that it is necessary in consequence of the extreme coldness of the rooms during the last winter. - The Stoves are at present remotely situated from the entrance doors, as shewn on the Accompanying plan, consequently the cold air entering thereby, and before it reaches the stoves, makes the outer end of the rooms very uncomfortable; to remedy which it is proposed to remove the Stoves to the position indicated in Yellow on the accompanying Plan. - This service is considered indispensibly necessary for the comfort of the Troops during the approaching winter, and is therefore brought forward for authority. There being no available funds out of which to defray the expense, it is therefore suggested that the amount, £22.12.10 be made chargeable on the incidental Item N° 48. - any excess on which will it is expected, be covered by savings on the authorized specific Items of the Barracks Annual Estimate for the Current Year. - The renewal of the upper floor boarding & hearths, Item 20. B.A.E. 1854-5, being now under execution, the alterations of the hearths can be effected without incurring any additional expense beyond the extra length of stove pipes which as also the alteration of hearths and
extra length of pipe for the ground floor, are herein provided according to the following detail.

Take down clean & refit stoves (14) and existing stovepipe. Take up and reset (7) brick on edge hearths in stone lime mortar. - Take up and refit (7) curbs to hearths and cut out and renew the floor boarding 7/6' x 4' (when hearths are removed) with 2" pine wrought rebated and fillitted [sic] and provide and fix 14/22 feet lineal of 7" sheet iron stove pipe. -

[Estimate]

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<thead>
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<th>Description</th>
<th>Unit Price</th>
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<td>Sup. yards Brick-on-edge paving</td>
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<td>taken up and reset in Mortar</td>
<td>2/- yd</td>
<td></td>
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<tr>
<td>7</td>
<td>curbs and fillets to hearth</td>
<td>3/- ea</td>
<td>£1.10</td>
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<tr>
<td>14</td>
<td>Stoves taken down, cleaned and refixed</td>
<td>1/6 ea</td>
<td>£1.10</td>
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<tr>
<td>308</td>
<td>feet lineal 7 inch Stove pipe N° 22</td>
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<td>£12.16</td>
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<td>208</td>
<td>feet lineal old stove pipe taken</td>
<td>1 1/2&quot;</td>
<td>£1.15</td>
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<tr>
<td>1 8/10</td>
<td>square 2 inch pine flooring, wrought rebated &amp; fillitted, in</td>
<td></td>
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<tr>
<td></td>
<td>making good under old hearths</td>
<td>30/- sqre</td>
<td>£2.14</td>
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Add Contingent 1/10th

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<td>£22.12.10</td>
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</table>
Report and Estimate for constructing a permanent roof, pointing the masonry, and altering the chimneys, 1855

The work was done as described here.

Mem

Forwarded to the I.G.F. with the C.R.E.'s Report No. 646

This Service approved by Order dated 28th July 1853

T 265 (See Page 262. Barrack letters rec'd.), and ordered by the Treasury to be executed as a Barrack Service

Barrack Special Service

Report and Estimate for roofing over the Cavalier at the Citadel, Halifax, N.S.-

Raising the Chimnies, & Pointing the Masonry, &c- &c

Amounting to £994.0.7 Sterling

This Estimate amounting to £944.0.7, Sterling, is submitted in obedience to the instructions of the Inspector General of Fortifications dated 2nd April, and the Boards' Order of 31st March 1855 657, with reference to the C.R. 1 Eng. Report No. 636 dated 8th July last.- It provides, under "Part 1-" for the construction of a Roof over the Cavalier to secure the Casemates against leakage from the top;— and under "Part 2," for raising the chimney
shafts so as to command the ridge of the proposed roof; pointing the defective joints of the masonry of the walls both externally and internally, and limewashing the interior of the Casemates, and painting the Work, which Services are essentially necessary in order to render the Casemates habitable.

Part 1. - Specifications

To provide and raise the East wall as shown on Plan from A to B, and in Section C, with brick work set in hydraulic Cement and fresh water Sand (in the proportion of $\frac{1}{2}$ Cement and $\frac{1}{2}$ Sand). - The chain & rafter plates to be bedded in hydraulic Cement ($\frac{1}{2}$ cement & $\frac{1}{2}$ Sand). To provide, frame and fix the roofing as shown in the drawing, the several Scantlings of which to be in accordance with those given in the Table on the drawing; and to be boarded outside with inch rough Pine, close jointed and shingled over with the best pine Shingles laid 4 ins to the weather, - the hips and ridge to have inch pine wrought saddle boards, and pine roll 3" x 3", wrought and rounded, sunk & fixed on top arris. - Gutters 6" wide to be formed at backs of chimneys with inch rough Pine on rough Spruce bearers 4" x 2", fixed on back of rafters. - To provide and lay milled sheet lead 7 lbs to the Sup foot in gutters & 5 lbs to step and top flushings round the chimneys. - To provide and fix cast iron eaves gutters 5" semicircular to eaves of new roof, at the East and West sides with cast iron water trunks (3 to
each side) $2\frac{1}{2}''$ bore with swan junctions at top and Shoes at bottom, the whole to be secured with proper wrought iron brackets and holdfasts.- The ridge capping, eaves, gutters & trunks to be painted 3 coats, common colours, in oil.

**Ordnance [actually Barracks]**

Special Estimate for roofing over the Cavalier at the Citadel, Halifax, Nova Scotia, and Pointing the Masonry &c - &c

<table>
<thead>
<tr>
<th>Part 1:</th>
<th>Roofing, Gutters &amp;c</th>
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<tbody>
<tr>
<td>11</td>
<td>Take up and reset Chimney Capping 10/- in Hydraulic Cement each 5.10.0</td>
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<tr>
<td>56</td>
<td>perches Brickwork in hydraulic Cement 38/- perch 106.8.0</td>
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<tr>
<td>266</td>
<td>feet lineal Cutting out for and bedding rafter plates in hydraulic Cement 4(\text{d f.}^{t}) 4.8.8</td>
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<tr>
<td>1309</td>
<td>Cubic feet rough Spruce Timber framed &amp; fixed 1(\frac{1}{2} \text{f.}^{t}) 76.17.2</td>
</tr>
<tr>
<td>163</td>
<td>(\frac{1}{5}) Squares inch rough pine boarding 12/6 sqe 102.0.0</td>
</tr>
<tr>
<td>167(\frac{1}{2})</td>
<td>-d(o)-shingling with clear pine split and shaved shingles 28/9 240.15.7(\frac{1}{2})</td>
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<tr>
<td>Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>301 feet sup. inch pine ridge Capping</td>
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</tbody>
</table>
Part 2.- Specification

To take up existing chimney capping. To provide & build chimney shaft to the height and sectional dimensions figured in the section, with brick work in hydraulic cement ($\frac{1}{2}$ cement & $\frac{1}{2}$ Sand), and to set the existing chimney capping on the same.- To rake out, pin & point the defective joints of the external face of the Masonry of E.W.N. and South walls with hydraulic Cement and Fresh water Sand ($\frac{1}{2}$ cement and $\frac{1}{2}$ Sand) to the extent of, on East wall 170' x 9',- West wall 170' x 20',- N. & S. walls 2/18'.0" x 12'.0", from which deduct doors 3/-7'..4" x 2'..8";- windows 39/-4' x 2'.- To rake out and point the defective joints of the internal faces of the masonry of the Casemates, (14) with Stone lime mortar to the extent of 14/-30' x 6'. window jambs 2/22/5'x2,- 2/28"-4'.4" x 5';- door jambs- 2/6/7'..6" x 2',- 2/6/-5' x 4'.- To rake out & point the defective joints of the brick arches of the upper Casemates (7) with hydraulic Cement ($\frac{1}{2}$ Cement & $\frac{1}{2}$ Sand) to the extent 2/7/12' x 27'. To scrape, brush, clean and lime whiten two coats, the whole of the walls, cienings [sic] & arches of the Casemates, agreeably to the following dimensions;- the lower floor walls 7/.117' x 9'..2";- cieing or [sic] underside of floors, 7/-41' x 18',- sides of joists, 36/2/7- 18' x 1'.- Walls upper floor, 7/-117' x 6',-7/-18' x 6'- arches 7/.41' x 27': add Window jambs & soffits 22/-14' x 2',- 28/.12'..9" x 5'..0";- door jambs and soffits 6/.19' x 2';- 6/.24' x 4',- from which deduct windows 22/5' x 4', 28/4'..3"
x 4'..0".- Doors 6/-7'..8" x 3'..4",-2/6/-7'..6" x 4'..0", and fire places 14/-4' x 4'.

To paint 2 coats, common colours in Oil on doors 6/2/-7"..0" x 3'..6", d^- frames 6/18'..9" x 0'..8", musket band rails, collected, 1120 feet, sash frames inside & out (50), 10 and under 20 feet sup., and on sash squares both sides 50/12,- and to provide & renew the locks on entrance doors, 6-10 inch iron rim dead locks, and 6 large thumb Latches.

The division of the service into two parts, is done with the view, should funds not be available, that the roofing & gutters might be authorised and executed before the winter sets in, so as to secure the building against leakage, and the pointing, whitewashing and painting &c- under Part 2 not being of a nature to be advantageously executed during the winter, may therefore be included in the Annual Estimate 1856-7,- and to be executed early in the ensuing Year, by which time the walls and arches in the interior will have become sufficiently dry to have the Service performed with the greatest advantage.

There are no funds available at the Station out of which the expense of the proposed Service under part 1 could be defrayed unless there might arise a saving on the O.A.Est. for 1855/6 which in the present state of the Works in progress cannot be foreseen with any degree of certainty.
Part 2. Estimate

Raising Chimneys; Raking Out, pinning and pointing &c,

\[
\begin{align*}
530\frac{1}{2} \text{ sup. yards raking out, pinning & c. pointing the joints of rubble Masonry with hydraulic Cement} \\
\frac{1}{2} \text{ Cement & } \frac{1}{2} \text{ Sand} & \quad \frac{1}{2} \text{ y.} & 30.18.11 \\
67 \text{ Perches Brickwork in hydraulic Cement} & \quad 38/-\text{-perch} & 127.6.0 \\
510 \text{ Sup. Yards raking out pointing joints of rubble Masonry with stone lime Mortar} & \quad 1/-\text{-y.} & 25.10.0 \\
504 \text{ Supl yards raking out & pointing joints of brick arches, with hydraulic Cement} & \quad 1/9 \text{ yd} & 44.2.0 \\
367 \text{ Squares Scrape and Lime White,} & \quad 1/3 \text{ sqe} & 22.18.9 \\
41 \text{ yards sup. 2 Coats Oil painting} & \quad \frac{1}{2} \text{ d.} & 1.5.7\frac{1}{2} \\
50 \text{ Sashes & Frames -"- from 10 to 20 feet} & \quad 1/9 \text{ d. ea} & 4.7.6 \\
50 \text{ dozen sash squares do.} & \quad 2/6 \text{ doz.} & 6.5.0 \\
1120 \text{ feet lineal painting musket band rail} & \quad 4^{d} \text{ f.} & 18.13.4 \\
6 \text{ 10 inch iron deal Locks & fixing} & \quad 12/6 \text{ ea.} & 3.15.0
\end{align*}
\]
The main casemates were numbered 1-14 and appropriated as soldiers' quarters for 280 NCOs and privates but were, "Unoccupied except 2 rooms on the ground floor occupied by Military Prisoners," the reason being that "A very considerable extent of dampness is observable in the upper rooms and which penetrates for the most part to the lower floor." The report concluded that, The dampness arises chiefly from the very defective masonry of the escarp and retaining walls which admit the wet through the joints so as to penetrate beneath the Asphalt. Owing to
the frost of the last winter, there is reason to believe that
the Asphalt is considerably injured beneath the earth of the
terreplein.

On the small casemates and upper rooms, the report
noted that the upper rooms in the south end were occupied by
one colour sergeant, one provost sergeant and the signal
director; the upper rooms in the north end by the cells, and
that, "there is no appearance of dampness in these rooms."
The two small casemates in the north end were in use as a
cooking kitchen and "Apparently in good repair," while the
washing room in the south end was in use as a temporary
forge for the Engineer department, and, as a result, the
interior was, "much discoloured from smoke." 10

1856 Report

The main casemates were reported to have 280 NCOs and privates.
There was a "slight appearance of damp on the external west
wall." The report noted:

This building has been covered with a shingled roof
and the top of the end and side walls with a composition
of pitch and tar covered with sand and fine shingle:-
The walls have been most carefully pointed, and I have
not a doubt but by attention to the pointing the building
will be kept dry and serviceable:-

One of the two small casemates in the south end was in use
as a cooking kitchen with five boilers; the other was being
"fitted as a Bakehouse with oven to Bake for 700 men." Both small casemates in the north end were in use as cooking kitchens with five boilers each.

The upper rooms in the south end were in use as a staff sergeant's quarters and those in the north end as prison cells.

Both end buildings were reported dry owing to their "being slated."
"Plan N° 3", 1825 (plan 03-1825-12-3). This was Colonel Nicolls's original design for the cavalier. The design was much altered in the course of construction. The terreplein and parapet were ultimately constructed in a somewhat different manner. There is no evidence that the staircases leading from the upper storey of the casemates to the terreplein were ever built; indeed, there is some mystery as to the mode of access to the roof before 1877. The most likely explanation was that a staircase was constructed through the south end wall leading from the upper storey of the southernmost casemate to the roof. (Public Record Office.)
Plan and section of the south cooking casemates, 1836 (plan 03-1836-2-2). These casemates were added to provide kitchen space. Structurally, they served as buttresses to the trunk of the building. The space over the arches was used for accommodation in the following decade. (Public Archives of Canada.)
Longitudinal section of the south cooking casemate, 1836 (plan 03-1836-2-14). The north cooking casemates were identical. (Public Archives of Canada.)
The rooms over the additional casemates to have underwood roof, floor of brick blanket 31 feet X 4. The kitchen to be flagged with iron stone slabs. 10 feet panel doors and frames. 10 dashes and frames. Eight common doors and frames.
"Sketch of the room over the South Cooking Casemate...", and "Sketch of the room over the North Cooking Casemate...", 1843 (plan 03-1843-5-5). The arches of the cooking casemates were sufficiently high that the floor level of these rooms was considerably above that of the casemated second storey adjoining them. The construction of these rooms, therefore, necessitated the addition of a third storey to the ends of the verandah. The cells over the north cooking casemate were demolished when the roof was altered in the 1870s. (Public Archives of Canada.)
Sketch of the room over the South Cooking Casemates, showing how it is intended to appropriate it.

To accompany Estimate dated 22. May 1803.

Scale 1ft. is an inch.

Sketch of the room over the North Cooking Casemates showing how it is prepared to fit it up for Cells for military confinement.

Scale 1ft. is an inch.

Cha[im] B[arre]t
Lt. R.E.

Signed:
[Signature]
22. May 1803.
"Plan and Section of the top of the Cavalier shwing [sic] the proposed Arrangement of Seven Guns also the Flagging and Counterflagging of Arches over the Existing Tiles," 1846 (plan 03-1846-3-11). The flagging and counterflagging detailed in this plan were ultimately superseded by other materials (most notably asphalt), but the curbs, pivots and racers were installed as shown here. (Public Archives of Canada.)
Plan and Sections of the Tonnage of the Cavaliers showing the supposed arrangement of compartments into the planning and carrying forward of Arrows over the Docking. To accompany the Supplementary Estimate. Dated 21st March 1855.

Plan

Sections

Scale of feet to foot south

Note: The small squares show the locations where the Arrows should only pass through, as mentioned.
"Sections of Cavalier showin [sic] the mode proposed for rendering the arches secure against leakage...", 1849 (plan 03-1849-4-4). This plan illustrates the drainage provisions of Colonel Savage's staunching estimate of 30 April 1849. It is not entirely certain how many of the proposals contained in this estimate were implemented. The main drain running under the parade, next to the verandah footing in the section, was built as shown, but it is not certain whether the interior down pipes or the verandah gutters were arranged as shown here. (Public Archives of Canada.)
"Plan shewing the proposed alteration of the stoves in Soldiers' Rooms," 1854 (plan 03-1854-9-1). This plan gives some idea of the basic layout of the barrack quarters in the mid-1850s. It is not entirely accurate. It does not show, for example, the divisions in the cooking casemates at either end of the building. (Public Archives of Canada.)
HALIFA AX NOVA. SCOTIA.
CAVALIER BARRACKS

Plan showing the proposed alterations in the position of
the buildings as directed herein.
To accompany the Council of Engineers Report
1859.
And the Special Regulations dated
1859.

REFERENCE.

The plans in the text are accurate
flats 1:10 inches on a scale similar
to 1:200. This plan shows
1. on the end and 5 & 6 the elevations
the existing position of the store
and a section of the alterations
7 & 8 and 9. These buildings
indicate the position of the
store and the direction and
width of the court. Their plan
indicates.

PLAN OF GROUND FLOOR.

Scale, 30 feet to an inch.

W. J. C. I.,

Commr. of Works

16 Sept. 1859.
"Plan and Section shewing the Proposed Roof for Covering the Cavalier," 1855 (plan 03-1855-6-1). This plan shows the permanent roof and enlarged chimneys constructed in the summer of 1855. Although the section does not show gun positions, they were certainly extant by this time. The guns were also on the roof, although it is uncertain whether or not they were mounted. (Public Archives of Nova Scotia.)
HALIFAX, NOVA SCOTIA.
CITADEL, FORT GEORGE.

PLAN AND SECTION SHewing THE PROPOSEd ROOF
FOR COVERING OVER THE CAVALIER

To accompany the Special Estimate and the
Commanding Royal Engineer's
Report dated 20 June
1866.

[Signature]

PLAN shewing proposed roofing to cover
over the terreplein and
walls of the cavalier

Transverse Section shewing
proposed roof B C

Scale for section 1/2 inch = 1 ft.
12 "Plan of Cavalier in Citadel," 1877 (plan 03-1877-7-1). Plans and sections of the cavalier after the alteration of the upper storey and roof in 1875-77. Note the alterations to the rooms over the cooking casemates produced by the new arrangement. The stairs leading to the upper storey, which were added at this time, still provide the means of access to the cavalier roof. (Public Archives of Canada.)
Photograph of the cavalier, about 1880. This photograph clearly shows the enlarged roof after the conversion of the top storey to barrack space. The bottom two storeys of the building had not changed appreciably since the mid-1850s.
Plan bibliography

1  03-1825-12-3: Nicolls's original plan of the cavalier (Fig. 4).

2  03-1825-12-4: A variation on the above, also signed by Nicolls. This plan provides some additional information on the intended layout of the chimneys.

3  02-1825-12-2: Elevation of the cavalier as originally designed; included in Nicolls's sections of the entire work.

4  02-1832-2-2: Longitudinal section of the cavalier; included in Colonel Boteler's sections of the Citadel.

5  02-1832-4-2: Two south end elevations of the cavalier.

6  03-1834-3-7: Plan, two sections and elevation of the cooking casemates as proposed by Colonel Jones, included in the first version of the revised estimate.

7  03-1836-22: Plan and section of the cooking casemates, included in the approved version of the revised estimate (Fig. 5).

8  03-1836-2-14: Longitudinal section of the south cooking casemates from the approved version of the revised estimate (Fig. 6).

9  03-1843-5-5: Plan of the rooms over the south cooking casemate, and plan and section of the cells over the north cooking casemate (Fig. 7).
10 03-1846-3-11: Plan and section of the cavalier platform from the 1846 estimate (Fig. 8).

11 05-1847-4-1: South end elevation of the cavalier, from a plan illustrating the demolition of the 1812 magazine (Part 1, Fig. 10).

12 01-1849-4-2: Surface plan of the Citadel, showing the ramparts cut away to show the casemate dos d'anès beneath. This plan was drawn for Colonel Savage's 1849 staunching estimate. The cavalier platform is shown along with the rampart casemates, and an insert shows the second storey of the building. This plan suggests that a staircase in the wall between the southernmost two-storey casemate and the cooking casemate adjoining provided access to the roof (Fig. 34).

13 03-1849-4-4: Two sections of the cavalier, also from the 1849 staunching estimate, detailing the proposals for waterproofing and drainage (Fig. 9).

14 02-1852-4-2: Two sections and elevation in a set of general sections and elevations of the Citadel (very small scale).

15 03-1854-9-1: Ground floor plan showing proposed re-location of the stoves (Fig. 10).

16 03-1855-6-1: Plan, section and reference notes for the permanent roof and enlarged chimneys (Fig. 11).
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<thead>
<tr>
<th>No.</th>
<th>Date</th>
<th>Description</th>
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<tr>
<td>17</td>
<td>03-1875-10-1 and 10-2:</td>
<td>Plans of the proposed conversion of the cavalier roof into a barrack.</td>
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<tr>
<td>18</td>
<td>03-1877-7-1:</td>
<td>Record plan of the conversion (Fig. 12).</td>
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<td>19</td>
<td>03-1921-3-3:</td>
<td>Plan of the conversion of one of the casemates into a grocery bar.</td>
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<td>20</td>
<td>03-1924-10-1:</td>
<td>Plan of new roof.</td>
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<td>21</td>
<td>03-1925-6-1:</td>
<td>Three plans, two sections.</td>
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<tr>
<td>22</td>
<td>03-1945-12-1:</td>
<td>Plan and elevation.</td>
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<tr>
<td>23</td>
<td>03-1945-12-2:</td>
<td>Three elevations.</td>
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1 **General Discussion.**

In 1812, Gustavus Nicolls, then only a captain, received permission to build a stone powder magazine within the crumbling walls of the third citadel. Thirteen years later, when Colonel Nicolls drew up his plans for the present Citadel, he retained the old magazine within the new fort. Although the magazine was inconveniently located and was, in fact, higher than any part of the ramparts, Nicolls's desire for economy prevailed over any other consideration.

It was not until after Nicolls left Halifax that anyone questioned the wisdom of his decision. In his first report to London, Colonel Boteler condemned the building as being too small and dangerously situated.\(^1\) When he drew up his estimates for the completion of the Citadel in the autumn of 1832, he provided for the construction of new magazines. In his first estimate, Boteler submitted a design for two magazines, one in each of the western bastions. Each magazine consisted of a pair of subterranean casemates.\(^2\) In his second estimate, which was drawn up as an expression of his own personal preferences, he modified this somewhat.

Only one of the magazines was, he felt, absolutely necessary,
and he proposed to place it in the southwest bastion. The cost was estimated at £3,128 4s 0\(\frac{3}{4}\)d for one or £6,256 4s 1ld for two.

Captain Peake, who succeeded Boteler, was not convinced that the old magazine needed replacing. In his set of estimates, drawn up early in 1833, Peake provided only for a retaining wall for the old magazine, arguing that the wall would be sufficient to make the building convenient and safe. Peake, like Nicolls, put considerations of economy before everything else. In any case, he was merely a junior officer, and his opinions carried little weight with the Fortifications department. The necessity of replacing the old magazine was accepted, and it was left to Colonel Jones, Peake's successor, to draw up the final estimate.

Jones was initially inclined to follow Boteler. The first version of the revised estimate (1834) repeated, almost verbatim, the proposal for two casemated subterranean magazines (see Fig. 14). This, however, did not satisfy the Inspector General of Fortifications, who thought that it would be impossibly difficult to ventilate a subterranean magazine properly. Jones eventually substituted a design for two above-ground magazines, each enclosed by an area wall and located in the gorge of one of the western bastions.

The Inspector General had one major reservation about the design. He thought it unnecessary to buttress the magazine, and requested that the estimate be once again
revised. Jones made the necessary revision, and submitted the estimate for the third time in December 1836.

The final design called for two identical, arched, bombproof magazines, each entered by a door in the south end of the building (see Fig. 15 and section 4, below). The design was approved in 1838, and the buildings were constructed in the early 1840s. Colonel Jones's successor was not, however, entirely satisfied with them. In his 1843 estimate, Colonel Calder proposed the addition of north-end doors, porches and shifting rooms. At the same time, he proposed to renew the magazine roofs; they had been covered with tiling laid in cement, but this arrangement had failed. (See section 5 below and Fig. 16; for the shifting rooms, see "Casemates".)

Calder's proposals were accepted, but work had still not begun on the alterations when Calder sent in his second supplementary estimate in March 1846. In this he brought forward two incidental services for the magazines and areas: the addition of lightning conductors for the magazines (see Fig. 17 and section 6, below), and flagging of the areas. The former was accepted, but the Inspector General suggested the substitution of asphalt for flagging as paving in the magazine areas.

As work was beginning on the alterations to the new magazines, the history of the old (1812) magazine came to an inglorious end. By the spring of 1847, it looked a little
forlorn, sitting incongruously on top of a miniature hill, ten feet above the level of the parade. On 7 April it was demolished (see section 3, below, and Part 1, Fig. 10).

By 1850, all the alterations and additions proposed in Calder's two estimates had been carried out. Two of them had not been particularly successful. The asphalt, which had been applied to part of one of the areas in the autumn of 1849, proved to have little resistance to the ravages of the Halifax winter. It cracked every time the temperature fell below freezing. The lightning conductors refused to stay attached to the building. Other problems, however, were of greater importance at the time, and neither matter was attended to for several years. Indeed, despite the gloomy initial report on the usefulness of asphalt, the north magazine area was asphalted annually in the early 1850s. There is no indication that the same was done to the south magazine area.

In the course of the 1850s, several further alterations and renewals became necessary. In the autumn of 1852, the floor of the north magazine failed and had to be rebuilt. (Apparently there were no alterations made in the structure of the floor at that time, although it is difficult to be certain because the estimate for the service has not survived.) In 1853, the floor of the south magazine was similarly renewed. At about the same time, the arrangement of the powder racks was altered in both magazines (see Fig. 18).
Finally, in 1859 a proposal was put forward for the installation of adequate lightning conductors in the Civil Buildings Estimate for 1859-60. The proposal was accepted (see Fig. 19 and section 7, below).

There were apparently no further major alterations to either of the magazines until the late 1890s. By then, neither was of much importance to the garrison, and a proposal to convert the north magazine into a canteen was accepted (see Figs. 21 and 22).

There remains the problem of the splinter-proof magazines. An item was inserted in the annual estimate for 1861-62 for "Two splinter Proof Traverse Magazines." Unfortunately the detail of the estimate is missing, as this was a re-submission of an item included in the estimate for the previous year, which has not been located. These magazines were intended for the traverses of the northern and southern fronts. There is no evidence that the magazines were ever built, and the matter would be of little importance were it not for the fact that there are two structures extant, both in approximately the right locations, which might be the magazines. As these structures have been kept covered with earth for several years, I have not been able to identify them, nor has any other researcher. On the chance that these structures should be the splinter-proof magazines, Figures 24 and 25 are included in this report, these being the only documents about the structure which we possess.
2 Summary of structural information

The following section represents an attempt to consolidate the known facts about the structure of the north and south magazines as finally constructed. The main sources used are the 1836 estimate (section 4), the 1843 estimate (section 5), and the 1882 plan (Fig. 20). Where there are variant figures from two different sources, both sets are given. In most instances, the figures from the 1882 plan are the most accurate, but exceptions are noted.

Exterior dimensions (excluding porches)
68 ft. x 42 ft. 4 in. (1836).
68 ft. x 42 ft. 6 in. (1882).

Walls and Foundations
Side Walls
Length: 68 ft. (1836).
Foundation: 9 ft. 4 in. wide x 4 ft. deep (1836).
Wall: 8 ft. 8 in. wide x 8 ft. high (1836).

End walls
Length: 25 ft. (1836).
Foundation: 4 ft. 6 in. wide x 4 ft. deep (1836).
Wall: 4 ft. wide and 15 ft. mean height (1836).

The end walls are coped at the top along the raking eve. This
is not mentioned in the 1836 estimate and not shown on the section within the estimate. It is, however, shown on both the 1858 and 1882 plans.

Joist wall

**Length:** 60 ft. (1836).
**Width:** 2 ft. 6 in. (1836).
**Depth:** 4 ft. (1836).

The joist wall was intended as a support for the floor and ran from end wall to end wall. It was not shown on the 1882 plan. It is therefore unlikely to have ever actually been built.

Material

All walls and foundations were built of masonry, type and quality unspecified (1836).

Roof

There were three main elements in the roof. The magazine itself was covered by an arch; this, in turn, was covered by masonry to form a medium gable roof; finally, roofing material was placed over the masonry. The layer between the arch and the outer surface of the roof was called a dos d'ane by the contemporary engineers.

Arch

**Length:** Not given in 1836 estimate; presumably about 64 ft.
Span: 25 ft. (1836), 25 ft. 6 in. (1882).

Thickness: 3 ft. (1836), 1 ft. 4 in. (1882).

Material: Brick.

It is unlikely that the figure given in the 1882 plan for the thickness of the arch is from actual measurement. It is therefore impossible to ascertain which figure is the correct one. Possibly neither is.

Dos d'ane

The only figures which can be ascertained without measurement of the plans are for the maximum thickness (i.e., between the crown of the arch and the ridge of the roof) and these, naturally, are contradictory. The 1836 estimate gives the distance as 5 ft. 6 in. and the 1882 plan gives it as 6 ft. 6 in. As the 1882 figure is not sufficiently great to make up the difference between the two figures for the thickness of the arch (1 ft. 8 in.), it would appear that neither the arch nor its masonry covering was built to the thickness recommended in the original estimate.

The remainder of the masonry covering varied in thickness according to the distance between the slope of the roof and the arch. At its thinnest, at the mid point of the slope, it was less than 2 in. thick (1836).

The type and quality of masonry used was not recorded in the estimate.
Roofing

Type: Duchess slate laid in cement (1886). In 1843 a method of fixing the slates with rafters and boards was substituted.

Porches These first appear in the 1843 estimate. Unfortunately the text of the estimate states that the dimensions are given on the plan annexed to the estimate. None of the surviving plans has the dimensions, so that one must rely on the 1882 plan which, fortunately, seems to agree with the original specifications in most respects.

The porches are something of a miniature edition of the magazine itself. Both are covered by arches which in turn are covered by masonry. In both cases the end wall is coped along the raking eve.

Dimensions

Exterior: 10 ft. 6 in. x 6 ft. (1882).

Interior: 6 ft. 6 in. x 4 ft. 6 in. (1843). The 1882 plan agrees.

Foundations

The only information given in the 1843 estimate is that the foundations were constructed of masonry, type and quality not specified. The 1882 plan shows a section of the end wall, including foundation. The latter is approximately 4 ft. deep and 3 ft. wide (figures from measurement of plan).
Walls

End walls: (i.e., walls parallel to magazine wall). $8\frac{1}{2}$ ft. high x $1\frac{1}{2}$ ft. thick (1843). The former appears to be a mean height figure, while the latter is confirmed by the 1882 plan. The 1882 plan also shows the end wall coped along the raking eve, although this is not mentioned in the 1843 estimate.

Side walls: 7 ft. high x $2\frac{1}{2}$ ft. thick (1843). The 1882 plan shows the walls as 2 ft. thick.

Material

Masonry, type and quality not specified (1843).

Roof

Like the magazine itself, there are several elements in each porch roof. First there is a brick arch; above that, a masonry covering forming a gable roof; above that, a slate roof held in place by rafters and laths.

Arch: Built of brick; 1 ft. 2 in. thick (1843).

Dos d'ane: Listed in 1843 as 6 in. thick. This was apparently the mean thickness (1843).

Rafters: Each 3 in. x $2\frac{1}{2}$ in. (1843).

Laths: Each $2\frac{1}{2}$ in. x 1 in. (1843).

Roofing material: Duchess slating, the ridge covered with sheet lead (1843).
Floor

Joists: 7 in. x 4 in., laid 15 in. from centre to centre (1843).

Flooring: 2 in. pine plank, planed on one side, grooved and tongued, fixed with dowels (1843).

Doors and windows

See below.

(II)

Interior dimensions

Length: 60 ft. (1836), 60 ft. 6 in. (1882).

Width: 25 ft. (1836), 25 ft. 6 in. (1882).

Height: to springing of arch, 7 ft. (1836), 6 ft. 3 in. (1882); to crown of arch, 14 ft. 3 in. (1836), 13 ft. 6 in. (1882).

The 1882 figures are, presumably, accurate.

Floor

Plates: 2, each 60 ft. x 8 in. x 4 in. (1836).

Joists: 40, each 25 ft. x 4 in. x 8 in. pine scantling (1836). The magazine floor were renewed in the early 1850s. At this time, the arrangement of plates and joists was probably altered. The 1882 plan (Fig. 20) shows the flooring as substantially different from the arrangement described above. There is, therefore, no way of telling whether or
not the floor was ever installed as described in the 1836 estimate.

Doors
In its final version, each magazine had no fewer than five doors, one in each end of the magazine, two in the porch facing the shifting room, and one in the porch on the opposite end (see plan in the 1843 estimate, and all subsequent plans). In the 1836 version, which had neither porches nor adjoining shifting room, each magazine had apparently only two doors, a double set at the south end. This cannot be established with any certainty because no plan of the 1836 proposal has survived, and the only concrete evidence for this arrangement is in Colonel Calder's covering letter for the 1843 estimate. The letter reads, in part:

...with reference to Lt. Col. Jones' [who drew up the 1836 estimate] to the formation of doors in the north ends of [the magazines], I beg to state that all the magazines at Halifax stand North and South and that each of them have doors in both ends....

It would seem, then, that the three porch doors and the north end door in each magazine were all added in 1843.

Unfortunately, the most complete account of the main magazine doors and the copper work associated with them is contained in the 1836 estimate. It is unfortunate because
one cannot be certain whether doors to these specifications were ever built and installed in the magazines. Since the 1843 specifications call for copper for "additional door to magazine," it would seem that the south door in each magazine was built to the 1836 specifications. Therefore, in the section which follows, the north end and south end main doors to each magazine are treated, perhaps incorrectly, as separate entities.

The 1882 plan adds little to this general information, except in showing the direction in which each door opened; the two leading into the magazine proper opened inward, while the other three opened outward.

South end door (both magazines), porch into magazine

**Frame and sill:** Oak, 8 in. x 6 in. (1836).

**Door:** Oak, 6 ft. x 3 ft. x 3 in. (1836).

**Covering:** Sheet copper, 20 oz. per foot; the 1836 estimate calls for covering inside only, although since this door is shown opening inward in later plans, it would have been logical to cover both sides.

**Hinges:** Copper or brass (1836).

**Lock:** 12 in. copper or brass, with spring and tumbler box, staple, and four bolts with nuts to fix (1836).

**Door handle:** Copper (1836).

**Other:** Copper hooks to hold doors open; forged brass-headed nails used in construction of door (1836).
North end door (both magazines), porch to magazine

Frame and sill: Pine, 6 in. x 4 in., planed and rebated (1843).

Door: Pine, 2 in. thick, framed bead and bulb, flush on both sides (1843).

Covering: Sheet copper, 20 oz. per foot (29 lbs. in all). It is not clear whether it was intended to cover one or both sides of the door. Since the door opened inward (see 1882 plan) it would seem necessary to cover both (1843).

Hinges: 6 in. copper built (1843).

Lock: 12 in. copper stick (1843).

Other: The estimate also calls for a 9 in. copper plate with bolts and copper hook and eye hinges. The former may have been for the door, the latter for the windows, although this is uncertain (1843).

Three porch doors (both magazines)

Specifications as for north end doors above, except that there was apparently no copper work, and there is no record of locks, hinges, etc.

Windows

There is much the same confusion with windows as with doors. The 1836 estimate calls for two frames for shutters, each 10 ft. x 6 in. x 6 in., and four shutters, each 3 ft. x 2 ft.; both frames and shutters to be covered with copper (the
shutters on both sides) and secured with copper bolts. There is no evidence as to where the windows were to be put. I would guess the most likely location to be immediately over the doors, although this is only one possibility. In any event, the alterations made in the magazine by the addition of porches and of a north door may well have prevented the arrangement of the window as proposed in the original plan. This list is also only a supposition on my part.

The 1843 estimate contains little in the way of specific information. In his covering letter, Colonel Calder suggests "the construction of a small window (say 3.0 x 2.6) in each end of the magazines above the porches to admit light when the men are at work in them," but these are not mentioned in the estimate. The window called for in the estimate would appear to be for the magazine porch, although this is not entirely clear from the text. For particulars, see below under the entry for porch windows.

The two windows in the gable suggested by Colonel Calder in 1843 do not appear to have been built at that time. The elevation accompanying the estimate for lightning conductors (in Item 4 of Ordnance Annual Estimate for 1859-60 and plan 06-1858-8-1) clearly shows no window in the gable, and, since one of the copper conductors runs directly across where the window would have been, it is unlikely that the omission was a draughtsman's error. The two gable
windows do appear, however, in the 1882 plan, and the meagre information on the subject given below is taken from that source.

Porch window

Location: North porch, south magazine, and south porch, north magazine (both 1843 and 1882 plans).

Other information: The 1843 estimate only specifies "9 supl. feet. Sash, pane and glass".

Gable windows

Location: In each gable, immediately above porch and beneath arch (1882).

Width: 2 ft. (from measurement of 1882 plan).

Height: of window, 2 ft. 6 in. (1882), of window shaft on inside of wall, 4 ft. (1882).

Ventilation

If the windows and doors are subjects for which we possess little information, the system of ventilation is a subject about which we know almost nothing. The only mention of the subject in the 1836 estimate is a listing for "16 lbs. of strong sheet copper in 6 gratings for air holes, 12" x 8" each, equal to 4 feet 4 lbs. per foot." There is no indication where the gratings were to be used.

The legend of the plan accompanying the 1843 estimate
read, in part, "Plan...showing the proposed...ventilators."
Unfortunately, although four ventilation shafts are shown on
the plan, they do not rate a mention in the text.

The 1858 plan clearly shows four rectangular openings
for ventilators on each side of the magazine. The 1882 plan
agrees with the 1843 plan as to the location, shape and size
of the upper ventilator, and with the 1858 plans as to the
location of the lower one, but differs with the latter as to
its shape.

The information given below attempts to illustrate the
admittedly sketchy information from these three sources.

Upper ventilator

**Location:** 2 in each side wall, each 4 ft. above floor level
(figure from measurement of the 1843 plan; measurement of the
1882 plan gives a figure of 16 ft.) from nearest wall.

**Shape:** Straight shaft, broken by a masonry pillar in the
middle of the wall.

**Approximate dimensions:** (Figures from measurement of both
1843 and 1882 plans) 6 in. x 18 in. high (1882). The 1858
plan shows opening of the same shape, but somewhat larger.

Lower ventilation

**Location:** 2 in each wall in the same plane as the upper
ventilator (1858 plan. Another section in the 1852 set of
sections of the Citadel (Plan 02-1852-4-2) agrees, but is so
Small as to be otherwise useless in this matter). The interior end of the shaft is located under the floors (1882 plan). 
**Shape:** Straight shaft, unbroken at any point (1882). 
**Size:** Approximately 6 in. high (measurement of 1882 plan). 
The 1858 plan, showing the opening in the outer wall, seems to indicate that the lower ventilator was the same size as the upper one, and located higher up in the wall.

**Interior fitments**

**Walls**
The 1836 estimate called for the walls to be covered up to the springing of the arch. The entry reads, "139 yards of wainscoat, including furring, &c. &c". The 1882 plan seems to indicate that this, or something very similar, was done.

**Partitions for holding powder barrels**
The 1836 estimate calls for stud partitions constructed of pine with the following components:
- 20 skids, 60 ft. x 4 in. x 4 in.
- 42 cross pieces, 11 ft. x 4 in. x 4 in.
- 160 skids, 8 ft. x 4 in. x 4 in.
- 4 plates, 60 ft. x 6 in. x 4 in.
- 8 cross plates, 25 ft. x 6 in. x 4 in.
- 120 cross skids, 11 ft. x 4 in. x 4 in.
Lightning conductors

There are two estimates for lightning conductors. The first one, made in 1846, called for copper lightning rods set 3 ft. above the ridge of the coping and grounded with wrought iron wire run 5 ft. into the earth at the foot of the magazine. The wire was to be "put up with copper holdfasts set into the masonry and run with lead, each eye to be lined with the neck of a common glass pint and half bottle." By 1858, this relatively simple arrangement had failed. A more complicated conductor was proposed in the Civil Buildings estimate for 1859-60. The report detailed the reasons for the changes:

These magazines are at present fitted with iron conductors all of which...are detached from the buildings....It is proposed to use the old conductors, if found available, as underground conductors.

The plan accompanying this estimate is a projection of the north magazine, and only shows one side and one end. It is reasonable to assume that the invisible side and end were identical to those shown. The arrangement proposed in this plan is, as follows:

1) Two vertical rods on the ridge of the roof immediately behind the masonry coping.

2) Flat copper conductor running along the ridge connecting the rods, also running from each rod, over the coping, down
the middle of the gable, and along the ridge of the roof of each porch, terminating at the coping.

3) Copper eaves gutters running along the eaves on each side with a copper drain pipe at each corner; copper eaves gutters also used along both eaves of each porch, again with a copper drain pipe on each corner.

4) Flat copper conductor running along the base of the gable, connecting the magazine gutters with the porch gutters.

5) Tubular copper conductor running immediately behind the coping of both ends of the magazine roof and both porch roofs, connecting with the flat copper along the ridges with the gutters.

6) All eight down spouts grounded ("flat underground conductor").

From the estimate, it would seem that copper holdfasts and copper nails were used to hold the conductors in place, and that coal ashes were packed around the underground conductors.

It was decided in London that it was not necessary to extend the lightning conductors to the porches or across the base of the gable ends, and this part of the scheme was abandoned. The rest was approved and, presumably, implemented.

Boundary walls, magazines

General information
Date: First appear in revised estimate of 1836.
Location: Separating magazines from parade square.
Extant remains: South magazine wall still intact. North magazine wall demolished ca. 1900.

Structural data and commentary
Source: Item 14 of the revised estimate of 1836.
Dimensions: Foundation: $3\frac{1}{2}$ ft. wide x 2 ft. deep (plan attached to item shows foundation as 4 ft. deep). Wall: 10 ft. high x 3 ft. wide.
Materials: Estimate does not specify type or quality of masonry. Top of wall coped.
Doors: Two in each wall. Oak frames 8 in. x 6 in. and doors of oak plank, 6 ft. x 3 ft. x 3 in.

3 The 1812 Magazine
The following two documents detail briefly the origins and dimensions of the 1812 magazine.

Early in 1812 orders were given to put the forts in repair.
The Citadel was again in a dilapidated condition, and was temporarily repaired and otherwise patched up. In 1812 Nicolls built there, at the south end of the Cavalier, a store bomb-proof magazine for 1,344 barrels of powder.16

Undated report by Lt. Philpotts, RE. The report concerns the demolition of the magazine. The portion here quoted describes
the state of the magazine at the time of demolition. This magazine was built in the year 1812, of rough rubble masonry. The arch was built of brick, and turned in one ring. The crown of the arch was slightly cracked, owing, it is supposed, to the settling of the masonry.

The ground on which the magazine was built, is considerably above the level of the interior of the Fort, and it was accordingly left standing on a mound of earth, the top of which was about 9 feet above the level of the surrounding ground.

The following were the dimensions:

Exterior length. . . . 62 feet.
" breadth. . . . 30 "
Interior length. . . . 50 "
" breadth. . . . 16 "

The side walls consequently were 7 feet thick, and the ends 6 thick. At the foundations the walls were increased in thickness by an offset on each side of 8 inches. There was a window in the north end, and a door in the south; the latter was covered by a ruined Porch, which was taken down previous to commencing operations. 17

4 Estimate for two bomb-proof magazines, 1836 18

This was the original estimate for the north and south magazines. The buildings were subsequently altered by the addition of porches, and the roof was later rebuilt, but the
magazines were actually built according to the specifications described here.

**Item 14**

Two bombproof Magazines

This Item provides for the construction of two bombproof Magazines to contain 1500 barrels each, according to the annexed Section:- their position is shown on Plan N° 1.-

[Section of magazine. Scale 10' - 1". Signed by Lt. Wentworth]

Length of Magazines 60 feet by 25 feet wide; - arch 3 feet thick; - flooring 2 inch plank on joists of 8 ins x 4, supported by dwarf walls; - To be slated with dutchess slates; - the ridge &c secured with sheet lead. -

The Magazines to be enclosed by a boundary wall, 10 feet high and 3 thick, joining on to the retaining wall, as shown on Plan N° 1 and Section above. - The Copper work to be detailed when demanded. -

[Section of magazine]

Excavation for body of Magazine and area round it 90 x 30 x 20 from terreplein of old fort; - for foundations, side walls or piers 2(68 x 9 \(\frac{1}{2}\) x 4); - end walls 2(25 x 5 x 4); - joist wall 60 x 2 \(\frac{1}{2}\) x 4 and boundary wall 110 x 4 x 3. -

Masonry: - foundations 2(68 x 9.4 x 4) side walls or piers; - for end walls 2(25 x 4 \(\frac{1}{2}\) x 4). - joist wall 60 x 2 x 4; for boundary wall 110 x 3 \(\frac{1}{2}\) x 3. - Walls above foundations; side walls or piers 2(68 x 8 x 8). - end walls 2(25 x 4 x 15
mean height)- Boundary wall 110 x 3 x 10, and also dos d'ane 2(68 x 20 x 1.6).- The workmanship is for the face of the walls above described and for both sides of the boundary wall including the coping.- The brick arch is 68 feet in length 3 feet thick, with a span of 25 feet.- Slating 2(68 x 26) to be laid in cement.- Plates for joists 2(60 x 8 x 4);- 40 joists 25 feet long 8 in x 4 in. 2 inch pine plank flooring 60 x 25.- 3 oak door frames with sills 20' x 8" x 6", and 2 frames for shutters 10' x 6" x 6".- 4 Oak doors 3 inch, 6 feet by 3 feet: the Magazine having a double door, the outer one without a frame, copper hooks for hinges, fixed into stone work:- Double shutters 4(3 x 2).- Sheet lead to ridge of roof 68 x 5.-

Detail of the £75 for copper work, inserted in the Estimate.-

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<tr>
<td>150</td>
<td>150 lbs of sheet copper 20 oz. per foot for covering outside door and shutters and frames, both sides</td>
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<td>240</td>
<td>240 lbs of copper or brass hinges to 4 doors &amp; 4 shutters</td>
<td>2/-</td>
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<td>Item</td>
<td>Description</td>
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<td>2</td>
<td>12 inch copper or brass locks, with spring &amp; tumbler, box staple and 4 bolts with nuts to fit do.</td>
<td>130/-</td>
<td>13.0.0</td>
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<td>12 inch copper or brass stock locks, with box staples and screws &amp;c. complete for doors of boundary wall</td>
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<td>Copper handles for pulling to doors</td>
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<td>Copper foot scraper 6 lbs.</td>
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<td>36</td>
<td>lbs of forged brass headed nails</td>
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<td>44</td>
<td>lbs do. do. smaller size</td>
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<td>5.10.0</td>
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<td>24</td>
<td>lbs copper in shutter bolts set in plates &amp;c</td>
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<tr>
<td>25</td>
<td>lbs do. in hooks to hold open doors &amp; shutters</td>
<td>2/-</td>
<td>2.10.0</td>
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<tr>
<td>16</td>
<td>lbs of strong sheet copper in 6 gratings for air</td>
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holes $\frac{1}{2} \times \frac{1}{8}$ each,
equal 4 feet at 4 lbs
per foot $1/8$ $1.6.8$
Sum inserted in the Estimate.- £75.0.2

Before the Magazines are appropriated for the reception of powder they will require lining and studded partitions;—length in the clear 60 feet, breadth 25 feet, height to the springing of the arch 7 feet;—

For each magazine:

132 yards wainscoat including furring &c in lining to walls 3/- 19.16.0
546 cubic yards of pine in studded partitions and skids $1/6$ 40.19.0

£60.15.0

20 skids 60 feet long 4" x 4".— 42 cross pieces 11 feet long 4" x 4".— 160 studs 8 feet long 4" x 4".— 4 Plates 60 feet long 6" x 4". 8 cross do 25 feet long 6" x 4".
120 cross skids 11 feet long 4" x 4".—

The buttresses being dispensed with & the length of the boundary wall reduced, makes a saving of 1000 sup feet in the workmanship on face of walls, which at 1/8 per sup foot will amount to £83.6.8 or £166.13.4 for the two Magazines; this sum will cover the expense
of the lining &c in this Item & the studded partitions
in the last, without adding to the Estimate.

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<td></td>
<td>excavated for body</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of Magazine, and foundations</td>
<td>10d</td>
<td>96.10.10</td>
</tr>
<tr>
<td>1743</td>
<td>perches of masonry,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>in walls &amp; foundations</td>
<td>14/2</td>
<td>1234.12.6</td>
</tr>
<tr>
<td>5990</td>
<td>supl. feet of workmanship, on</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>face of Walls</td>
<td>1/8</td>
<td>499.3.4</td>
</tr>
<tr>
<td>349</td>
<td>perches of Brickwork, in</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>arch</td>
<td>30/-</td>
<td>523.10.0</td>
</tr>
<tr>
<td>38</td>
<td>squares of Dutchess slating</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>62/-</td>
<td>117.16.0</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>cubic feet of pine Scantling, in joists</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/1</td>
<td>13.10.10</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>squares of 2 inch pine Plank flooring</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>32/2</td>
<td>24.2.6</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>cubic feet of oak timber, in door frames</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/11</td>
<td>3.12.11</td>
<td></td>
</tr>
<tr>
<td>$97\frac{1}{2}$</td>
<td>supl. feet 3 inch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
oak Plank, in doors 1/5 6.18.1\textsuperscript{1/2}

cwt of sheet Lead, 30 48.15.0

10 lbs per supl. foot, for Roof 32/6

Copper Work, covering to doors, locks, bolts, &c 75.0.0

[Total] 2643.12.0\textsuperscript{1/2}

Contingencies 1/10\textsuperscript{th}

[Total] for one 2907.19.2\textsuperscript{3/4}

[Total] for two £5,815.18.5\textsuperscript{1/2}

5 Estimate for porches, doors and roofs, 1843\textsuperscript{19}

The porches and roofs were installed as detailed in these estimates. There is some controversy about the doors (see above, section 2).

Item 3 - Four Porches and Two additional Doors to Magazines

This Item provides for covering the doors of the Magazines with Porches and furnishing an additional door in each as shown on the Plan annexed to Item 2.-

The Masonry is in the foundation walls & dos d'anès, feet ins
the dimensions are given on the Plan. - the end walls 7.. 0
f ins x 2 ..6, the front 8..6 x 1..6, - dos d'anès 6 ins thick. - ins
The Brickwork in arch 1..2 thick. - Joists 7 x 4 ins, 15 ins from center to center; 2 inch floors as in Item 2 - [which reads
"planed on one side, grooved and tongued, and held with dowels"

doors frame 6 x 4 ins as [in] d0 ins - [which reads "planed and rebated"]  Doors 2 [in.] as in Item 2.- [which reads "framed bead and butt, flush on both sides"] Windows as in d0 ins - [no entry] Rafters and Roof 3 x 2 1/2 ins, 1 laths 2 1/2 x 1

**Estimate**

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
<th>Description</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry in foundation, walls, and dos d'anies</td>
<td>26</td>
<td></td>
<td>14/2</td>
</tr>
<tr>
<td>Brickwork in arch</td>
<td>3 2/3</td>
<td></td>
<td>30/</td>
</tr>
<tr>
<td>Square Dutchess Slating including rafters and laths, over dos d'anies</td>
<td>1</td>
<td></td>
<td>82/</td>
</tr>
<tr>
<td>Cubic feet Pine timber in joists</td>
<td>3 1/2</td>
<td></td>
<td>1/1</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot; d0 in door frames</td>
<td>2 1/2</td>
<td></td>
<td>1/6</td>
</tr>
<tr>
<td>Square 2 inch Pine plank flooring</td>
<td>1/4</td>
<td></td>
<td>28/6</td>
</tr>
<tr>
<td>Sup. feet 2 inch pine framed doors</td>
<td>36</td>
<td></td>
<td>1 1/10</td>
</tr>
<tr>
<td>&quot; &quot; &quot; Sash, frame &amp; Glass</td>
<td>1</td>
<td></td>
<td>1/10 1/2</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td>Price</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>10</td>
<td>lbs. Copper in 2 pairs Hook &amp; eye hinges</td>
<td>2</td>
<td>2/-</td>
</tr>
<tr>
<td>1</td>
<td>12 inch Copper Stock</td>
<td>1</td>
<td>50/-</td>
</tr>
<tr>
<td>4</td>
<td>9 &quot; &quot; Bolts, on plates with screws</td>
<td>4</td>
<td>4/-</td>
</tr>
<tr>
<td>29</td>
<td>lbs. Sheet Copper, 20 oz per foot, to cover additional door to Magazine</td>
<td>1/4</td>
<td>1.18.8</td>
</tr>
<tr>
<td>1</td>
<td>pair 6 inch Copper Butt hinges</td>
<td>1</td>
<td>5/-</td>
</tr>
<tr>
<td>1/2</td>
<td>Cwt Sheet lead, to cover ridge</td>
<td>32/6</td>
<td>32/6</td>
</tr>
</tbody>
</table>

Add Contingent 1/10th

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>For one</td>
<td>42.7.10\ 1/4</td>
</tr>
<tr>
<td>For four</td>
<td>£169.11.5</td>
</tr>
</tbody>
</table>

**Item 10. Roof of Two Magazines, and of Two Guardhouses in the North & South Ravelins**

**Report**

This Item provides for covering the dos d'anes of the
Magazines, and of the Guardhouses on [sic] the North and South Ravelins with Slates laid on Rafters & Boards instead of laying them in Cement as proposed in the Revised Estimate, that method having failed on the roofs of the latter buildings, the severe frost removing a considerable portion of them [i.e., the slates] each Winter.-

The Rafters to be $3 \times 2\frac{1}{2}$ inches, Boards 1 inch and Slates fixed with Composition nails.

The Slates for the Magazines are provided for in the Revised Estimate,— provision is made in this Item for making good those that have become unserviceable and may be broken by removal from the roofs of the Guardhouses

<table>
<thead>
<tr>
<th>Roofs of Magazines</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>360</td>
<td>cubic feet pine in rafters &amp; [c.]</td>
<td>1/4</td>
<td>24.0.0</td>
</tr>
<tr>
<td>74</td>
<td>Squares rough Boarding for Slating</td>
<td>11/</td>
<td>40.14.0</td>
</tr>
<tr>
<td>228</td>
<td>lbs composition nails $N^0_{164}$ for $d^0_{2}$</td>
<td>1/6</td>
<td>17.2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Roofs of Guardhouses</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>cubic feet Pine timber, in rafters &amp;[c]</td>
<td>1/4</td>
<td>5.9.4</td>
</tr>
<tr>
<td>18</td>
<td>Squares rough Boarding for Slating</td>
<td>11/</td>
<td>9.18.0</td>
</tr>
</tbody>
</table>
19. Squares Dutchess Slates
fixed on rafters & boards,
with composition nails,

\[ N^0 164. \quad 69/ \quad 65.11.0 \]

\[ £ 162.14.4 \]

Add Contingent 10th

\[ £ 16.5.5 \]

\[ £ 178.19.9 \]

Deduct for Slates in present roofs
of above Guardhouses, which it is
supposed will work in again - say
one half or \[ 28\frac{1}{2} \] cwt @ 6/6

\[ £ 169.4.6 \]

6 Estimate for the installation of lightning conductors, 1846

The lightning conductors were installed in the manner detailed
in this estimate at some point in the late 1840s. They
ultimately failed. A new estimate was put in in the late 1850s,
and the lightning apparatus was altered accordingly (see
section 7, below).

Item 7

This Item provides for furnishing and attaching
to each of the magazines, two lightning conductors,
as shown in the accompanying plan & Elevation \[ N^0 8: \]
at A. [space in ms.] The conductors to be of wrought
th
Iron \[ 5/8.\] inch dias: the upper part to be of copper gilded
and raised 3 feet above the ridge of the coping,
& to terminate at foot into the earth 5 feet deep at an angle of 45° to be put up with copper eye hold-fasts set into the masonry, & run with lead, each eye to be lined with the neck of a common glass pint and half bottle.

Item 7 - Estimate

**Four Lightning Conductors to Magazines**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td>1 lbs wrought &amp; rounded Iron in conductor, and putting up</td>
<td>5</td>
<td>5d</td>
<td>3.14.2</td>
</tr>
<tr>
<td>36</td>
<td>1 lbs wrought copper eyes in holdfasts</td>
<td>2/6</td>
<td>2/6</td>
<td>4.10.0</td>
</tr>
<tr>
<td>[1]</td>
<td>Rivetting to Iron</td>
<td>1/3</td>
<td>1/3</td>
<td>0.1.3</td>
</tr>
<tr>
<td>36</td>
<td>36 holes morticed in granite, and run with lead.</td>
<td>8</td>
<td>8d</td>
<td>1.4.0</td>
</tr>
<tr>
<td>12</td>
<td>1 lb wrought &amp; shaped copper on tops</td>
<td>2/-</td>
<td>2/-</td>
<td>1.4.0</td>
</tr>
<tr>
<td>8</td>
<td>8 tops of conductors gilded</td>
<td>5/-</td>
<td>5/-</td>
<td>2.0.0</td>
</tr>
</tbody>
</table>

£ 12.13.5

Add Contingent 10th

£ 1.5.4

[Total] £ 13.18.9
7 Civil Buildings Annual Estimate, 1859-60

This provides for new lightning conductors for both magazines. The new conductors replaced the ones detailed above (see section 6) which had failed.

Item 4

This Item provides for fixing Lightning Conductors to the Powder Magazines at the Citadel and North of the city, agreeably to the Circular memorandum No. 260 dated 1st January 1858.

These Magazines are at present fitted with Iron Conductors all of which, with the exception of the Naval Magazine, are detached from the Buildings. The Conductors to the Citadel Magazines, terminate in Water tight tanks.

It is proposed to use the old Conductors, if found available, as "underground Conductors."

The Citadel Magazines are alone provided with Copper Gutters and down Pipes.

This Service is proposed to be executed on day Work by the Department.

[Estimate]

Powder Magazines

Provide Lightning Conductors
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>525</td>
<td>1b flat Copper</td>
<td></td>
<td></td>
<td>1.9.9</td>
</tr>
<tr>
<td>[726]*</td>
<td>rivetted and fixed</td>
<td>1/9 lb</td>
<td>45.18.9</td>
<td>[63.10.6]</td>
</tr>
<tr>
<td>378</td>
<td>&quot; Hollow copper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3/4&quot; dia: in the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>clear 1/8&quot; thick</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D°</td>
<td>1/8&quot;</td>
<td>31.10.0</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>&quot; Solid Copper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/2&quot; dia: pointed at</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the end, Secured and fixed</td>
<td>1/9&quot;</td>
<td>1.8.0</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>&quot; Copper</td>
<td>Holdfasts -D°</td>
<td>1/7&quot;</td>
<td>2.15.5</td>
</tr>
<tr>
<td>3</td>
<td>&quot; Copper Nails, wrought</td>
<td>2/-&quot;</td>
<td>0.6.0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>&quot; Screw joints, fig 4</td>
<td>1/10&quot;</td>
<td>0.11.0</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>&quot; - D° -fig. 10</td>
<td>1/1&quot;</td>
<td>5.10.0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cubic yards</td>
<td>Excavation for underground Conductors</td>
<td>1/-y.</td>
<td>0.10.0</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td>Unit</td>
<td>Cost</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------</td>
<td>----------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>3</td>
<td>D. filling in and ramming with Coal ashes</td>
<td>1/6&quot;</td>
<td>0.4.6</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Yards Sup. relaying Asphalte</td>
<td>1/3&quot;</td>
<td>3.15.0</td>
<td>93.18.5</td>
</tr>
</tbody>
</table>

*Note added in London, in red ink:* It is not considered necessary to put the lightning Conductors to the Porches or across the base of the Cable ends,— the Estimate has been reduced accordingly.

*Numbers in parentheses are from the original estimate. These figures were altered in London; the alterations appear in red ink in the original manuscript.*
"Section through one of the Magazines," 1834 (plan 06-1834-3-6). This was Colonel Jones's initial proposal for the new magazines. It is identical to a similar scheme put forward by Colonel Boteler in his first revised estimate (1833). The Inspector General of Fortifications rejected the idea on the grounds that a subterranean magazine would be impossible to keep well-ventilated and dry. Considering the problems which were later experienced with the casemates, it is difficult to escape the conclusion that the Inspector General was right. (Public Archives of Canada.)
The undertaker for the construction of the Bond Store Magazine in the Plantation Town of Boston, and according to the annexed plans, to contain such

...
Two sections of Colonel Jones's second proposal for new magazines, 1836 (plan 06-1836-2-1). Jones first wanted to provide buttresses for the magazine, but the idea was rejected in London. The second section shows the design as finally accepted. There is no evidence that the joist wall was ever built. If it was built, it was removed in the renewal of the floor in the early 1850s, but this seems rather unlikely. (Public Archives of Canada.)
The plan provides for the construction of two large
Magazines to contain 1,870 barrels each, according
to the annexed Section. Their position is shown on
Plan No. 1.

Side of Magazine.

The foundation shall be 25 feet wide, and 3 feet
thick, forming a vault 25 feet in width of 3 feet 4
inches in height, and divided by a brick wall 2 1/2
feet thick. The upper part is to be covered with
sheet lead. The Magazine
shall be enclosed by a boundary wall 3 1/2 feet high and
3 thick, joining on to the retaining wall at a height
Commencement and Section above. The Ogee roof
shall be detailed when required.

Decoration for body of Magazine and area round it 90 x 30
inches from top of roof to floor. For foundations, side walls
or pier 2 (25 x 3 1/2 x 4), and walls 2 (25 x 6 x 4), Joint
wall 60 x 25 x 4 and boundary wall 110 x 4 x 3.

Boundary: foundation 2 (25 x 3 1/2 x 4) side walls or pier—
for each wall 2 (25 x 6 x 4) joint wall 60 x 25 x 4, boundary
wall 110 x 4 x 3. Walls above foundations, side walls or
pier 2 1/2 (25 x 6 x 4), and walls 2 1/2 (25 x 4 x 10 mean height).—
Boundary wall 110 x 3 x 10 and also the same 2 (25 x 3 1/2 x 6).
The thickness of the wall shall be sufficient for both sides of the boundary wall including the coping.
The bricks used in the foundations and the pier wall shall be of
35 feet. Yellow stone 2 (25 x 3 1/2) to be laid in cement. Plates for
pier 2 (25 x 3 1/2) 45 lifts to 3 feet long 3 inch iron plate.
Concrete 1/2 x 3 1/2 in. iron plate. Floor 25 x 3 1/2 in. thick, 3
inches thick, forming a vault 25 x 3 1/2 in. thick, with the 25 x 6 x 4, and 2
inches for the 10 x 6 x 4. 10 in. thick. 3 inch iron plate. The Magazine being a double storey, the outer consisting of a storage
office, the door for opening faced with stone work. Double
"Plan of the Magazines...", 1843 (plan 06-1843-5-2).

This plan shows the porches and shifting rooms added by Colonel Calder in the mid-1840s. Before this, the magazines had no porches and only south end doors. Despite the reference in the legend to ventilators, there are no references to the ventilation system in the estimate. (Public Archives of Canada.)
Plan of one of the Magazines showing the proposed
Ponches, Watertight, and Shifting Room.
The parts coloured red are provided for in the Revised Estimate.

H. and S.博物.

Drawn by E. J. C. E.
Bomrd by D. H. Wingham, C.S.E.
22nd May 1843.
"Plan and Elevation shewing the situation of Proposed lightning Conductors...", 1846 (plan 06-1846-3-9).
The lightning conductors were installed (briefly) in this fashion and shortly thereafter failed. They were ultimately replaced by a different system (see Fig. 19). This is also our earliest elevation of the magazine as built. (Public Archives of Canada.)
Plan and Elevation showing the situation of Proposed Lightning Conductors to the Magazine.

To accompany the Supplementary Estimate Draft Rolls 1826.

Plan

Scale of Plan 120 Feet to One Inch

Scale of Elevation 120 Feet to One Inch.
"Plan and Section of the Gunpowder Magazine at the Citadel," 1852 (plan 06-1852-1-1). The sections show the arrangement of the powder racks then in use and a proposed rearrangement of them. The proposal was apparently accepted. (Public Archives of Canada.)
"Projections shewing the mode of arranging the lightning conductors...", 1858 (plan 06-1858-8-1). These projections were drawn to accompany an item in the Civil Buildings Estimate (not the Ordnance annual estimate, as stated in the legend) for 1859-60 for the renewal of the lightning conductors in the Halifax area. The lightning conductors were installed as shown in Figure 1 in the plan, except for the conductor provided for the gable ends and porches. (Public Archives of Canada.)
"Citadel. Main Magazines...", 1882 (detail from plan 06-1882-8-1). Record plans of the magazines drawn from measurement in 1882. These plans and sections are therefore the most accurate record of the magazines as finally constructed. (Public Archives of Nova Scotia.)
"Record Plans of Canteen," 1902 (plan 21-1902-8-1). The north magazine had been converted into a canteen in the preceding year. Part of its structure survived in the new canteen; the masonry of the old building up to the spring of the arch was put to use as the canteen's basement. (The masonry so used is shaded in the elevation.) (Public Archives of Canada.)
Halifax, N.S.
Citadel
Record Plans of Canteen

Note: See Sheet IV for authority, cost, etc.

Roof Plan

East Elevation

South Elevation

West Elevation

Site Plan

Scale 1" = 100'

North Elevation

Plan Identification No. 0
Plan of Building, Warden, Work, Water

Drawn by J.W. Smith, September 1900

125
"Record Plan of Canteen," 1902 (plan 21-1902-8-3).

Plans and sections showing the construction details, room use, etc., of the addition made to the north magazine in the conversion. (Public Archives of Canada.)
The north magazine and area wall, ca. 1880. The south magazine was identical. In the southwest demi-bastion, however, the access to the ramparts was by means of a ramp.
"Sketch shewing at a,a, the positions of the two proposed...Splinter Proof Magazines," 1860 (plan 01-1860-10-1). There is no evidence that these two magazines were ever built. There are, nonetheless, two surviving structures in approximately the right positions. These have not been carefully examined, since in recent years they have been closed up and buried. They may be the missing splinter-proofs. (Public Archives of Canada.)
Sketch showing at a-a, the relative positions of the two proposed 32 Barrel Splinter Proof Magazines.

Scale 200 feet to 1 inch.

From a Drawing by Mr. Gordon Co.

Alex. Ross

5.10.60
25 "Plan, Section and Elevation of proposed New splinter proof Magazines," 1862 (plan 06-1862-7-1). See caption for Figure 24. (Public Archives of Canada.)
Plan Bibliography

1  01-1825-12-1: Nicolls's plan No. 1, showing the position of the 1812 magazine within the trace of the present Citadel (Part 1, Fig. 5).

2  02-1825-12-2: Section, keyed to No. 1, showing the relation of the old magazine to the level of the parade within the new fort.

3  06-1833-6-3: Section from Boteler's revised estimate, showing the first design for a new magazine.

4  06-1834-3-6: Section of Jones's initial design for a new magazine (identical to Boteler's) (Fig. 14).

5  06-1836-2-1: Jones's second and third designs for the magazine (one section of each). The design without buttresses is the one adopted (Fig. 15).

6  06-1843-5-2: Plan of magazine and shifting room, showing porches (Fig. 16).

7  06-1846-3-8: Plan of magazine, area and shifting room.

8  06-1846-3-9: Plan and elevation showing the lightning rods (Fig. 17).

9  05-1847-4-1: Plan, sections, etc. illustrating the demolition of the 1812 magazine (Part 1, Fig. 10).

10  06-1852-1-1: Plan, two sections and reference notes, detailing existing and proposed arrangements of the powder racks (Fig. 18).

11  02-1852-4-2: Two small-scale elevations in a set of general elevations and sections of the Citadel.
12 06-1858-8-1: Perspective drawing, showing lightning rods (Fig. 19).

13 01-1860-10-1: General plan, showing the location of the proposed splinter-proof magazines (Fig. 24).

14 06-1862-7-1: Plan, sections of proposed splinter-proof magazines (Fig. 25).

15 06-1882-8-1: Plans, sections and photographs of both magazines (Fig. 20).

16 21-1900-9-1: Plan and section showing proposed alteration of north magazine.

17 21-1900-9-3: Plans and sections of proposed canteen on site of north magazine.

18 21-1900-9-4: Elevations and roof plan of proposed canteen.

19 21-1902-8-1: Elevations and roof plan (record plans) of canteen (Fig. 21).

20 21-1902-8-3: Plans, sections (record plans) of canteen (Fig. 22).

21 21-1913-4-1: Ground floor plan of canteen, showing room use.

22 21-1921-3-2: Ground floor plan of canteen.

23 06-1943-7-2: Plan, two sections of the south magazine.

24 21-1944-12-1: Plan showing plumbing and heating, canteen.

25 21-1945-7-1: Plan, elevation, sections of canteen, showing building fitted up as a sargeants' mess.

26 21-0004-13-1: Undated plan and section of the canteen cellar.
Casemates

1 General Discussion
The first problem to be overcome in any discussion of the casemates in the Halifax Citadel is that of determining their number. In fact, one could make a case for almost any number of casemates, from 54 to 80, depending on one's definition of the term. "Casemates" may be stretched to include almost any arched masonry structure; the seven arched rooms in the cavalier are considered casemates, and the three ravelin guardhouses are invariably described as "casemated defensible guardhouses". Even the six storage cellars under the parade square in the redan have the same basic structure as the casemates. At the other extreme, a really narrow definition of the term would exclude a number of the arched structures under the ramparts, the privies, for example, or the shifting rooms. For the purposes of this report, any arched structure found beneath the ramparts will be treated as a casemate. This gives a total of 60, counting the three privies, the shifting rooms, the small casemates in the redan re-entrants, and the two small arched rooms off the western sally ports.

The second problem arises when one attempts to devise a
numbering system to encompass all 60 casemates. There have been at least three numbering systems in use since the first was devised in the late 1840s, and all of them are, in some ways, inadequate. No two of them arrive at the same total, and all leave some casemates out. The system currently in use is perhaps the best, but even it has some anomalies. It has, for instance, a casemate No. 0, completely ignores the casemates of defence in the western bastions, and for some reason numbers the shifting rooms as 6A and 15A. Early in my research, it became obvious that a comprehensive system was necessary, and, at the risk of making an already complicated situation worse, I devised a numbering system of my own, which I use throughout this report. It utilizes Nos. 15 through 50 of the previous system and re-numbers the remaining 23. Numbering is consecutive, going clockwise from the southernmost casemate in the curtain. Even this system has one anomaly: I mistakenly numbered the privy off the north end of the northern sally port in the curtain and the small room behind it as 7A and 7B respectively. In fact, as I discovered later, the two are entirely separate entities, having been built at different times. However, rather than alter all the numbering used in the report, I leave the system as it is.

Table of the standard system compared with the system presently in use.
Nos. 1-5 (formerly 7-10 with one unnumbered): South end, curtain.
Nos. 6-11 (formerly 11-4 with two unnumbered): North end, curtain. The first casemate past the sally port (the privy) and the small room behind it are numbered 7A and 7B respectively.
Nos. 12-13 (formerly unnumbered): The casemates of defence in the northwest demi-bastion. No. 12 is the westernmost.
Nos. 15-23 (numbered as before): North side, northeast salient.
Nos. 24-33 (numbered as before): East side, northeast salient.
Nos. 34-42 (numbered as before): North side, redan.
Nos. 43-50 (numbered as before): South side, redan.
Nos. 51-3 (formerly 0-2): East side, southeast salient.
Nos. 54-5 (formerly 3-4): South side, southeast salient.
Nos. 56-7 (formerly 5-6): South side, southwest demi-bastion.
No. 58 (formerly 6A): Shifting room, south magazine.
Nos. 59-60 (formerly unnumbered): Casemates of defence, southwest demi-bastion. No. 60 is the westernmost.

2 Building the Casemates
In Colonel Nicolls's original plan for the Citadel, casemates were intended solely for storage and the defence of the ditch. He provided for 16 of them, arranged in pairs, to flank the ravelin ditches (see Part 1, Fig. 5). The alterations of the early 1830s brought about two major changes in this plan. In the first place, the decision to build a redan on the eastern front caused the deletion of four of
the original casemates (those intended for the eastern curtain to flank the east ravelin) and the addition of eight more casemates of defence to flank the ditch on both faces of the redan and the eastern faces of the eastern salients. This brought the total number of defence casemates up to the present figure of 20.

The second major change resulted from the decision not to build the north and south cavaliers. Additional barrack space was required, and Colonel Jones decided that the best solution to the problem would be the construction of dwelling casemates. The real reason for this change in policy may have been the result of the escarp collapses of the early 1830s. Casemating was one way of taking the loading weight of the ramparts off the escarps, and Jones and the Fortifications department may well have felt that casemating would, in the end, prove cheaper and more efficient than building escarps of a very thick profile.

In all, Jones estimated for 28 new casemates: 12 two-storey casemates in the redan for officers' quarters (Nos. 36-41 and 43-8); eight additional casemates of defence (Nos. 31-2, 34-5, 49-50, 52-3); five storage casemates on the north front (Nos. 17-21); two small casemated privies on the west front (Nos. 6 and 7A); and one small two-storey casemate at the redan salient, the bottom storey of which was also a privy (No. 42). (See Fig. 26 and Section 7, below.)

As work proceeded on the casemates provided in the
revised estimate, Jones's successor, Colonel Calder, decided that even 40 casemates would be insufficient for the needs of the garrison. In January 1843, he proposed that casemating be extended to fill most of the available space under the ramparts. London responded by inviting him to justify the additional casemates. Calder canvassed the other department heads to see how much space they would need in the completed fort, and, on the basis of the information he received, decided that 19 additional casemates were necessary. He formally proposed their construction in an estimate for the completion of the Citadel dated 22 May 1843, (see Part 1, Fig. 8, and section 8 below). He also included in the estimate an item providing for the rebuilding of the area wall of the casemates of defence in the northwest bastion to replace an earlier wall which had collapsed (see Fig. 27 and section 8, below).

As Calder's estimate was being debated, the redan casemates reached completion and it became necessary to provide them with their interior partitions. Unfortunately Jones had neglected to leave a plan of the proposal for the partitions behind when he left. After a lengthy exchange with London, a plan was decided upon, and the partitions were constructed (see Figs. 28 and 29).

The casemates included in Calder's 1843 estimate included four on the west front (Nos. 1-2, 10-11); two on the north front (Nos. 15-6); seven on the east side of the
northeast salient (Nos. 24-30); one in each of the redan re-entrants (Nos. 33 and 51); two on the south front (Nos. 56 and 57) and two shifting rooms for the magazines (Nos. 14 and 58). (For a section of the shifting rooms, see Fig. 16.) These were brought forward in the Ordnance annual estimate in the years following 1843. The detail provided in these annual estimates was infinitely greater than the brief sketch of the proposed service provided in the 1843 estimate, but unfortunately only the text of the Ordnance annual estimate for 1844-45 has been located. This gives a detailed account of the construction of Nos. 24-30, 33 and 51 (see section 9, below).

The new casemates were still in the process of being constructed when Calder submitted his supplementary estimate in March 1846. The casemate provisions of the earlier estimates were reiterated in this document, but no additional information was provided. The only new projects involving casemates were the demolition and rebuilding of the retaining walls of the casemates of defence in the western curtain (Nos. 3-4 and 8-9) and the casemates of defence in the northwest demi-bastion (Nos. 12-3) (see Figs. 30 and 31 and section 10, below).

By 1848, all the casemates were completed (see section 12, below). But the problems with them were only beginning. Most of them leaked.
3 Staunching the casemates

The Engineer department in Halifax spent almost a decade (1848-56) trying to find a satisfactory solution to the problem of casemate waterproofing. I have already dwelt at some length, in Part 1, on the problems involved and the solutions adopted. This section is a brief summary of the earlier chapter on the subject.

The heart of the staunching problem lay in the difficulty of finding a satisfactory covering for the casemate dos d'anes which would shed water. The problem was influenced by three main factors. In the first place, the comparative severity of the Halifax winter, with its sudden thaws, made frost and water damage in subterranean structures a major difficulty. This was further complicated in the case of the casemates by the nature of the drainage system initially adopted to lead the water off the dos d'anes. In fact the only drainage provided was a lead gutter in the troughs between the casemates leading to a gargoyle in the retaining wall and an exposed down pipe. The pipe, needless to say, blocked up at the first frost, leaving the surface water trapped in the rampart earth. To cap everything else, neither the casemate arches nor the dos d'anes were carried very far into the end walls of the casemates. This meant that there was a comparatively weak join between the casemate roofs and the end walls, and it was this part of the casemates which was particularly likely to leak.
Colonel Jones, the engineer responsible for the introduction of dwelling casemates into the Citadel design, did not anticipate that leakage would be a serious problem; indeed, he proposed to cover the dos d'anés with only a layer of tiling laid in cement (see Section 7, below). After some practical experience with the work, he substituted duchess slates for tiles,\(^7\) and this arrangement remained unaltered until after his departure from Halifax.

Colonel Calder, on taking over the command, decided that the slate and cement covering was inadequate for the demands of the climate, and requested that he be allowed to substitute granite flagging for the slates.\(^8\) London equivocated, but in the end, flagging replaced both slates and tiles on most of the casemates.

By 1848 Calder had come to the conclusion that flagging alone was not enough. He was beginning to encounter serious leakage problems, most of which involved dampness on the end walls of the casemates. To solve this, he experimented with hipping the dos d'anés and flagging and counterflagging the hip. In February 1848, he wrote to the Inspector General of Fortifications to inform him of the extent of the problem, and of the means he had adopted to combat it\(^9\) (see Fig. 32 and Section 11, below).

The question of waterproofing then became the subject of a transatlantic controversy. London's response was to provide information on expedients adopted to meet similar
situations in other stations (notably Plymouth and Kingston) and to press for radical alterations involving the use of asphalt. Calder, in the meantime, went on experimenting with solutions of his own devising, a process which his successor, Colonel Savage (who arrived in June 1848), continued.

In the course of 1848, Calder and Savage came to realize that correcting the weak joins at either end of the arches and dos d'anes would not by itself be sufficient to solve the problem. Something had to be done about the drainage. The solution decided upon was the provision of an internal down pipe running from the mid-point of the dos d'ane gutter through the arch and down inside the casemate beneath. (It is not clear who was most responsible for the changes - probably it was Savage.) The warmth of the casemate would, they hoped, keep the pipes from freezing in cold weather (see Fig. 33).

In November 1848, Savage had Lieutenant Burmester, RE, inspect the casemates and produce a report. This document is especially interesting for the light it throws on the staunching expedients tried up to that time¹¹ (see section 12, below). It reveals that no fewer than five different methods of casemate covering were then in use. Of the 54 casemates (the re-entering angle casemates and the privies were not included), 12 had been flagged and hipped (Nos. 12-3, 15-23 and 58); 30 had been flagged (Nos. 8-9, 14, 24-53);
two still retained their tile covering (Nos. 3-4); four were covered in a combination of tiles and dry flagging (Nos. 54-5 and 59-60) and six were flagged, hipped and piped (Nos. 1-2, 10-11 and 56-7) (see Part 1, Figs. 9 and 33). In his report, Burmester did not recommend the introduction of internal piping. He thought it an unnecessary extravagance. Savage disagreed, but to keep the expense down, he proposed the re-location of the down pipe from the centre of the pier wall to the corner formed by the pier and retaining walls. 12

Without waiting for London to react to his proposals, Savage framed an estimate for staunching the casemates and sent it off in April 184913 (see section 13, below). This was the most elaborate of all the general estimates ever drawn up in the course of the construction of the Citadel. It represented a culmination of Savage's (and Calder's) experimentation with the types of waterproofing needed to withstand Halifax's formidable climate. It estimated for an extension of the hipping, flagging and counterflagging to all the casemates (privies and re-entering angle casemates again excepted), the provision of internal down pipes, the construction of a system of drains and water tanks, the alteration of the top of the rampart retaining wall to alleviate some of the water problems, and a number of lesser changes (see Figs. 34 and 35). The estimate was unique in that it also proposed similar alterations to the terreplein of the cavalier.
Unfortunately few of the provisions of this very detailed estimate were ever carried out. The Fortifications department had its own ideas about the best means of staunching leakage. In the end, a system involving the extensive use of asphalt and asphalted brick was adopted. It is unfortunate that we know little about the nature of the change. The estimates for the service were included in the Ordnance annual estimates beginning in 1851-52, and, since the texts of these documents have not been located, we can only speak in very general terms of the changes made. The major component in the new solution was "Claridge's Patent Seyssel Asphalte" (see section 14 below). The other materials were brick, concrete and course shingle. The dos d'anies were altered so that the hip extended to the centre of the casemate and the down pipe was moved back to the centre of the pier wall. The top of the retaining wall and escarp and the chimney casing were also altered, and extensive use was made of asphalted brick (see Fig. 36). In February 1854, Colonel Savage reported on the measures adopted (see section 15) and was relatively sanguine about their success.

Ten months later, Savage's successor, Colonel Stotherd, had the casemates inspected (see section 16, below). The results were depressing. Despite all the care and attention lavished on them in the preceding six years, 21 of the rampart casemates and all of the cavalier casemates still leaked. This revelation provoked something of a minor
crisis. It is impossible to determine the exact nature of Stotherd's response to the problem, but he seems to have confined himself to repairing the asphalt and repointing the masonry. This seems to have worked. A second inspection report, made in the summer of 1856, describes a substantial improvement (see section 16, below). And with that, the long history of the casemate staunching appears to have come to an end.

4 Subsequent events
There was a good deal of routine maintenance done, however, and items for such work appear in almost all of the annual estimates. Unfortunately few of these documents have survived. In some instances, we have the abstract of an estimate, but not the detailed calculation of materials and labour. It is therefore impossible to tell to what extent the casemates were altered in the course of ordinary repairs.

As an example, in 1862 the Barrack Annual Estimate included the following Citadel items:

Citadel. Sheet the ceiling of all the rooms £70
Citadel. Cavalier Casemates. Renew the floor boarding £1,466
Citadel. N° 18 Casemate [standard system No. 25] - Convert into a Woman's Wash House £111
Citadel. Ablution Room N° 23 Casemate. [standard system No. 30]. Provide 5 baths £64.
Citadel. Provide 1 Steel Oven and 15 Boilers £249
Officers' Quarters. External Pointing. £11
Officers' Quarters. Preparatory Repairs. £9
Soldiers' Quarters. External pointing £94

It would be interesting to know if, for example, the cavalier floor was much altered in the process of being renewed, but the lack of detail in the abstract makes it nearly impossible to find out. We can, therefore, only conclude that the casemates were subject to continual repair and renewal work and may have been substantially altered from their original form.

We do possess detailed estimates for three such alterations. In 1856, a supplementary estimate for the construction of cess pits and drains and the alteration of the soldiers' privies (Nos. 6 and 7A) was submitted and approved (see Fig. 37 and section 17, below). This is especially important, since we have no other documentation for the privies.

The other two alterations for which we possess estimates both reflect the continuing preoccupation with waterproofing. In 1859 an item was inserted in the Fortifications annual estimate for 1860-61 for the construction of a subterranean area between the pier of No. 1 casemate and the adjoining ramp (see section 18, below, and Fig. 38). In 1861 two items were inserted in the Civil Building Estimate for 1862-
63 for waterproofing and ventilating the magazine shifting rooms (Nos. 14 and 58) and for renewing the floor of the south magazine shifting room (see Fig. 39 and section 19, below). It is not certain whether either of these proposals were carried out. They probably were.

5 Digest of the information on the individual casemates

The purpose of the following list is to give an account of the location of the estimates for the completion of each of the casemates and to indicate which of them are represented in illustrations in this report, either by individual plans or by sections. The individual estimates listed below are located as follows in the following sections:

a) 1836 estimate, items 2, 3, 4 and 13: see Section 7.
b) 1843 estimate, items 1, 2, 5 and 6: see Section 8.
c) Ordnance annual estimate, 1844-45: see Section 9.
d) 1846 estimate, items 1 and 2: see section 10.
e) 1856 supplementary estimate: see section 17.
f) Civil building estimate, 1862-63: see section 19.

Several of the casemates were built under the provisions of Colonel Nicolls's general estimate of 1825. Since the estimate is rather sketchy, we know very little about these casemates. In some instances, estimates for alterations or rebuilding exist; these are listed below.
No. 1: Provided in item 1, 1843 estimate. See Figure 38.
No. 2: Provided in item 1, 1843 estimate.
No. 3: Casemate of defence. Provided in the 1825 estimate. Retaining wall, windows, etc. rebuilt under item 2 of 1846 estimate. See Figures 31 and 35.
No. 4: As for No. 3.
No. 5: No record. This small casemate was built some time between 1870 and 1890.
No. 6: Provided in item 4, 1836 estimate; altered under provisions of the 1856 supplementary estimate. See Figure 37.
No. 7A: As for No. 6.
No. 7B: No record. This small casemate is similar to No. 5 and was also constructed between 1870 and 1890.
No. 8: Casemate of defence. Provided in the 1825 estimate. Retaining wall, window, etc. rebuilt under provisions of item 2, 1846 estimate. See Figure 31.
No. 9: As for No. 8.
No. 10: Provided in item 1, 1843 estimate.
No. 11: As for No. 10.
No. 12: Casemate of defence. Provided in 1825 estimate. The retaining wall of the area was rebuilt under the provisions of item 5, 1843 estimate. The retaining wall of the casemate was rebuilt under the provisions of item 1 of the 1846 estimate. See Figures 27 and 30.
No. 13: As for No. 12.
No. 14: Shifting room. Provided in item 2 of the 1843 estimate.
Repairs and waterproofed under the provisions of the Civil Buildings Estimate, 1862-63. See Figure 39.

No. 15: Provided in item 1, 1843 estimate.
No. 16: As for No. 15.
No. 17: Provided in item 4, 1836 estimate.
No. 18: As for No. 17.
No. 19: Provided in item 13, 1836 estimate. See Figure 26.
No. 20: As for No. 19. An additional section of this casemate will be found in Figure 35.
No. 21: Provided in item 13, 1836 estimate. See Figure 26.
No. 22: Casemate of defence. Provided in the 1825 estimate. Provided again in item 4, 1836 estimate.
No. 23: As for No. 22.
No. 24: Provided in item 1, 1843 estimate. Re-submitted in greater detail in the Ordnance annual estimate for 1844-45.
No. 25: As for No. 24.
No. 26: As for No. 24.
No. 27: As for No. 24. A section of this casemate will be found in Figure 34.
No. 28: As for No. 24.
No. 29: As for No. 24.
No. 30: As for No. 24.
No. 31: Casemate of defence. Provided in item 3, 1836 estimate.
No. 32: As for No. 31.
No. 33: Provided in item 6, 1843 estimate. Re-submitted
in greater detail in the Ordnance annual estimate for 1844-45.

No. 34: Casemate of defence. Provided in item 3, 1836 estimate.

No. 35: As for No. 34.

No. 36: Two-storey redan casemate. Provided in item 2, 1836 estimate. See Figures 28 and 29.

No. 37: As for No. 36.

No. 38: As for No. 36.

No. 39: As for No. 36.

No. 40: As for No. 36.

No. 41: As for No. 36.


No. 43: As for No. 36.

No. 44: As for No. 36.

No. 45: As for No. 36. A photograph of the interior of this casemate will be found in Figure 40.

No. 46: Same as No. 36. An additional section of this casemate will be found in Figure 35.

No. 47: As for No. 36.

No. 48: As for No. 36.

No. 49: Casemate of defence. Provided in item 3, 1836 estimate.

No. 50: As for No. 49.

No. 51: Provided in item 6, 1843 estimate. Re-submitted
with greater detail in Ordnance annual estimate, 1844-45.

No. 52: Casemate of defence. Provided in item 3, 1825 estimate.

No. 53: As for No. 52.

No. 54: Casemate of defence. Provided in the 1825 estimate.

No. 55: As for No. 54. A section of this casemate will be found in Figure 35.

No. 56: Provided in item 1, 1846 estimate.

No. 57: As for No. 56.

No. 58: Shifting room. Provided in item 2, 1843 estimate. Repaired, waterproofed and the floors replaced under the provisions of the Civil Buildings Estimate, 1862-63. See Figure 39.

No. 59: Casemate of defence. Provided in the 1825 estimate.

No. 60: As for No. 59. A section of this casemate will be found in Figure 35.

(Note: A section of the casemates provided in item 1 of the 1843 estimate will be found in Part 1, Fig. 8).
### 6 Structural Summary
Redan two-storey casemates (Nos. 36-41, 43-8)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Number</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piers (side walls)</td>
<td>12</td>
<td>$38\frac{1}{2}$ ft</td>
<td>5 ft.</td>
<td>9 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Foundations (deep)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>masonry</td>
</tr>
<tr>
<td>Piers (side walls)</td>
<td>12</td>
<td>$38\frac{1}{2}$ ft</td>
<td>4 ft.</td>
<td>19 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Above foundations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>masonry</td>
</tr>
<tr>
<td>End walls (facing parade)</td>
<td>1</td>
<td>280 ft.</td>
<td>4 ft.</td>
<td>10 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Foundation (deep)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>faced with granite</td>
</tr>
<tr>
<td>End walls (facing parade)</td>
<td>1</td>
<td>280 ft.</td>
<td>2 ft.</td>
<td>20 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Above foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>faced with granite, cope at top.</td>
</tr>
</tbody>
</table>
Arches 12 40 ft. 18 ft. 2 ft. Brick, to
8 in. 9 in. into (thick) end walls;
remainder of stone.

Dos d'anès 12 $38\frac{1}{2}$ ft. 27 ft. 1 ft. -- (mean thickness)

Interior height: 8 ft. in lower storey,
11 ft. to crown of arch in upper storey.

Floors (between storeys): Plates: 6 in. x 4 in.
Joists: 10 in. x 4 in. pine scantling (placed not more than 17 in. apart)
19 to each casemate.
Floor: 2 in. pine planks

Floors (ground level): Kitchen (No. 45B) floored with brick-on-edge paving. Estimate calls for 960 square yards of brick-on-edge paving, so this may quite possibly have been the normal paving for casemate basements.
Doors (outside): 10 in number; oak frames and 3 in. oak plank in doors.

Doors (inside): Details not given. Possibly oak framed with 2-in.-thick plank doors (wood not specified).

Windows: Estimate calls for 58 oak sashes and frames, plus bars and gratings for windows. More detail not given.

Interior stairs: 6 flights with 2 in. plank treads. More detail not given.

Interior partitions: These present a host of problems.

The nearest contemporary plan, a tracing from Jones's sketch of 1836, dated 1844 (plan 04-1844-4-1) shows how it was originally intended to divide the upper storey. It was presumably the arrangement described briefly in the text of the estimate ("4 1/2 brickwork framed"). There is nothing to indicate that the arrangement detailed in this way was ever carried out. Three plans, one a copy of a sketch by Lieutenant Wentworth, also from the 1830s (plan 04-1844-6-1) and two by Colonel Calder, one of the upper storey and one of the lower (plans 04-1844-3-1 and 04-1844-3-2 respectively) do something to clarify the issue. Wentworth's sketch can, I think, be disregarded. Calder's plan of the upper storey corresponds exactly to the 1847 block plan (plan 01-1847-12-1) and was almost certainly the arrangement adopted. Its legend reads, "the partition to be of lath and plaster,
lined on the side near[?] the passages with 1" boards to
the height of 4 feet". Calder's plan for the lower storey
partitions is also likely to have been adopted. Here the
legend reads, "Partitions to be of 4\(\frac{1}{2}\)" brick with frames",
and this agrees with the 1836 specification.
Casemates of defense (Nos. 31-2, 34-5, 49-50, 52-3)

<table>
<thead>
<tr>
<th>Feature</th>
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<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Material</th>
</tr>
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<td>5 ft.</td>
<td>9 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
<td>(deep) masonry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piers (side walls)</td>
<td>14</td>
<td>38 1/2 ft.</td>
<td>4 1/2 ft.</td>
<td>7 ft.</td>
<td>Ironstone above masonry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End walls</td>
<td></td>
<td>3 ft.</td>
<td>20 ft.</td>
<td>Ironstone</td>
<td>faced with granite</td>
</tr>
<tr>
<td>Arches</td>
<td>8</td>
<td>38 1/2 ft.</td>
<td>16 ft.</td>
<td>2 ft.</td>
<td>Brick (span) 3 in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(thickness)</td>
</tr>
</tbody>
</table>

Floors: Brick-on-edge paving
Doors: 10 in number
Frames: 6 ft. x 3 ft. x 3 in. of oak
Doors: 3 in. oak plank.
Windows: 30 sashes, 4 1/2 ft. x 3 ft.
Embrasures: 200 superficial feet of cut granite. No further information given.

Interior partitions: Nos. 49-50 were intended to be fitted up as a guardroom and as solitary cells respectively. The only surviving plan of No. 50 (plan 04-1844-6-1) does not show it as it is today. In any case, there is no detailed information given in the 1836 estimate, except for an entry for 50 perches of brickwork in the guardroom partitions and another for four strong padlocks for the cells.

Well: The well in No. 49 was to arched over with brick and a pump placed outside. There is no evidence that this was done.
Casemates, northern front (Nos. 17-8, 22-3)

The 1836 estimate (section 7, below) supplies no information about the piers for the two casemates of defence (Nos. 22 and 23) leading one to suppose that these, as part of the original plan, were already begun in 1836.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Number</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Material</th>
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</thead>
<tbody>
<tr>
<td>Piers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nos. 17-8)</td>
<td></td>
<td>50 ft.</td>
<td>5 ft.</td>
<td>12 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(deep)</td>
</tr>
<tr>
<td>Piers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nos. 17-8)</td>
<td></td>
<td>50 ft.</td>
<td>4 ft.</td>
<td>11 ft.</td>
<td>Ironstone</td>
</tr>
<tr>
<td>Above</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(deep)</td>
</tr>
<tr>
<td>foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End walls</td>
<td></td>
<td>3 1/2 ft.</td>
<td>5 ft.</td>
<td>Ironstone</td>
<td></td>
</tr>
<tr>
<td>Foundations</td>
<td></td>
<td>(mean faced with</td>
<td></td>
<td>depth) granite</td>
<td></td>
</tr>
<tr>
<td>End walls</td>
<td></td>
<td>3 ft.</td>
<td>20 ft.</td>
<td>Ironstone</td>
<td></td>
</tr>
<tr>
<td>Above</td>
<td></td>
<td></td>
<td></td>
<td>faced with</td>
<td>granite</td>
</tr>
<tr>
<td>foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Arches 4 50 ft. 15 ft. 2 ft. brick
(span) 3 in.
(thickness)

Dos d'anes 4 50 ft. 22 ft. 1 ft.
(mean
thickness)

Floors: Brick-on-edge paving
Doors: Frames: 8 in. x 6 in. oak timber
Doors: 3 in. oak plank
Windows: No information available.
Casemates, northern front (Nos. 19-21)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piers</td>
<td>50 ft.</td>
<td>5 ft.</td>
<td>10 ft.</td>
<td></td>
</tr>
<tr>
<td>(Foundation)</td>
<td></td>
<td></td>
<td></td>
<td>(depth)</td>
</tr>
<tr>
<td>Piers</td>
<td>50 ft.</td>
<td>4 ft.</td>
<td>7 ft.</td>
<td></td>
</tr>
<tr>
<td>(Above</td>
<td></td>
<td></td>
<td></td>
<td>foundation)</td>
</tr>
<tr>
<td>End walls</td>
<td></td>
<td></td>
<td></td>
<td>(Foundation)</td>
</tr>
<tr>
<td>End walls</td>
<td></td>
<td></td>
<td></td>
<td>(Above</td>
</tr>
<tr>
<td>Arches</td>
<td>50 ft.</td>
<td>15 ft.</td>
<td>2 ft.3 in.</td>
<td>Brick</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(span) (thick)</td>
</tr>
<tr>
<td>Dos d'anés</td>
<td>50 ft.</td>
<td>22 ft.</td>
<td>9 [in.]</td>
<td>Tile laid in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(mean cement with lead</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>thickness] gutters 50 ft. x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 ft. wide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>covered with iron-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>stone slabs</td>
</tr>
</tbody>
</table>
Floor:  Brick-on-edge paving

Doors:  Frames: 8 in. x 6 in. oak timber

Doors: 3 in. oak planks

Dimensions: 6 ft. x 3 ft. x 6 in.

Windows:  $4 \frac{1}{2}$ ft. x 3 ft.
Miscellaneous Casemates

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nos. 1-2, 10-1, 56-7)</td>
<td>45</td>
<td>5</td>
<td>4</td>
<td>No information available for any of these</td>
</tr>
<tr>
<td>(foundations)</td>
<td></td>
<td></td>
<td>(depth)</td>
<td></td>
</tr>
<tr>
<td>Piers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nos. 1-2, 10-1, 56-7)</td>
<td>53</td>
<td>10</td>
<td>8 ft(?)</td>
<td>casemates</td>
</tr>
<tr>
<td>(foundations)</td>
<td></td>
<td>8</td>
<td>5</td>
<td>(depth)</td>
</tr>
<tr>
<td>Piers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nos. 1-2, 10-1, 56-7)</td>
<td>45</td>
<td>4</td>
<td>6</td>
<td>(walls)</td>
</tr>
<tr>
<td>Piers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nos. 15-6)</td>
<td>45</td>
<td>4</td>
<td>6</td>
<td>(walls)</td>
</tr>
<tr>
<td>Arches</td>
<td></td>
<td></td>
<td></td>
<td>brick casemate (span)</td>
</tr>
<tr>
<td>Dos d'anès</td>
<td>22 ft.</td>
<td>9 in.</td>
<td>(mean thickness) (maximum</td>
<td></td>
</tr>
</tbody>
</table>
thickness
3 ft. from
crown of
arch)

Floors:  Nos. 1-2, 10-11, 56-7: Brick on edge
         Nos. 15-6: Flag pavement

Doors:  Frames: 4 in. x 6 in. planed and rebated pine
        Doors: 2 in. pine, frames, 4-panel, bead
               and butt, flush on both sides
        Sashes: bevelled bar.

Windows: No information.
This estimate is for the construction of Nos. 6, 7A, 17-21, 31-2, 34-5, 36-50 and 52-3. The casemates were all built in accordance with the provisions of this estimate, although certain features, notably the dos d'anes were subsequently altered many times. The list of fitments proposed for the redan casemates in item 1 is the best such list we possess.

Item 2. Casemates in Redan, Eastern front

This Item provides for building 12 Casemates to accommodate 2 field officers and 17 Captains & Subalterns with Mess establishment, Kitchens, Privies, &c.- The front Wall 3 feet thick of granite and iron stone, as before described.- The piers 4 feet 6 inches thick of iron stone.- The arches of brick 2 feet 8 inches thick with dos d'anes of one foot mean thickness, covered with tiles.- The gutters lined with lead, 3 feet wide.- The Casemates are 18 feet wide.

The lower Story 8 feet high, the upper 11 feet to the crown of the arch.- The upper rooms to be floored with 2 inch plank upon joists 10 x 4, [Note: no dimensions given.] Kitchens brick on edge flooring.- 18 outside doors of oak with frames &c.- 52 inside doors with frames, 58 sashes and frames.- Interior partitions as shown on Plan n° 1, to be $4\frac{1}{2}$ inch brickwork framed.- 6 flights of steps from the basement story.- The iron work provides for gratings to embrazures, bars, bolts, hinges &c. as also
a railing on retaining Wall of rampart 280 feet in length,  
instead of a dwarf wall of masonry.  

[Space left in ms.]  
The area wall is necessary in front of the basement  
story, 270 feet long and 3 feet thick, as shown in plans  
n° 1 and 2. Six arches across the area to form a  
communication to the upper floor with steps and iron  
railings. The area to be paved with brick on edge,  
270 feet long and 6 feet wide.  

The excavation is for the rear wall of the Casemates  
280 feet in length, 4 feet wide and 6 feet deep,— also for  
the piers 12 in number 38½ feet long by 5 feet wide and  
5 feet deep.  

The masonry is for the foundation 280 x 4 x 10 and  
foundation of 12 piers 38½ x 5 x 9 each;— the foundation of  
the masonry appears more than the excavation which is in  
consequence of a part of the foundation being above the  
present level of the ground;— Above foundations 280 x 3  
x 20, 12 piers 38½ feet x 4½ x 19 and the dos d'ane of  
the arches, 12 in number, 38½ x 27 x 1 foot.— The workman-  
ship on face is for the wall of the Casemates including  
the coping 280 x 27.  

12 arches to Casemates 40 feet long, the brick work  
to run 9 inches into the front and rear walls, the remainder  
of the arches running through the wall to be of stone, [sic]
span of arch 18 feet by 2'8" thick. Plates are included for the joists to rest on $6^\text{in} \times 4^\text{in}$,- joists not exceeding 17" from Center to Center in each Casemate.

The iron railing on the retaining wall is 280 feet in length with two bars of $\frac{3}{4}$ inch square, and standards at each 10 feet of $1\frac{1}{2}$ inch square iron.-

The area wall foundation is 3 feet deep by 3'6" thick, wall above 3 feet by 10 feet.- The workmanship includes the face of the wall & coping.

The following fitments will be required before these Casemates are appropriated as Officers Quarters.-

[Author's note: Square brackets in the subsequent estimates indicate the original figures, which were later revised at the IGF's suggestion. The totals are also revised.]

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Franklin stoves for Officers rooms</td>
<td>100/-</td>
<td>120.0.0</td>
</tr>
<tr>
<td>Setting do....... in sheet iron</td>
<td>19/-</td>
<td>24.0.0</td>
</tr>
<tr>
<td>19 grates set in Officers Kitchens</td>
<td>20/-</td>
<td>19.0.0</td>
</tr>
<tr>
<td>1 Kitchen range set in Mess Kitchen</td>
<td>24/-</td>
<td>1.4.0</td>
</tr>
<tr>
<td>1 Hot hearth &quot; &quot;</td>
<td>30/-</td>
<td>1.10.0</td>
</tr>
<tr>
<td>1 Oven and one Boiler &quot; &quot; &quot;</td>
<td>26/-</td>
<td>2.12.0</td>
</tr>
<tr>
<td>1 Cast iron oven 1'.6&quot; deep, 1'.4&quot; wide &amp; 1'.9&quot; high with</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2 shelves and cast iron flues:-

\[ \frac{3}{4} \text{ Cwt.} \quad \text{complete} \quad 30/- \quad 3.7.6 \]

1 Cast iron Boiler 1'.10" x

\[ 1'.5" \times 1'.4" \times \frac{3}{4} \text{ inch thick} \]

\[ 1: 2: 14 \quad 30/- \quad 2.8.9 \]

1 -do.-Grate with door &

\[ \text{complete for heating do.} \]

\[ 0: 3: 7 \quad 30/- \quad 1.4.4 \frac{1}{2} \]

105 lineal feet of moulded cornice for curtains, Office rooms

\[ 5d \quad 2.3.9 \]

237 yards of plain wainscot in cupboards-do.-

\[ 3/- \quad 35.11.0 \]

178 yards of plain wainscot in dressers and shelves for Kitchens

\[ 3/- \quad 26.14.0 \]

750 yards of 3 coat oil painting on woodwork

\[ 8d \quad 25.0.0 \]

66 brass labels for Keys with chains

\[ 6d \quad 1.13.0 \]

6 Bells for Mess & Field Officers' rooms with carriages

\[ 5/- \quad 1.10.0 \]

18 Bell cranks

\[ 4d \quad 1.6.0 \]

6 Bell pulls

\[ 2/- \quad 1.12.0 \]

6 Cheek springs

\[ 3d \quad 1.1.6 \]
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>lbs of copper wire</td>
<td>2/6</td>
<td></td>
<td>1.12.6</td>
</tr>
<tr>
<td>177</td>
<td>yards of patent sash cord for sashes officers rooms</td>
<td></td>
<td>1d</td>
<td>1.14.9</td>
</tr>
<tr>
<td>3½</td>
<td>dozen sash fasteners</td>
<td>18/-</td>
<td></td>
<td>3.3.0</td>
</tr>
<tr>
<td>41</td>
<td>Metal pulley boxes (5 inch) brass lace</td>
<td></td>
<td>1/-</td>
<td>2.1.0</td>
</tr>
<tr>
<td>24</td>
<td>pairs of 2 inch wrought butt hinges for cupboards</td>
<td>4d</td>
<td></td>
<td>2.8.0</td>
</tr>
<tr>
<td>24</td>
<td>strong brass buttons</td>
<td>8d</td>
<td></td>
<td>2.16.0</td>
</tr>
<tr>
<td>3</td>
<td>doz. Iron cloak pins for Mess Establishment</td>
<td>5/-</td>
<td></td>
<td>2.15.0</td>
</tr>
<tr>
<td>8</td>
<td>do. do. for Officers rooms</td>
<td>5/-</td>
<td></td>
<td>2.0.0</td>
</tr>
<tr>
<td>10</td>
<td>for Officers rooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>French latches with 2 keys for Officers rooms</td>
<td>4/6</td>
<td></td>
<td>[5.17.0]</td>
</tr>
<tr>
<td>19</td>
<td>lbs Iron curtain rods, 12 oz. per foot do.</td>
<td>4d</td>
<td></td>
<td>1.6.4</td>
</tr>
<tr>
<td>826</td>
<td>lbs cast Iron sash weights – 7 lbs each weight</td>
<td>2d</td>
<td></td>
<td>6.17.8</td>
</tr>
</tbody>
</table>

[Total] £291.17.7½
[295.15.1½]
Contingencies 10th 29.3.9
[29.10.6]
[Total] £321.1.4½
[324.15.1½]
### [Estimate, Item 2]

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<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
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<tbody>
<tr>
<td>764</td>
<td>cubic yards of earth excavated for foundations</td>
<td>10d</td>
<td>31.16.8</td>
</tr>
<tr>
<td>6107</td>
<td>perches of masonry, in rear walls, piers and foundations</td>
<td>14/2</td>
<td>4325.15.10</td>
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<tr>
<td>7560</td>
<td>supl. feet of workmanship, on face of wall</td>
<td>1/8</td>
<td>630.0.0</td>
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<tr>
<td>1823</td>
<td>perches of brick work in arches</td>
<td>30/-</td>
<td>2734.10.0</td>
</tr>
<tr>
<td>130</td>
<td>squares of Tiling, laid in cement</td>
<td>62/-</td>
<td>403.0.0</td>
</tr>
<tr>
<td>128(\frac{1}{2})</td>
<td>cwt of sheet Lead, 10 lbs p foot for gutters</td>
<td>32/6</td>
<td>208.16.3</td>
</tr>
<tr>
<td>1980</td>
<td>cubic feet of pine Scantling in joists, plates &amp;c</td>
<td>1/1</td>
<td>107.5.0</td>
</tr>
</tbody>
</table>

[1380] [74.15.0]
86\(\frac{1}{2}\) squares of 2 inch pine plank, in flooring 32/2 139.2.5

960 square yards of brick on edge Paving, kitchen floors 5/6 264.0.0

120 cubic feet of oak timber in door frames 2/11 17.10.0 [14.0.0]

351 suppl. feet of 3 inch oak plank in doors 1/5 24.17.3

819 do. in Sashes and frames 1/10\(\frac{1}{2}\) 76.15.7\(\frac{1}{2}\)

166 perches of brick work, in interior partitions 30/- 249.0.0

15 squares 2 inch plank, steps and doors 32/2 24.2.6

6485 lbs of wrought Iron, bars and grates &c. 3d 81.1.3
7\frac{1}{4} \text{ cwt Lead for securing Iron work} \quad 32/6 \quad 11.15.7\frac{1}{2}

1785 \text{ lbs wrought Iron, bars } \frac{3}{4} \text{ inch, 30 oz per lineal foot, iron railing on retaining wall of Rampart} \quad 3d \quad 22.6.3

1 \text{ cwt Lead for the above} \quad 32/6 \quad 1.12.6

663 \text{ perches of masonry in area wall front of Casemates} \quad 14/2 \quad 469.12.6

4590 \text{ supl. feet of workmanship, on face of wall and coping} \quad 1/8 \quad 382.10.0

24 \text{ perches of Brick work in arches over area to doors} \quad 30/- \quad 36.0.0

180 \text{ square yards brick on edge paving to area} \quad 5/6 \quad 49.10.0
<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Unit / Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 supl. feet cut granite, Steps, &amp;c.</td>
<td>2/5</td>
<td>36.5.0</td>
<td></td>
</tr>
<tr>
<td>949 lbs wrought Iron 3/4 inch square, Iron railings to footway</td>
<td>3d</td>
<td>11.17.3</td>
<td></td>
</tr>
<tr>
<td>1 cwt Lead for the above</td>
<td>32/6</td>
<td>1.12.6</td>
<td></td>
</tr>
<tr>
<td>26 iron rimmed knob Locks, for officers' rooms</td>
<td>7/-</td>
<td>9.2.0</td>
<td></td>
</tr>
<tr>
<td>26 pairs of Butt hinges do.</td>
<td>1/6</td>
<td>1.19.0</td>
<td></td>
</tr>
<tr>
<td>18 best large Padlocks for outside doors</td>
<td>5/-</td>
<td>4.10.0</td>
<td></td>
</tr>
<tr>
<td>40 10 inch Stock locks for Kitchen</td>
<td>3/-</td>
<td>6.0.0</td>
<td></td>
</tr>
<tr>
<td>40 pairs HL[?] hinges do.</td>
<td>2/6</td>
<td>5.0.0</td>
<td></td>
</tr>
<tr>
<td>40 strong thumb Latches do.</td>
<td>1/6</td>
<td>3.0.0</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td>Rate</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>24</td>
<td>stone Chimney pieces for officers rooms</td>
<td>50/-</td>
<td>60.0.0</td>
</tr>
<tr>
<td>4072</td>
<td>running feet of Skirting</td>
<td>2d</td>
<td>33.18.8</td>
</tr>
<tr>
<td>2112</td>
<td>architrances</td>
<td>3d</td>
<td>26.8.0</td>
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<tr>
<td>2425</td>
<td>yards of 2 coat plastering on walls</td>
<td>1/1</td>
<td>131.7.1</td>
</tr>
<tr>
<td>816</td>
<td>do. 2 coat Lath &amp; plastering on kitchen Ceilings</td>
<td>1/9</td>
<td>71.8.0</td>
</tr>
<tr>
<td>1518</td>
<td>do. Distemper on walls officers' rooms</td>
<td>$2\frac{1}{2}$d</td>
<td>15.16.3</td>
</tr>
<tr>
<td>836</td>
<td>do. 3 [2] coat white Painting on wood work</td>
<td>7d</td>
<td>27.17.4</td>
</tr>
</tbody>
</table>

**Total** £ 10777.0.9

Contingencies 1/10th £ 1073.14.0\(\frac{3}{4}\) £ 1069.15.1\(\frac{1}{4}\)

**Total** £ 11810.14.9\(\frac{3}{4}\) £ 11767.6.2\(\frac{1}{4}\)
Additional
fittings Detailed
in Report

\[ \text{Total} \quad £12131.16.2\frac{1}{4} \]

**Item 3**: Casemates of defence Casemated Guard room, Sally ports, Main Entrance and retaining Wall of Rampart, Eastern front

This Item provides for joining the Redan faces of the North East & South East Bastions, including eight Casemates of defence, two Sally ports, the main Gateway and the retaining wall of the Rampart of the Eastern front with its steps of communication.

The walls and piers of these Casemates are of the same thickness as quoted in Item 2.- The piers to the retaining wall of the Rampart 2 feet 6 ins thick, the retaining wall 3 feet thick, arches 1 foot 6 ins thick.- The Casemates of defence are only 15 feet wide with arches 2 feet 3 inches thick.- Sally port arches 1 foot 6 ins thick.- There are 42 cut granite steps.- 8 embrasures 200 feet sup\(\frac{1}{2}\) of cut granite in each.- The Gateway 320 sup1 feet.- 36 steps to Sally port of cut granite.- The flooring to casemates brick on edge.- 10 oak outside doors & frames 6 feet by 3 feet 3 ins.- 3 sashes & frames 4 feet 6 ins by 3 feet.- The iron work is for bolts, bars, gratings &c.- Two of the Casemates of defence are to be fitted up as Guardrooms and solitary cells, as shewn on Plan \(\text{n}^\circ\) 1 and a well which will fall within the
Guardroom, to be arched over, with Pump outside; See Plan n° 1.- Lead gutters as before described.

The excavation is for the foundation of the rear wall of the Casemates, Sally ports gateway, steps to rampart &c. 290 feet in length, 4 feet wide and 6 feet deep;— retaining wall of the rampart 280 feet in length 3/2 feet wide and 6 feet deep.— 24 piers to retaining wall 7 feet long 3 feet wide and 6 feet deep;— 14 Casemate piers 38 1/2 feet long, 5 feet wide & 6 feet deep, and for walls and pit of privy 20 x 13 x 12 [feet?].

The masonry is for the foundation of the rear wall of the Casemates and retaining wall of rampart,— of the Casemate piers and piers to the retaining wall, and walls of the pit for the privy of the same dimensions as above stated; also for the walls above foundations; viz. 290 x 3 x 20 and 280 x 3 x 20;— dwarf wall of Rampart 570 x 2 1/2 x 2: 24 piers to retaining wall 7 x 2 1/2 x 9 1/2 high with dos d'anès to the arches; 14 Casemate piers 38 1/2 feet long by 4 1/2 by 7 feet high with dos d'anès, including Gateway & Sally ports & walls &c. of privy.— The rear walls of the cells of the retaining wall to be convex towards the Rampart.— There are 24 arches to retaining wall of the dimensions shewn on the sketch,— 8 to Casemates of defence 38 1/2 feet long 2': 3" thick and 15 feet span; 2 Sallyports 38 1/2 feet 1'.6" thick span 6 feet,— Gateway 38 1/2 by 2'.3"
thick span 10 feet; privy 13 feet by 2' .3" thick & span 10 feet. – The tiling is for the Casemates 8 (38\(\frac{1}{2}\) x 22); Sallyports 2 (38\(\frac{1}{2}\) x 13); Gateway 38\(\frac{1}{2}\) x 26 and Privy 13 x 22. –

The workmanship is for the face of the wall including the coping 570 x 27 the [?] &c making up for the openings. –

The 76 steps to ramparts and Sallyport are 6 x 1.6 tread and riser. The 10 door frames are 6 x 8 and the doors of 3 inch oak; – 12 joists to privy 11 feet long 8" x 4" of pine; the 2 inch plank includes the floor, seats, &c.

The extra cut Granite is for the exterior facade of the Gateway as shewn in the plan and Elevation: the 320 feet of common cut for the ribs of the archway. –

The length of the bridge is 35 feet including the drawbridge, that being the width of the ditch on the Eastern front; the joists of the standing part of the bridge 12 x 4 and pieces 12 x 6 and cross piece for [?] 12 x 12 are of oak; the joists of the drawbridge of pine so as more easily to balance, of the same dimensions: – The platform of the bridge which is 12 feet wide is first covered with 2 inch planks and a second covering of the same 9 feet wide. The counterpoise to be framed of oak and loaded with shot, the under side being lined with 3 inch oak plank. – The two sets of Gates to be framed with 3 inch oak plank, pannells [?] on one side, and lined with two inch oak plank on the other nailed: – wickets in each. – There are also a set of Barrier Gates at the entrance of the Bridge on the Counterscarp framed
of 3 inch oak 12 feet by 7 feet high. - The trunnions with the
straps made of 4 inch flat iron \(\frac{3}{4}\) of an inch thick, to
spread over and under the trunnion piece; and running along
the joists at each side, will weigh 3:1[?] 121; the trunnions
will be 3 inches in diameter and 6 inches long; 15 bolts with
nuts 12 inches long made of \(\frac{7}{8}\) inch square iron 0:3[?] 0.-
2 iron straps with loops to receive the chains at each end
of the drawbridge 3 x \(\frac{5}{2}\) 2:0:0.- Iron rollers or wheels with
iron frames to play in brass bearings 2:0:0.- 2 Cable made
chains \(\frac{5}{8}\) inch round iron 30 feet long each for drawing up
bridge 1:3:0.- 4 Common made chains of \(\frac{1}{2}\) inch round
iron from the hand rail each side to the piers, to be
headed into the piers and to hook and unhook from the handrail
1: 1: 0.- 2 Cast metal (brass) bearers for trunnions
of drawbridge with caps [?] &c.- and cast metal bearers
for the wheels or rollers for drawing up the bridge.

The two sets of double gates will take 4 pairs of double
strap hinges, flat iron 3 x \(\frac{3}{8}\) 2:0 4 pair of hooks for
hinges leaded into stone 1:2:0:0.- 2 Iron swing bars with
half staples & hasp &c. 1:2:0 2 strong shutting bolts for
bottom of gates 1:1:0:- 4 hooks for holding back
Gates, 14 lbs.-

The under side of the drawbridge is lined with
2 inch oak plank.-

The Scantlings of the Drawbridge &c are as follows-
3 Sills 12 feet long.....14 x 14 pine
3 Plates 12 do. do......14 x 14 do.
9 Posts 14 do. ......14 x 14 do.
Sleepers, braces, rails & posts ...6 x 6
Planking of 3 inch oak for Gates &c.-
and oak Scantling for framing.-

[Note added in London calls for detailed drawing of
gates, bridge, etc.]

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Contingencies 1/10th

\[ £9119.2.9\frac{1}{2} \]

\[ 911.18.1\frac{1}{2} [?] \]

Total

\[ £10030.1.0\frac{3}{7} \]

\[ [10013.12.1\frac{1}{1}] \]

**Item 4**

Retaining Wall of Rampart, North, South and West fronts, including Sally ports, Ramp. Steps, Casemate over Well, and
Casemate for Stores, &c under Rampart, North front.—
This Item provides for completing the retaining Wall of the Rampart of the North, South and West fronts—two Sally ports, two Casemates at the Well, north front, two Casemates of defence and a Soldiers' Privy.

The construction of the retaining wall of the Rampart is shewn in the last Item and on Plan n° 1.—The piers, arches, dos d'anes, front walls, &c of the Casemates are the same as those detailed on Item 2.—

There are 20 granite steps to communicate to the Rampart and 40 for the Sally ports.—The flooring of the Casemates and Sally ports to be of brick on edge.—8 oak doors and frames complete.—8 sashes and door d°. The Iron is for gratings, hinges, bars bolts &c.—The lead is for gutters as before described.

The excavation is for the foundation of the retaining wall 1000 feet in length by 3$\frac{1}{2}$ feet wide, and 5 feet [mean depth], piers to retaining Wall 64(7 x 3 x 5 mean depth). 2 Sallyports 45 feet long 13 feet wide & 21$\frac{1}{2}$ feet deep through old Ramparts; also for ramp 33 x 18 x 9; for steps 17 x 12 x 6$\frac{1}{2}$ and Privy 23 x 19 x 20 excavated from old Ramparts of West front,—and for the foundation of the piers of the Casemates at the well 4(50 x 4 x 8).
The Masonry is as follows,— retaining wall

foundation 1000 x \(\frac{1}{2}\) x 5 mean:— foundation of 64 piers

to retaining 7 x 3 x 5 mean; 4 Sallyport piers 45 x
\(\frac{1}{2}\) x 3;— two Ramp walls 24 x 4 x 9 mean. 2 Walls to
Steps 15 x 3 x 9 mean;— Casemate over well 2(50 x 5
x 12) for foundations of piers and 2(50 x 4 x 7) for piers
above foundation.—

Retaining wall above foundation 1000 x 3 x 20 and
1000 x \(\frac{1}{2}\) x 2 for dwarf wall of Rampart;— 64 piers to
retaining wall 7 x \(\frac{1}{2}\) x 9\(\frac{1}{2}\);— dos d'anes to arches
60(7 x 14 x 1);— 4 Sallyport piers 45 x 3 x 7 and
dos d'anes 2(45 x 14 x 1) and dos d'anes to Casemates
at well 2(50 x 22 x 1) and walls to privy and pit, &c.—

The workmanship is for the face of the wall including
the coping 1000 feet in length by 27 feet,— the 60 openings
of cells 9 x 10 being deducted. The brickwork is for the
arches to retaining wall 60 in number, 1'.6" thick and 9
feet span;— 2 Casemates of defence, 50 x 2'.3" thick and 15
feet span;— 2 Sallyports 45 by 1:6 thick and 6 feet
span: 2 Casemates at Well 50 by 2'.3" thick 15 feet span;
as also for arches of Privy, dust hole steps and
Ramp.—

The tiling is for the above arches, excepting the
arches of the cells of the retaining wall, which have a dos
d'ane only, to be laid so as to turn off the wet sufficiently.—
The Granite steps to the Rampart and Sallyports are 6 feet by 1'6". The door frames 8" x 6" and the doors of 3 inch oak plank; 10 joists to Privy 11 feet in long 8 x 4

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621 suppl. feet of cut granite
Steps to Rampart and Sally ports 1/8 57.15.0

367 square yards brick on edge, Paving to floors 5/6 100.18.6

48 cubic feet of [37] oak Timber in door frames 2/11 7.0.0

157 suppl. feet 3 inch oak plank, outside doors 1/5 11.2.5

77 do. Sashes & frames, complete 1/10 7.4.4

1400 lbs wrought Iron in hinges, bars, bolts, &c 3d 17.10.0

1 1/2 cwt of Lead, for the above Iron work 32/6 2.8.9
### Item 13

Three additional Casemates for Commissariat and Barrack Store accommodation North front

The three additional Casemates for Commissariat and Barrack store accommodation, suggested by the Inspector General of Fortifications; each Casemate being 50 feet long and 15 feet

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<td>p supl. foot for gutters</td>
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wide, to be completed in the same manner as the Casemates before detailed,—(See Plan No. 1,) are provided for this Item.—

These three Casemates are to be placed between the Casemates at the well and the Casemates of Defence, North front,—by which means two additional piers only will be required, the excavation for which will be 2(50 × 5 × 10).—

The masonry as follows,—Foundation of piers 2(50 × 5 × 10). Piers above foundations 2(50 × 4 × 7). Dos d'anes 3(50 × 22 × 1). 3 Brick arches 50 feet long by 2.3 thickness and 15 feet span.—Tiling 3(50 × 22). Brick-on-edge paving for floors 3(15 × 50).—3 oak door frames in 8 × 6.—Doors 3 inch oak plank 6 × 3.6.—Windows 4.6 × 3.—The Iron work is for the hinges, bars, bolts, and common Grates.—The lead for securing the Iron work:—Sheet lead is also provided for two gutters to roofs 50 feet long by 3 feet wide; the gutters to be covered with Iron stone slabs.—3 Stock locks for the doors.—

Before appropriating these Casemates as Storerooms, some common studded partitions will be required to keep the barrels in their places, and skids for them to lie on:—8 in in in in skids 50 feet long 4 × 4;—56 studs 6 feet long 4 × 4;—4 in in sills and 4 plates each 50 feet long 6 × 4 and 42 crosspieces in in each 5 feet long by 4 × 4,—Making 175 cubic feet for each Casemate, which at 1/6 per cubic foot will amount to £13.2.6 or £39.7.6 for the three Casemates.—
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Sashes & frames

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Contingencies

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[Total] £ 1464.14.6

8 The 1843 Estimate

This estimate provides for the construction of Nos. 1-2, 10-1, 15-6, 24-30, 33, 51, 56, 58, and 14. It also provides for the rebuilding of the retaining walls of the areas of Nos. 12 and 13. This was only a preliminary estimate, detailing the anticipated expenses. A more detailed account of each item was included as each service was included in
the ensuing Ordnance annual estimates. Unfortunately, we only possess the annual estimate for 1844-45 (see section 9, below) which provides a detailed account of the construction of Nos. 24-30 and Nos. 33 and 51. The more detailed account should be used to supplement the rather meagre information provided in this section for the construction of all 15 of the casemates included in this estimate.

As with the preceding estimate, the account given here of the roofing material for the dos d'anes should be disregarded. A more elaborate arrangement was substituted later. The plan referred to in item 1 will be found in Part 1 of this report as Figure 8.

**Item 1. Fifteen additional Casemates in the East, North, West, and South Fronts**

This item provides for the additional casemated accommodation shown on the Sketch marked A, in the East, North, West and South Fronts. The Casemates to be [built] agreeably to the Plan and Sections attached to this Item, which is similar to those introduced into the Revised Estimate Item 13.-

The excavation is for the Piers. The Masonry in the foundation of 6 pier walls 38 x 12 x 5,- in one 38 x 12 x 6, in the East front; of one pier 58 x 10 x 8 and one 53 x 8 x 5 in the North front; of 6 pier Walls 45 x 5 x 4, and of rear walls 65 x 5 x 4 West and South fronts; piers above foundations
and rear walls agreeably to dimensions of plan, and in dos
feet ins
d'anes] 22.0 x 0.9, and the length of the Casemates as above.-

The Brickwork in the arches of the Casemates lengths
f ins
as above 20.0 x 2.3, and in Chimnies of eight 22.0 x
ins
6.0 x 0.9.-

The Dos d'anes to be covered with flags.-

Eight Casemates required for the Troops to be floored
feet ins
with wood, seven 38 x 15 and one 53 x 15;- Joists 10 x 4.15
ins from center to center,- boards 2 ins thick planed on one
side, grooved & tongued; The Brick on edge Paving is for
6 Casemates, West & South fronts, and the Flag pavement
for two in the North front that may be used as fuel Stores.-

The door frames 6 x 4 ins, planed & rebated.- Doors
2 inch framed, 4 pannel [sic], bead & but, flush on both
sides. Sashes bevelled bar.- The Sheet lead is for the
foot ins
Gutter to roofs, 1. 6 wide by the lengths of the
Casemates, and 8 lbs. P foot.

N.B.-The retaining wall of the Ramparts as provided for in the
Revised Estimate is equivalent to the execution for the
fronts of the Casemates, after deducting the piers of the
small arches to be formed in it, with the Brickwork in these
arches, their dos d'anes and covering with Tiles, the
estimated amount of which is deducted at the end of the
Item.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1784</td>
<td>cubic yards of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item Description</td>
<td>Quantity</td>
<td>Unit Price</td>
<td>Total</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>----------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>Earth excavated and removed, for foundations</td>
<td>10d</td>
<td>74.6.8</td>
<td></td>
</tr>
<tr>
<td>3371(\frac{2}{3}) perches Masonry in foundations, pier walls and dos d'anes</td>
<td></td>
<td></td>
<td>2388.5.3</td>
</tr>
<tr>
<td>1837(\frac{1}{4}) perches Brickwork in arches of Casemates &amp; Chimmies</td>
<td></td>
<td></td>
<td>2755.17.6</td>
</tr>
<tr>
<td>160 Squares of Flag covering to dos d'anes</td>
<td>40/</td>
<td>320.0.0</td>
<td></td>
</tr>
<tr>
<td>56(\frac{1}{4}) cwt. Sheet lead</td>
<td></td>
<td></td>
<td>91.8.1(\frac{1}{2})</td>
</tr>
<tr>
<td>450 Sup.(\frac{1}{2}) yards Brick on edge</td>
<td></td>
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</tr>
<tr>
<td>Paving in Store</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Casemates</td>
<td>5/6</td>
<td>123.15.0</td>
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</tr>
<tr>
<td>15 Squares flag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flooring in d(\frac{0}{7})</td>
<td>35/</td>
<td>26.5.0</td>
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<tr>
<td>853 cubic feet Pine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Quantity</td>
<td>Rate</td>
<td>Total</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>timber in Joists</td>
<td>1/1</td>
<td>46.4.1</td>
<td></td>
</tr>
<tr>
<td>40 Squares 2 inch pine Plank flooring</td>
<td>28/6</td>
<td>57.0.0</td>
<td></td>
</tr>
<tr>
<td>40 cubic feet Pine in door frames</td>
<td>1/6</td>
<td>3.0.0</td>
<td></td>
</tr>
<tr>
<td>270 Sup(^1) feet framed doors, 2 ins. thick</td>
<td>11(d)</td>
<td>12.7.6</td>
<td></td>
</tr>
<tr>
<td>141 &quot; &quot; Sashes, frames</td>
<td>1/10(\frac{1}{2})</td>
<td>13.4.4(\frac{1}{2})</td>
<td></td>
</tr>
<tr>
<td>120 lbs wrought Iron in hinges</td>
<td>4(\frac{1}{2})</td>
<td>2.5.0</td>
<td></td>
</tr>
<tr>
<td>15 Stock locks, 12 inch</td>
<td>4/</td>
<td>3.0.0</td>
<td></td>
</tr>
<tr>
<td>15 Thumb latches</td>
<td>1/</td>
<td>0.15.0</td>
<td></td>
</tr>
<tr>
<td>[Total]</td>
<td></td>
<td></td>
<td>£ 6590.8.10</td>
</tr>
<tr>
<td>Add Contingent 10</td>
<td></td>
<td></td>
<td>591.15.4</td>
</tr>
<tr>
<td>[Total]</td>
<td></td>
<td></td>
<td>£ 6509.8.10</td>
</tr>
</tbody>
</table>

Deduct Value of Masonry in foundation, pier walls & dos d'anes, Brickwork in arches and Tiling over dos d'anes of 27 small arches in retaining Wall of Rampart as provided for in Revised Estimate, at each £30.5.0

| Deduct Value of Masonry in foundation, pier walls & dos d'anes, Brickwork in arches and Tiling over dos d'anes of 27 small arches in retaining Wall of Rampart as provided for in Revised Estimate, at each £30.5.0 | 816.15.0 |
| [Total]                                                              |          |       | £ 5692.13.10 |
Item 2. Two Shifting Rooms to Magazines

This Item provides for a Shifting room to each of the Magazines agreeably, to the annexed Plan and Section.

The masonry is in the foundations side & rear walls, the dimensions of which are given on the drawing; and in the dos d'anes 25 x 22 x 0.9.- The brickwork in the arch 21 x 20 x 20. 2.- Flags for covering dos d'anes 2/25 x 12.- Floor joists 10 x 4 ins - 15 ins from center to center.- Boards 2 ins thick, planed on one side, grooved & tongued and fixed with dowels;- door frames 6 x 4 ins planed & rebated;- Door 2 inch framed, bead & butt, flush on both sides.- Sash beveled bar.-

N.B. The front is provided for in the same manner as stated in Item 1.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>223</td>
<td>perches Masonry in foundation, side and rear walls and dos d'anés</td>
<td>14/2</td>
<td>157.19.2</td>
</tr>
<tr>
<td>57\frac{1}{4}</td>
<td>perches Brickwork, in arch</td>
<td>30/</td>
<td>85.17.6</td>
</tr>
<tr>
<td>6</td>
<td>Squares Flag Covering, for d°</td>
<td>40/</td>
<td>12.0.0</td>
</tr>
<tr>
<td>Item Description</td>
<td>Quantity</td>
<td>Unit</td>
<td>Cost</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>66 cubic feet Pine timber in joists</td>
<td>1/1</td>
<td></td>
<td>3.11.6</td>
</tr>
<tr>
<td>2(\frac{2}{3}) &quot; &quot;  d^0 in door frame</td>
<td>1/4</td>
<td></td>
<td>0.3.7</td>
</tr>
<tr>
<td>3 Squares 2 inch Pine flooring</td>
<td>28/6</td>
<td></td>
<td>4.5.6</td>
</tr>
<tr>
<td>18 feet Sup(\frac{1}{2}) 2 inch pine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>framed door</td>
<td>11d</td>
<td></td>
<td>0.16.6</td>
</tr>
<tr>
<td>9(\frac{1}{2}) &quot; &quot; Sash, frame and glass</td>
<td>1/10(\frac{1}{2})</td>
<td></td>
<td>0.17.9(\frac{3}{4})</td>
</tr>
<tr>
<td>1 12 inch Copper Stock lock</td>
<td>50/-</td>
<td></td>
<td>2.10.0</td>
</tr>
<tr>
<td>1 pair 6 inch Copper Butt hinges &amp; screws</td>
<td>5/</td>
<td></td>
<td>0.5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Total]</td>
<td></td>
<td></td>
<td>£ 268.6.6(\frac{3}{4})</td>
</tr>
<tr>
<td>Add Contingent 10</td>
<td></td>
<td></td>
<td>26.16.7(\frac{3}{4})</td>
</tr>
<tr>
<td>[Total]</td>
<td></td>
<td></td>
<td>£ 295.3.2(\frac{1}{2})</td>
</tr>
</tbody>
</table>

Deduct value of masonry in foundation, pier Walls, & dos d'anés - Brickwork in arches & Tiling over dos d'anés of 2\(\frac{1}{2}\) small arches in retaining wall of Parapet as provided in Revised Estimate at each £30.5.0
Item 5 Retaining Wall of Area North West Bastion

This Item provides for rebuilding, agreeably to the annexed Section, the retaining Wall of the area of the Casemates of defence, which it was necessary to take down in 1842, as reported on 15\textsuperscript{th} October, and to renew the wooden Steps of Communication.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>330</td>
<td>perches Masonry in foundation, walls,</td>
<td>14/2</td>
<td>233.15.0</td>
</tr>
<tr>
<td></td>
<td>Counterforts &amp; [sic]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>running feet 3 inch</td>
<td>5/</td>
<td>14.10.0</td>
</tr>
<tr>
<td>59\textsuperscript{1/2}</td>
<td>cubic feet pine timber, rough,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>framed, in string boards, rails &amp; to stairs.-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>Sup\textsuperscript{1} feet 2 inch</td>
<td>6d</td>
<td>2.8.0</td>
</tr>
<tr>
<td></td>
<td>Pine, rough, in treads to stairs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
[Total] £253.17\frac{1}{2}

Add Contingent 1/10\textsuperscript{th} 25.7\frac{3}{4}

[Total] £279.5.2\frac{1}{2}

**Item 6** Two Casemates in re-entering angles

This Item provides for casemates in the re-entering angles of the Redan (as shown on Sketch, Item 1) which will form two Coal Stores for the Commissariat Dep— about 30 x 15 feet.

The Masonry is in the foundation, one pier wall and dos d'anies of each, foundation \(20 \times \frac{4}{4} \times 4\) — pier walls \(20 \times \frac{7}{7}\) feet x 3 and dos d'anies \(20.0 \times 11.0 \times 0.9\)

The Brickwork in the arches, each \(30.0 \times 20.0 \times 2.3\).

The Flags are for covering the dos d'anies & floors.

The Lead for Gutters \(4/30.0 \times 1.6\)-

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>149\frac{2}{3}</td>
<td>perches Masonry, in foundation walls, and dos d'anies</td>
<td>14/2</td>
<td>106.0.3</td>
</tr>
<tr>
<td>163\frac{2}{3}</td>
<td>perches Brickwork in arches</td>
<td>30-</td>
<td>245.10.0</td>
</tr>
<tr>
<td>14\frac{1}{2}</td>
<td>Squares Flag covering dos d'anies</td>
<td>40/</td>
<td>29.0.0</td>
</tr>
</tbody>
</table>
This estimate provides for the construction of Nos. 24-30, 33 and 51. The casemates were constructed to the specifications in this estimate, but the dos d'ane coverings were altered later. There is no evidence that any of these casemates was ever fitted up as a convict room, despite the wording of the estimate.
Report and Estimate of Works and Repairs Proposed to be carried out in the R.E. Department...1844-5

The Sum of £12,000 is proposed, being the Amount that can be advantageously expended in advancing the Citadel toward completion: - of which Sum the following detailed Services form a part, Amounting to £3176..15..3.-

These detailed portions of the Item are parts of Items 1 & 6 of the Estimate for "Alterations and Renewals" forwarded and dated 22nd May 1843, - and directed by the Inspector Gnl. of Fortifications' Minute of 18th July, on the Boards letter of the 12th July 1843 E/889, to be brought forward for examination and consideration in the Estimate for the Year in which it is proposed to execute the work, - and consists as follows, viz

Seven additional casemates East front, as per accompanying plans and Sections which are to be executed with the following descriptions of Materials, Workmanship, Scantlings and dimensions. - Provision is therefore made to excavate for the foundations of the party walls 7/38..0 x 10..0 x 12..0. also under the floors for ventilation 1 foot 6 ins. deep; - the foundations of these walls are to be of rubble masonry, in mortar as well as those of the Superstructure, foundations for the hearth 7/6..6 x 2..0 x 1..2, dwarf walls 7/38..0 x 1..6 x 1..0, in the centre of each room running longitudinally for support of joists, and are also to be of
Masonry in mortar. - The walls are to be lined with $4\frac{1}{2}$ inch of Brick work in mortar, every 4th course being headers bonded into the masonry. - No provision is here made for taking down and rebuilding the walls of the East front and portions of the North proposed to be executed this year having been authorized as Item 4 of the Estimate above alluded to:— Neither is there any provision made for the front or retaining wall it being considered that the masonry in the revised Estimate of the 1st February 1836 is equivalent to the cost of the proposed alterations, and the extra work not required by this mode of construction is deducted from this Item.

The Casemates are to be vaulted 3 Bricks thick, the chimney openings lined with Bricks, and the flues carried up with Brick work, and all set in mortar. - Dos d'anés of Iron Stone flagging in mortar; between each Dos d'anés a gutter is to be formed and lined with lead 8 lbs to the foot Supl. and 2.6 wide to carry off the water through gargoyles in the front of the retaining wall. - The dos d'anés are to be laid with Iron Stone flagging in Mortar. - The hearths front and Back to be of 4 inch chiseled Granite, viz 7/5.0 x 2.0 -- 7/4.0 x 1.9. - The chimney joists and heads are to be of chiseled Granite having a Brick arch turned over the head Jambs 2/7 - 3' 6 x 1' 9 x 1' 0 - Head 7/6' 0 x 1' 0 x 1' 0.- The Grates to be ventilated each room with 4 cast iron ventilators 12 x 9
and $\frac{1}{2}$ inch thick each perforated with 140 holes 3/8 inch in diameter, - those in the retaining wall to be kept up 2 feet above the level of ground outside, and them in the Angle of the room, as shown in the longitudinal Section-

Holes are to be jumped in Window Head and Sill of Convict room for window bars of inch Square Iron and run with leads. - Wall plates (3 in each room 6 x 4 ins) and joists 12 ins apart 8 x $2\frac{1}{2}$ ins are to be of rough pine. - Wrought rebated and chamfered pine door frames 6 x 4 ins prepared for 2 inch wrought and framed pine doors 6' 0 x 3' 0 filled in front with inch wrought and rebated sheeting and herring boned back, hung with 24 inch Wrought Iron Flanges and furnished with Latches and 10 inch iron rimmed Dead Locks.

Pine window frames prepared for 2 inch single hung bevilled bar sashes 3 x $10\frac{1}{2}$ x 2'6, with brass faced pully boxes, patent sash line, Iron weights, spring fasteners and glazed. The Windows to the loop holes to be wrought bevilled bar sashes hung with $2\frac{1}{2}$ inch wrought iron butts, and secured with 3 inch wrought iron Turn Buckles, and glazed. - The frames to be wrought framed rebated and headed pine 4 x 3 ins and fixed to the Masonry. -

The Rooms to be fitted up with cast iron skirting Cantilever shelves rails and pins excepting shelves in the Convict Room but the wood brick are to be built in for their future reception if required. -
Wrought and chamfered pine band rails and armbands in the six soldiers rooms, and shapes cut for feet of Muskets. - (The doors lettered) frames Sashes and frames, Skirting, Cantilever Shelves rails and pins, hand rails and arm bands, Iron window bars and ventilators to be painted 3 oils common. - The Rooms Lime washed 2 Coats, and Door frames and sashes bedded. -

The Convicts Room to be furnished with a fixed Guard bed as per accompanying Section; the Wall plate rough pine $\frac{1}{2} \times \frac{3}{2}$ ins, Rail wrought, rebated and beaded pine 5 x 4 legs wrought and framed 4 x 4, the legs secured to the floor with wrought iron Knees 3 ins wide and half inch thick, and screwed to the floor; the top sheeting to be of 3 inch wrought ploughed and tongued Birch built into the Wall and screwed to the bottom rail with a wrought iron strap $4 \times \frac{1}{2}$ ins rounded on top, and fixed with 13 wrought iron screw bolts.

This portion of the Item provides for casemating the two Reentering Angles of the Redan for Coal Stores as per accompanying Sketch. -

The external wall and steps were provided for in the Revised Estimate beforementioned. - this provides only for the following Work - excavating for foundations of external walls coloured yellow 2/20'0 x 8'0 x 4'0. - The foundation to be of Stone Masonry in mortar. (The Floors to be laid with iron stone flagging in mortar) - The vaulting to be
of Brick work 2'3 in thick, and the Dos d'anes to be covered with iron stone flagging in Mortar. Gutters of 8 lb milled Lead. - Doors, doorframes, Locks, Hinges Latches, holdfasts &c. are to be similar to those of the other detailed Casemates, and Painted 3 Oils, common colours. -

**Estimate**

<table>
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<th>Description</th>
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<th>Unit</th>
<th>Cost</th>
</tr>
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<td>Halifax Citadel</td>
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<td></td>
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<tr>
<td>Seven Casemates East Front</td>
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<tr>
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<td>53.11.0</td>
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<tr>
<td>1471 Perches of Masonry</td>
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</tr>
<tr>
<td>in foundations</td>
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<td></td>
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<tr>
<td>Superstructure and dos d'anes</td>
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<td>15/-</td>
<td>1103.5.0</td>
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<tr>
<td>636 Super yards of Iron</td>
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<tr>
<td>Stone flagging in dos d'anes, laid in mortar</td>
<td>3/8</td>
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<td>116.12.0</td>
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<tr>
<td>520 feet lineal extra</td>
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</tr>
<tr>
<td>cutting skew[?] backs</td>
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<td>26.0.0</td>
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<tr>
<td>119 feet Sup. chiseled</td>
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</tr>
<tr>
<td>Granite set in hearths</td>
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<td>2/2</td>
<td>12.17.0</td>
</tr>
<tr>
<td>128 cubic feet of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granite chimney Jambs and head Set</td>
<td>1/1</td>
<td></td>
<td>6.8.0</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td>Unit</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>219</td>
<td>feet Supl. chiseled work on do</td>
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<td>16.8.6</td>
</tr>
<tr>
<td>28</td>
<td>Ventilator Gratings Set</td>
<td>1/3</td>
<td>1.15.0</td>
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<tr>
<td>12</td>
<td>Holes jumped for window bars of Convict-room, and run with lead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>920</td>
<td>perches of Brickwork in lining of walls, and vaulting of Casemates</td>
<td>23/5</td>
<td>1077.3.4</td>
</tr>
<tr>
<td>7</td>
<td>Soldiers Grates set with fire Brick</td>
<td>19/4</td>
<td>6.15.4</td>
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<tr>
<td>694</td>
<td>feet cube of rough pine in Joists and Plates</td>
<td>1/-</td>
<td>34.14.0</td>
</tr>
<tr>
<td>46</td>
<td>Joists and Plates in Wood Plates for Cantiliver [sic] shelves</td>
<td>1/-</td>
<td>2.6.0</td>
</tr>
<tr>
<td>390</td>
<td>feet lineal of wrought and chamfered band rail</td>
<td>$3/4$ inch</td>
<td>$1\frac{1}{2}$</td>
</tr>
<tr>
<td>$5\frac{1}{2}$</td>
<td>feet cube of wrought [sic] and rebated and framed do. in do.</td>
<td>1/6</td>
<td>0.8.3</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td></td>
<td></td>
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<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2½</td>
<td>Feet cube wrought</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rebated and framed</td>
<td>1/4</td>
<td>0.3.4</td>
</tr>
<tr>
<td>4</td>
<td>&quot; &quot; wrought Pine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>in wall plate for head</td>
<td>1/-</td>
<td>0.4.0</td>
</tr>
<tr>
<td>1½</td>
<td>Feet cube of wrought</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and framed Pine in legs</td>
<td>1/2</td>
<td>0.1.0</td>
</tr>
<tr>
<td>19¼</td>
<td>Cubic feet, wrought</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rebated and chamfered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pine, in door frames</td>
<td>1/6</td>
<td>1.8.10¹/₂</td>
</tr>
<tr>
<td>39¼</td>
<td>Squares of 2 inch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>wrought and rebated pine flooring</td>
<td>3l/-</td>
<td>60.16.9</td>
</tr>
<tr>
<td>126</td>
<td>Supl. feet 2 inch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>wrought and framed pine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>doors filled in front</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with pine wrought and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rebated sheeting and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>herring boned back</td>
<td>10d</td>
<td>5.5.0</td>
</tr>
<tr>
<td>68</td>
<td>Supl. feet 2 inch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>wrought bevilled bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pine sashes, 1 inch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>frames single hung</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with patent line iron</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
weights and Brass face pully boxes; and

Glazes \[\frac{1}{10\frac{1}{2}}\] 6.7.6

12 feet Supl. 2 inch wrought and bevilled bar pine Sash hung with 2\(\frac{1}{2}\) inch wrought Iron butts, and secured with wrought Iron Turn buckles, and Glazed \[\frac{1}{8}\] 1.0.0

266 feet Supl. of 3 inches wrought-plug- and -tongued Birch Wood, in Bed of Convict Room 8d 8.17.4

7 Spring Sash fasteners and fixings 1/3 0.8.9

120 Shapes cut for feet of Muskets 4d 2.0.0

120 Arm bands fixed \[\frac{2}{2}d\] 1.5.0

6 Iron Knees fixed to feet of Guardbed 2d 0.1.0

58 cwt of 8 lb. Milled lead laid in Valley Gutters between Casemates 34/- 98.12.0
<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td></td>
<td>lbs of Pig lead for Setting holdfasts for Door-frames</td>
<td>28/- 39.4.0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Bushels Coal</td>
<td>9d 0.2.3</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Window and Door frames bedded and ranged</td>
<td>1/3 0.17.6</td>
</tr>
<tr>
<td>1179</td>
<td></td>
<td>Yards Supl. of Lime washing in Casemates 2</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>Yards Supl. 3 Oils, head, on doors &amp;c.</td>
<td>7d 3.10.0</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>feet lineal Window bars, 3 Oils</td>
<td>3d 0.1.6</td>
</tr>
<tr>
<td>6000</td>
<td></td>
<td>feet lineal Cantilever rails and pins do</td>
<td>1d 2.10.0</td>
</tr>
<tr>
<td>390</td>
<td></td>
<td>feet lineal Musket bands and rails d°</td>
<td>2d 3.5.0</td>
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<tr>
<td>22</td>
<td></td>
<td>Sashes and frames under 20 feet, 3 Oils</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>White</td>
<td>1/6 1.13.0</td>
</tr>
<tr>
<td>28</td>
<td></td>
<td>Cantilevers - d°</td>
<td>2\frac{1}{2}d 0.5.10</td>
</tr>
<tr>
<td>96</td>
<td></td>
<td>inches Letters</td>
<td>3\frac{3}{4}d 0.6.0</td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>Arm bands</td>
<td>3\frac{3}{4}d 0.17.6</td>
</tr>
<tr>
<td>Quantity</td>
<td>Description</td>
<td>Price</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>cwt Cast iron in Cantilever Shelves Pin rail &amp;c and screws</td>
<td>22/6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>65.5.0</td>
<td></td>
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<tr>
<td>80</td>
<td>lbs. of wrought Iron in Spuds [?] and holdfasts</td>
<td>4(\frac{1}{2})d</td>
<td>1.10.0</td>
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<tr>
<td>144</td>
<td>lbs &quot; &quot; in Window bars</td>
<td>4d</td>
<td>2.8.0</td>
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<tr>
<td>280</td>
<td>lb cast Iron in Ventilators</td>
<td>22/6 cwt</td>
<td>2.16.3</td>
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<tr>
<td>24</td>
<td>lbs wrought Iron in Knees including Screws</td>
<td>5d</td>
<td>0.10.0</td>
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<tr>
<td>266</td>
<td>lbs &quot; &quot; in strap or foot of Guardbed</td>
<td>5(\frac{1}{2})d</td>
<td>6.1.11</td>
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<tr>
<td>20</td>
<td>lbs. &quot; &quot; in Nuts and bolts for d°</td>
<td>6d</td>
<td>0.10.0</td>
</tr>
<tr>
<td>7</td>
<td>10 inch Iron rimmed lead Shot Locks &amp; fix</td>
<td>5/11</td>
<td>2.1.5</td>
</tr>
<tr>
<td>7</td>
<td>Thumb Latches &amp; Screws and fix</td>
<td>(\frac{1}{2})</td>
<td>0.8.2</td>
</tr>
<tr>
<td>7</td>
<td>Pairs 24 inch strong wrought Iron Hooks and eye hinges and Screws for 2nd door</td>
<td>3/-</td>
<td>1.1.0</td>
</tr>
<tr>
<td>7</td>
<td>Keys labelled and lettered</td>
<td>6d</td>
<td>0.3.6</td>
</tr>
<tr>
<td>Item Description</td>
<td>Quantity</td>
<td>Rate</td>
<td>Total</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>3268 lbs. cast Iron in Soldiers Grates</td>
<td>2½d</td>
<td>33.19.7</td>
<td></td>
</tr>
<tr>
<td>129 wrought Iron Arm bands &amp; screws</td>
<td>4½d</td>
<td>2.5.0</td>
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</tr>
</tbody>
</table>

**Casemates in re-entering Angle of Redoubt**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>40 yards cube of Earth excavated &amp; removed</td>
<td>10d</td>
<td>2.0.0</td>
<td></td>
</tr>
<tr>
<td>150 perches of ruble</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[sic] Masonry in foundations and [sic]</td>
<td>Superstructure</td>
<td>15/-</td>
<td>112.10.0</td>
</tr>
<tr>
<td>160 yds Supl. Iron Stone flagging in dos d'anes</td>
<td>laid in Mortar</td>
<td>3/8</td>
<td>29.6.8</td>
</tr>
<tr>
<td>164 perches of Brick</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>work in vaulting of Cas{tes[sic]}</td>
<td></td>
<td>23/5</td>
<td>192.0.4</td>
</tr>
<tr>
<td>100 Yards Supl. Iron Stone pavement laid in mortar</td>
<td>3/8</td>
<td>18.6.8</td>
<td></td>
</tr>
<tr>
<td>100 feet lineal of extra cutting of skewbacks</td>
<td>1/-</td>
<td>5.0.0</td>
<td></td>
</tr>
</tbody>
</table>
5½ feet cubic wrought rebated and Chamfered Pine, in door frames 1/6 0.8.3

36 ft. Supl. 2 inch wrought & framed pine doors filled in front with inch wrought & rebated sheeting and herring boned back 10d 1.10.0

18 cwt. of 8 lb. milled lead in Vallies 34/- 30.12.0

7½ lbs Pig lead 28/- 0.1.9

½ bushel Coal 9d 0.0.4½

12 yards Supl. 3 Oil, lead on doors 7d 0.7.0

48 inches of Letters on doors 0.3.0

2 Door frames bedded and ranged 0.2.6

16 lbs wrought Iron for holdfasts doors spuds &c. 0.6.0

2 10 inch iron rim's dead Shot Lock and fixing 0.11.10

2 wrought iron latches and fixing 0.2.4
2 Labels to Keys, lettered and fixing 0.1.0

2 pairs 24 inch wrought iron Strong Hook and eye hinges with screws for 2 inch doors 3/- 0.6.0

[Total] £3217.19.4

Contingent 1/10 321.15.11

[Total] £3539.15.13

Deduct value of Masonry in foundations, Pier Walls & Dos d'anes Brick work in arches, and Tiling over dos d'anes, in 12 Small Arches in retaining Walls of Rampart as provided for in Revised Estimate of 1' -February 1836 each £30..5.0 363.0.0

[Total] £3176.15.3

10 The 1846 Estimate

This estimate provides for the reconstruction of the retaining walls of Nos. 12-3 and of the retaining walls, floors, windows and so forth of Nos. 3, 4, 8 and 9. All of these casemates were constructed under the provisions of the
1825 estimate, and this is virtually all the information we have about them. Nos. 59 and 60 are similar to Nos. 12 and 13, and the information provided here might shed some light on their construction. Unfortunately there is no evidence that the retaining walls of Nos. 59 and 60 were ever reconstructed. In all probability, the retaining walls of these casemates were of inferior dimensions.

Report

This Item provides for taking down and rebuilding the retaining wall of the Casemate of defense in the NW Bastion which has become necessary from the decayed state of the Mortar and bad Quality of the Stone with which the present Wall was Constructed, altho, when the revised Estimate dated 1st February 1836, was prepared it was Considered as a part of the work "Already built and expected to stand".-

The part to be taken down and rebuilt is Coloured Yellow on the accompanying Drawing No. 1.-

The dimensions of the old wall to be taken down will feet average 43 x 15 x 3.- the Materials not being of any Value no deduction is made for them.- All the masonry to be of Iron Stone set in lime and sand mortar except when otherwise described.-

The Foundation wall to be of rubble masonry with
horizontal beds, the superstructure Carried up with Horizontal and Vertical joints faced with random punched rustic Granite Ashlar Chiselled drafted, bedded & jointed 6 Inches in the face of wall with roman Cement and Coped with 6 Inch Chiselled Granite Coping 2'..8" wide throat ed both projections.

Chisel Dress the reveals [?] to the Doors & Windows, Viz 4/10.0" 2/.7" - 2/.16'0". 9 Inches wide with sunk sills, (Viz 4/2'..0" 2/-3'..0". - 2/- 6'..0") 10 inches wide.- Chisel Check[d] out & sunk on Sides and Soffits of Doors and windows (Viz) 4/.10'8". 2/-6'..0" - 2/-16'..8" 2 ins. wide.

Chisel Dress the ends of bonds stones of the Door & window openings (Viz 8/4'..4"x).11" 6/.4..'4x1.0 [?] 4/5..'0 x 1..'0", 4/2'..8" x 0'.11".-2/13..8" x 1.11".. 2/5'.'8" x 1..0" 2/3'.. 8" x 11".[?] -4/3'..0 x 1.11".- 2/-5'.'8" x 1..0" and 2/3'.8 x 11".-

Chisel dress the windows seats and door steps, and Chamfer on Edge of the former.- Sunle [sic] two Mortice holes in each door Step and three for the reception of Iron Bolts run with lead to secure the frames of the doors and three to each of the upper Window frames.

No provision is herein made for Carpenters or Joiners work, these having been provided in the revised Estimate of 1st Feb'y 1836.-
Estimate

**Halifax Citadel**

**Work Necessary in Consequence of Failures Viz Two**

**Casemates of defence North West Bastion.** Taking down and rebuilding the retaining walls

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>perches old Masonry taken down and removed</td>
<td>10d</td>
<td>6.4.2</td>
</tr>
<tr>
<td>31</td>
<td>perches of rubble masonry in foundations</td>
<td>14/2</td>
<td>21.19.2</td>
</tr>
<tr>
<td>166</td>
<td>do- do over foundations</td>
<td>15/-</td>
<td>124.10.0</td>
</tr>
<tr>
<td>870</td>
<td>1 feet Sup of punched Granite rustic work on face, Chiselled Drafts, Work only</td>
<td>1/6</td>
<td>65.5.0</td>
</tr>
<tr>
<td>455</td>
<td>do- plain Chiselled work on Granite (Straight)</td>
<td>1/4</td>
<td>30.6.8</td>
</tr>
<tr>
<td>164</td>
<td>do- Sunk Do-&quot;-&quot;-</td>
<td>1/8</td>
<td>13.13.4</td>
</tr>
<tr>
<td>120</td>
<td>1 feet Sup- 6 inch Chiselled Granite Coping throated &amp; set in Mortar</td>
<td>2/-</td>
<td>12.0.0</td>
</tr>
<tr>
<td>35</td>
<td>6 inch Chiselled and Chamfered Granite on</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Item 2

Four Casemates of defence West Curtain. Taking down and rebuilding wall, renewal of Floors, doors, and sashes.

This Item provides for taking down and rebuilding the retaining walls of four Casemates of defence in the West Front which is in the same dilapidated state as that in Item 1. It was also considered as part of the work "already built and expected to stand." in the revised Estimate of 1st February 1836. The floors of two of these Casemates are 18 inches below the level of the interior of the work, which inconvenience, or rather evil will be remedied in the execution as it is proposed to remove the present brick floors of the four casemates & substitute boarding as hereafter described; it also provides for the renewal of the doors and frames, and sashes and frames, the old ones being entirely decayed.
The extent and nature of the work is shown in the accompanying drawing No. 2. coloured yellow.

The dimensions of the walls to be taken down are feet as follows; 2/43 x 19 x 3. The old materials being of no value no deduction for them is made. all the masonry to be of Iron stone set in Lime mortar except where otherwise described. -

The new work to be carried up in horizontal courses with vertical joints, faced with random punched granite rustic work, chisel drafted, bedded and jointed 6 inches in face of wall, with roman cement, and coped with 6 inch chiselled granite coping 3 feet wide both projections [?] throated[?]. chisel dress the doors & windows, viz: (8/- 6'..2", 4/.2'..6" 8/.4'..0", 4/.2'..0") 4/.3'..0") 8/.1'..9" inches wide with sunk sills (viz 4/2'..6" 4/.2'..0" and 4/.3'..0", 10 inches wide) Chisel check out and sink on sides and soffits[?] for doors & windows (viz: 8/6'..6", 4/.3'..3", 8/4'..1", 4/2'..8", 8/.1'..7", and 4/.3'..8"). 20 inches wide on an average. Chisel dress the ends of bond stones to the door and window openings (viz 8/6'..6" 4/.4'..6" and 16/.4'..0", 4/2'..4" and 4/.3'..8"). These will average 22 inches wide Cut 8 mortice holes in step for door frames, and for reception of Iron bolts run with lead, for securing the frames, 3 to each, & 3 to each of the upper window & chamfer the front edge of window seats which are to be chiselled as well as the door steps. -
Take up the old brick floor, and excavate 2 feet deep for ventilation under proposed new floor. Build brick piers or dwarf walls to carry wall plates & joists, those on the sides or offsets to be 12 x 9, and those in the middle 13 1/2 x 12. Lay 6 in. chiselled granite hearths & ft back hearths, viz 4/.5 x 2 and 4/4'..0" x 1'.6" on rubble masonry 4/.6 x 3 x 1. Prepare for dress and fix in the masonry as shown at a, cast iron ventilators 12 x 9 ins. 1/2 in thick, each perforated with 154 holes. Cut out & dress for ventilating shafts or flues 9 x 4 1/2 ins: 2 in each room, in situation as shown at b, & chisel dress, prepare for, & set a Granite frame at c for cast iron ventilators as before described.-

Build up the old door opening at d with rubble masonry to correspond with the existing work.-

All the wood work to be fir.

Fix wall plates on the dwarf walls, 4 x 3 ins: for the reception of the joists 6 1/4 x 2 1/2 ins & 12 inches from center to center.-

Lay 2 inch wrought rebated & filleted deal Floor with cast iron skirting.-

Fix wrought framed, rabbeted skirting and herring boned back hung with 24 in: wrought iron hook & eye hinges, 10 in: iron rimmed dead locks, & thumb Latches.

Fix the frames to the masonry with wrought iron bolts run with lead and secured with a nut sunk in door frames.
Fix fir cased sash frames with oak sunk sills for bottom windows prepared for & hung with 2 in: bevelled bar sashes, 3'..10" x 2'..0", single hung with patent[?] lines, brass case pulley boxes, and cast iron weights, and secured with spring sash fasteners.-

Prepare & fix for the upper windows, wrought framed rabbated and chamfered solid sash frames 6 x 4 ins: with 2 in: wrought & chamfered sashes, the frames to be secured with bolts as the door frames. Bed and cauge[?] in hair mortar the whole of the sash and door frames.-

Glaze with [?] glass, and paint the whole of the wood work usually painted, and the skirting 4 oils common colours.

<table>
<thead>
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<th>Detail</th>
<th>Rate</th>
<th>Amount</th>
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<td>297</td>
<td>perches old masonry</td>
<td>10d</td>
<td>12.7.6</td>
</tr>
<tr>
<td></td>
<td>taken down and</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>removed</td>
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<td></td>
</tr>
<tr>
<td>300</td>
<td>perches rubble</td>
<td>15/-</td>
<td>225.0.6</td>
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<tr>
<td></td>
<td>masonry over</td>
<td></td>
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<tr>
<td></td>
<td>foundations</td>
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<tr>
<td>404</td>
<td>feet suppl. 6 inch</td>
<td>2/-</td>
<td>40.8.0</td>
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<tr>
<td></td>
<td>chiselled granite</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>coping throated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; set in mortar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1863</td>
<td>do. punched granite</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rustic work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Quantity</td>
<td>Rate</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>chiselled drafts,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>work only</td>
<td>1/6</td>
<td>139.14.6</td>
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</tr>
<tr>
<td>do plain chiselled work on granite, straight</td>
<td>1/4</td>
<td>37.1.4</td>
<td></td>
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<tr>
<td>do. sunk do.</td>
<td>1/8</td>
<td>20.18.4</td>
<td></td>
</tr>
<tr>
<td>suppl. yards taking up &amp; removing old brick on edge flooring</td>
<td>2d</td>
<td>2.11.2</td>
<td></td>
</tr>
<tr>
<td>cubic yards excavating and removing earth for ventilation</td>
<td>10d</td>
<td>8.10.10</td>
<td></td>
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<tr>
<td>perches stock brick work in mortar in dwarf walls &amp; piers</td>
<td>23/5</td>
<td>29.11.3</td>
<td></td>
</tr>
<tr>
<td>feet lineal bedding &amp; ranging wall plates</td>
<td>1d</td>
<td>2.6.0</td>
<td></td>
</tr>
<tr>
<td>do. sash &amp; door frames in hair mortar</td>
<td>1/2d</td>
<td>1.0.9</td>
<td></td>
</tr>
<tr>
<td>granite stone set in mortar, in hearths</td>
<td>1/-</td>
<td>1.12.0</td>
<td></td>
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</tbody>
</table>
8 granite frames
prepared & fixed &
cut for interior
ventilating plates 16/- 6.8.0
25 feet lineal
Chamfering granite 2d 0.4.2
8 mortices in granite
sills for door
frames 6d 0.4.0
24 mortice holes in
grates run with
lead 8d 0.16.0
8 openings cut with
granite and grooved
to take ventilating
plate 12/- 4.16.0
352 feet cube rough
fir fixed in
joists, plates, &c. 1/- 17.12.0
19 feet cube wrought,
framed, rebated
and chamfered fir
in door and
window frames 2/- 1.18.0
40 feet suppl. deal
cased sash frames,
prepared for 2
inch sashes,
single hung | 6d | 1.0.0

| 31 | do. 2 inch bevelled bar sashes, single hung, with weights, line &c. | 1/6 | 2.6.6 |

| $27\frac{1}{4}$ | squares 2 inch wrought, rabbeted and filleted deal flooring | 31/- | 42.4.9 |

| 15 | cwt of cast Iron skirting and fixing | 23/- | 17.5.0 |

| 19 | feet supl 2 inch deal bevelled bar sash, fixed | 8d | 0.12.8 |

| 62 | do. 2 inch wrought, framed, braced & sheeted deal door, herring boned back | 10d | 2.11.8 |

| 4 | 10 inch iron rimmed dead Locks and fixing | 7/- | 1.8.0 |

<p>| 4 | spring sash fasteners &amp; do. | 1/3 | 0.5.0 |</p>
<table>
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<th>Quantity</th>
<th>Description</th>
<th>Price</th>
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<tr>
<td>80</td>
<td>1b wrought Iron hook &amp; eye hinges, with bolts and nuts</td>
<td>6d 2.0.0</td>
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<tr>
<td>18</td>
<td>1bs wrought Iron in bolts &amp; nuts to secure door window frames</td>
<td>6d 0.9.0</td>
</tr>
<tr>
<td>4</td>
<td>large thumb Latches with screws and fixing</td>
<td>1/3 0.5.0</td>
</tr>
<tr>
<td>$1\frac{1}{2}$</td>
<td>cwt cast Iron ventilating plates</td>
<td>2/0/- 1.10.0</td>
</tr>
<tr>
<td>90</td>
<td>yards supl. 4 oils, common colors</td>
<td>10d 3.15.0</td>
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<tr>
<td>48</td>
<td>panes glass 9 x 7 &amp; glazing</td>
<td>4d 0.16.0</td>
</tr>
<tr>
<td>16</td>
<td>do. 8 x 10 &amp; do.</td>
<td>6d 0.8.0</td>
</tr>
</tbody>
</table>

**[Total]** £642.12.5

Add Contingent $1/10th$ 64.5.2$\frac{3}{4}$

**[Total]** £706.17.8

11 **Staunching Estimate, 1848**

This special estimate, submitted by Calder in the winter of 1848, was the genesis of the large staunching estimate sent in the following year (see section 13 below). The provisions
of this estimate were never implemented, but it does shed some light on the work involved in hipping the casemate dos d'anès.

Special Report and Estimate of the expense of remedying the leakage of the Officers, Soldiers and Guard room Casemates. Halifax Citadel 1848.9. Amounting to £1369.18.4 Sterling

The service here brought forward has arisen from leakage over the Windows and doors of the Officers, Soldiers, and Guard room Casemates in the Redan & East Front the cause of which and remedy proposed is explained in my accompanying letter of this date.

Provision is here made for uncovering as much of the dos d'anès of these casemates as may be found necessary to construct or lay to [?] or hipped counter-flagging of Iron stone in Cement and mortar on rubble masonry in the Vallies between the dos d'anès, and setting a continuous water table into the front and rear wall along its ridge or apex, to cover the joining of the flagging with the walls. It also provides for taking up and resetting the upper course and masonry and coping in the inner or retaining wall & as well as for taking up & resetting the flagged coping of the outer or escarp wall - and Carpenters time for forming the necessary
profiles for the ramparts &c.

The data of quantities on which the estimate is grounded is as follows. Digging & filling in 850'..0" x 7'..0" x 4'..0". 96'..0" x 7'..0" x 4'..0". 653'..0" x 8'..0" x 9'..0 and 94'..0" x 8'..0" x 6'..0" - Rubble masonry (mortar & work only) 75/8'..0" x 10'..0" x 3'..6" - Flagging and counterflagging 75/-8'..0" x 10'..0" - Sod work in slopes 866'..0" x 9'..0 x 1'..0" dO in revetment 766'..0" x 4'..0" x 1'..0" - Take down and rebuilt masonry 489'..8" x 2'..0" x 2..6" - 489'..0" x 2'..0" x 3'..0" and 2/-185..0 x 2'..0" x 3..0" - Coping 750 feet lineal - water table 1500 feet lineal taking up and resetting flagging 750'..0" x 3'..0" - rubble masonry in slopes to flagging 750'..0" x 3'..0" x 1'..0".

Halifax Citadel Officers, Soldiers & Guard room

Casemates Redan & East Front

2889 Yards cube digging, throwing out filling & ramming earth $10^d y_w$ 120.7.6

$1242\frac{3}{4}$ Perches rubble masonry in mortar to bed the flagging (using up the spalls [?] of stone accumulated from the dressing of granite.) 2/6 perch $159.1.10\frac{1}{2}$
677 Yards sup.\ l flagging & counterflagging in mortar and cement 5/6 y\ irr 183.8.6

10,858 feet rebuilding sod work (including cutting and carrying soils) 3\d ft.. 135.14.6

460\ 1/2 perches taking down & rebuilding rubble masonry in mortar 15/6 perch 356.17.9

750 feet run\g. taking up and resetting granite coping in cement 5\d ft. 15.12.6

1500 feet lineal granite water tabling prepared and set in cement 1/9" 131.5.0

250 yards sup.\ l taking up and resetting stone flagging in cement 3\d \frac{\text{d}}{4} 41.5.0

136 Perches rubble masonry in mortar (as in foundation work) 14/2\Ph 96.6.8

25 days Civil Carpenters 4/day 5.0.0

\text{Total} 1245.7.7 \frac{1}{2}
Add 1/10th Contingent 124.10.9
£1360.18.4

[signed] P D Calder
Lt Colonel Comg R Engr &
Colonel [?]
5 Febry. 1848

12 Report on the State of the Casemates, 1848

The report is self-explanatory. The casemate numbering system in use in it, however, is different from the present standard system (and indeed from the system in use in the 1850s). The correspondence between the system used in the report and the standard system is as follows:

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Vide C.R.E.'s letter to I.G.F. No 288, dated 28th Dec 1848

Sir:

In obedience to your order bearing date 21st November 1848, directing me in conjunction with the Clerk of Works to make a "minute inspection of every casemate in the Citadel, reporting the present state of each whether any of them are sufficiently dry to receive Troops; also their mode of construction with respect to the means adopted to prevent leakage with a view of forming a Special Estimate for securing them from damp by similar means to those carried into execution at Fort Henry Canada West, by Colonel Holloway Comg Royal Engineer Canada": -

I have the honor to report that on the 22d Ins I inspected every casemate in the Citadel as desired by your order of the 21st with the exception of the casemates in the cavalier, which being covered with a Shingle roof, and terreplein and parapet not yet completed, no satisfactory conclusions could be arrived at.

As regards the remaining Casemates being sufficiently dry for the reception of Troops, I have the honor to refer you to the accompanying return and drawing by which it appears that the Casemates numbered 1 & 2 appropriated for men are
floored and dry, and fit for occupation; these two casemates are for guns.

No. 3. 4. 5. 6. 7. 8. 9. appropriated for Stores, are dry, and fit for the occupation of troops or Stores, when the flooring is completed in No. 6. - No. 6 has a windlass well in it. No. 10 & 11 Gun rooms, dry and fit for occupation when the flooring is completed No. 12, the Shifting room belonging to the North magazine, dry. No. 13. 14. 15. 16. are dry. No. 13, 14, appropriated for stores, No. 15, 16 for Gun rooms floored, and may be occupied by Troops, No. 17 & 18 Gun rooms are damp unfit for troops No. 17 & 18 not floored - No. 19 & 20 appropriated for stores, dry, flooring not complete, fit for the accommodation of Troops when finished. No. 21. 22. very damp. Gun rooms, unfit for Troops.

No. 23 Shifting room South magazine. Dry.

No. 24 & 25. for stores dry fit for troops when flooring is completed.

No. 26 & 27. Gun rooms unfit for Troops. Damp, old brick floors worn out and defective.

No. 28. damp at one end, fit for Troops, no flooring or joists laid. No. 29. 30 & 31, dry, fit for troops, the flooring laid in No. 31 only, (the Guardroom) -

As regards the officers Quarters extending from No. 32 to No. 43 inclusive they are fit for occupation during the dry summer months, but become damp in the winter, apparently from the reasons that will be assigned hereafter (the painting
of these quarters is not yet completed, and I submit that
the completion of it be deferred until the leakage be cured).

Nos. 44 to 54 are likewise damp in wet weather, but may
be temporarily occupied during the summer.

I may as well observe here when the doors & windows are
closed for a few days that to a casual observer the whole of
these casemates will appear damp on account of the sweating
or drying out of the moisture contained in the walls, which
in such massive work will take a considerable period to
evaporate, considering that no fires are kept in these rooms,
and that the evaporation is completely stopped for nearly
six months during the severe frosts of winter; all the case-
mates have fire places constructed in them so that grates or
stoves may be fixed [marginal note in pencil: "QY are they
not fixed"] & if fuel was authorized it would materially
assist in drying out the rooms.

It is to be perfectly understood that altho' some of
these rooms are stated to be fit for occupation by Troops &c
this merely refers to the state of dryness of the rooms as
regards leakage none of these rooms, with the exception of
Nos. 26 & 27, have any fitments fixed, and in consequence
of the late regulations altering the accommodation [sic]
of rooms as regards their cubical contents, it will be
necessary to revise Item 10. of the supplimentary [sic]
Estimate dated 31 March 1846, to meet the accommodation
proposed by these regulations.
The Guard-rooms in the North & South Ravelins are dry - as regards the mode of construction of the [*] Casemates I have to state that they are covered as follows viz: the Brick arch is 2'.3" in thickness backed in and covered with rubble masonry, having the vallies between each arch formed into a gutter lined with cement and lead. The gutters lead through the interior retaining wall into [crossed out in pencil and "of" substituted] the body of the place, having gargoyles projecting about 8 inches beyond the face of the wall, but the openings of which are entirely exposed to the action of the weather and consequently are, during the winter months, completely closed by the frost acting upon the water that would otherwise drain off; and I have no doubt that Ice is formed in the gutters the whole thickness of the wall, by which means the exit of the remaining portion of the water is prevented until the gargoyles be cleared out, by the thaws in the spring thus putting the masonry of the arch to a most severe and unfair test. The dos d'anes of the arches are flagged & counterflagged ["counter" underlined in pencil with "Q\(^Y\)" in the margin] (over the backing up of the arch with rubble masonry) with flagging of from 4 to 8 inches in thickness, set in mortar and jointed with cement with the exception of the Gun Casemates on the South front Nos. 21. 22. 26 & 27. which are covered with tiles set in mortar and

*Originally "these". Pencil notation above "the"- "Q\(^Y\) Mc" and in margin, "Q\(^Y\)".
flagging laid dry and Nos. 17 & 18, which are tiled only.
Nos 1 to 11 are hipped and flagged
No 12 flagged
Nos 13 & 14 are flagged hipped and piped
Nos 15 & 16 flagged
Nos 17 & 18 tiled only
Nos 19 & 20 flagged hipped and piped
Nos 21 & 22 tiled and dry flagged
No 23 flagged and hipped [pencil notation in margin: "Shifting Rooms"]
No 24 & 25 flagged hipped & piped
No 26 & 27, tiled and dry flagged
No 28 to 54 flagged only
Guard rooms in North and South ravelins stated.

From the foregoing it appears that those casemates which are flagged hipped & piped are in every respect dry, as regards leakage, and that altho' the gargoyles may freeze the water passes off through the pipes there thus being no chance for the water remaining on the covering of the arch & soaking through by being retained there, also that those that are flagged and hipped are dry, and have hitherto been found completely staunch, the hipping and flagging being sufficiently water tight to resist the soakage of the water when the gargoyles are closed, those that are flagged only with the exception of Nos 12, 15, 16 29. 30. 31. leak, and this leaks [sic] invariably occurs at the end of the arches
the water not being thrown off as in the other casemates from the retaining scarp and interior walls by being hipped, that those which are dry flagged and tiled or tiled only are likewise defective in a similar manner, and I must observe that the retaining walls on the south front have receded [sic] from the ends of the arches of the Gun casemates [pencilled notation: "No 21, 22"]: The 'scarp wall from three to four arches, and the interior retaining wall perhaps half an inch to an inch; this is also the case with the scarp wall of Nos 17 & 18 [originally "13-14" - crossed out Marginal comment: "Qy if not 15 & 16"] but in a lesser degree. I have further to state that the arches are dry throughout their whole length in every case, and although No. 27 appears a little damp in the arch no leakage has yet occurred.

[Marginal note in pencil: "Suggested Remedies 1."]

From the foregoing it appears that the remedy to prevent the leakage of those arches which are flagged only would be to uncover them and have them hipped, as has been done in those which have been found to answer up to the present time, and which was recommended in the letter No. 234 of the 5th Feb. 1848, and accompanying Est. forwarded from Colonel Calder Com. R. Engineer at this station to the Inspector General [of] Fortifications, so as to turn the water off from the retaining walls, should this plan be adopted care should be taken to examine the existing flagging & Gutters to see that
no failure has taken place in the Cement pointing of the former
or in the lead of the latter, and that metal hopper heads with
stock pipes be fixed to the gargoyles and carried down the face
of the interior wall as provided for in Item 8 of Supplementary
Estimate dated 31 March 1846, transmitted in furtherance of
the Inspector Gen. Fortifications order of 18 July 1843, N. 628,
[marginal note in pencil, "Qy, if these pipes can be obtained
on the strength of that Estimate if not. And when provided in
the proposed Estm. the Estim. or Item attached to [it] should
be revised so as to give credit for the pipes. J. [or T.] F.H."
the Items of which estimate are to be brought forward in the Year
it is proposed to execute the service, and in which funds can
be allotted, vide Insp. Gen. Fortifications letter N. 809, dated
15th Sep. 1846, and in addition to which I submit that the hopper
heads and pipes be secured in stone casings built as buttresses
which would not disfigure the appearance of the work in General
but tend to break the present straight line of wall, and give
an additional strength to the work both in reality and appearance,
and that the shoe of the pipes be carried into under ground
drains for which provision must be made when required.

[Marginal note in pencil: "2nd Suggestion"]

With respect to those casemates which are tiled and dry
flagged, or tiled only, viz. Nos 17. 18. 21. 22. 26. & 27.
I submit that they be entirely uncovered and either flagged
and counterflagged and hipped, having stock pipes &c as
pointed out above, or that the remedy pointed out by Colonel
Holloway R.E. to have succeeded at Fort Henry, Kingston, C.W. be adopted, but with reference to the means used at Fort Henry I most respectfully submit the following remarks, viz.

It appears from Colonel Halloway's (sic) letter 19th July 1848, that the water percolated through the whole length of the arches which has hitherto not been the case at Fort George, Halifax, if I may except casemate No. 27, referred to above, and which appears a little damp, but having no decided leakage throughout the length of the arch. - with reference to the plan of cutting through the arch and forming a chase down the piers for the insertion of a pipe to carry off the water from the Vallies at Fort George, Halifax, this plan would be attended with considerable expense, the piers being built of Iron stone rubble masonry, coursed, the piers of casemates Nos: 1 to 9. 13. 14. 19. 20. 24 & 25 and 48 to 54 having 4\(\frac{1}{2}\) inch brick linings; taking these circumstances into consideration I submit that the flagging and counter flagging together with having the arches hipped be adopted for the remedy of those casemates which are found defective, the stock pipes being carried down the face of the interior retaining walls, and secured as proposed, in preference to the plan followed at Fort Henry C.W. but should the method of securing the casemates in the Citadel from damp be adopted as at Fort Henry C.W., data must be furnished either from England or Montreal as to the price of the Asphalte and the means of applying it.

I must also call your attention to the proposed plan of
collecting the water that falls on the terre plein of the ramparts into tanks already submitted in the supplementary Estimate dated 31st March 1846 Item 4 and agreeable to the instructions from the Insp' General Fortifications dated 15th Sep'r 1846 No. 809, postponed until brought forward in the annual Estimate [marginal note above, in pencil: "ought not this be executed while the ground is open for the staunching of the arches as it would save expense and prevent the necessity of again disturbing the surface -"], and provided for as funds can be allotted, which when carried into execution, will in a great measure tend to remove the evil complained of by turning the water almost entirely off the covering of the arches, the water being drained off into the different mains leading to the tanks.

[signed] R. Burmester

13 **Stanching Estimate, 1849**

The provisions of the first item of this estimate were never implemented. A different method of stanching was adopted, as described in Part 1 of this report. But this estimate does provide some information on the type of labour involved in stanching and the materials used. The drainage pipes, for example, were installed in a different manner from that described here, but the same materials were used in the method ultimately adopted. The casemate numbers used in the text are explained in the introductory note to Section 12, above.
Ordnance Special Estimate for Staunching the Casemates in the Citadel at Halifax, Nova Scotia.

Amounting to ______ Item 1 - _________ 3766..2..23/4
Additional Services Item 2 - £665..1..51/4
connected therewith Item 3 - 597..1..1

1262..2..61/4

Total £ 5028..4..9

Transmitted with the Com* Royal Engineers letter of 30th April 1849 - No. 317.

Item 1 Report

This estimate provides for staunching the leakage found to exist in the Casemates of Fort George after the manner suggested by the Com. R. Engineer in his Report to I.G.F. No. 288, dated 28th Dec. [?] 1848, and is brought forward in accordance with the I.G.F.s instructions No. 955 dated 16th Jan. 1849 and No. 963 dated 1st February 1849, par. 2.

Provision is also made for rendering the Cavalier secure against similar leakage by the introduction of cast Iron pipes, underground drains and hipping the dos d'anes as proposed to be done in the Casemates. The whole of which project is explained in the accompanying Drawings Nos. 1. 2. 3. 4 (6 5) and in the specification.

And further, the better to secure the permanence of the work in connection with the staunching of the Casemates by carrying
off the surface water from the ramparts. - Item 16, of the revised Estimate dated 1\textsuperscript{st} Feb: 1836 and Item 4 of the supplementary Estimate dated 31\textsuperscript{st} March 1846 are brought forward.

Item 16, of the Revised Estimate provides for the surface gutters of the place, but it has been thought advisable to further revise this item, from the consideration that gutters formed with pebbles[?] in this country have proved defective from the action of the frost, consequently requiring annual reparation[?]. Independent of which from the heavy rains of this climate a large quantity of water must necessarily penetrate between the interstices of the pebbles, and consequently tends very much to promote the defects which it is now sought to remedy in the casemates. Wherefore, it is proposed to substitute for the pebble gutters on the ramparts a granite channel course. -

And still further, as no provision appears to have been made for carrying off this water from the surface gutters (except that made under Item 4 of the supplementary Estimate dated 31\textsuperscript{st} March 1846, which provides for the drainage of the ramparts of the North & part of the east faces into a Tank with a Filter to be constructed in the casemate (N\textsuperscript{o} 30) South of the Guard room and which service is herein brought forward) a plan (N\textsuperscript{o} 5) is here-with submitted shewing the situation of the proposed surface gutters, and the mode proposed for carrying off the water from the west and south fronts and from a portion of the East front and which will be further explained in the specification to the revision of Item 16 above adverted to. -
Casemates & Cavalier.

Specification.

Diggers Work.

The earth work of the Terreplein - Banquette, parapet and slopes of the ramparts over the Casemates numbered (on plan No. 2) 15. 16. 17. 18. 21. 22. 26 & 27 and 28 to 54 inclusive, and of the Terreplein over 1 to 11 inclusive to be dug out to expose the covering and gutters of the dos d'anes and to be filled in again, rammed[?] and reformed agreeably to their existing sections. The clay filling over the casemates up to the heights of one foot above the ridge of the dos d'anes and over the escarp wall to be properly puddled, tempered and rammed, and the sodwork of the revetment and exterior slope to be reformed with new sods -

The ground also to be dug out to the requisite depth and width for the reception of the proposed drains as shewn in the sections (Drawings 3 & 4) the situation of which drains is shown on drawing No. 1 by the blue dotted lines marked abc. de. fg. hi. k. l. mn. op. and qr. and for the branch drains leading from the proposed pipes in the casemates and cavalier, and also within the casemates and cavalier to admit of the footings being cut through at the angles where it is proposed to carry down the pipes as shewn in the Sections (Drawings 3 & 4) The earth to be filled in and rammed after the Masons work is completed, and all the surplus stuff to be removed to the Glacis to assist in its formation.
Masons Work

The footing of retaining walls of the casemates and cavalier to be cut through as shewn, by the red dotted lines and by the Yellow tint[?] at x in the sections (Drawing 3 & 4) and drains 6" x 5" in clear of brick work \( \frac{1}{2} \) brick flat bottom and covered with a brick flat in Roman Cement to be constructed through the openings and to be respectively connected with the existing drains outside and with the proposed drains abc. de. fg. hi. kl. mn. op. qr (Drawing N° 1) which are to be 14" x 14" in the clear the sides of dry rubble masonry 12 inches thick the bottom & the top covering the self faced Iron stone flagging 4 inches thick jointed and laid dry, the bottoms with an inclination of \( \frac{1}{2} \) inch in ten feet towards the existing drains to which they are to be properly connected.

A chase to be cut in the masonry of the footings for receiving the pipes and the openings through the footings to be made good round the brick drains with rubble masonry in mortar using the stone removed in the formation of the openings one half of which it is calculated will be serviceable. And part of the masonry of the footing of verandah of Cavalier to be taken up and reset in mortar for the purpose of carrying the branch drains through - the old tiles and dry flagging of the dos d'anes of Casemates 17. 18. 21. 22. 27 & 28 to be taken up, the tiles removed to store and the flagging to be used in making good any deficiency in the flagging and counter flagging of the hopper ends of the dos d'anes of casemates 1 to 11 inclusive, which as
well as the rubble masonry beneath it and a portion of the side flagging and counter flagging next the retaining walls of casemates and Cavalier to be taken up (for the purpose of inserting the hopper heads and pipes) and reset the masonry in mortar, and the flagging and counterflagging in half mortar half cement viz: the center part of each flag in mortar and the remainder portion [sic] and the joints in Roman Cement. -

The lead gutters to be turned back (vide plumbers work) from the retaining wall of casemates and cavalier & holes to be cut through haunch of the arches (as shewn in sections drawings 3 & 4) for inserting the cast Iron Hopper heads and elbow pipes, which are to be securely built in and those openings as also the gargoyle openings to be [fitted?] up and made good with brick work in Roman Cement.

The coping and masonry of the retaining and escarp walls (shewn by the reddish brown tint on plan and section drawing 2.3. & 6) to be taken down and reset in Roman Cement and a chase 12" x 9" to be cut in the walls of cavalier over the flagging of the dos d'anhes and made good with rubble masonry in Roman Cement) [sic] for the purpose of introducing a water table of granite 18" x 9" punched weathered sunk and set in Roman Cement.

The retaining wall of redan (s.t.w. Drawing N° 2 and section Fig.: 2 Drawing N° 3) to be carried up to the height of 2 feet from the bed of the existing coping in granite - masonry with horizontal beds and vertical joints faces punched and chisel drafted round the joints (and set in Roman Cement)
to correspond with the adjoining parapet to which it is to be properly connected at s & u. -

The joints formed by the junction of the dos d'anes with the escarp and retaining walls of casemates (where exposed) from 1 to 54 inclusive to be raked out to the depth of from two to three inches, and to be flushed and pointed with Roman Cement, and a fillet of the same 3 inches wide to be formed in the angle over the joints. -

The chimnies (uncover) which are of brick work in mortar to have the joints raked out to the depth of $\frac{3}{4}$" to 1 inch and to be pointed with Roman Cement. The Casemates 21, 22, 26 & 27, not being provided with gutters at vvvv, Drawing N° 2, it is proposed to supply that deficiency. The gutters to be formed (for receiving the lead lining vide Plumber work) 9 inches wide of brick work in Roman Cement (the backing and sloping sides at top of rubble masonry in mortar) and the concave surface rendered throughout with Roman Cement.

The proposed cast Iron pipes in the angles within the casemates as numbered from 1 to 54 inclusive on drawing N° 2 as well as those within the cavalier to be cased round with brick work one brick thick in Roman Cement (shewn on plan Drawing N° 3. Fig: 10 & 11 [numbers crossed out and 9 and 10 substituted] every fourth course to be toothed into the walls right and left alternately) on footings of rubble masonry in mortar. The hopper ends of the Dos d'anes of Casemates from 15 to 54 inclusive and those of the Cavalier to be constructed to the angles
indicated by the dotted lines in the sections (Drawing Nos. 3 & 4) of rubble masonry in mortar for receiving the flagging and counter flagging, which together with the sides and edges of No. 17, 18, 21, 22, 26 & 27. to be of Iron stone averageing [sic] from 4 to 6 inches thick joined and bedded flush in $\frac{1}{2}$ cement $\frac{1}{2}$ mortar and jointed with cement as before described, with dry flagging and counterflagging of a like description over the gutters of 17, 18, 21, 22, 26 & 27 - Holes to be cut in the walls of officers' rooms in the redan, and in Soldiers rooms of first floor of Cavalier for receiving the ends of trimming Joists round pipe casing. -

N.B. where Roman Cement is named in the foregoing specification it is to be understood as being composed of $\frac{1}{2}$ cement & $\frac{1}{2}$ fresh water sand and the mortar one part stone lime and two parts fresh water sand.

Plumbers Work

Milled sheet lead of 8 lbs. to the superficial foot to be provided and laid in the gutter at v.v.v.v. over Casemates 21, 22, 26 & 27. and which together with the existing gutters of these and the other casemates and cavalier to be dressed and chased into the retaining walls and run with lead, and the bottoms over the cast Iron hopper heads to have a hole 5" diameter cut in same and to be fitted with a lead soldered pipe of the same diameter & soldered to the gutter to dip 6 inches below the bottom of gutter into the hopper head thus in section [drawing in text].
The several existing lead gutters of the uncovered casemates to be carefully examined and repaired where found defective making good such (probable) defects and deficiencies with new lead and solder.

The Plumbers and Laborers time solder [sic]. Lead coals & tallow is for dressing back the gutters (prepatory to the masons inserting the hopper heads) and dressing down same, making and connecting the drip or nozzle pipes to gutters and repairing defects. –

Carpenters Work.
The boarding [?] and joist in the Casemates officers & Soldiers Quarters (and in Cavalier) to be cut out (as shewn in Sections drawing N° 3) to admit of the introduction of the Cast Iron pipes and brick casing round same and to be made good again using the same materials and supplying the deficiency by new boarding nails and trimming Joists round the pipe casing shewn in Drawing N° 3, Figs: 10 & 11, and the planking & Joisting of the footway under the verandah of Cavalier to be taken up and relayed [sic] for the purpose of admitting the branch drains being constructed.
The existing battening [?] to walls and dado in Officers rooms in Redan to be removed at the angles for admitting the cast Iron pipes and brick casing and trimming the floors round same.
The circular brick casing to be lined with inch deal wrought one side and rebated dado, and fixed on rough fir bond timber $\frac{1}{2} x 3$ to be built into the brickwork. The existing dado to be made
good to the new circular part which is to have a capping of inch deal 2 inches wide, wrought and rounded and scribed to the brickwork and mitred at the angles of junction with the existing straight capping with Inch torus moulded skirting at bottom & mitred to the existing skirting. The rough fir 2 inch rough deal and the nails is [sic] for making good the deficiencies consequent on taking up the flooring & Joisting, and trimming round the pipe casing, and the carpenters time is for making good the dado and battening of walls in officers rooms consequent on the same.

Plasterers Work.
The lathed and plastered ceiling at angles of officers Kitchens and the lath & plaster on walls in officers rooms over dado where the pipes are to be carried through to be taken down and made good with Lath and plaster 2 coats and set with fine stuff, and the brick casing of pipes in officers rooms above the dado to be rendered 2 coats and set with fine stuff, and that in the officers Kitchens. Soldiers Quarters in Casemates and Cavalier to be lime whited 2 Coats.

Smiths Work.
Cast Iron Hopper heads with 3" bore cast Iron rain water pipes and wrought Iron bands to be provided and fixed in the Casemates and Cavalier as shown in the Sections drawings N° 3 & 4.

The joints to be staunched with white lead ground in oil
to prevent effluvia ascending into the room from the drains.

**Painters Work.**

The cast Iron Hopper heads and pipes including the wro. Iron bands, and the new dado in officers rooms to be painted 4 Coats common color in oil. The following is the data from which the Estimate is framed with reference to the foregoing specifications.

**Diggers Work.**

Dig out and remove earth 50 Yards & fill in and ram over casemates (15.16.17 & 18) 2/51.6 x 20.0 x 4.0 2/60.0 x 34.0 x 7.6 (over 21 & 22) 50.0 x 10.0 x 4.0. 56.0 x 34.0 x 7.6. (over 26 & 27) 53.0 x 19.0 x 4.0. 58.0 x 34.0 x 7.6. (over 28 to 45 inclusive) 481.0 x 16.0 x 4.0. 455.0 x 31.0 x 7.6 (over 46 to 54 inclusive) 213.0 x 17.0 x 4.0 204.0 x 28.0 x 17.6. (over 21 & 22) 50.0 x 10.0 x 4.0. 56.0 x 34.0 x 7.6. (over 28 to 45 inclusive) 481.0 x 16.0 x 4.0. 455.0 x 31.0 x 7.6 (over 46 to 54 inclusive) 213.0 x 17.0 x 4.0 204.0 x 28.0 x 17.6. (over 1 to 9 inclusive) 193.0 x 9.0 x 3.0 (over 10 & 11) 48.0 x 9.0 x 3.0.

Puddling and tempering earth. (Over 15 to 54 inclusive) 2/51.6 x 54.0 x 3.0. 50.0 x 44.0 x 3.0. 53.0 [or 530?] x 53.0 x 30. 481.0 x 47.0 x 3.0. 213 x 45.0 x 3.0. Over 1 to 11 inclusive 43.0 x 9.0 x 2.0 48.0 x 9.0 x 2.

Sodwork with new sods. Revetment of parapet 976.0 x 5.0 x 1.0. Exterior slope 888.0 x 8.0 x 1.0.

Dig and throw out ground for drains. abc. de. fg. hi. k. l. mn. op. collected. 728.0 x 5.6 x 4.6 qr. 142.0 x 4.0 x 4.6 [or 46?] for branch drains officers area 12/5.6 x 4.6 x 4.6 d° cavalier 6-12.0 x 4.0 x 4.0.
Fill and ram over drains 728.0 x 5.6 x 4.6. 142.0 x 4.0 x 4.6. 12/5.6 x 4.6 x 4.6. 6/12.0 x 4.0 x 4.0. –

Deduct from d° and call[?] removing stuff 200 yards section of drains [sic]. 728.0 x 3.2 x 1.10. 142.0 x 3.2 x 1.10. 15/1.3. 1.0 x 1.0 6/12.0 x 1.0 x 1.0. –

Dig throw out fill in and ram within casemates 49/4.6 x 3.0 x 3.0 Cavalier 6/4.6 x 3.0 x 3.0. –

Masons Work.

Cut through footings of rubble masonry and make good round drains in Casemate. 37/4.6 x 2.6 x 2.6. 13/4.3 x 2.6 x 2.6.

In Cavalier 6/4.3 x 2.6 x 2.6. Brick drains 6 x 5 in clear in Roman Cement in Casemates. 50/6.0 Cavalier 6/16.9. –

Dry rubble drains 14" x 14" in clear collected 870'.0".

Cut chase for pipes in footings of masonry. Casemates 50/2.6 Cavalier 6/1.9. Take up old flagging & remove &. 4/33.0 x 11.6 x [sic] 4/40.0 x 11.6.

Take up and remove old Tiles 4/33.0 x 11.6. 4/40.0 x 11.6. Take up flagging and counter flagging & reset Hopper ends No. 1 to 11. 10/19.0 x 2.6 4/12.0 x 2.6. Sides & ridges 1 to 16 & 28 to 54, inclusive 82/11.6 x 4.0. 82/4.0 x 1.9. 4/12 x 2.6 Cavalier sides & ridge 10/11.6 x 4.0. 2/20.4 x 4.0. 5/4.0 x 1.9.

Take up and reset rubble masonry in mortar, hopper ends of 1 to 11. 14/9.0 x 5.6 x 2.3 cavalier footing of verandah 6/4.0 x 2.9 x 1.9.
Cut open through arches to insert hopper heads & pipes in Casemates 50/3.0 x 1.0 x 1.0. Cavalier 6/3.6 x 1.0 x 1.0.

Build up gargoyle holes in Brick Work in Cement. Casemates 50/3.0 x 9 x 9 Cavalier 6/3.0 x 9 x 9. Take up and reset granite coping cement.

(At N° 15, 16, 17 & 18) 2/50.0 x 3.0 (d° 21 & 22) 42.0 x 3.0 (d° N° 26 & 27) 43.0 x 3.0 (d° 28 & 29) 48.0 x 3.0 (d° 30 to 54) 585.0 x 3.0.

Take down and reset masonry in Roman Cement. Retaining Wall 425.0 x 3.3 x 3.0. 425.0 x 2.0 x 2.6. 390.0 x 3.0 x 3.0. Escarp wall 806 x 2.0 x 2.0.

Granite water table 18 x 19 over casemates 15 to 54 inclusive 1598.0 cavalier 384.0.

Cut chase 12 x 9 in rubble walling. Cavalier over dos d'anes 340.0.

Rubble masonry with horizontal beds & vertical joints in cement. Redan 372.0 x 2.0 x 3.0.

Punched rustic work & chisel drafted 2/372.0 x 2.0 Rake out joint of dos d'anes flush & point with cement 140/11.6. 4/9.0. 4/10.0.

Filletting with Roman Cement 3" wide. 140/11.6. 4/9.0. 4/10.0.

Rake out and point Brick work with cement 7/11.0 x 10.8. 7/9.0 x 6.6. 2/10.0 x 10.8. 4/15.6 x 10.8. 14.6 x 13.10. 20.2 x 6.6. 12/11.0 x 17.0. 12/10 x 8.0 12/9.0 x 10.0. 4/11.0 x 13.10. 2/12.0 x 6.6. 3/14.0 x 8.0.
Brick gutters 9" wide in cement 2/34.0. 2/40.0

Brick work in Roman Cement, pipe casing casemates 37/13.3 x 1.6 x 9" 13/23.5 x 1.6 x 9" Cavalier 6/22.4 x 1.6 x 9" curved face on Brick work 37/13.3 x 2.3. 13/23.4 x 12.3 6/22.4 x 2.3.

Rubble masonry in mortar Base to Brick casing 50/1.6 x 1.6 x 1.0. 6/1.6 x 1.6 x 1.0. -

Cut chase or indent[?] in rubble walling, casemates 198.0 x 1.3. Cavalier 33.6 x 1.3.

Rubble masonry in mortar Hopper ends of casemates N. 15 to 54 next retaining walls 25/9.0 x 5.6 x 2.3. 4/7.6 x 5.6 x 2.3. 16/6.0 x 5.6 x 2.3 next escarp wall 25/9.0 x 3.10 x 1.10 16/6.0 x 3.10 x 1.10 Cavalier next escarp wall 4/10.6 x 4.0 x 1.6. 2/15.6 x 4.0 x 1.6 next retaining wall 4/10.6 x 4.0 x 1.10. 2/15.6 x 4.0 x 1.10.

Iron stone self faced flagging and counter flagging in mortar & cement, sides of Casemates 17. 18. 21. 22. 26 & 27. 4/44.0 x 11.6. 4/33.0 x 11.6. 4/40.0 x 11.6 Ridges of same 2/44.0 x 1.9. 2/33.0 x 1.9 2/40.0 x 1.9 Hopper ends from 15 to 54 inclusive 25/9.0 x 10.0. 16/6.0 x 10.0. 4/7.6 x 10.0. 25/9.0 x 8.0. 16/6.0 x 8.0. 4/7.6 x 8.0 Cavalier 4/10.6 x 7.0. 2/15.6 x 7.0. 4/10.6 x 8.0 2/15.6 x 8.0. -

D° - d° - laid dry over gutters (of N° 17. 18. 21. 22. 26 & N° 27) 44.0 x 2.0 3/33.0 x 2.0. 3/40.0 x 2.0. -

Cut holes in walls for receiving ends of joists officers rooms. 13 cavalier 6.
Plumbers Work.

Milled lead 8 lb. per ft (gutters to N° 21. 22. 26 & 27) 2/35.0 x 2.6. 2/42.0 x 2.6. nozzles 51.1.3 x 6" repairs to gutters 20.0 x 2.6. - cavalier nozzles 6/1.3 x 6[in.?].-

Cut chase in joints of masonry and run with lead casemates (21. 22. 26 & 27) 4/2.6 Cavalier 6/2.6 chase run with lead 47/2.6.

Carpenters Work.

Cut out flooring and Joist relay and make good casemates 49/7.6 x 6.9. 13/2.6 x 1.6 cavalier 6/7.6 x 6.9 6/2.6 x 1.6 Verandah 6/10.0 x 4.0.

Inch deal wro. one side & rebated circular on plan officers rooms dado. 13/3.0 x 2.0.

\(\frac{1}{4}\) inch deal rounded capping 2" wide circular 13/2.0 Inch deal torus moulded skirting circular 13/2.0 x 8"

Rough fir and fixed circular (Bond timber) 13/3/2.6 x 4\(\frac{1}{2}\)" x 3".

Plasterers Work.

Take down lath & plaster officers kitchens ceilings 13/4.0 x 2.0.

Officers rooms walls 13/2/3.0 x 1.3 Lath & plaster 2 coats & set with fine stuff ceilings 13/4.0 x 2.0 Walls 13/2/3.0 x 2.5.

Deduct from same 13/1.0 x 1.0. 13/2/3.0 x 1.3 render 2 coats and set with fine stuff. 13/3.0 x 2.0. Lime white 2 coats, casemates on brick casing casemates N° [not given] 50/8.0 x 2.3 cavalier 6/17.6. x 2.3.
Smiths Work.

Cast Iron rain water pipes 3" bore $\frac{3}{8}$ thickness of metal with wro. Iron bands. - Casemates 36/15.3 13/24.3 Cavalier 6/24.9 Hopper heads cast Iron 49/28 lb. 6/28 lb. white lead ground in oil 203 lb. -

Painters Work.

4 coat painting common colours in oil on dado officers rooms 13/3.3 x 2.3 on rain water pipes collected 1013.6 Hopper heads N° 55.

Estimate

Halifax Citadel.

Staunching leakages in Casemates, Cavalier &c. -

[Item 1]

10207 Cubic Yards digging, throwing out & removing earth - 10$^{d}$ y. 425.5.10

4,845$^{\frac{1}{2}}$ " " - puddling & tamping earth 3$^{d}$ 60.11.4$^{\frac{1}{2}}$

631$^{\frac{1}{2}}$ " " - digging, throwing out, filling in & ramming earth - 10$^{d}$ 26.6.3

192 " " - filling in and removing Stuff averaged distance of 200 yards 8$^{d}$ 6.8.0

113 " " - distance of Cubic Yards filling in & ramming earth over drains. - 2$^{\frac{1}{2}}$ 1.3.6$^{\frac{1}{2}}$
11,984 " feet sod work in reforming Slopes
& revetments - 3d 149.16.0

59$\frac{1}{2}$ sup. Yards taking up & removing old tiles 1$\frac{1}{2}$d 3.14.5$rac{1}{4}$

373 " " taking up & removing flagging. - 3d 4.13.3

622 Sup. Yards taking up Iron stone flagging & counterflagging & resetting in cement 3/4 103.13.4

2454 feet sup. taking up & resetting Granite Stone in Cement 5d 51.2.6

94$\frac{1}{2}$ perches taking up & relaying rubble masonry in mortar - 15/6 73.4.9

789$\frac{3}{4}$ Perches taking down & rebuilding rubble masonry in cement 16/- 631.16.0

484$\frac{1}{4}$ " rubble masonry in mortar as in foundations 14/2 343.0.2$rac{1}{2}$

135$\frac{1}{4}$ " rubble masonry in Cement with horizontal bed and vertical joints - 19/4 130.14.10

870 " rubble masonry laid dry in drains 14" x 14" in clear covered with self faced Iron Stone flagging 2/5 105.2.6

68$\frac{3}{4}$ " Brick work in cement 32/- 110.0.0

400$\frac{1}{2}$ lineal feet Brick drains thro' walls laid in Roman Cement 1/6 30.0.9
255

148 " " Brick gutters 9" wide bedded & rendered with cement to receive lead lining 1/3 9.5.0

869 Sup. Yards raking out Brickwork & pointing with Cement - 1/- 43.9.0

1467 Sup. yards Iron Stone flagging & counterflag in cement & mortar 5/6 403.8.6

58½ " " d. d. jointed & laid dry. 2/8 7.16.0

1982 feet lineal Granite water tabling in Cement punched, sunk & weathered 1/9 173.8.6

482 " " raking out joints in masonry & pointing with cement 2d 4.0.4

482 " " filletting in cement on face of masonry - 2d 4.0.4

1.488 Sup. f. punched rustic work with chisel drafted margin 1/6 111.12.0

2,078½ lin. f. curved face on brickwork 1½d 13.0.11¾

289½ Sup. " cutting chace [sic] or indent in walls for tieing [sic] in brickwork - 6d 7.4.9

135½ lineal f. cutting chace in footings of rubble masonry for securing vertical pipe 9d 5.1.7½

10 " " cutting chace in Joints of masonry & running with lead 1/4 0.13.4

132½ feet lineal chace run with lead
including lead fuel & Labour

9d  4.19.4½

" cutting chace 12" x 9"

to receive granite water tabling

& making good with masonry and cement 1/-

19.4.0

cubic ft. cutting thro' masonry to
form drains & making good the same
(usuing ½ new stone)

10½d  67.11.10½

" cutting openings thro'
brick arches & making good round
the same in cement

3/4  28.10.0

cutting out holes for end of joists
at pipes

1/-  0.19.0

sup. yards taking down old lath &
plastering & removing rubbish

2d  0.5.2

" 2 coat lath & plaster -

1/3  1.3.9

" render & set 2 coats
with fine stuff (curved)

8d  0.6.0

Squares Lime whiting 2 coats

1/-  0.11.4

cubic feet rough fir Timber

1/-  2.16.0

d. fixed circular

1/4  0.12.0

f. sup. 1 inch deal wrought one
side, rebated & bent

6d  1.19.0

feet lineal 1¾" deal wrot' &
rounded, capping circular,
mitred & fixed

6d  0.13.0

sup. 1" deal torus moulded
<table>
<thead>
<tr>
<th>Material/Work</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Total Cost</th>
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<tbody>
<tr>
<td>Skirting &amp; fixing (circular on plan)</td>
<td>9 d</td>
<td>0.13.1 (\frac{1}{2})</td>
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<tr>
<td>Squares cutting out and making good flooring and joisting to insert pipes &amp; relay the same</td>
<td>15/-</td>
<td>23.5.0</td>
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<td>129 sup. yards painting 4 coats in oil, common colour</td>
<td>10 d</td>
<td>5.7.6</td>
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<tr>
<td>203 lb white Lead ground in oil for staunching joints of pipes</td>
<td>5 d</td>
<td>4.4.7</td>
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<tr>
<td>31/(\frac{1}{2}) Cwt cast Iron in water pipes 3&quot; bore (\frac{3}{8})&quot; thick, including wro. Iron [galvanized*] bands &amp; fixing</td>
<td>20/-</td>
<td>111.10.0</td>
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<td>14 (\frac{3}{4}) &quot; D° in Hopper heads to d° and fixing</td>
<td>20/-</td>
<td>14.15.0</td>
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<td>40 Bushels Coal</td>
<td>8 d</td>
<td>1.6.8</td>
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<td>33 cw. milled sheet Lead 8 lb per f. and fixing</td>
<td>34/-</td>
<td>56.2.0</td>
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<td>170 lb Solder</td>
<td>1/3</td>
<td>10.12.6</td>
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<td>8 &quot; Tallow</td>
<td>3 d</td>
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<td>13 &quot; Class nails N° 32</td>
<td>4 d</td>
<td>0.4.4</td>
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<td>280 &quot; D° &quot; 42</td>
<td>3 d</td>
<td>3.10.0</td>
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<tr>
<td>1182 feet 2 inch pine plank</td>
<td>100/-</td>
<td>5.18.2 (\frac{1}{4})</td>
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<td>46 days civil painter</td>
<td>4/-</td>
<td>9.4.0</td>
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<tr>
<td>46 &quot; &quot; labour</td>
<td>2/3</td>
<td>5.3.6</td>
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</table>

*Author's note: The material in brackets is superscribed in the manuscript, probably in London at a later date.*
13 " " carpenters 4/- 2.12.0

[Total] £3423.14.9\textsuperscript{\(\frac{1}{4}\)}

Add contingent 10\textsuperscript{th}

342.7.4\textsuperscript{\(\frac{1}{2}\)}

[Total] £3766.2.2\textsuperscript{\(\frac{3}{4}\)}

[signed] H.J. Savage Lt Col.

Comd\textsuperscript{\(\frac{1}{2}\)} R. Engineer

30\textsuperscript{th} April 1849.

[Item 2]

This Item which is the service provided for under Item 4 of the supplementary Estimate dated 31 March 1836 for Tanks & Filters amounting to £665..1..5\textsuperscript{\(\frac{1}{4}\)} is herein brought forward for authority, it being considered essential to have this work executed in connection with that proposed under Item 1 of this Estimate. The only alteration suggested in its provisions is to carry the vertical part of the conduit pipe in the interior angle of the casemate (N\textsuperscript{\(\circ\)} 30 where it is proposed to construct the Tank) instead of bringing it down the exterior face of retaining wall as has been proposed and also to fix the pump within the casemates [sic] N\textsuperscript{\(\circ\)} 31. in which the well is situated by which means it will be protected from the frost the point y on Drawings N\textsuperscript{\(\circ\)} 1. 2 & 5 shows the suggested altered position of the pipe and Z Drawing N\textsuperscript{\(\circ\)} 1 that of the pump. This alteration will not it is considered affect the amount of the Item as originally estimated.
[Item 2 - estimate]

**Water Tanks.**

For the detail of this Service See Item 4 of the Supplementary Estimate dated 31\(^{st}\) March 1846 £665 1 5\(\frac{1}{4}\)

[Item 3]

This Item is a revision of Item 16 of the Revised Estimate dated 1\(^{st}\) Feb. 1836, which provides for "2000 ft in length of surface drains 3' wide for the interior 2300 for the Ramparts, "the drains to be formed of pebbles laid on edge in fine gravel &c" But as has been stated in the prefactory part of the Report to this Estimate par: N. 4 that surface gutters formed of pebbles are objectionable (more especially on the Ramparts over the casemates) and there being no provision made for carrying off the water from the surface gutters of the ramparts on the west and South faces & part of the east face. Therefore this Item provides for substituting a granite channel course instead of the "2300 feet" of pebble surface drains for the Ramparts only. & for granite basin stones with gargoyles, cast Iron hopper heads & pipes & underground drains in the interior as shewn on the drawings 1 & 5 accompanying this Estimate. The water it is to be observed is by this arrangement permitted to run to waste in the underground drains, but should it be hereafter found desirable to save it for consumption by the Troops, it can be collected with facility from the vertical pipes (herein provided) by means of conduit pipes connected thereto & leading to a Tank which may
be constructed in either of the casemates 13, 14, 15 or 16 or in any other situation that may be considered more desireable [sic].

Dig out & remove the earth for the reception of surface gutters at back of parapet of retaining wall of Rampart of the west, south & part of the East faces to the extent of (collected) 1171.0 x 2.3 x 9 & remove the stuff to a distance of 200 yards. Provide & set Granite channel course (2192.0 x 2.3) 9" thick tooled, sunk, & set in mortar & jointed with Roman Cement and 5 granite Basin stones with gargoyles 5.0 x 2.0 x 1.0 (vide drawing No. 5 at b.b.b.b.b.) tooled sunk & set in Roman Cement the underside of the projection of the gargoyle to be throated thus [section drawn in text]. Take down coping 5/4.0 x 3.0 and the masonry under the same 5/4.0 x 2.6 x 2.0. 5/4.0 x 3.0 x 1.0 and reset in Roman cement for the purpose of introducing the gargoyles. -

Dig out ground for receiving the drains from the proposed pipes (vide drawing No. 1 at V. W. X. Y. Z) collected 88[?] x 5.6 x 4.6 & ram the ground over same and remove the surplus stuff 88.0 x 3.2 x 1.10 to a distance of 200 yards. - Build drains 14" x 14" in clear 88.0 in length the sides of dry rubble masonry 12" thick the bottom & the top covering of 4 inch self faced Iron stone flagging jointed and laid dry. -

Smiths Work.

Provide & fix (at c.c.c.c.c. drawing No. 5) 5/24.0 of 4"
cast Iron rain water pipe and 5/60 lb. Hopper heads with wrought Iron bands and Holofasts [sic].—

Painter.

The pipes & hopper heads to be painted 4 coats common colours in oil. —

All the materials & articles estimated for in the above services under Item 1. 2 & 3 [sic] can be advantageously procured on the spot, with the exception of Roman Cement, for which a Demand of Stores accompanies this Estimate. —

[Item 3 - estimate]

Surface Drainage of Ramparts &c.

Revision of Item 16, of the Revised Estimate dated 1st Feb. 1836

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>73 cubic yards digging &amp; removing earth</td>
<td>10d</td>
<td>3.0.10</td>
</tr>
<tr>
<td>$61\frac{3}{4}$ &quot; &quot; digging throwing out</td>
<td>10d</td>
<td>2.11.5 $\frac{1}{4}$</td>
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<tr>
<td>filling in &amp; ramming earth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 cubic yards removing stuff on</td>
<td>8d</td>
<td>0.12.8</td>
</tr>
<tr>
<td>average distance of 200 yards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$9\frac{3}{4}$ Perches taking up &amp; rebuilding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ashlar masonry in cement</td>
<td>16/-</td>
<td>7.16.0</td>
</tr>
<tr>
<td>60 feet sup. taking up Granite coping</td>
<td>5d</td>
<td>1.5.0</td>
</tr>
<tr>
<td>&amp; resetting in cement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88 feet lineal rubble masonry laid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry in drains 14&quot; x 14&quot; with Iron stone flagging</td>
<td>2/5</td>
<td>10.12.8</td>
</tr>
</tbody>
</table>
There are no surviving detailed estimates for the staunching method finally adopted at the Citadel, but there are several indications of the materials employed and the manner...
in which they were used. The most important material used was "Claridge's Patent Seyssel Asphalte," and the following section describes its composition and application.22

There are several accounts of casemate staunching using asphalt, both in the primary and secondary literature, and these should be consulted for comparative purposes. None, unfortunately, is very accessible. The easiest to come by is the account of the staunching operations carried out at the citadel at Plymouth contained in Colonel John Oldfield's article on the uses of asphalt in the Professional Papers of the Royal Engineers.23

...Seyssel Asphalte, known also as Claridge's Patent Asphalte, is made from a bituminous rock found at Pyrimont Seyssel, in the Jura Mountains.

It is a limestone saturated with bitumen, and contains about 90 to 92 per cent carbonate of lime and 10 to 8 per cent of bitumen.

This material is ground, mixed with grit and with heated mineral tar until the mass has thoroughly amalgamated and become reduced to a mastic. It is then run into moulds to form blocks.

These blocks are 18 inches square, 6 inches deep, and weigh about 125 lbs. each; countersunk on two sides with the words PYRIMONT and SEYSSEL as the trade mark.
The asphalte is imported in this form by the Pyrimont Seyssel Asphalte Company, from whose circular most of the following information is obtained: -

QUALITIES. - There are three qualities in the market -

1. Fine, without grit, used for magazine floors and as a cement for very close joints in brickwork.

2. Fine-gritted, for covering roofs and arches, lining tanks, as a cement for brickwork, and for running the joints of stones.

3. Coarse-gritted, containing more and larger grit; used for pavements and floorings where great strength is required, as gun-shed floor, tun-room floors, margins of stall floors, etc. In gateways for heavy carriage traffic small pieces of granite chippings, etc., are introduced.

MIXING. - The blocks of asphalte are broken up into pieces of not more than 1 lb. weight each, and melted in iron caldrons heated by wood or peat.

Coal is objectionable on account of the smoke it creates; coke injures the material and destroys the caldron.

The following directions are from the circular of the company:

"The fire having been lighted in the caldron, put into the boiler 2 lbs. of mineral tar, to which add 56 lbs. of asphalte, broken into pieces of not more than 1 lb. each. Mix the asphalte and tar together with the stirrer, till the former becomes soft, and then place the lid on the caldron, keeping up a good fire. In a quarter of an hour repeat the stirring, and add 56 lbs. more
asphalte, in similar sized pieces, distributed over the surface of that in the caldron. Again cover the caldron for ten minutes, after which keep the contents constantly stirred, adding by degrees asphalte in the proportion of 112 lbs. to 1 lb. of tar, until the caldron is full and the whole is thoroughly melted.\footnote{Practice, however, best regulates the quantity of tar to properly flux the asphalte. In exposed situations, particularly on the coast during cold and other unfavourable weather, a strong fire is necessary to be kept up, and at such times the asphalte work is longer in execution. On this account the tar is more quickly consumed, and a small quantity will have to be added. A somewhat larger proportion of tar is also necessary in the application of asphalte to brickwork, and also in running the joints of stones. In warm climates an excess of tar must be avoided. From the first lighting of a caldron about $3\frac{1}{2}$ hours will be occupied before the entire mass with which it is to be filled will become melted. The subsequent operation will occupy about half an hour less time.} When fit for use the asphalte will emit jets of light smoke and freely drop from the stirrer".

The asphalte is removed from the cauldron in ladles, poured over the concrete foundation, or other place where it is to be applied, brought to a smooth surface with wooden rubbers, and finished, either with a mixture of slate-dust and silver sand in equal parts, or roughened by grit stamped in while the asphalte is soft....
15 Report on the use of asphalt, 1854

This is the best brief account of the uses of asphalt in waterproofing operations at the Citadel.

Report

On the Seyssel Asphalte used
at Fort George Halifax Nova Scotia.

From 1849 to the end of 1853, 478 tons of Seyssel Asphalte were used in Fort George for covering a Magazine yard, Staunching Arches of Casemates, and Lining and covering tanks.

The Magazine Yard was covered in 1849 with Seyssel Asphalte of the fine quality laid \( \frac{1}{4} \) inch thick on a bed of concrete, and having a fall from the Magazine to a gutter turned in the Asphalte.

Asphalte fillets were laid against the Magazine and Area Walls. Each winter (till the present Year 1854) when occasional mild weather rendered it practicable to remove the frozen snow and examine the Asphalte, many and extensive cracks were found in it, and the general level of its Surface appeared considerably elevated by the frost, the gutters being in several places so much so as to throw the water from them towards the Magazine, and the fillets were found to be loosened from the surface.

The defects so discovered in Asphalte were thoroughly repaired each year, before the commencement of the cold weather, but invariably with the same result each succeeding Winter.
The Asphalte covering of the superior slope of the Parapet of the Cavalier Barracks which was laid on a bed of concrete in the summer of 1850, has each winter failed in a similar manner to that on the Area of the Magazine, and apparently from the same cause namely from the expansion caused by the bursting of the moisture absorbed and contained in the Masonry as also being unprotected by a covering of earth from the severe frost which instance affords ample proof that where asphalte is exposed to the direct action of the frost it will always prove a failure in a climate so severe as this country. -

In 1851./52 & 53, fifty-four casemates for Officers and Soldiers Barracks were covered with $\frac{3}{4}$ inch Asphalte, fine quality, laid in two coats breaking joint, each coat being $\frac{3}{8}$" thick, and the earth forming the Rampart filled in upon the Asphalte from 3/2 to 6 feet in depth. - Two of the first casemates asphalted and covered with earth were found to have leaks where the arches butted against the interior retaining wall. On examination the fillet in connection with the wall, was found to have parted from it, although grooves had been cut in the stone to receive it; - the use of fillets was then discontinued, Asphalted Bricks being built upon the $\frac{3}{4}$" covering of the Arch until a joint in the Ashlar Masonry was reached, when the upper stones being removed, a coat of Asphalte (vide accompanying sketch) was carried well into the knees[?] of the wall. - This practice was continued throughout the remainder of the Casemates, and these from being uninhabited on account of the water coming in streams through
the Arches, are since the application of the Asphalte perfectly dry and are now occupied by Officers and Soldiers. -

Wherever it was impracticable to do without fillets, deep grooves were cut in the Brickwork or Masonry to receive them and rubbed with a small quantity of mineral tar. - The thickness of the Asphalte over the Casemates exceeds that stated in Company's Book of instructions as sufficient for covering Arches, viz \( \frac{7}{16} \) of an inch, on account of the practical difficulty of laying it so thin and evenly in two coats; and although the wooden guages [sic] were less than \( \frac{3}{8} \) thick it was found from the expenditure of Asphalte that the two layers actually amounted to nearly \( \frac{3}{4} \)" in thickness. - In this extra quantity there appeared a decided advantage, as bubbles of air or gas arising were rarely found to extend quite through the \( \frac{3}{8} \)" coat. - Their number and occasional large size shewed the utility of the precaution of laying the Asphalte in two coats. - In the course of the work it was found desirable [sic] to effect adhesion between cast iron and asphalte, so as to leave no opening for water to insinuate itself between the Asphalte covering and the iron hopper heads of the vertical drain pipes.

A small quantity of mineral tar rubbed over the surface of the iron, caused the Asphalte to adhere to it so strongly that a surface of 4 square inches lifted a weight of 60 lb and would apparently have sustained more. - Asphalte was found readily to adhere to Granite and Ironstone when their surfaces were in like manner rubbed with mineral tar. -
Two tanks each to contain 66,000 gallons of water and their filtering chambers together with a smaller Reserve Tank for 30,000 Gallons have been built.

The top of the arches being 4 feet below the surface of the Parade in the Fort the groined inverts at the bottom being floated over with Asphalte, fine quality \(\frac{3}{4}\)" thick laid in two coats \(\frac{3}{8}\)" thick, the wall, lined with Asphalted brick, and the dos d'anes asphalted \(\frac{3}{8}\)" thick with fillet over the joint, (thus in Section) [drawing in text] these three Tanks have been found perfectly free from external leakage, and are perfectly watertight, neither has the water in them, been apparently affected in any way by the Asphalte. - In the before mentioned services 122,000 Asphalted bricks were laid, and in every way have answered the purpose to which they were applied, forming a very compact and watertight lining to Wall.

The Interior (Vertical) Slope of the Parapet of the Cavalier, lined in 1850 with asphalted brickwork appear [sic] to have been affected by the frost to which it has been exposed it having cracked in several places - evidently from contraction of the material. - There is no other Asphalted brick in the fort exposed to the weather except the top of the parapet but the evidence here afforded shews that unless it is protected by a covering of earth it will not stand the climate even for a season. - The Asphalte was generally mixed with about 10 per cent of Mineral Tar, great care was taken in laying it, to have all surfaces perfectly dry,
the joint free from dust, and all the bubbles of air or gas that raised were pricked with pins and the holes filled in with hot asphalte. - The Asphalted Bricks were prepared, and the whole of the asphalte was laid by a portion of the 18th Company Royal Sappers and Miners instructed by Corporal Penton who had been sent to learn the process at the Seyssel Asphalte Company's Works in London. -

[signed] R.M. Parson's [sic]
Lieu Royal Engineer
13th Feb 1854. -

16 Casemates: condition and usage, 1848, 1854 and 1856

The casemates are listed in order by their standard system numbers (see section 1, above). The sources for the information given below are, as follows:

(1) Inspectional Report, 30 November 1848
(2) Tabular statement, 28 November 1854
(3) Tabular statement, 17 June 1856

Casemate No. 1

Contemporary number and comment, 1848:
"No. 20 appropriated for stores, dry, flooring not complete, fit for accommodation of troops when finished."

Contemporary number and comment, 1854:
No. 10. Designated as artillery store. Use: same.
"The lower part of the arch and the wall next to the ramp appear to be very damp."
"It is suggested that the inner face of the wall next to the ramp be battened and boarded."

Contemporary number and comment, 1856:
No number. Designated as artillery store. Use: artillery side arms store.
"The wall next to and in contact with the earthen ramp is damp."
"It is suggested to batten and board these walls."

**Casemate No. 2**

Contemporary number and comment, 1848:
No. 19. Comments as for No. 1, above.

Contemporary number and comment, 1854:
No. 11. Designated as Ordnance store. Use: engineer's carpentry shop (temporary).
"No appearance of dampness."

Contemporary number and comment, 1856:
No number. Designated as Ordnance store. Use: soldiers' quarters for one sergeant and 19 privates.
"The Escarp wall at the end of this casemate is damp, there being no ventilation."
"It is recommended to batten and board these walls."

Casemate No. 3

Contemporary number and comment, 1848:
"No. 18 gun room. Damp and unfit for troops."

Contemporary number and comment, 1854:
"No appearance of dampness."

Contemporary number and comment, 1856:
No number. Gun room, appropriated as above. Use: temporary military prison.
"Quite dry and in serviceable state."

Casemates Nos. 4, 5, 6, 7A and 7B

No record in any of the three sources.

Casemate No. 8

Contemporary number and comment, 1848:
"No. 16 Gunroom. Floored and may be occupied by troops."

Contemporary number and comment, 1854:
No. 14. Gun room No. 6, appropriated for 14 NCOs
privates. Use: Barrack Master's storeroom.

"This casemate next the privies is liable to objection on account of the bad smell." No appearance of dampness.

Contemporary number and comment, 1856:
No number. Gun room, appropriated as above. Use: quarters for one sergeant and 19 NCOs. Damp at down pipe and front wall.

"The down pipe must be opened and examined. It is fully expected that the dampness near the front escarp wall will be remedied by the pointing now in progress."

Casemate No. 9
Contemporary number and comment, 1848:
"No. 15. Gun room. Floored and may be occupied by troops."

Contemporary number and comment, 1854:
No. 15. Gun room No. 7, appropriated for 14 NCOs and privates. Use: one sergeant and one corporal.
"No appearance of dampness."

Contemporary number and comment, 1856:
No number. Appropriated as above, and occupied by one sergeant and 19 NCOs and privates. Comments
as for No. 8, above.
"Damp at escarp wall."

**Casemate No. 10**

Contemporary number and comment, 1848:
"No. 14 dry, appropriated for stores."

Contemporary number and comment, 1854:
"No 16 appropriated as a commissariat store and in use as a temporary engineer timber store."
"No appearance of dampness."

Contemporary number and comment, 1856:
No number. Appropriated as above. Use: quarters for one sergeant and 19 NCOs and privates.
"Quite dry and in good serviceable state."

**Casemate No. 11**

Contemporary number and comment, 1848:
"No 11 gun room, dry and fit for occupation when the planning is complete."

Contemporary number and comment, 1854:
No. 3. Gun room No. 1, appropriated for 12 NCOs and privates. Occupied by one private of the Royal Corps of Sappers and Miners.
"No appearance of dampness."
"These gun rooms are not provided with requisite fitments."

Contemporary number and comment, 1856:
No. 1. Gun room, appropriated as above. Use: band room.
"Damp near escarp wall."
"It is proposed to try careful surface drainage as above, [see Nos. 59-60, below] and external pointing in cement."

Casemate No. 13
Contemporary number and comment, 1848:
"No 10, dry, fit for occupation when planning is completed."

Contemporary number and comment, 1854:
No. 4. Gun room No. 2, appropriated for 12 NCOs and privates. Occupied by one private, Royal Corps of Sappers and Miners.
"Slight dampness in the left spandrel of the arch."
"The dampness would seem to proceed from some defect in the Asphalt coating which at this season [cannot] be repaired."
Contemporary number and comment, 1856:
No. 2, appropriated as above. Use: shoemaker's shop.
"Damp near the down pipe and escarp wall." Other comments as for No. 12, above.

Casemate No. 14

Contemporary number and comment, 1848:
"No. 13, the shifting room belonging to the North Magazine, very dry."

Contemporary number and comment, 1854:
Not listed.

Contemporary number and comment, 1856:
Not listed.

Casemate No. 15

Contemporary number and comment, 1848:
"No. 9, appropriated for stores, dry and fit for the occupation of troops or stores."

Contemporary number and comment, 1854:
No. 8. Appropriated as quarters for 24 NCOs and privates. Use: provost prisoners (10 men).
"Slight appearance of dampness at surface of arch."
"The dampness which appears in these casemates [Nos.
15-20] is of a very partial nature and seems for the most part to proceed from the evaporation of the moisture in the mortar and concrete used in forming the dos d'anés for the reception of the asphalt coating. The heat from the stoves it is expected will, in a few days entirely remove the appearance of dampness.

"The defect in the chimneys may it is considered be permanently cured by contracting the fireplace openings and providing cast Iron chimney tops on the whole of the chimneys of the casemates."

Contemporary number and comment, 1856:
No. 8. Appropriated as above. Use; quarters for one sergeant and 23 NCOs and privates.
"In good order, well ventilated with draft and dry."
"These four casemates [Nos. 15-18] were partially damp but as I expected, as the terreplein of the Rampart became consolidated and the moisture in the walls was drawn out and evaporated by the heat from the stoves within the walls, have become quite dry."

Casemate No. 16

Contemporary number and comment, 1848:
No. 8. See comments for No. 15, above.

Contemporary number and comment, 1854:
No. 9. Appropriated as quarters for 24 NCOs and privates. Occupied by 22 NCOs and privates of the 76th Regiment. See comments for No. 15, above.

Contemporary number and comment, 1856:
No. 9. Appropriated as above. Occupied by one sergeant and 23 NCOs and privates. See comments for No. 15, above.

Casemate No. 17

Contemporary number and comment, 1848:
No. 7. See comments for No. 15, above.

Contemporary number and comment, 1854:
No. 10. Appropriated for 24 NCOs and privates. Occupied by 22 NCOs and privates of the 76th Regiment. See comments for No. 15, above.

Contemporary number and comment, 1856:
No. 10. Appropriated as above. Occupied by one sergeant and 23 NCOs and privates. See comments for No. 15, above.

Casemate No. 18

Contemporary number and comment, 1848:
"No 6 flooring incomplete." See also comments for
No. 15, above.

Contemporary number and comment, 1854:
No. 11. Appropriated for 24 NCOs and privates. Occupied by 18 NCOs and privates of the 76th Regiment. Comments as for No. 15, above, with the additional statement that the chimney drew well.

Contemporary number and comment, 1856:
No. 11. Appropriated as above. Occupied by one sergeant and 23 NCOs. See comments for No. 15, above.

Casemate No. 19

Contemporary number and comment, 1848:
No. 5. See comments for No. 15, above.

Contemporary number and comment, 1854:
No. 12. Appropriated for 24 NCOs and privates and occupied by 19 NCOs and privates of the 76th Regiment. "Chimney smokes on stove being first lighted in the morning." Other comments as for No. 15, above.

Contemporary number and comment, 1856:
No. 12. Appropriated as above. Occupied by two sergeants and 22 privates.
"Damp near the conduit pipe, the slight appearance of
dampness near the escarp."

"The Rampart and Arches between [Nos. 19 and 20] will be opened and the Asphalt examined: this is provided for in the Current Annual Estimate, but it has been deferred until the spring rains are over: - as far as this service has been executed in other parts of the citadel, the Asphalt has been found perfect but between the arch and interior wall slight cracks appear where ever the slightest settlement or bulge has taken place."

**Casemate No. 20**

Contemporary number and comment, 1848:
No. 4. See comments for No. 15, above.

Contemporary number and comment, 1854:
No. 13. Appropriated for 24 NCOs and privates.
Occupied by 15 NCOs and privates of the 76th Regiment.
"Slight appearance of dampness on surface of arch and wall near fireplace. Chimney draws well." Other comments as for No. 19, above.

Contemporary number and comment, 1856:
No. 13, appropriated as above. Occupied by one sergeant and 23 NCOs and privates.
"Damp near the conduit pipe, otherwise dry and in good order." Other comments as for No. 19, above.
Casemate No. 21

Contemporary number and comment, 1848:
No. 3. See comments for No. 15, above.

Contemporary number and comment, 1854:
No. 14, appropriated as quarters for 24 NCOs and privates. Occupied by 21 NCOs and privates of the 76th Regiment.
"No appearance of dampness. Chimney draws well."

Contemporary number and comment, 1856:
No. 19, appropriated as above. Occupied by one sergeant and 23 NCOs and privates.
"Quite dry and well ventilated."

Casemate No. 22

Contemporary number and comment, 1848:
"No. 2 floored, dry and fit for occupation. Gun casemates."

Contemporary number and comment, 1854:
No. 15, appropriated as gun room and quarters for 15 NCOs and privates. Occupied by 14 NCOs and privates of the 76th Regiment. See comments for No. 21, above.

Contemporary number and comment, 1856:
No. 15, appropriated as store. Occupied as provost prison, housing 21 NCOs and privates.

"Quite dry and well ventilated."

"The gun platforms fitted for 5 additional men."

Casemate No. 23

Contemporary number and comment, 1848:

No. 1. See comments for No. 22, above.

Contemporary number and comment, 1854:

No. 16, appropriated as gun room and quarters for 15 NCOs and privates. Unoccupied.

"Very damp from water percolating [through] the arch and east wall. Not at present habitable."

"This dampness is owing to the great mass of earth in the salient angle, the asphalt covering, not, it is conceived, extending sufficiently over the retaining and springing walls to prevent the leakage approaching them. At this season of the year, nothing can be done to remedy the defects. This casemate might as a temporary measure be appropriated as an ablution room for the troops."

Contemporary number and comment, 1856:

No. 16. Appropriated as above. Use: ablution room.

"Wet at drain pipe on the east side."

"This dampness is owing to the mass of earth in the salient angle being in contact with the escarp wall, the asphalt covering not extending sufficiently to prevent the moisture and soakage from penetrating and affecting them. In such a situation a double wall with an intermediate passage, it is suggested, would have remedied the defect."

Casemate No. 24

Contemporary number and comment, 1848:
"No. 54 damp in wet weather but may be temporarily occupied in summer."

Contemporary number and comment, 1854:
No. 17, appropriated as quarters for 17 NCOs and privates. Unoccupied.
"No appearance of dampness. In good condition. No stove."
"This casemate was appropriated for the reception of convicts as a temporary measure a few years since. Might now if required be reappropriated for NCO and privates quarters."

Contemporary number and comment, 1856:
No. 17, appropriated as above. Use: provost prison.
"Very dry and in good order."
"No. 17 has further to be used as a Convict room and Provost Prison. The fitments of No. 17 have been removed. Nos. 17 and 18 hitherto always dry."

Casemate No. 25
Contemporary number and comment, 1848:
No. 53. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 18, appropriated as quarters for 17 NCOs and privates. Occupied by 17 NCOs and privates from 17th Regiment.
"No appearance of dampness. Chimney smokes particularly when the wind is from the NE."
"The above observation [see No. 15, above] in respect to the mode proposed for curing the chimneys is applicable in this and subsequent cases where defects have been noticed."

Contemporary number and comment, 1856:
No. 18, appropriated as above. Occupied by one sergeant and 16 NCOs and privates.
"Very dry and in good order."

Casemate No. 26
Contemporary number and comment, 1848:
No. 52. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 19, appropriated for 17 NCOs and privates. Occupied by 16 NCOs and privates of the 76th Regiment. "No appearance of dampness. Chimney draws well."

Contemporary number and comment, 1856:
No. 19, appropriated as above. Occupied by one sergeant and 16 NCOs and privates. "Damp at pipe and near Escarp wall." "No 19 hitherto dry."

Casemate No. 27

Contemporary number and comment, 1848:
No. 51. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 20, appropriated as quarters for 17 NCOs and privates. Occupied by 13 NCOs and privates of the 76th Regiment. See comments for No. 26, above.

Contemporary number and comment, 1856:
No. 20, appropriated as above. Occupied by one sergeant and 16 NCOs and privates. "Dry and in good order."
Casemate No. 28

Contemporary number and comment, 1848:
No. 50. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 21, appropriated as quarters for 17 NCOs and privates. Occupied by 16 NCOs and privates of the 76th Regiment. See comments for No. 26, above.

Contemporary number and comment, 1856:
No. 21, appropriated as above. Occupied by one sergeant and 16 NCOs and privates.
"Dry and in good order."

Casemate No. 29

Contemporary number and comment, 1848:
No. 49. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 22, appropriated as sergeants' mess room. Used as mess by the sergeants of the 76th Regiment.
"Dampness is observable in the arch and wall where the pipe from the spandrel passes down, but not to an extent to be inconvenient.

"The dampness in this case may possibly proceed from an obstruction in the lower part of the vertical
pipe and therefore instructions have been given to examine it accordingly."

Contemporary number and comment, 1856:
No. 22, appropriated as above. Use: not stated.
"Slight appearance of damp occasionally on escarp wall and near down pipe.

"Not of sufficient consequence to require external examination."

Casemate No. 30

Contemporary number and comment, 1848:
No. 48. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 23, appropriated as schoolroom and schoolmaster's quarters. Occupied by colour sergeant, 76th Regiment.
"Slight appearance of dampness. Chimney draws well.

"The dampness which is of a very trifling nature would seem to proceed from some defective joints of the exterior facing of the escarp wall and will be remedied by pointing. The open joints of the coping appears [sic] likely to admit the rain water beneath the asphalt and which would consequently penetrate into the interior A [?] capping and facia [?] to the coping would secure it to a great extent against leakage."
Contemporary number and comment, 1856:
No. 23, appropriated as above. Occupied by 16 NCOs and privates.
"Damp at pipe and near escarp wall."
"No. 23 will be examined when the more serious defects have been remedied. It is partially fitted for men: 5 more fitments required."

Casemate No. 31
Contemporary number and comment, 1848:
No. 47. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 24, appropriated for soldiers' library and used as same.
"No appearance of dampness. Chimney draws well."

Contemporary number and comment, 1856:
No. 24, appropriated and used as above.
"Dry and in good order."

Casemate No. 32
Contemporary number and comment, 1848:
No. 46. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 25, appropriated as quarters for two staff sergeants. Occupied by one sergeant, 76th Regiment.
"Slight appearance of dampness at escarp. Chimney smokes occasionally." See also comments for No. 30.

Contemporary number and comment, 1856:
No. 25, appropriated as above. Occupied by 17 NCOs and privates.
"Damp near the escarp wall."
"This slight defect will be watched and examined."

Casemate No. 33
Contemporary number and comment, 1848:
Not listed.

Contemporary number and comment, 1854:
No. 26, appropriated as pump room and engineer stores. Used as storeroom and meat store.
"No appearance of dampness."

Contemporary number and comment, 1856:
No. 26, appropriated and used as above.
"Dry and in good order."

Casemate No. 34
Contemporary number and comment, 1848:
No. 45. See comments for No. 24, above.
Contemporary number and comment, 1854:
No. 27, appropriated as quartermaster sergeant's quarters and storeroom. Occupied by paymaster sergeant. "No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
No. 27, appropriated as quartermaster sergeant's quarters and gun room. Occupied by one sergeant and 16 NCOs and privates.
"Damp near pipe and escarp wall."
"Will be opened and examined near the pipe."

Casemate No. 35

Contemporary number and comment, 1848:
No. 44. See comments for No. 24, above.

Contemporary number and comment, 1854:
No. 28, appropriated as sergeant major's quarters and occupied by the acting sergeant major.
"Dampness is observable in the arch and wall where the pipe from the spandrel passes down, but not to any extent to be injurious to the occupation of the room. Chimney smokes occasionally." See also comments for No. 29, above.
Contemporary number and comment, 1856:
No. 28, appropriated as sergeant major's quarters and gun room. Occupied by one sergeant and 15 NCOs and privates.
"Damp near pipe."
"Will be opened and examined near the pipe."

Casemate No. 36A

Contemporary number and comment, 1848:
"No. 43 fit for occupation during the dry summer months, but became damp in the winter."

Contemporary number and comment, 1854:
Nos. A1 and A2, appropriated as officers' quarters. Used as quartermaster's quarters, 76th Regiment.
"1 - No appearance of dampness. Chimney smokes occasionally."
"2 - Slight dampness on escarp. Chimney smokes occasionally."
"The smoking of the chimneys in the officers quarters generally will it is considered be remedied effectively by fitting sheet blowers[?] to the franklin stoves and providing cast iron tops to the whole of the chimneys, the flues of which as well as those of the soldiers quarters to be swept periodically under the direction of the barracks master."
"The dampness observable in Nos. 2 & 3 in A would seem to have proceeded from same effect in the joints of the masonry and coping such as that remarked in [No. 30]."

Contemporary number and comment, 1856:
Nos. A1 and A2, appropriated and occupied as officers' quarters.
"1 - Damp near pipe. Will be opened and examined near pipe.
"2 - Dry and in good order. A slight settlement of the escarp wall has recently been observed but no injurious effects have hitherto arisen therefrom."

Casemate No. 36B
Contemporary number and comment, 1848:
No. 43. See comments for No. 36A, above.

Contemporary number and comment, 1854:
The statement makes no direct reference to individual basement rooms, and merely mentions that they were collectively in use as officers' kitchens and servants' quarters.

Contemporary number and comment, 1856:
Nos. A1 and A2. A1 was appropriated as a servant's
room and A2 as a staff sergeant's quarters. Both were in use for stores.
"Both quite dry."

**Casemate No. 37A**

Contemporary number and comment, 1848:
No. 42. See comments for No. 36A.

Contemporary number and comment, 1854:
Nos. A3 and A4, appropriated as officers' quarters.
Occupied by Captain O'Donoghue, 76th Regiment.
"3 Slight dampness on escarp. Chimney smokes occasionally."
"4 No appearance of dampness. Chimney smokes occasionally." See also comments for No. 36A.

Contemporary number and comment, 1856:
Nos. A3 and A4, appropriated as above and used as officers' quarters.
"3 - Slight damp near the escarp."
"4 - Dry and in good order."

**Casemate No. 37B**

Contemporary number and comment, 1848:
No. 42. See comments for No. 36B.
Contemporary number and comment, 1854:
See comments for No. 36B.

Contemporary number and comment, 1856:
Nos. A3 and A4, appropriated and in use as a storeroom (A3) and a servant's room (A4).
"Both quite dry."

Casemate No. 38A

Contemporary number and comment, 1848:
No. 41. See comments for No. 36A.

Contemporary number and comment, 1854:
Nos. B1 and B2, appropriated as officers' quarters.
Occupied by Lieutenant Adams (B1) and Lieutenant Caldecott (B2), both of the 76th Regiment.
"1 - No appearance of dampness. Chimney draws well.
   2 - ditto."

Contemporary number and comment, 1856:
Nos. B1 and B2, appropriated as above and in use as officers' quarters.
"1 - now dry but sometimes damp over the down pipe. The arch will require to be opened and the asphalt examined.
   2 - Dry and in good order."
Casemate No. 38B

Contemporary number and comment, 1848:
No. 41. See comments for No. 36B.

Contemporary number and comment, 1854:
See comments for No. 36B.

Contemporary number and comment, 1856:
Nos. B1 and B2, appropriated and in use as a servant's room (B1) and appropriated as a storeroom and occupied by a staff sergeant (B2).

"1 - dry."

"2 - quite dry."

Casemate No. 39A

Contemporary number and comment, 1848:
No. 40. See comments for No. 36A.

Contemporary number and comment, 1854:
Nos. B3 and B4, appropriated as officers' quarters.
Occupied by Lieutenant Clerks (B3) and Captain Senhouse (B4), both of the 76th Regiment.

"3 - Dampness appears to a slight extent near the fireplace. This dampness, which is of trifling extent, is supposed to proceed from some defect in the asphalt and the base of the chimney."
"4 - No appearance of dampness."

Contemporary number and comment, 1856:
Nos. B3 and B4, appropriated and in use as officers' quarters.
"3 - Dry and in good order."
"4 - Now dry but sometimes damp near the down pipe. The arch will require to be opened and the asphalt examined."

Casemate No. 39B

Contemporary number and comment, 1848:
No. 40. See comments for No. 36B.

Contemporary number and comment, 1854:
See comments for No. 36B.

Contemporary number and comment, 1856:
Nos. B3 and B4, appropriated as a storeroom (B3) and servant's room (B4). Both in use as servants' rooms.
"3 - quite dry."
"4 - now dry, but the down pipes frozen in the winter months, this room very wet."

Casemate No. 40A

Contemporary number and comment, 1848:
No. 39. See comments for No. 36A.

Contemporary number and comment, 1854:
Nos. C1 and C2, appropriated as officers' quarters.
Occupied by Dr. Frazer (C1) and Ensign Lees (C2).
"1 - No appearance of dampness. Chimney draws well except when fresh fuel is put in."
"2 - Slight dampness in arch next escarp, and small spot in centre of arch chimney smokes occasionally."
See also comments for No. 36A.

Contemporary number and comment, 1856:
Nos. C1 and C2, appropriated and in use as officers' quarters.
"1 - very damp in locality of down pipe."
"2 - now dry but formerly damp near escarp wall."
"The arches over Nos. 1 & 4 [i.e., C1] have been opened and the asphalt examined: - no cracks were observed on the arches, but between them and the interior revetment walls cracks about $\frac{3}{16}$ inch in extent which appear to be attributable to a slight bulge scarcely perceptible in the interior revetment walls."

Casemate No. 40B

Contemporary number and comment, 1848:
No. 39. See comments for No. 36B.
Contemporary number and comment, 1854:
See comments for No. 36B.

Contemporary number and comment, 1856:
Nos. Cl and C2, appropriated as servant's room (Cl) and storeroom (C2). No. Cl occupied by a staff sergeant, No. C2 used as storeroom.
"1 - Down pipe froze in winter."
"2 - Damp in locality of down pipe."

Casemate No. 41A

Contemporary number and comment, 1848:
No. 38. See comments for No. 36A.

Contemporary number and comment, 1854:
Nos. C3 and C4, appropriated as officers' quarters. Occupied by Ensign Corrance (C3) and Brevet Major Dennis (C4).
"3 - Dampness to a considerable extent is observable on the Escarp wall and adjoining arch. Chimney smokes occasionally. From all that can be seen at present it would seem that the dampness proceeds from the mass of earth forming the rampart at the salient angle of redan, the asphalt covering this not having, it is considered, [been] extended sufficiently in the direction of the salient to prevent the leakage from the
surface coming into contact with the side wall and arch. The lateness of the season prevents any immediate remedy being applied. This room may be said to be uninhabitable for the present."

"4 - No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
Nos. C3 and C4, appropriated and in use as officers' quarters.
"3 - Now dry but formerly damp near the escarp wall."
"4 - Very damp near the drain." See also comments for No. 40A.

Casemate No. 41B

Contemporary number and comment, 1848:
No. 38. See comments for No. 36B.

Contemporary number and comment, 1854:
See comments for No. 36B.

Contemporary number and comment, 1856:
Nos. C3 and C4, appropriated and used as a storeroom (C3) and servant's room (C4).
"3 - dry"
"4 - down pipe froze in winter."
"The officers privies cut off the mass of earth on the salient angle from [?] contact with [?] C. These privies however are quite dry."

**Casemates Nos. 42A and 42B**

Not listed in any of the three sources. See comments for No. 41B.

**Casemate No. 43A**

Contemporary number and comment, 1848:

No. 37. See comments for No. 36A.

Contemporary number and comment, 1854:

Nos. D1 and D2, appropriated as officers' quarters and occupied by the Engineer office (D1) and Ensign O'Malley (D2).

"1 & 2: A considerable degree of dampness appears to exist in the arch and North side wall. The existing dampness in these three (D3 also) is to be ascribed to the same cause as that stated in respect to [No. 41A] in addition to which it is also considered that the coping stones of the escarp admit the rain water through the joints and which finds its way inside the asphalt and saturates the masonry and the brickwork of the arch. The lateness of the season as before observed will prevent any immediate repairing [being]
carried into effect before the ensuing spring. These rooms may reasonably be regarded as uninhabitable at the present time."

Contemporary number and comment, 1856:
Nos. D1 and D2, appropriated as officers' quarters. No. D1 in use as Engineer office; No. D2 as officers' quarters.

"1 - Damp in locality of drain pipe."

"2 - Damp on North side wall."

"D 1 & 2 were formerly so very damp on the side wall in contact with the mass of earth in the salient angle, as to be considered uninhabitable: as this mass dried and consolidated, and the surface of the terreplein hardened, these casemates have greatly improved and are now occupied. The down pipes however are so damp as to necessitate the opening of the arches and the examination of the asphalt."

Casemate No. 43B

Contemporary number and comment, 1848:
No. 37. See comments for No. 36B.

Contemporary number and comment, 1854:
See comments for No. 36B.
Contemporary number and comment, 1856:
Nos. D1 and D2, appropriated as a servant's room (D1) and storeroom (D2). No. D1 in use as servant's room and D2 occupied by military police.
"1 - Quite dry."
"2 - Quite dry."

Casemate No. 44A
Contemporary number and comment, 1848:
No. 36. See comments for No. 36A, above.

Contemporary number and comment, 1854:
Nos. D3 and D4, appropriated as officers' quarters.
No. D3 unoccupied; No. D4 occupied by Lieutenant Weshopp.
"3 - Dampness to a considerable extent appears on the escarp and adjoining arch." Considered uninhabitable. See also comments for No. 43A, above.
"4 - No appearance of dampness. Chimney draws well. Stove fitted with a blower."

Contemporary number and comment, 1856:
Nos. D3 and D4, appropriated and in use as officers' quarters.
"Both dry and in good order."
Casemate No. 44B

Contemporary number and comment, 1848:
No. 36. See comments for No. 36B, above.

Contemporary number and comment, 1854:
See comments for No. 36B, above.

Contemporary number and comment, 1856:
Nos. D3 and D4, appropriated as a storeroom (D3) and servant's room (D4). No. D3 occupied by military police; No. D4 in use as sergeant's quarters.
"Both quite dry."

Casemate No. 45A

Contemporary number and comment, 1848:
No. 35. See comments for No. 36A.

Contemporary number and comment, 1854:
No. El, appropriated and in use as officers' mess room.
"No appearance of dampness. Chimneys [?] appear to draw well except on change of wind."

Contemporary number and comment, 1856:
No. El, appropriated as above and used as officers' quarters.
"Very dry and in good order. The Mess and Plate rooms have always been [in] a very satisfactory state. The ante room is in a fair state [see No. 46A] but the slight symptoms of damp which appear shall be examined and corrected if possible. The Mess Room, the Plate and Anteroom are temporarily occupied as Officer's Quarters by the 62d just arrived from the Crimea until their mess shall have been established."

Casemate No. 45B

Contemporary number and comment, 1848:
No. 35. See comments for No. 36B, above.

Contemporary number and comment, 1854:
See comments for No. 36B, above.

Contemporary number and comment, 1856:
No. El, appropriated and in use as a mess kitchen.
"Quite dry."

Casemate No. 46A

Contemporary number and comment, 1848:
No. 34. See comments for No. 36A, above.

Contemporary number and comment, 1854:
Nos. E2 and E3, appropriated and in use as a plate
room (E2) and anteroom (E3).

"No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
Nos. E2 and E3, appropriated as above and used as officers' quarters.

"2 - dry and in good order."

"3 - slight appearance of damp."

See also comments for No. 45A, above.

Casemate No. 46B

Contemporary number and comment, 1848:
No. 34. See comments for No. 36B, above.

Contemporary number and comment, 1854:
See comments for No. 36B, above.

Contemporary number and comment, 1856:
Nos. E2 and E3, appropriated and in use as a mess-man's room (E2) and a scullery (E3).

"Both quite dry."

Casemate No. 47A

Contemporary number and comment, 1848:
No. 33. See comments for No. 36A.
Contemporary number and comment, 1854:
Nos. Fl and F2, appropriated as officers' quarters and occupied by Captain Lacey (Fl) and Lieutenant Preston (F2).
"No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
Nos. Fl and F2, appropriated as field officers' quarters and in use as officers' quarters.
"Very dry and in good order. F. Casemates have always been dry."

Casemate No. 47B
Contemporary number and comment, 1848:
No. 33. See comments for No. 36B, above.

Contemporary number and comment, 1854:
See comments for No. 36B, above.

Contemporary number and comment, 1856:
Nos. Fl and F2, appropriated as a servants' kitchen (F1) and storeroom (F2). In use as sergeant major's quarters (F1) and storeroom (F2).
"Both very dry and in good order."
Casemate No. 48A

Contemporary number and comment, 1848:
No. 32. See comments for No. 36A.

Contemporary number and comment, 1854:
Nos. F3 and F4, appropriated as field officer's quarters. Occupied by Ensign Palliser (F3) and the paymaster's office and quarters (F4).
"Both: No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
Nos. F3 and F4, appropriated as field officers' quarters and in use as officers' quarters.
"Very dry and in good order."

Casemate No. 48B

Contemporary number and comment, 1848:
No. 32. See comments for No. 36B.

Contemporary number and comment, 1854:
See comments for No. 36B.

Contemporary number and comment, 1856:
Nos. F3 and F4. No. F3 appropriated and in use as a storeroom; No. F4 appropriated as a servants'
kitchen and in use as a servant's room.
"Both very dry and in good order."

Casemate No. 49

Contemporary number and comment, 1848:
"No. 31 fit for troops."

Contemporary number and comment, 1854:
No. 1, appropriated as a guard room and gun room and occupied by the Citadel guard.
"Slight appearance of dampness in arch next entrance passage. This appears to proceed from some slight defect in the asphalt which at this season cannot be repaired."

Contemporary number and comment, 1856:
No. 1, appropriated and used as above.
"Dry and in good serviceable state. Citadel Guard 1 serjeant and 16 Rank and file."

Casemate No. 50

Contemporary number and comment, 1848:
"No. 30. dry, fit for troops but no flooring."

Contemporary number and comment, 1854:
No. 2, appropriated as lock-up room and gun room,
and in use as lock-up.
"No appearance of dampness."

Contemporary number and comment, 1856:
No. 2, appropriated as above and used as lock-up and cells.
"Damp over fireplace."

**Casemate No. 51**

Contemporary number and comment, 1848:
Not listed.

Contemporary number and comment, 1854:
No. 3, appropriated as storeroom and used as provost prisoners' hard labour room.
"Dry, floor unfinished."

Contemporary number and comment, 1856:
No. 3, appropriated and used as Engineer store.
"Dry and in serviceable state. Has neither window nor fire place."

**Casemate No. 52**

Contemporary number and comment, 1848:
No. 29. See comments for No. 50.
Contemporary number and comment, 1854:
No. 4, appropriated as an orderly room and gun room and in use as the military prison chapel.
"No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
No. 4, appropriated as above and used as an orderly room.
"Dry and in a serviceable state."

Casemate No. 53
Contemporary number and comment, 1848:
"No. 28 Damp at one end, fit for troops; no flooring or joists laid."

Contemporary number and comment, 1854:
No. 5, appropriated as a gun room and used as an office and boardroom.
"No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
No. 5, appropriated as soldiers' quarters and gun room; used as an office and boardroom and as temporary military prison.
"Dry and in a serviceable state."

Casemate No. 54

Contemporary number and comment, 1848:
"No. 27 gun room, unfit for troops. Damp old brick floors, worn out and defective."

Contemporary number and comment, 1854:
No. 6, appropriated as gun room No. 2 and in use as military prison kitchen.
"No appearance of Dampness. Chimney smokes occasion­ally."

Contemporary number and comment, 1856:
No. 6, appropriated as soldiers' quarters and gun room; in use as a storeroom, kitchen and temporary military prison.
"Very damp in locality of pipe. In winter during thaws the water percolates through the East Wall in contact with the mass of earth in the S.E. Salient angle. Casemate must be opened and examined."

Casemate No. 55

Contemporary number and comment, 1848:
No. 26. See comments for No. 54.
Contemporary number and comment, 1854:
No. 7, appropriated as gun room No. 3, and used as military prison surgery.
"No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
No. 7, appropriated as soldiers' quarters and gun room; used for first class prisoners' room, storeroom and temporary military prison.
"Dry and in a serviceable state. Casemates to be opened and examined."

Casemate No. 56

Contemporary number and comment, 1848:
"No. 25 for stores, dry, fit for troops when flooring [is] completed."

Contemporary number and comment, 1854:
No. 8, appropriated as quartermaster's store No. 1; in use as provost prison wood store.
"No appearance of dampness. Chimney smokes occasionally."

Contemporary number and comment, 1856:
No. 8, appropriated as quartermaster's store and in
use as soldiers' quarters for one sergeant and 20
NCOs and privates.
"Slightly damp near escarp wall."
"These casemates have no thorough ventilation and
require a constant fire to keep them dry: - it is
expected that the careful pointing of the Escarp wall
which has been too long neglected will improve No.
8 casemate; if not the removal of the entire mass of
Parapet and rampart will be a serious and expensive
service - and will be delayed until there is no other
remedy."

**Casemate No. 57**

Contemporary number and comment, 1848:
No. 24. See comments for No. 56, above.

Contemporary number and comment, 1854:
No. 9, appropriated as Royal Engineer store No. 2 and
used as an engineer tool store.
"No appearance of dampness. Chimney smokes occasion­
ally."

Contemporary number and comment, 1856:
No. 9, appropriated and used as above.
"In serviceable state." See also comments for No.
56, above.
Casemate No. 58

Contemporary number and comment, 1848:
"No. 23. Shifting room, south Magazine, dry."

Not listed in 1854 or 1856 sources.

Casemate No. 59

Contemporary number and comment, 1848:
"No. 22 very damp, gun room, unfit for troops."

Contemporary number and comment, 1854:
No. 1, appropriated as gun room No. 1 for 12 NCOs and privates; occupied by one private, Corps of Royal Sappers and Miners.
"No appearance of dampness."
"These gun rooms are not provided with the requisite fitments."

Contemporary number and comment, 1856:
No. 1, appropriated as soldiers' quarters and gun room; unoccupied.
"Very damp at down pipe and near the escarp wall."
"These casemates have hitherto been dry and serviceable their present state, it is believed, arises from defective surface drainage, and perhaps partially from neglect of pointing the external escarp wall now in the course of execution in cement
under the present Annual Estimate, being situated deep under the Rampart and parapet and under two heavy guns on traversing platforms, the opening and examination of the arches and drains would be a work of great labour and expense, it is proposed and hoped to effect a remedy by improved external surface drainage and laying the terreplein over these casemates in concrete (6 or 8 inches) covered with pitch, tar and sand."

Casemate No. 60

Contemporary number and comment, 1848:
No. 21. See comments for No. 59, above.

Contemporary number and comment, 1854:
No. 2, appropriated as gun room and quarters for 12 NCOs and privates; occupied by one private, Corps of Royal Sappers and Miners.
"No appearance of dampness." See also comments for No. 59, above.

Contemporary number and comment, 1856:
No. 2, appropriated as above; unoccupied. See comments for No. 59, above.
The two privy casemates involved in this estimate were Nos. 6 and 7A.

This Estimate shews the Additional expense, £157..12..9\textsuperscript{1/2} Sterling, incurred in completing the improvements in the Non Com\textsuperscript{d} Off\textsuperscript{rs}, Privates and Womens Privies at the Citadel, Halifax NS. which were rendered necessary in consequence of having to reconstruct the drain leading from the Cess pool in the Ditch, and constructing three Additional Cesspools on the Glacis, and altering the shape of the bottoms of the Pits under the floors, and reconstructing the floor and seats in the Mens Pravy, as shewn on the Accompanying Plan, and as reported in the Com\textsuperscript{g} Royal Letters [sic] N\textsuperscript{o} 684.

This additional Service...has received the Approval of His Excellency the Major General Commanding; - the expense of which, £157..12.9. has been charged to Item 8 of the Ordnance Annual Estimate for 1855-6, and will cause a corresponding excess on that Item, but which it is expected will be covered by savings on the gross Amount of the Estimate for the Current Year -

**Ordnance**

**Special Service**

Constructing Cess Pits and Drains leading from the Soldiers
Privies Citadel to the Glacis, and altering Main Cess Pit of Privies, &c -

<table>
<thead>
<tr>
<th>Laborers</th>
<th>Days</th>
<th>Cost</th>
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<tr>
<td>520 days Military Laborers</td>
<td>520</td>
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<tr>
<td>Excavating for Cess pit and drain</td>
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<td>213 d. Sappers &amp; Miners, sinking &amp; binding d.</td>
<td>213</td>
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<td>47 d. Military Artificers d.</td>
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<td>3.18.4</td>
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<td>158 d. Civil Masons, building Cess pool &amp;c</td>
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<td>47.8.0</td>
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<td>21 d. Civil Labourers, assisting d.</td>
<td>21</td>
<td>3.3.0</td>
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<td>11.18.6</td>
</tr>
<tr>
<td>200 -- &quot; -- 3&quot; spruce plank</td>
<td>187/6 M</td>
<td>1.17.6</td>
</tr>
<tr>
<td>400 -- &quot; -- 2 inch d.</td>
<td>137/6 &quot;</td>
<td>2.15.0</td>
</tr>
<tr>
<td>80 days Sapper Carpenters</td>
<td>1/ day</td>
<td>4.0.0</td>
</tr>
<tr>
<td>500 feet 1 inch pine Boards</td>
<td>75/ M</td>
<td>1.17.6</td>
</tr>
<tr>
<td>250 -- &quot; -- 1½ &quot; -- d. plank</td>
<td>93/9</td>
<td>1.3.5 1/4</td>
</tr>
<tr>
<td>50 lb. Nails - iron - under 5&quot;</td>
<td>4 1/2 lb.</td>
<td>0.18.9</td>
</tr>
<tr>
<td>18 pairs wro. Iron Hook &amp; eye Hinges</td>
<td>1/4 p</td>
<td>1.4.0</td>
</tr>
<tr>
<td>41 3/4 lb. English Sole Leather</td>
<td>2/9 lb.</td>
<td>5.14.9 3/4</td>
</tr>
<tr>
<td>3 gallons neats foot Oil</td>
<td>5/- gal.</td>
<td>0.15.0</td>
</tr>
<tr>
<td>1 Cwt Bar Iron</td>
<td>11/3</td>
<td>0.11.3</td>
</tr>
</tbody>
</table>
12 Bushel Coal
10d 0.10.0
15 days Sapper Smiths
1/- day 0.15.0
6 d. Civil d.
5/ " 1.10.0
Total expenditure on the work £187.0.7
Deduct, Authorized in Special Estimate
dated 19th Dec- 1854 £27.7.9½
Total Excess £157.12.9½
Comm R. Engrs & Colonel
15th Jan'y 1856

18 The Fortifications Annual Estimate, 1860-61, Item 3
The ramp was located between the south magazine area and
the pier of casemate No. 1. There is no evidence about
the building, but the service was probably carried out
as described in this estimate.

Item 3: This Item provides for draining the Ramp, with a
view to prevent the damp from penetrating through the side
wall of Artillery Store in the Citadel, which is now the
case to such an extent as to render the Casemate, almost
wholly unfitted for its purpose - the service is very neces­
sary, and is brought forward at the request of the Officer
Commanding Royal Artillery at this Station -

The following is the detail of the work in accordance
with the accompanying plan -
To excavate for Wall and area, and under drain, fill in and well ram the same, make good the gravelling on parade, and ramp, and remove the rubbish; to build the Wall of the area and then turn the arch of same on proper centers, in flat bedded iron stone rubble masonry, laid dry, and to form drain 9" x 9" in the clear, from area to the existing under drain, at opposite of the parade, (distant 200 feet) with rubble Masonry, side 9" thick, and flagged top and bottom with iron stone flags, the whole to be laid dry, and to have a fall of not less than \( \frac{1}{2} \)" in 20 feet, the side of the old drain to be opened, and the new one properly connected thereto. - The wall of store next to the ramp to be perforated with three openings 9" x 6" as shewn in dotted lines on plan and section for the purpose of Ventilation - for all of which and also making good of [sic] the gravelling, day time and materials, are provided -

This service is proposed to be executed on day work by the Department.

[Note added in London: "Suggested that it would be desirable to leave openings in the proposed drain for the admission of fresh air."

[Estimate]

Citadel Drainage of Ramp, at side wall of Artillery Store.

104 Cubic Yards excavated and removed 1/3 6.10.0
The shifting rooms are casemates Nos. 14 and 58. The

19 The Civil Buildings Annual Estimate, 1862-63, Items

6 and 7

The shifting rooms are casemates Nos. 14 and 58. The
services were performed as described here. The estimate for the floor of the south shifting room (item 7) should be compared with the original estimate for the floor (see above, section 8, item 2).

Item 6: This Item provides, at the request of the Deputy Superintendent of Stores, for Securing the Shifting rooms of the North and South Magazines at the Citadel Halifax N.S., against leakage.

This Service appears to be very necessary, as the rain water Soaks through the walls and arches to such an extent as to render the rooms useless for any purpose whatever.

It is therefore proposed to uncover the arches and back of walls and to remove the rough iron Stone flagging which at present covers the dos d'ane, Substituting a coating of Portland Cement Concrete, and to render the back of the walls, and the dos d'anes so formed with Portland Cement concrete one inch thick; also to form a Gutter at the base, round the sides of the walls with Portland Cement concrete, the surface of which to be rendered and graded so as to discharge the Soakage through the weep-holes to be cut through and formed in the front walls, as shewn on plan. Loose stones and coarse gravel to be filled in over the gutters to facilitate in carrying off the Soakage from the Superincumbent Soil.

In addition to which it is proposed to ventilate the interior of the Shifting rooms by the formation of lateral
openings in the front and end walls, and vertically through the arches, connected by 9 inch glazed earthenware [pipes] as shewn in the drawing. Figs 1. 2. & 3. -

This Service is proposed to be done by the Royal Engineer Department on day work.

Item 7: This Item, providing for removing the decayed floor boarding and joists in the Shifting room of the South Magazine in the Citadel...and substituting a floor of Seyssel Asphalte on Concrete, is a necessary consequence of the provision under Item 6 for staunching the leakage in the walls and Arch, the existing floor having become quite decayed from dampness and want of ventilation. -

It is proposed to execute the Service by the Engineer Department on day work.

No provision has been made for the Asphalte as there is a Sufficiency in Store to execute this service.

[Estimate]


Ventilate and secure against leakage.

516\(\frac{2}{3}\) Cubic Yards. - Digging and throwing out ground, wheeling and re-wheeling under 50 yards, includ\(\text{g}\) filling in and ramming

\(1/6\ y^d\) 38.15.0
50 feet lineal Taking up and resetting existing Granite Surface Gutter in $\frac{1}{2}$ Portland Cement and $\frac{1}{2}$ Sand

\[ 9[d] \text{ ft.} \quad 1.17.6 \]

\[ 74\frac{2}{3} \text{ yards Sup.} \] Stripping off and removing old iron Stone flagging on dos d'ane including masonry at apex

\[ 1/ \text{ yd.} \quad 3.14.8 \]

8 Cutting through Granite and Ironstone walls, from 3 feet to 4 feet in thickness and forming ventilated apertures & weep holes in Same 12" to 14" x 9" in the clear, including fixing gratings, - all materials and labor.

\[ 20/ \quad 8.0.0 \]

2 Ditto, & in brick Arch, for inserting 9 inch pipes Materials and Labor

\[ 5/- \quad 0.10.0 \]

31 cubic Yards Concrete, composed of 5 parts Screened gravel, 1 part fresh water Sand & 1 part Portland Cement, round base of Walls and over dos d'ane of Arch &c

\[ 12/ \text{ yd.} \quad 18.12.0 \]

17 - " - " - Broken Stone & screened gravel, filled in over gutter

\[ 4/ \text{ yd.} \quad 3.8.0 \]

70 f. lineal 9 inch glazed Stone ware
pipes with socket joints & Set
in Portland Cement for air ducts.

Straight

2 - Ditto - do - do Bends (L)

4 Ditto - do - do Junction ( )

134\(\frac{1}{3}\) Sup. Yards, Raking out joints
of Masonry to form Key for
Cement rederind [?]

221 Render & float one Coat 1 inch thicke \([\text{sic}]\) with pure Portland Cement (to walls and dos d'ane. - \([\text{sic}]\)

25\(\frac{1}{9}\) Ditto - do - 1" thick, with equal parts of Portland Cement and fresh water Sand, in forming [?]
gutters round walls. -

6 Ventilating plates 12" to 14" & \(\frac{1}{4}\)" thick of Zinc perforated with holes \(\frac{1}{4}\)" diameter and \(\frac{1}{4}\)" apart

[Total] £134.13.11\(\frac{3}{4}\)

Add Contingent 1/10th

Total for North Magazine 148.3.4\(\frac{1}{2}\)
Total for South Magazine 148.3.4\(\frac{1}{2}\)

[Total] £296.6.9
Item 7: Shifting Room, South Magazine. Substituting a floor of Concrete and Asphalte for the Wooden decayed one. -

\[
\begin{align*}
\text{3} & \frac{82}{100} \quad \text{Squares taking up and removing old floor boarding, joists and plates} \\
& \quad 2/6 \text{ Sq} \quad 0.96\frac{1}{2} \\
10 & \frac{5}{9} \quad \text{Cubic Yards Concrete foundation for asphalte with 5 parts Screened ballast, 1 part fresh water Sand,} \\
& \quad \& 1 \text{ part ground lime} \\
& \quad 9/- \text{ yd.} \quad 4.15.0 \\
42 & \frac{4}{9} \quad \text{sup. Yards fine D.} \ \& \ D. \ \& \ - \text{ floated} \\
& \quad 9^d \ y. \ \& \ \ 1.11.0 \\
42 & \frac{4}{9} \quad - " - \text{Asphalte, 1" thick, laid in two thicknesses of} \frac{1}{2}" \text{ each,} \\
& \quad \text{fuel & labor only} \quad 1/- " \quad 2.25\frac{1}{4} \\
84 \quad \text{feet lineal Filleting with Asphalte} \\
& \quad \text{in angles round walls, fuel and Labor only} \quad 3^d \ ft \quad 1.1.0 \\
1 \quad \text{use, wear and tear, repair of} \\
& \quad \text{Cauldrons, tools &c.} \quad 20/- \quad 1.1.0 \\
\end{align*}
\]

[Total] £10.19.9\frac{3}{4}

Add Contingent 1/10:\text{th} \\
\[\text{Total} \quad £12.1.9\frac{1}{2}\]
"F.F.F. Casemates for Stores &c." 1836 (plan 04-1836-2-13). This is the only surviving plan of Colonel Jones's proposed casemates and is accurate, so far as it goes. The dos d'anés were much altered in the course of the staunching operations in the following decade. There is no independent evidence that the footings were as substantial as shown here, but there is no reason to suppose that they were not constructed in this manner. (Public Archives of Canada.)
Slope of the Terrace of the Ramppark.

F.F.F. Cisterns for Stove, see Plan No. 1.

Refect to an Index.
"Plan and Section of the proposed retaining wall of the Area of the Casemates of Defence, N.W. Bastion...", 1843 (plan 08-1843-5-3). The area wall was built according to this plan. The plan of the casemates (Nos. 12 and 13) may not be very accurate. The retaining wall did not extend past the pier walls as shown on the plan. (Public Archives of Canada.)
Plan and Section of the proposed retaining wall of the area of the Curtain of defence S.W. Bastion, the steps to be of wood as in the S.W. Bastion.

Item 5.

Scale is foot to an Inch.

Barnes Whittemore, L.R.E.

Stamp and Sign.

22. May 1821.
"Plan of Upper Floor of Redan..., 1844 (plan 04-1844-3-1). Plan showing the partitions of the upper storey of the redan casemates (Nos. 36A-48A). The partitions were constructed in the manner shown in this plan. The abbreviations used as follows: O.R. - Officers' Room; F.O.R. - Field Officers' Room. No use is shown for the small casemate at the salient (No. 42), and it would seem from this plan that there was no way of getting to its upper storey. As the lower storey of this casemate was a privy (see Fig. 29) it is possible that casemate No. 42 had no floor, and that the window shown in the plan was for illuminating the privy beneath. (Public Archives of Canada.)
Plan of Upper floor of Bedan Building founded showing the Partitions proposed in the Offices rooms.

To accompany 17th May, 1832 letter.

The Partitions to be built and plastered, lined in the roof and the passages with 6' boards on the barge and soffit.

A. M. 1832

J. B. Munn
1st May, 1832

Scale of Feet to an inch.
"Plan of the Basement floor of the Redan...", 1844 (plan 04-1844-3-2). Plan showing the partitions of the basement storey of Nos. 36B-48B. The partitions were built in the manner shown here. The abbreviation "S.R." stands for servant's room. (Public Archives of Canada.)
Plan of the Assembly House of the Nation, Southwark, founded during the Puritans' regime, as described in the Framework Act of 1662. The plan is signed by John Wrench, Esq., on 20 March 1662.
"Plan Elevation and Section of Retaining wall to two Casemates of Defence...", 1846 (plan 08-1846-3-2). This plan provides the only good indication of the dimensions of the masonry of casemates Nos. 12 and 13, as well as one of the few elevations of the fronts of any of the casemates. (Public Archives of Canada.)
Plan, Elevation and Section of
Defensive Wall to the Conner of
Fifteen Foot Wall. East Wall Section and
marked O & C on General Plan proposed
for taking down and rebuilt.
To accompany the Supplementary
Report to dated 31st March 1846.
31 "Plan Elevation and Section of Retaining Wall to be rebuilt to 4 Casemates of Defence....", 1846 (plan 11-1846-3-3). The retaining wall was rebuilt according to this plan. In addition, the plan provides the only account of the structure of Nos. 3-4 and 8-9, and one of the few descriptions of the ventilation system for the casemates. The elevation is one of the better illustrations of the casemate doors, windows and exterior ventilators. Compare Figure 30. (Public Archives of Canada.)
Plan, Elevation, and Section of
Reinforced Wall to be placed in
Communicating of Defence Wall 1849
B by the General Plan
To accompany the Specifications
Estimate dated 3rd March 1849.
Hipping the casemates, 1848 (plan 04-1848-2-1). This sketch is from the black margin of Calder's letter to Burgoyne of 5 February 1848. The sketch was drawn to illustrate Calder's proposal for a flagged and counter-flagged hip (the shaded part at right) to help prevent leaks. This ultimately became the basis for a later staunching proposal. Compare Figures 33-6. (Public Archives of Canada.)
...
"Longitudinal Sections...", 1848 (plan 04-1848-12-3).

This plan shows three of the types of dos d'ane covering in use in the winter of 1848, and was drawn to illustrate the points put forward in Lieutenant Burmester's report (see Section 12, above). No. 3 is the section of a casemate which had been built to the original specifications and covered with flagging; No. 2 is a section of a casemate which had been hipped. In both cases the surface water was drained off by a gutter in the dos d'ane valley which led out through a gargoyle in the retaining wall. No. 3 is a section of a casemate in which the first experiments in internal piping had been carried out. Note that the exterior gargoyle had been removed, and the valley altered so that the water drained towards the centre of the pier wall. Compare Figures 36 and 37. (Public Archives of Canada.)
HALIFAX CITADEL
NOVA SCOTIA.

Longitudinal Section A.A.

No. 1.

Showing the Committee as Plugged, Ripped.

Longitudinal Section B.B.

No. 2.

Showing the Committee as Plugged, Ripped.

Longitudinal Section C.C.

No. 3.

Showing the Committee as Plugged, Ripped and Picked.

To accompany the Con. H. Engineers letter of 7th Oct. 1868.

341
"Plan showing the mode proposed for staunching the leakage...", 1849 (plan 01-1849-4-2). This plan was drawn for Colonel Savage's staunching estimate of 30 April 1849. Sections of seven of the casemates were provided to accompany this plan (see Fig. 35). Eleven casemates are not shown in this plan. Of these, six ight (Nos. 1, 2, 10, 11, 56 and 57) had already been fitted out in a manner closely resembling that described here. The remaining five were all small casemates (Nos. 6, 7A, 33, 42 and 51) and it was not proposed to provide them with elaborate waterproofing. (Public Archives of Canada.)
"Sections...showing the mode proposed for staunching the leakage...", 1849 (plan 04-1849-4-3). These sections are keyed to plans 01-1849-4-1 and 01-1849-4-2 (for the latter, see Fig. 34). The six casemates illustrated are No. 46 (Fig. 2), No. 55 (Fig. 3), No. 60 (Fig. 4), No. 3 (Fig. 5), No. 20 (Fig. 6) and No. 27 (Figs. 7 and 8). The system finally adopted for staunching differed considerably from the one shown here (see Fig. 36, but these sections are useful for the detail they provide of the layout of the casemates. (Public Archives of Canada.)
"A sketch of the covering of the Casemates with Asphalte," 1854 (plan 04-1854-6-1). The plan and sections show the method of staunching finally adopted. Note that the down pipe was placed in the centre of the pier wall, and that asphalt and asphalted bricks were used extensively. Compare Figures 33, 34 and 35. (Public Archives of Canada.)
FORT GEORGE
HALIFAX, N.S.
A Sketch of the covering of Osmator with Asphalte.

- a. Asphalted Bricks
- b. Course Shingle
- c. Asphalt
- d. Concrete
- e. Rattle Masonry
"Plan and sections showing the work executed in improving the soil pits &c. of the Soldier's Privies...", 1856 (plan 04-1856-1-1). This is one of the few plans extant which show the drains. It also constitutes virtually the whole of our documentation of the structure of the privy casemates (Nos. 6 and 7A). In addition, it offers the only large-scale cross-section of one of the sally ports.

(Public Archives of Canada.)
"Plan and Sections of Proposed Drainage of the Ramp...", 1859 (plan 04-1859-11-1). The ramp, which led from the parade to the terreplein, was located between the south magazine area and the first of the west curtain casemates. The casemate shown in the section is No. 1. (Public Archives of Canada.)
HALIFAX, N.S.

PLAN AND SECTIONS OF PROPOSED DRAINAGE OF THE RAMP IN THE CITADEL IN ORDER TO PREVENT DRAPNESS IN THE ARTILLERY STORE

ADJOINING
Fort Frederick A.D. 1826-28
June 3.

SECTION ON LINE A-B

REFERENCE
a, v, z. Openings for Ventilation

SIGNED FROM DRAWING BY MCLeod & Co.
By C. S. B. Co. 1828

SECTIONAL ELEVATION THROUGH C-D
"Plan and Sections showing the mode Proposed for Staunching leakage and ventilating the Shifting Rooms of the North and South Magazines...", 1861 (plan 07-1861-11-1). This plan ought to be compared with the earlier staunching plans, since it sheds some light on the evolution of the methods used in staunching. It is also the best plan of casemate ventilation. But, since the shifting rooms were specialized casemates, the ventilation system used in them was probably unlike that used in the others. (Public Archives of Canada.)
The interior of the redan casemates, ca. 1890. The casemate shown is probably the mess room (No. 45).

(Public Archives of Nova Scotia.)
41  Interior of one of the redan casemates, ca. 1890.

(Public Archives of Nova Scotia.)
Plan Bibliography

1 01-1825-12-1: Nicolls's original plan of the Citadel, showing the location of the original 16 casemates of defence (Part 1, Fig. 5).

2 04-1833-6-1: Boteler's proposal for additional casemating.

3 04-1833-6-2: Another section of Boteler's proposal for a one-storey casemate.

4 04-1836-2-13: Section of Jones's proposal for Nos. 18-20 (Fig. 26).

5 04-1843-5-1: Plan of the north end of the Citadel and section of three casemates on the east front (Part 1, Fig. 8).

6 06-1843-5-2: Section of the shifting rooms (Nos. 14 and 58) (Fig. 16).

7 08-1843-5-3: Plan and section of the areas of Nos. 12 and 13 (Fig. 27).

8 04-1844-3-1: Plan of the upper storey of the redan casemates (Nos. 36A-48A) showing the interior partitions (Fig. 28).

9 04-1844-3-2: Plan of the lower storey of the redan casemates (Nos. 36B-48B) showing the interior partitions (Fig. 29).

10 04-1844-4-1: Plan of the upper storey of the redan casemates, showing a rejected proposal for the interior partitions.
11 04-1844-6-1: Plan of the upper storey of the redan casemates, showing a rejected proposal for the interior partitions.

12 04-1845-11-1: Plan of Nos. 54-5, showing the interiors fitted up as a guardroom and prison.

13 08-1846-3-2: Elevation of Nos. 12-3 and plan of adjoining area (Fig. 30).

14 11-1846-3-3: Plan, elevation and section of Nos. 3-4, 8 and 9 (Fig. 31).

15 04-1846-3-6: Plan and sections of Nos. 49 and 50, showing a proposal to install water tanks under No. 50 and a well in No. 49 (Fig. 77).

16 08-1846-3-8: Small plan of shifting rooms (Nos. 14 and 58).

17 01-1848-12-1: Ground plan showing casemate numbering.

18 04-1849-12-2: Section of six casemates, showing the types of waterproofing then in use (Part 1, Fig. 9).

19 04-1848-12-3: Three longitudinal sections, keyed to plan No. 18, above (Fig. 33).

20 04-1848-12-4: Two sections and plan of Savage's proposal to waterproof the dos d'anies.

21 11-1848-12-5: Small section of an unidentified redan casemate.

22 04-1849-4-3: Sections of Nos. 3, 20, 27, 46, 55 and 60, showing proposed waterproofing system (Fig. 35).

23 02-1852-4-2: Several small sections of casemates
(north front, south front and redan) in a set of general sections of the Citadel.

24 04-1854-6-1: Plan, two sections of a typical casemate showing the waterproofing finally adopted (Fig. 36).
25 04-1856-1-1: Plan, sections, etc. of Nos. 6 and 7A showing drains (Fig. 37).
26 04-1859-1-1: Plan and sections showing proposal for stopping leakage from ramp adjoining No. 1 casemate (Fig. 38).
27 07-1861-11-1: Plan and sections showing proposal for staunching and ventilating the shifting rooms (Nos. 14 and 58) (Fig. 39).
28 07-1882-8-2: Plan and sections of shifting rooms (Fig. 20).
29 04-1911-9-4: Plan and sections of Nos. 45-8.
30 04-1913-6-1: Plan and section of four unidentified casemates.
31 01-0003-13-1: Undated (ca. 1860) basement plan of the Citadel.
32 04-0005-13-1: Undated (ca. 1906) plan of Nos. 49-50.

Staunching Plans
1 03-1846-3-11: Plan and sections of flagging and counterflagging on the cavalier casemates (Fig. 8).
2 04-1848-2-1: Plan and section of the dos d'anes (Fig. 32).
04-1848-12-1: Ground plan of the Citadel showing the drains and the casemate numbering system.

04-1848-12-2: Plan of dos d'anes and section of a block of six casemates, showing the waterproofing system then in use (Part 1, Fig. 9).

04-1848-12-3: Longitudinal section of three casemates, keyed to plan No. 4, above (Fig. 33).

04-1848-12-4: Plan and two sections of Colonel Savage's proposal for waterproofing.

11-1848-12-5: Section of a redan casemate, showing proposed alterations to the retaining wall coping to facilitate drainage of surface water.

01-1849-4-1: Ground plan showing drains (Fig. 45).

01-1849-4-2: Surface plan cut away at edge to show the dos d'anes. Illustrates the mode of staunching proposed in the 1849 special estimate (Fig. 34).

04-1849-4-3: Sections of Nos. 3, 20, 27, 46, 57 and 60, keyed to plans Nos. 8 and 9, above. The sections show the proposed staunching method (Fig. 35).

03-1849-4-4: Two sections of the cavalier casemates, showing the provisions of the 1849 estimate as applied to the cavalier (Fig. 9).

01-1849-4-5: Surface plan, showing gutters.

28-1849-4-7: Small section of a gutter and hopper head.

28-1849-4-8: Small section of a casemate gutter.

11-1849-4-6: Two small sections of a gargoyle and one
small plan showing the surface gutter behind the rampart retaining wall and the upper portion of the wall.

16 04-1854-6-1: Plan and sections of a casemate, showing the staunching method finally adopted (Fig. 36).

17 04-1859-11-1: Proposal for preventing leakage from the ramp adjoining No. 1 (Fig. 38).

18 07-1861-11-1: Proposal for staunching the shifting rooms (Nos. 14 and 58) (Fig. 39).
Drainage

1 General Discussion

The whole question of drainage and water supply is one of the most vexing of all the problems connected with writing about the construction of the Citadel. The problems involved are twofold. In the first place, there is a great deal of ambiguity in the documents concerning the water system which survive from the period prior to 1850. In the second place, we have no documentation at all for the critical period of 1851-54 in which the final system of pipes, tanks and drains was installed.

There seem to have been three different drainage systems. One was to keep the ditch dry, one was a sewage system, and one was a complicated system of pipes and tanks designed to collect and store surface water for the consumption of the garrison. In addition, there were two wells in the Citadel and provision was at one point made for the construction of a third. The wells, however, appear to have been entirely inadequate for the purpose of supplying drinking water\textsuperscript{1} and were of only marginal importance.

Colonel Nicolls, in his usual fashion, simply did not mention drainage at all. It was not until Colonel Jones
drew up his revised estimate that the question of drainage and water supply was even raised. In the revised estimate, there are two provisions for drainage. Item 1 contains the specification for a main drain, and item 16 the specification for a surface drain for the ramparts (see Fig. 42 and "Walls", section 7). It is not clear where the main drain was to be placed, but presumably it was for sewage, and, as the estimate calls for 761 feet of it, it may well have connected with the city sewers. The surface drain was provided "for the interior [of the fort] and...for the Rampart." There is no indication where the surface drain for the interior of the fort was to go, but the rampart portion of it was designed for the rear of the retaining wall. The drains were to be constructed of "Pebbles laid on edge" and the water from the ramparts was apparently to run to waste in the parade square: "656 Sup. feet of 2 inch pine Plank in shoots [sic] for [blank in ms.] down behind the ramparts."

Nothing further was done about the problem until the mid-1840s. The main drain was probably built sometime in the early 1840s, but there was no progress made in the matter of surface drainage. When Colonel Calder drew up his supplementary estimate in 1846, he felt compelled to add a number of provisions for securing an adequate water supply. He proposed a system of drains to collect the surface water from the ramparts and store it in a tank which he proposed to build under casemate No. 50 (see Fig. 45 and section 2.
below). He also proposed to construct an underground communication from the counterscarp gallery opposite the northeast salient to a well on the glacis. In addition, he estimated for the provision of hopper heads, stack pipes and gutters for "all the gargoyles and buildings with open roofs" to connect with the surface gutters in the parade square. These were not, apparently, provided to supply additional water to the tanks, but only to keep the water off the masonry of the buildings (see Fig. 44).

Before any of Calder's suggestions could be carried out, the whole problem of casemate staunching arose. As water was the principal trouble, the question of drainage and water supply became inextricably tied to the staunching operations. In the process of finding a solution to the waterproofing problems, most of the earlier plans for drainage were altered beyond recognition or abandoned altogether. The well on the glacis and the passage leading to it were never constructed. The principle of water tanks was accepted, but the ones finally built were not placed under casemate No. 50. The surface gutters in the parade square were apparently abandoned. All these changes were relatively minor; the major problem was to dispose of the water from the ramparts and gargoyles. It rapidly became evident that the earlier expedients would not work.

The rampart surface drains proposed in the 1836 estimate (and never constructed) were intended only for the
northeast salient and the redan. The pebble construction proposed was badly suited to the climate, and by 1848 it had become obvious that nothing short of granite gutters running along the entire circumference of the rampart retaining wall would suffice. Provision for the gutters was made in the staunching estimate of April 1849⁴ (see "Casemates", section 13, and Fig. 46, below). The provision of the tank under casemate No. 50 was retained, but only a portion of the surface water (that from the northeast salient and the redan) was routed into it. The remainder was "permitted to run to waste in underground drains," but, as the estimate's preamble noted,

should it hereafter be found desirable to save it [the water] for consumption by the Troops, it can be collected with facility from the vertical pipes (herein provided) by means of conduit pipes connected thereto & leading to a tank in either of the casemates 13, 14, 15 or 16 [Nos. 8-11, standard system] or in any other situation that may be considered more desireable [sic].⁵

At the same time, provision was made for providing a more sophisticated system of draining the dos d'anes. The old system of draining off the water from the gargoyles into the surface drains in the parade had one obvious disadvantage: the whole system froze solid in winter. The 1849 estimate proposed the substitution of an interior down pipe in each of the casemates and a system of underground drains
beneath the parade square to carry off the water (see Figs. 45 and 34-5). It is not clear whether the water so collected was intended to be drained into a tank or whether it was to be allowed to go to waste, although the latter is more probable.

As has been noted above (see "Casemates"), the provisions of the 1849 estimate were never carried out. The method of staunching was much altered, and with it the water system. Unfortunately we know almost nothing about the installation of the system finally adopted. We do, however, have some idea what it looked like. The total lack of documentary evidence means that the system described below is based, to a certain degree, on speculation, but it is, I think, fairly accurate.

The water tanks under No. 50 were never installed. Instead Colonel Savage proposed around 1850 to construct three rain-water tanks and filters under the parade square. The two main tanks, each holding 66,000 gallons, were located in the northeast and southeast salients, while the third, a reserve tank for 30,000 gallons, was located behind the redan. The abandonment of the original proposal for tanks meant that some of the provisions for piping the water had to be drastically altered. The most obvious casualty was Colonel Calder's drain pipe for surface water running beneath the ramparts in the northeast salient and the redan. As this was no longer needed, it was dispensed
with altogether (see Figs. 48 and 49).

The water for the tanks was provided by the surface gutters behind the rampart retaining wall which were, in the end, constructed more or less according to the 1849 estimate. The water was collected by a series of pipes and deposited in one or another of the main tanks. The reserve tank was intended only for the overflow from either of the other two (see Fig. 47).

Apparently only the water from the surface gutters was to be collected in the tanks. The water from the down pipes in the casemates was carried off through yet another system of underground drains into the main drain. Why this rather elaborate system of drainage was considered necessary, and, indeed, why the water drained from the dos d'anes was considered less palatable than the surface water, is something of a mystery. Nonetheless, the available plans seem to indicate that the system was installed as described above. I say "seem to indicate" because the earliest plan we possess which details all the Citadel drains dates from 1891, by which time the addition of new buildings and the Citadel's inclusion in the Halifax city water system (in 1868) had altered the situation somewhat (see Fig. 51).

The tanks were in use by 1855, but, much to the horror of all concerned, they did not at first provide a supply of potable water. The 1856 committee examining the state of the Citadel, commenting on the water supply,
is eloquent for what it does not say:

10. On the 26th Oct. 1855, after the Citadel had been in the course of construction for 27 years, only one tank was reported as having water in it. -

A Medical Board inspecting it declared it neither fit for culinary or internal purposes. -

What state is it in now, and what supply of water is in the remaining tanks?

10. The water in the North tank is reported by a medical Board held on 1st April 1856 as being clear, of good quality and fit for all purposes. -

The water contained in the south tank is impregnated with lime and unfit for drinking or culinary purposes. -

That the water contained in the reserve tank is muddy and contaminated with lime and other impurities rendering it also unfit for use. -

The north tank is now 8/9ths full; the other two are quite full. -

The entire water system had an active life of less than 12 years. As has been mentioned, the Citadel was connected to the Halifax city water supply and the Citadel system passed into disuse. The water tanks were kept up, but the other components of the system were quickly forgotten. By 1869 the wells were quite literally lost; on 1 September, the CRE wrote to the Assistant Quartermaster
General announcing that "In the Citadel two wells have been discovered since the report of 30th April last was forwarded." 8

None of the above has much bearing on the system of drainage adopted for the ditch. Colonel Nicolls constructed drains for the ditch almost as soon as he had begun to dig it. These drains ran down into the glacis from the salient angles (see Fig. 67), but it is by no means certain where they emptied. The only documentary evidence is a plan for a drain for the privies (casemates Nos. 6 and 7A) which is shown connecting with a drain at the salient of the west ravelin and running down to cess pits dug in the lower part of the glacis slope (see Fig. 37).

An item was included in the Ordnance annual estimate for 1859-60 for providing a cunette for the ditch. The plan accompanying this item shows that there were cess pits leading to existing drains at six points in the circumference of the ditch (at the redan salient, the northeast salient, the northwest salient, the west ravelin salient, the southwest salient and the southeast salient). The drains from the cess pits led "out of the Ditch through the Glacis," (see Fig. 50).

2 Estimate for the installation of water tanks, 18469

This estimate provided for the construction of two water
tanks and a filter under the floor of casemate No. 50 for the storage of water collected from the surface drains of the ramparts of the northeast salient and the redan. Neither the tanks nor the pipes were installed as described in this estimate, but it is included because it is the only documentation we possess for the sort of materials commonly used in tanks and filters, and may therefore be useful for determining the type of materials used in the three tanks which were finally constructed.

A major component in the tanks which were actually built was asphalt, and the reader is referred to "Casemates", sections 14 and 15, for a description of the type of asphalt used and the results obtained.

**Item 4**

This Item provides for constructing two Tanks with a filter under the floor of the defensible casemate next to the Guard Room at the main entrance (See accompanying plan no 4) to be supplied with rain water collected from the rampart of the work, but the surface [sic] drains and conveyed to the filter by an under ground 6 inch Metal main as shown on the accompanying Plan (No 5) these tanks will contain about 12000 Gallons, and should they become full the overflow will pass into the well in the adjoining casemate which receives only a scanty water supply from springs. -

The small supply of water that can be obtained from the
two wells within the Citadel renders this service as well as following Item necessary.

Dig and throw out the earth 38'.4" x 15'.6" x 10.0 for tanks, and line the walls all round and construct the filtering chambers with 14 inch Brick work, turning an 18 inch arch of brick over the tanks with proper man hole in the crown, and lay the floor with brick on edge. The whole of the work to be set in roman cement & sand and all the walls and floor to be rendered and floated 2 coats with similar Materials.

The Tank vide drawings N° 4 & 5) [sic] to be supplied by a Main at N° 5 as follows the surface drains shown by a yellow line on the plan and elevation N° 5 is [sic] provided for in the revised estimate, the blue lines on elevation denote the supply pipe which is to be of cast iron with socket joints put together with oakum, and run with lead, the excavation for which is 820 x 2 x 3.

The pipes at a are to be cast with a neck as shown at B, to receive the trough pipe C, which is to be of cast iron 1\(\frac{1}{4}\) inch thick Set and run with lead in a block of Chiselled Granite at D. The trough pipes to be covered with a cast iron perforated grating 1 inch thick.

The pipes at E. to pass thro' the wall to F. and descend in front of the wall as shown at the elevation on G. at the foot of which it again passes thro the wall at H, in plan (N° 5.) into the filtering chamber of the Tank, which
is to be constructed in the following manner

The first chamber filled with course [sic] gravel resting on cast iron perforated plate \( \frac{3}{8} \) inch thick \( \frac{1}{4} \) inch holes & 12 inches from the bottom of the Tank supported on 4" chiselled Granite corbels 6 inches square, similar to those shown in the section, - the water after filtration down through the Gravel will pass into the 2\textsuperscript{nd} chamber through the openings 6 x \( \frac{1}{2} \) inches at I. - in Section 4, - this chambers [sic] to be in [three] Vertical compartments, the middle division filled with fine washed gravel and sand on a cast iron plate, as above described, - the upper Compartment filled with Charcoal on a perforated lead plate, the holes \( \frac{3}{10} \) [possibly \( \frac{3}{8} \)] inch in diameter, the Top plate to be of cast iron as above described, and the whole of the plate supported on chiselled granite corbels as above described; the water after passing up through this chamber discharges itself into the tank thro' the openings at K  the inner tanks to be filled by the overflow openings at L, left on upper part division wall, the waste or overflow Water to be carried off to the well through the 6 in cast iron pipe M. - Provision is also made for breaking through and making good all openings in the walls for insertion of all the pipes of supply, as well as those for the discharge, and drawing off the water by a pump which is to be of Cast iron with \( \frac{1}{2} \) ins brass working barrel buckets, and valves, to be enclosed in a Square Cast Iron case \( \frac{1}{4} \) in
thick and secured to the wall with wrought iron hold fasts run with lead, the case to have a door hung with [blank in ms.] front and provided with an iron lock.

The suction pipe for the pump at N, - from the working barrel to the cock to be of cast iron two thirds of the diameter of the working barrel the cock to be of brass 3 in bore and a lever shifting handle enclosed in the wall with a cast iron door and frame, and iron lock 0. - The suction pipes communicating from the cock with the tank to be of milled lead 2\frac{1}{2} inch bore that to the outer tank to be perforated at the foot resting on a chiselled granite shoe cupped to receive the end, - the suction pipe communicating to the inner tank to have a copper perforated rose head at the end, resting on a cupped granite shoe. -

The lead pipes to be put together with soldered joints those of iron with flanges[?] put together with leather and white lead.

N.B, the surface drains are provided for in the Revised estimate of 1836. -

Additional Services, Viz Water Tanks

Additional Item for North and South Ravelins...

220 yards cube excavating and removing 10d 9.3.4
182 do. do. and filling in 1/2 10.12.4
108 perches stock brick work in roman Cement 32/- 172.16.0
46 Sup: Yards brick on edge paving in roman cement 5/6 12.13.0
102 Sup: Yards rendering and floating in roman cement 2/- 13.4.0
9 cubic feet granite stone in Corbels and Curb stones set. 1/- 0.9.0
57 supr: do. plain chiselled work on the above 1/4 3.16.0
40 cubic do Granite Stone in blocks for trough pipes (D) 1/- 2.0.0
20 sup: ft. plain chiselled [sic] work on do 1/4 1.6.8
95 sup: ft. circular chiselled work on granite 2/- 9.10.0
80 do " ½ plain do on do - 8d 2.13.4
4 holes broken in masonry and the work made good round pipes at E. H. N. & M. 60/- 12.0.0
1 hole broken in masonry and forming chamber for 3 way cock and setting cast iron door frame at _0. 80/- 4.0.0
6 holes jump: in granite and run with lead to secure pump case 8d 0.4.0
2 Cups dished out in grante 2/6 0.5.0
5½ cwt cast Iron in perforated plates for filtering chamber 18/- 4.19.0
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<th>Description</th>
<th>Cost</th>
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<tr>
<td>$\frac{4}{2}$</td>
<td>cwt cast iron in pump case including Locks, hinges, bolts and nuts and putting up</td>
<td>18/6</td>
</tr>
<tr>
<td>$\frac{3}{4}$</td>
<td>cwt cast iron in door and frame to cock chamber including lock and hinges</td>
<td>18/6</td>
</tr>
<tr>
<td>252</td>
<td>cwt do pipes and troughs and laying with lead &amp; all materials</td>
<td>23/-</td>
</tr>
<tr>
<td>1</td>
<td>cwt sheet lead, milled in plate for filtering chamber</td>
<td>30/-</td>
</tr>
<tr>
<td>4</td>
<td>cwt milled lead pipes, $2\frac{1}{2}$ in bore</td>
<td>38/-</td>
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<tr>
<td>1</td>
<td>cast iron lifting pump $3\frac{1}{2}$ in brass working barrel buckets and valves, 8 to 10 stroke fixed Complete</td>
<td>160/-</td>
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<tr>
<td>1</td>
<td>Three way brass Cock 3&quot; bore with lever handle complete</td>
<td>60/-</td>
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<tr>
<td>1</td>
<td>Copper Rose head</td>
<td>30/-</td>
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<tr>
<td>5</td>
<td>solder joints on head pipe &amp; cock, all materials</td>
<td>2/6</td>
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<tr>
<td>23,655</td>
<td>holes drilled in the cast iron plates</td>
<td>$\frac{1}{4}d$</td>
</tr>
<tr>
<td>637</td>
<td>dozen holes punched in lead plates for filtering chamber</td>
<td>1d</td>
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Supplying & cleansing Gravel sand and
<table>
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<td>charcoal for filtration</td>
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<tr>
<td><strong>[Total]</strong></td>
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<td>£665.1.5(\frac{1}{4})</td>
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Two sections of the main drain, 1836 (plan 28-1836-2-3). It is by no means certain which of the versions of the main drain shown here was actually built. The estimate reads, "The floor may be constructed concave as suggested without increasing the expense...", so either version was acceptable to Colonel Jones. The version with the concave floor was the one favoured by the Fortifications department in London. (Public Archives of Canada.)
The foundation is for the foundation of the原型 breast in length, 10 feet wide, and an average depth of 10 feet 3 inches.

The secant for the form makes it for 20 feet in length, 6 feet wide, and an average depth of 9 feet, 1 inch, also for 10 feet in length, 6 feet wide, and 11 feet 6 inches for the sections near the lintel, and 9 feet makes a 10-foot in length, 9 feet mean breadth and 10 feet depth.

The rear of the secant is for the same above foundation, 10 feet long, 6 feet mean in depth, and 30 feet mean length, 10 feet long, 6 feet, 1 inch, and 30 feet mean breadth 1 for the sections near the lintel, and 9 feet makes a 10-foot in length, 9 feet mean bread and 10 feet depth.

The interior making on the front is for breast in width, a 9-foot, 3 inches, and depth of 9 feet 3 inches includes the site of the sections

The drain is to be placed in length, the secant is scheduled at 6 feet wide for the convenience of building purposes, and at a depth of 5 feet to the drain sufficiently deep to be cleaned frequently. The front of the drain is 2 feet, 6 inches wide. The draft is also advised for 6 feet, 6 inches. If it is intended to build the drain, the drain will terminate under the drain on the same side, extending to the only line, unless otherwise designated in the depth of the foundation.
"Plan and Elevation shewing the proposed method of supplying the Water tanks...", 1846 (plan 28-1846-3-5). This plan is of the earliest method proposed for using the surface water for drinking purposes. The surface drains shown were those provided in the 1836 estimate (the pebble drains) and the drain pipe was apparently intended to run along the tops of the dos d'anés, just below the terreplein. (There is some uncertainty, since the colour coding of the original plan is not reproduced in the available copy; a blue line in a black-and-white reproduction looks much like a black one.) The water tanks were to be provided in casemate No. 50, the second beyond the gate. None of this system was ever installed, although the granite surface gutter was ultimately laid in the position shown on the plan. (Public Archives of Canada.)
"Elevation and Section of Proposed Hopper Heads to enclose Weepers...", 1846 (plan 28-1846-3-10). The hopper heads were provided to lead the water from the gargoyles at the end of the dos d'ane drains to the surface drains in the parade square. A more elaborate system was ultimately used, but hopper heads were provided for the surface gutter drains at a later date. Since we have no surviving plans of the latter, this plan is provided on the assumption that the two were similar. (Public Archives of Canada.)
Item No. 9

Elevation and Section of Proposed Upper Heads to Resolve Wastes
To accompany the Supplementary Estimates Dated 21st March 1846.

Scale: 3 Inches to One Foot
"Ground Plan. Fort George or the Citadel...", 1849 (plan 01-1849-4-1). This plan shows the proposed drainage system for carrying off the water from the casemate dos d'anès. The water thus collected was not intended for storage in the tank under casemate No. 50 (No. 30 on the plan). It is not certain how much of the system shown here was ever constructed, but it would seem that much of it, including the drains running along the foot of the retaining walls in the northeast and southeast salients and the redan, was actually built. The internal piping shown in the casemates was altered in the course of the staunching operations (see Figs. 36 and 51). (Public Archives of Canada.)
"Plan showing the position of the proposed granite Surface Gutters...", 1849 (plan 01-1849-4-5). The surface gutters were, according to the arrangements detailed in this plan, to be served by two different drainage systems. Those in the northeast salient and redan drained into the pipes proposed by Colonel Calder in the 1846 estimate (see Fig. 43) and thence into the proposed tanks. The remainder of the surface gutters were connected to the same drainage system as the dos d'ane gutters (see Fig. 45). The method of disposing of the water was later altered, but the gutters were installed in the manner shown here. (Public Archives of Canada.)
"Fort George showing the position of Tanks and drains for supplying them," 1858 (plan 1858-8-3). The legend of this plan would seem to indicate that the drains are shown as built, but the notes (in the centre of the plan) make this a bit doubtful. The tanks were definitely installed in the locations indicated, and a comparison with the 1891 plan (Fig. 51) shows that the drains were installed in the manner shown here. Note that only the water from the surface gutters was drained into the tanks; another system of piping existed for carrying off the water from the dos d'anies. (Public Archives of Canada.)
"Plan and Section of the Rain Water Tanks," n.d. (plan 12-0003-13-2). This is our earliest plan of the water tanks. It is undated, but the signature would seem to be Colonel Savage's. This would date the plan sometime between 1848 and 1854. The plan may have been drawn before the tanks were built, or alternatively might be a record plan showing the tanks as constructed. A later plan exists of the large tanks (see Fig. 49) but this is the only plan of the reserve tank. (Public Archives of Canada.)
"Working Drawing of Tank," 1891 (plan 12-1891-2-1).
This is our best plan of the large tank. The two
66,000-gallon tanks were identical. (Public Archives
of Nova Scotia.)
"Plan and Section showing in Yellow the proposed Cunette...", 1858 (plan 01-1858-8-2). This plan is the only one showing the location of the cess pits in the ditch. (Public Archives of Canada.)
"The Citadel or Fort George...", 1891 (plan 01-1891-11-1). This plan shows the drains as they were in 1891. By then the situation had been changed radically by the introduction of city water; the main entered through the south ravelin ditch and the southern front. But the basic outlines of the early water systems are shown. The plan more or less confirms the arrangements for draining the surface water into the tanks (shown by broken lines) and the drains for leading off the dos d'ane water (shown by double broken lines). The 12-inch main drain which runs all the way round the ditch from the privies in the curtain to the drain at the redan salient was, I believe, added at some point after 1870. The remainder of the main drain, running down the glacis to Buckingham Street (shown on the site plan) is definitely not the same main drain estimated for in 1836 -- the materials are different -- but may well follow the same course. (Copy in possession of National Historic Parks and Sites Branch; original source unknown.)
Photograph of the east side of the southeast salient, ca. 1880. This photograph shows some of the gargoyles and down pipes for leading the water from the surface gutter, located just behind the coping at the top of the retaining wall, to the underground pipes connected to the rain water tanks. The south rain water tank is just out of sight behind the staircase landing in the centre of the picture. Of the down pipes shown, four are part of the water system (the ones at the extreme left, just to the left of the salient, at centre, and at the extreme right). The fifth pipe, just to the right of the salient, was not (at least according to the surviving plans) part of the system, and its purpose is unknown. Note that not all of the water went into the tanks (cf. the rain barrel under the pipe to the left of the salient). In the foreground, running along behind the wall and across the stair landing, is a sample of the type of surface gutter in use.
Photograph of a basin stone, 1971. This is one of the basin stones provided in the 1849 staunching estimate for the surface gutters. The purpose of the stone was to channel the water from the gutter out through the rampart retaining wall (the coping of which is visible at the bottom of the picture) through a gargoyle and into a down pipe leading to an underground pipe, and ultimately to the water tanks. This particular specimen is located on the south front. (Photograph by author.)
Plan Bibliography

1 14-1833-6-6: Section of main drain as proposed by Colonel Boteler.

2 14-1834-3-1: Section of main drain as proposed by Colonel Jones (Fig. 57).

3 28-1836-2-3: Sections of various proposals for a main drain (Colonel Jones) (Fig. 42).

4 15-1838-13-1: Plan and elevation of counterscarp at salient of northwest demi-bastion showing a portion of a drain at the salient (Fig. 67).

5 28-1846-13-1: Plan and elevation of the rampart retaining wall and drain, northwest salient and redan, showing surface gutter and drain. Also section of a hopper (Fig. 43).

6 04-1846-3-6: Plan and two sections of casemates Nos. 49-50, showing the proposed tank under No. 50 and the well under No. 49 (Fig. 77).

7 28-1846-3-7: Plan and section of proposed communication to well on glacis opposite northeast salient.

8 28-1846-3-10: Elevation and section of proposed hopper heads for gargoyles (Fig. 44).

9 01-1848-12-1: Ground plan showing proposed drains.

10 04-1848-12-2: Plan and sections of casemates, showing the drainage system in use (Part 1, Fig. 9).

11 04-1848-12-3: Sections similar to No. 10, above (Fig. 33).
04-1848-12-4: Plan and two sections of casemates, showing proposed system of internal piping.

01-1849-4-1: Ground plan showing proposed drains for carrying off the water from the casemate dos d'anes (Fig. 45).

04-1849-4-3: Casemate sections showing proposed internal drainage (Fig. 35).

03-1849-4-4: Sections of cavalier showing proposed drains (Fig. 9).

01-1849-4-5: Surface plan showing rampart surface gutters as proposed (Fig. 46).

11-1849-4-6: Two small sections of a gargoyle and one small plan of the surface gutter.

28-1849-4-7: Small section of a gutter and hopper head.

28-1849-4-8: Small section of a dos d'ane gutter.

02-1852-4-2: Small-scale sections of the main tank included in a set of general sections of the work.

04-1854-6-1: Plan and sections of a casemate, showing the system of internal piping finally adopted (Fig. 36).

04-1856-1-1: Plan and sections of the privies, showing drains, cess pits, etc. (Fig. 37).

01-1858-8-2: Surface plan showing cunette, cess pits, in ditch (Fig. 50).

01-1858-8-3: Surface plan showing rampart gutters, drains and water tanks (Fig. 47).
25  12-1891-2-1: Large-scale plan and section of main tank (Fig. 49).

26  01-1891-11-1: Block plan showing pipes, tanks, etc. (Fig. 51).

27  12-0003-13-2: Plan and sections of both main and reserve tanks, ca. 1852 (Fig. 48).