Primary Battery File

National Archives, Washington D.C.

Record Group 77

Correspondence of the Chief of Engineers

Entry 103

File, Fort, Battery:

20274

Ft Stevens

Btty Clark

SUBJECT: Defenses, mouth of Columbia River.

Office of the Chief of Engineers,
United States Army,

Washington, D. C., April 3, 1897.

Capt. W. L. Fisk,
Corps of Engineers,
Portland, Oreg.

Captain:

With funds appropriated by the Act of March 3, 1897, it is proposed to undertake the following work upon the defenses at the Mouth of the Columbia River, under the approved project:

At Point Adams, eight emplacements for 12-inch mortars on carriages, model 1896.

At Chinook Point, one 8-inch gun on experimental disappearing carriage, model 1894.

You are accordingly requested to submit detailed plans and estimates for the above works with a view to making the necessary allotments.

In considering the location of the eight mortar emplacements, provision should be made for the remaining eight emplacements of the battery either on the same line or directly in rear of the eight emplacements now authorized as may be found desirable upon future consideration.

The experimental 8-inch disappearing carriage, model 1894, referred to above, is the carriage which has been used at Sandy Hook for testing purposes.

In general appearance it is the same as the standard

REPRODUCED AT T

carriage, model 1894, now being issued, but differs slightly in some of its details and will require a platform slightly different from the standard carriage.

The platform sheet for this experimental carriage is now being prepared by the Ordnance Department and will be forwarded as soon as received.

It is the desire of the Chief of Ordnance that this experimental carriage be mounted in an isolated emplacement if possible.

Emplacement No. 4 of the four-gun battery at Chinook Point approximately fulfills the condition of an isolated emplacement, and has, therefore, been selected to receive this experimental carriage.

In submitting your plans, you are requested to recommend whether either or both of the above works can be done most advantageously by hired labor or by contract, and your reasons therefor.

It is desired that plans and estimates be submitted without unnecessary delay in order that as much work as possible may be accomplished during the present working season.

By command of Brig. Gen. Wilson:

Very respectfully,

Your obedient servant,

Captain, Corps of Engineers.

20274

REPRODUCED AT TF

U. S. ENGINEER OFFICE
PACIFIC DIVISION
Received MAY 28 1897

OFFICE, CHIEF OF ENGINEER.

20274

WAR DEPARTMENT.

Total est. cost $80,651.94
or practically $80,000.

(Blue prints)
Encls. 2 & 3 in Map Files, Dr. 92, Sh. 94

Forwd by Div Engr.

File
K

REC'D, BACK OFFICE CHIEF OF ENGRS. JUL 26 1897
encs 2 & 3 accompg

REC'D, BACK OFFICE CHIEF OF ENGRS. JUL 2, 1897
encs 2 and 3 accompg
back July 14 1897

1st. Endorsement.

U.S. ENGINEER Office,
Pacific Division,
San Francisco, Cal.,
May 25, 1897.

Respectfully forwarded to the Chief of Engineers, U.S. Army:

The choice of location and general design of the Mortar battery, appear to be good. Some of the details, however, seem to be susceptible of judicious modification. The magazines and shot rooms are arranged in the parapet in front of the pits, a not unsafe arrangement, but the detail capacity shown does not conform to the requirements of Circular of July 24th, [illegible] 110 lbs., [illegible] 800 [illegible] Fixed magazine [illegible] Captain [illegible] 11' instead [illegible] in the open, and from a position whence the Mortars are in full view. Voice pipe communication [illegible] receive [illegible] heading, [illegible] The [illegible] can be placed [illegible] and

entrance might prove objectionable, and even dangerous. It might perhaps be improved by swinging the magazine around parallel to the entrance gallery, and making the direction of approach to the door more indirect. I notice that the shot trolleys are carried clear out of the gallery, and across the pit. This seems an unnecessary expense, and offers objections as well. As these mortars use the regular loading truck, which carries both shell and cartridge, it might as well be loaded in the gallery and save a long trolley transit, which, especially with shell, is not unattended with danger. By doing away with the curves at end of shot galleries, the trucks could receive both cartridge and projectile at the end of the shot piles, and then be hauled to their respective pieces. The relocator and firing rooms are badly located. The relocator and telephone rooms especially should be in a reasonably quiet place. I would suggest the [illegible] to the right or left of the [illegible] for this purpose. [illegible] ing instrument is so large, that it and the necessary [illegible] require for their accommodation a room at least 12' x 10', and as much larger as possible. The firing room is unnecessary, the firing should be done in the open, and from a position whence the Mortars are in full view. Voice pipe communication [illegible] receive [illegible] heading, [illegible] The [illegible] can be placed [illegible] and

FORTIFICATIONS AT MOUTH OF COLUMBIA RIVER.
RIVER AND HARBOR IMPROVEMENTS IN OREGON.

CAPTAIN W. L. FISK,
Corps of Engineers, U. S. A.

UNITED STATES ENGINEER OFFICE,
P. O. DRAWER 50.
PORTLAND, OREGON,

May 25, 1897.

Brig. Gen. John M. Wilson,
Chief of Engineers, U.S.A.,
Washington, D.C.

General:-

I have the honor to submit herewith plans and estimates for emplacement for eight 12" Rifled Mortars on 1896 carriages at Point Adams, Oregon, as directed in letter from your office of April 3, 1897 (20274).

I have selected as the best site for such emplacements the tract in rear of the old quarters at Fort Stevens. This site offers the advantages of being sufficiently far in rear of other defensive works to prevent inconvenience to those serving in them from the discharge of the mortars; it is heavily wooded and will completely conceal the battery, it is as high as any tract available for the location of the emplacements, and its rear or land face is covered by an almost impassable swamp that would render defense against land attack from that direction very easy.

The site is at present, besides being thickly wooded, covered with what is called in Oregon "undergrowth", consisting of a network of rotten logs from 1 to 4 ft. diameter, piled indiscriminately on each other to a height of frequently eight feet, the interstices well filled with ferns 8 to 10 ft. high, laurel

REPRODUCE

and blackberry bramble. The levels used in calculating excavation and fill are taken from a partially finished map of unknown authorship supposed to have been made by some officer stationed at Fort Stevens. It is, however, the only information available without an expensive survey, and being tolerably accurate in other parts, may be considered as being fairly so on this.

The angle of possible exposure of this battery from extreme range along the coast around to the mined field is 190°30'. 60°30' of this angle the battery is concealed by dense woods of considerable extent and great height, and by high sand dunes, rendering location, even by smoke of firing, very difficult. This leaves an angle of 130° which I call the angle of probable exposure.

In order to avoid the defects of banks or walls in rear of the pits on various lines of fire (which exist in the typical battery from all directions and in other types from enfilading or oblique fire) I have made each emplacement or pit for 4 mortars entirely independent, and protected it by a parapet in the form of a blunted redan, whose faces lie on the extreme lines of probable exposure, i.e., make an angle with each other of 130°. Over the remainder of the angle of possible exposure (60°30') I have placed a parapet 8'6" high to protect the pit from direct fire, this parapet has a glacis held in a one on nine plane from the crest of the right face to the surface of the ground. Thus all projectiles from the angle of probable exposure will

either strike the parapet or pass clear over the battery, and from chance shots from the remainder of the angle of possible exposure, the same protection will be given to the entire pit as is enjoyed on the loading platform of the 10" emplacement.

It is proposed to arrange the pits on the corners of a rectangle as close as possible. The above parapet makes the interval between centers of pits 214', and considerations concerning effects of parades behind batteries have determined the distance between centres of pits 250'. This will place the centres of the four pits on the circumference of a circle of 157'6" radius, or very nearly that proposed in the typical battery. The proportion of the sides varies considerably from the typical form, but I consider that increased protection more than compensates for the slight loss of equal distribution of shots by parallel fire.

The platforms are placed at a reference of 17 feet above M.L.L.W., which is as low as is safe to give drainage to bottoms of the mortar pits.

The interior crest is taken at (38.0) or 21 feet above the platform to attain the protection on lines described above. From the interior crest, the superior slope is curved in section to the front convex upward; the curve of section making an angle of ten degrees with the horizontal where it leaves the interior crest. Thus projectiles of a less angle of fall than ten degrees will be deflected in all probability, if they strike the superior slope at any point where the thickness is not sufficient to prevent penetration.

Magazines for projectiles are arranged as shown on accompanying drawing to accommodate 64 torpedo shell, 360 800-lb. shell, 180 1000-lb. shell and 120 solid shot as recommended by the Board of Engineers.

Magazine for powder is arranged to accommodate 500 zinc powder cases. These cases average 2.9 charges to the case, so that 500 cases will represent 1450 charges or 360 rounds per mortar.

Latrine, tool-room, relocator-room, and storage battery and firing room are shown on accompanying blue print, also arrangements for ammunition service, electric lights, drainage, telegraph and telephone wires.

The protection throughout is computed by Major Knight's Rules with respect to 12" gun penetration, that being the heaviest caliber in proposed armament.

It is proposed to construct under allotment now contemplated the two mortar pits in the front line as shown on accompanying blue print. The rear two (shown dotted) to be exactly similar and constructed when funds are available.

I consider that it will be almost necessary to construct the battery by day labor and not by contract, for the following reasons:

The department is at present well provided with an expensive plant, suitable for the construction of this work, and which would undoubtedly suffer a great deal if trusted in the hands of a contracter.

Brought forward,			$56,024.76
44,750 lbs. Steel I-beams @ 3¢			1,342.50
Trolleys and rails,			1,500.00
Erecting same,			100.00
4 doors @ $50.	$200.00		
4 Doors @ $25.	100.00		
2 Iron Gates @ 50.	100.00		
2 Wooden partitions @$20.	40.00		
			440.00
1,520 ft. of 10" sewer pipe @ 20¢		$304.00	
220 ft. of 8" sewer pipe @ 18¢		39.60	
70 ft. of 6" sewer pipe @ 12¢		8.40	
340 ft. of 4" sewer pipe @ 10¢		34.00	
56 ft. of 3" drain tile @ 3¢		1.68	
			387.68
Laying Sewer Pipe, 2,150 ft. @ 30¢			645.00
Water and soil pipe,			276.00
44 Incandescent lamps with brass guards @ $1.60		$70.40	
3000 ft. of #000 leads, ins. @21¢ per lb		319.41	
540 ft. #8 leads, ins. @ 4-1/2¢ per lb		2.16	
12 Cedar poles @ $1.20		14.40	
Installation,		40.64	
Storage Battery		400.00	847.01
Fence around battery			75.00
Carried forward			61,637.95

Brought forward,		$61,637.95
288 Platform bolts @ $6.25	$1,800.00	
192 Platform Stones @ $2.00 per cu. ft.	4,250.00	
Setting stones and bolts,	480.00	
Drilling holes in stones,		
144 2 ft. holes @ $6.00	864.00	
432 15 in. holes @ $4.00	1,728.00	9,122.00
Mounting Carriages,		1,000.00
Mounting Mortars,		600.00
Repairs to plant,		960.00
		$73,319.95
10% for Engineering and contingencies,		7,331.99
		$80,651.94

or practically $80,000.00.

This estimate is probably a little high, but necessarily so owing to the unknown character of the site. I would suggest, however, that granolithic concrete in the proportions of 1 cement 2 sand, and 4 granolithic stone be used in place of the platform stones shown on drawings of Mortar Platform. In my opinion, this granolithic concrete is a better material for the purpose, bonds better with the surrounding concrete, possesses greater homogeneity, will not suffer from the weather, and can be easily repaired if chipped. The saving on above estimate by the substitution of granolithic concrete for the stone blocks would amount to $6,837.60, bringing the total to $73,814.34.

REPRODUCED AT THE N

I would respectfully request that action upon this estimate be taken as soon as possible in order that work on this Battery may be done during the fair season, instead of being constructed entirely during the worst season, as was the case with the West Battery.

Very respectfully,

Your obedient servant,

W. B. Fisk.

Captain, Corps of Engineers, U.S.A.

2 inclosures
(blue print in sep.pkg)

Through Col.Chas.R.Suter,

Corps of Engineers, U.S.A.

Pacific Division Engineer,

REPRODUCED AT THE NA

2nd *indorsement.*

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 10, *1897.*

Respectfully returned.

While Captain Fisk's design obviates all defects incident to covering masses in rear of the pits, this result has not been obtained without considerable exposure to direct fire. The height of the crest above the floor of the pit is but 21 feet as compared with 30 feet in the typical cross-section. The reduced relief affords ample protection against an angle of fall of 10° for shots coming in the direction of the capital of the redan-shaped parapet, but for fire near the limits of the sector of most probable exposure the increasing distance between the parapet and pit diminishes the cover. A parapet 8' 6" high is not regarded as of much value in protecting the pit from shots coming from the remaining sector of fire (60° 30').

The suggestion of the Division Engineer in regard to the employment of traverses for cover from this fire is regarded as preferable to the low retaining wall and glacis.

The magazine space is ample as the steel mortar does not require a uniform charge of 110 lbs. of powder for all ranges, as thought by the Division Engineer. The charges are varied to suit the range in the same manner as for

REPRODUCED AT THE NATIONAL ARCHIVES

the cast-iron steel-hooped mortar.

The increase in height to 9 feet of the magazines and shell rooms is, however, deemed judicious in the interest of a better ammunition service, and should be adopted.

The propriety of locating the magazine entrance and the entrance to the tool room as shown on the plans, is not regarded favorably. Experience from firings in the typical battery has demonstrated that the effect of the blast in the galleries is very severe even when the direction of fire is away from the entrance. In the present case the most probable fire is towards the entrance and it is almost certain that no ordinary doors in the magazine, firing, and relocator rooms can withstand the effects of the blast.

The interval between the pits is 214 feet as compared with 120 feet in the typical battery. The most recent investigations appear to indicate that in order to secure a uniform distribution of shots from the parallel method of firing, the best disposition is to increase still more than in the typical battery the disproportion between the breadth and depth of the rectangle containing the mortars. It is therefore deemed advisable to adhere as closely as possible to the established interval of 120 feet.

The remarks of the Division Engineer relative to the extension of the trolley lines across the pit and to the locations of the relocator room and latrines are concurred in.

There is forwarded herewith for Captain Fisk's information, a blue print of a design for a mortar battery of 8 mortars adopted by Col. P. C. Hains, for the defense of Baltimore, which is free from most of the objections pointed out in Captain Fisk's plans, and which appears to offer a satisfactory solution of the subject. This design calls for considerably more masonry and earthwork than does Captain Fisk's, but by a suitable modification of the profile, reducing it more nearly to the form adopted by Captain Fisk, a material reduction of quantities can be effected. The ends of the traverses afford sites for firing and relocating rooms with entrances from the roadway.

Captain Fisk is requested to prepare, as soon as practicable, revised plans following in general the trace adopted by Colonel Hains, with such modification of details as will appear advisable in the interests of economy and efficiency.

When such record as may be necessary has been made, these papers will be returned to this office.

By command of Brig. Gen. Wilson:

Joseph E. Kuhn

Captain, Corps of Engineers.

20274/1

Inclos. 2,3,& b.p. of 15820/20 in sep. roll.

Thru' Col. Suter, Division Engineer.

RECD. U. S. ENGR. OFFICE, PAC. DIV. JUN 16 1897

REPRODUCED AT THE NATIONAL ARCHIVES

3d Endorsement.

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
JUN 17 1897

Respectfully forwarded,

Chas. R. Suter

Colonel of Engineers, U. S. A.
Division Engineer

Det 149 | Eng'r Office, Portland, Or. RECEIVED JUN 19 | 1897

4th Indorsement.

U. S. Engineer Office,
Portland, Or., June 22, 1897.

Respectfully returned to the Chief of Engineers, U.S.Army.

Plans and estimates for 8 mortar emplacements will be prepared as soon as possible, as directed in the 2nd indorsement combining the details of Col. Haina' proposed type with the profile of those already submitted, so far as this can be done. It will, however, be impossible to do this work before the annual report of past work is completed, owing to pressure of work in this office.

Before abandoning entirely the project which is the subject of this paper, I wish to explain some of the details so severely criticised in the 1st and 2nd indorsements, all of which were the result of much thought and deliberation. It has been found in the construction of the parados for the West Battery that a reference of 40' was about the maximum height to which sand could be carried and dumped economically from the dunes where it is obtained. Above this height a double decked trestle is required up which two locomotives can pull trains of only five dump cars. Such a trestle makes an additional cost of at least $1800 and the cost per yard of depositing sand in place above this height is about doubled. To

avoid this expense it was the object of my plan to hold the top of the sand fill at about the reference 40. With the platform at (17.0) (the lowest possible for drainage) ample protection against fire from the probable angle over the entire platform is secured against an angle of fall of 1 in 10, or 6°. This is the maximum angle of fall obtainable from the right flank as the range is restricted by the Washington shore. To the front as the possible angle of fall increases the rear of the platform approaches the interior crest and increases the protection. It is only from the left flank that angles of fall of more than 6° are possible and dangerous at the same time, but for such fire the vessels must lie 2 miles off the coast in a very exposed position. Machine gun fire is not to be feared as no vessels can approach within three miles of the battery except inside the mouth and they will be then the focus of all the defensive works of the mouth of the river and will probably have better use for their machine guns than to fire at a thick mass of woods from some point of which smoke is issuing.

In my opinion the main fault of all types of mortar batteries from a defensive point of view, is the placing the mortars in pits which form shell traps more dangerous than direct

fire, whereas the object aimed at is concealed, yet they present a larger target to have effectually deposed to fully such action in the proposed plan from all directions except the doubtful angle to be reap. This is effected by placing the flanks of the parapet on the line of extreme probable fire so that all shells passing above the interior crest will come clear the battery entirely and strike far enough in rear to be harmless. The battery of the type proposed by Capt Haines while undoubtedly suitable for its own site, would from the point of Adams site of all its advantages, presenting at times a crater for shells from all directions, except one narrow angle and thus increasing the probability of silencing the battery by chance shots into its woods. The small contract of parapet and glacis now that left and rear of the pit might easily be dispensed with as of not much value owing to the improbability of shots from that direction. It was introduced as being cheap and likely to intercept a chance shot now and then and to offer a good position for the gunners in repelling attack from the rear. It is below the aeroplane and therefore harmless as regards catching projectiles which can be said to travel over and thrown back from the parapeted (later this as convenient in order that I

REPRODUCED AT THE NATIONAL ARCHIVES

The reason for carrying the shot trolleys along the side of the platform was to avoid confusion in loading them. The trolleys could be loaded in the shell rooms and run out following each other until each was over its truck, all standing ready in a single line and ready to start simultaneously for their proper mortars. The powder charges, being light, and assumed would be carried by hand and laid on the trucks while the shot was being lowered. This arrangement is not vital at all, but only designed to prevent crowding of the trucks at the entrance with consequent exposure to accident.

In regard to the location of the magazine entrance, it was placed on the line from the centre of the mortars to the end of Oliatopi Spit, Shoal 3-1/2 miles distant, and is the only direction within the 150° angle toward which fire would never take place. Errors in regard to size of location room and use of firing room are the result of meager information on those subjects. The size of the location room was taken from typical emplacement for 10" M.L.R. on 1896 carriage.

I would respectfully request that a decision as to the use of cut stone or granolithic concrete in the mortar platforms (page 7 this letter) be given as soon as convenient in order that I may begin to make arrangements for procuring cut stone if necessary. Granite is difficult to procure in this part of the country, and there is none that would be considered first class in the East.

W. L. Fitch
Captain, Corps of Engineers.

Through
Col. Chas. R. Suter,
Corps of Engineers, U.S.A.,
Pacific Division Engineer.

RECD. U. S. ENGR. OFFICE, PAC. DIV. JUN 25 1897

Endorsement.

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
JUN 25 1897

Respectfully forwarded.

Chas. R. Suter
Colonel of Engineers, U. S. A.
Division Engineer.

RECD. OFFICE CHIEF OF ENGRS. JUL 1 1897

REPRODUCED AT THE NATIONAL ARCHIVES

6th Indorsement.

Office, Chief of Engineers,
U. S. Army,
July 7, 1897.

Respectfully returned.

Captain Fisk is authorized to use a strong Portland cement concrete made of carefully selected materials as a substitute for the granite platform stones of the typical mortar platform.

Captain Fisk appears to have misunderstood the reference to the reduced relief in the 2nd indorsement. This was not intended as a criticism but to point out, in connection with the trace selected, the possible exposure to direct fire, and, that in obviating one danger, that of covering masses in rear, another danger has been encountered. Which of these two dangers should be regarded as most serious is in the present case largely a matter of opinion. Danger from covering masses in rear acting as parados as well as danger from direct fire behind low open parapets may be expected only at the longer ranges with large angles of fall when all shots are more or less uncertain. It may well be questioned whether a small contracted pit, open to the rear, as in Colonel Hains' type of battery, offers more danger as a "shell trap" than would the open pit of Captain Fisk with its exposure to direct fire. This question might easily be waived but for the position of the magazine entrance and the large interval between the mortar pits. The former is objectionable because the direction of fire from the mortars must always be more or less towards the opening and the effect of the blast will undoubtedly be particularly severe in the various magazines, rooms and passageways. The large interval between the pits will materially decrease the effects to be derived from parallel fire in the most probable direction, viz: to the front. As long as the parallel method of firing is to be retained as a feature, the disposition of the mortar groups should be planned approximately as outlined in the typical battery.

No definite information as to the floor space required for the relocating instrument is available. The dimensions shown on the typical battery plans prepared by The Board of Engineers are arbitrary and an increase of dimensions is advantageous where it can be secured. While the method of firing the mortars proposed by Colonel Suter will undoubtedly prove effective there are no objections to the introduction of a firing room which may be used for this purpose or not, as may be found desirable.

In forwarding the plans of Colonel Hains' battery it was not intended that they should be literally followed as a design suitable for the Point Adams site, but as a suggestion for obviating, in part at least, the objections to Captain Fisk's design. Any plan which will meet these objections will be favorably considered.

REPRODUCED AT THE NATIONAL ARCHIVES

Captain Fisk is requested to take as early action as is possible in this matter.

When such record as may be necessary has been made, these papers will be returned to this office.

Thos. H. Wilson
Brig. Gen., Chief of Engineers, U. S. Army.

20274
I
Incls. 2 & 3 in sep. roll.

Through Col. CHAS. R. SUTER,
Corps of Engineers.
Division Engineer, Pacific Division.

RECD. U. S. ENGR. OFFICE, PAC. DIV. JUL 21 1897

7th Endorsement.

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
JUL 12 1897

Respectfully forwarded

Chas. R. Suter
Colonel of Engineers, U. S. A.
Division Engineer

8th indorsement.

U. S. ENGINEER OFFICE,

Portland, Oreg., July 15 1897

Respectfully returned to the Chief of Engineers, U. S. A., the necessary record having been made.

W. D. Fisk.
Captain Corps of Engineers

Through Col. Chas. R. Suter
Corps of Engineers
Division Engr, Pacific Division

RECD. U. S. ENGR. OFFICE, PAC. DIV. JUL 1897

9th Endorsement.

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
JUL 19 1897

Respectfully forwarded

Chas. R. Suter
Colonel of Engineers, U. S. A.
Division Engineer

RECD. OFFICE CHIEF OF ENGRS. JUL 26 1897

REPRODUCED AT THE NATIONAL ARCHIVES

FORTIFICATIONS AT MOUTH OF COLUMBIA RIVER.
RIVER AND HARBOR IMPROVEMENTS IN OREGON.

CAPTAIN W. L. FISK,
CORPS OF ENGINEERS, U. S. A.

UNITED STATES ENGINEER OFFICE,
P. O. DRAWER 50.
PORTLAND, OREGON.

July 21, 1897.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.,
Washington, D. C.

General:-

I have the honor to request that a partial allotment be made for purchasing cement, for a survey, and for clearing, grading and building a R.R. track to the site selected for the construction of eight 12" Rifled Mortar Emplacements at Point Adams, Oregon.

Plans for these Emplacements were submitted from this office under date of May 25, 1897, but were returned for extensive revision.

No objection was offered, however, to the site selected, and if the preliminary work above referred to can be done at once, it will permit a portion of the construction of the emplacements before the rainy season.

This allotment should be at least $20,000, mainly for the purchase of cement. The cement market here is small and uncertain. Just at the present time one cement ship is due here, another one will probably arrive by the time the cement is needed, a third may be in before the work to be done is completed, and no other cargoes are afloat for this port; therefore to get the greatest competition in prices our bids should be taken at the earliest

possible moment. From these ships we can get the cement duty free, while if purchase is delayed until the cargo is unloaded the new duty of 44¢ per barrel will have to be paid.

I would respectfully request that this allotment be made by telegraph, if the above request meets with approval.

Very respectfully,

Your obedient servant,

W. L. Fisk.

Captain, Corps of Engineers, U.S.A.

Through Col. Chas.R.Suter,

Corps of Engineers,U.S.A.

SanFrancisco,Cal.

'97 Def. 799

120 | U. S. ENGINEER OFFICE PACIFIC DIVISION Received JUL 23 | 1897

OFFICE, CHIEF OF ENGINEERS

20274
4

WAR DEPARTMENT

Portland, Ogn.,
July 21, 1897.

F i s k, Capt. W.L.
Corps of Engineers.

Requests that a partial allotment ($20,000.) be made for purchasing cement, for a survey, and for clearing, grading & building a R.R. track to the site selected for the construction of eight 12-inch rifled Mortar emplacements at POINT ADAMS, Oregon.

Fwd by Div. Engineer.

$20,000 allotted and Capt. Fisk advised by telegraph Aug. 4, 1897.

Room 97 = Noted

1st. Endorsement.

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
July 23, 1897.

Respectfully forwarded recommended

Chas. R. Suter
Colonel of Engineers, U.S.A.,
Division Engineer.

FORTIFICATIONS AT MOUTH OF COLUMBIA RIVER.
RIVER AND HARBOR IMPROVEMENTS IN OREGON.

CAPTAIN W. L. FISK,
CORPS OF ENGINEERS, U. S. A.

UNITED STATES ENGINEER OFFICE,
P. O. DRAWER 50.
PORTLAND, OREGON.

August 3, 1897.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.,
Washington, D.C.

General:-

In accordance with instructions in indorsement from your office of June 10, 1897, (20274/1) on my letter of May 25, 1897, I have the honor to submit the following revised plans and estimates for eight 12-inch Rifled Mortars at Point Adams, Oregon.

In preparing this design I have governed myself entirely by the instructions of the Chief of Engineers and the Division Engineer as voiced in indorsements on my letter above referred to. In my opinion both trace and profile sacrifice largely the advantages offered by the site; but I have endeavored to retain all the advantages which pertain to the type fixed upon.

The cover has been computed throughout by Major Knight's rule for penetration of a 12-inch Rifle (that being the heaviest in proposed armament) and is ample except over the rear portion of the central passage, where it lacks 6 feet of sand. It is not thought worth the expense of increasing the concrete this amount (522 cu. yds., or $4,176.00) as no vital part of the battery is here exposed, and if the passage should be destroyed by a shell, ammunition could be served with fair speed through the relocator and firing rooms.

No observation stations are shown on the plan, as the battery

is in a thick woods of tall trees. Such stations will best be built when the necessity arises, on tall wooden towers with bullet proof protection around the observer, or else at some distance from the battery on open ground. The site selected is that mentioned in first plan and already approved.

All of the construction of these emplacements, except the clearing, excavation, building of R.R. track, and of drain to Swash Lake, must be done in the heavy rains and storms of the bad season in this locality, it has been found necessary to increase the cost of labor on other items entering the estimate 25%, over that of the estimate submitted May 25, which contemplated work during the fair season.

The following is the estimated cost of the 8 emplacements.

2,366 cu.yds. of excavation @ 40¢		$946.40
25,290 " " " fill @ 26¢		6,575.40
6,103 " " " concrete @ $8.00		48,824.00
45,600 sq.ft " slope protection @ 3¢		1,368.00
4,234 " " " granolithic finish @ 20¢		846.80
48,622 " " " plastering @ 3¢		1,458.66
5,428 " " " flooring @ 12¢		651.36
Clearing and grubbing		2,000.00
R.R. to Mortar Battery		800.00
Drain to Swash Lake		1,200.00
52,800 lbs. of steel I-beams @ 3¢		1,584.00
Trolleys and Rails,		1,600.00
4 Doors @ $50.00	$200.00	
8 " @ 25.00	200.00	400.00
	Carried forward	68,254.62

Brought forward,		$68,254.62
1,520 ft. 10" Sewer Pipe @ 20¢,	$304.00	
82 " 8" " " @ 18¢	14.76	
206 " 6" " " @ 12¢	24.72	
176 " 4" " " @ 10¢	17.60	
805 " 3" drain tile @ 3¢	24.15	
Laying 1,708 ft. of sewer pipe @30¢	512.40	
	$897.63	897.63
Water and telephone pipe		263.00
Electric Light Fixtures:		
43 Incandescent lamps with brass guards @ $1.60	$ 68.80	
3,000 ft. of #000 leads @ 21¢ per pound,	319.41	
1,030 ft. of #8 leads @ 14-1/2¢ per lb	149.35	
12 Cedar Poles @ $1.20	14.40	
Installation	40.64	
Storage Battery	400.00	
	$992.60	992.60
Fence around Battery		75.00
288 Anchorage Bolts @ $6.25		1,800.00
Granolithic work on platform,		485.00
Mounting Carriages		1,000.00
Mounting Mortars,		600.00
Repairs to plant,		960.00
		$75,327.85
10% for Engineering, etc.		7,532.79
25% on labor during rainy season,		8,088.48
Total		$90,949.12

Very respectfully,

Your obedient servant,

W. L. Fitch

Captain, Corps of Engineers, U.S.A.

Through Col. Chas. R. Suter,

Corps of Engineers, U.S.A.

Pacific Division Engineer.

(Incl. in separate package)

'97 Def. 837

U. S. ENGINEER OFFICE
PACIFIC DIVISION
Received. AUG 6 1897

20274
5

Portland, Oregon,
AUGUST 3, 1897.

F i s k, Captain W.L.
Corps of Engineers.

Revised plans & estimates for eight 12-inch rifled Mortars, at POINT ADAMS, Oregon.

($90,950.)

1 enclos. (B.pt.), sep. roll.
1 inc. (B.P.) 2 mdt
7 in Map Files, Dr. 92, Sh. 96.

File
K

RECD. BACK OFFICE CHIEF OF ENGRS. SEP 1 1897
addl inc. accy

1st. *Endorsement.*

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
AUGUST 6, 1897.

Respectfully forwarded recommended

Chas. R. Suter

Colonel of Engineers, U.S.A.,
Division Engineer.

2nd Indorsement.

Office, Chief of Engineers,
U. S. Army,
August 14, 1897.

Respectfully returned approved.

By Department telegram dated Aug. 4, 1897, a preliminary allotment of $20,000 was made from the appropriation for "Gun and Mortar Batteries," for construction of gun and mortar batteries, Act of March 3, 1897, for the construction of this battery. An additional allotment of $71,000 is hereby made from the above appropriation to be applied to the same purpose.

There is sent herewith a blue print of the Ordnance platform plate of the 12-inch mortar carriage model 1896, revised May 26, 1897, showing the following changes:

1. The diameter of the mortar pit is changed to 9 feet 9 inches.

2. The inner circle of anchor bolts is omitted.

Captain Fisk is requested to make the corresponding changes in the platform drawing prepared by The Board of Engineers and issued in lithograph form.

After the necessary record, Captain Fisk is requested to return these papers, substituting a tracing for the blue print, as required by circular letter from this office of March 5, 1896.

By command of Brig. Gen. Wilson:

Joseph E. Kuhn
Captain, Corps of Engineers.

20274
5

Inclo. 6 and 15486
in sep. roll. 73

Through Col. CHAS. R. SUTER,
Corps of Engineers,
Division Engineer, Pacific Division.

RECD. BACK U. S. ENGR. OFFICE, PAC. DIV. AUG 20 1897

3d. *Endorsement.*

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
August 20, 1897.

Respectfully forwarded

Chas. R. Suter

Colonel of Engineers, U. S. A.
Division Engineer

REPRODUCED AT THE NATIONAL ARCHIVES

4th Indorsement.
U.S. Engineer Office,

Portland, Or., Aug. 24, 1897.

Respectfully returned to the Chief of Engineers, U.S.A.,

The necessary record has been made, platform changes noted, and a tracing substituted for inclosure 20274/6, as directed.

W. L. Fisk
Captain, Corps of Engineers.

Tracing of
185/2 accompg. in sep. roll.

Through Col. Chas. R. Suter,
Corps of Engineers.
Pacific Division Engineer.

RECD. BACK U. S. ENGR. OFFICE, PAC. DIV. Aug 26 1897

5th *Endorsement.*

U. S. Engineer Office,
Pacific Division,
San Francisco, Cal.
August 26, 1897.

Respectfully forwarded

Chas. R. Suter

Colonel of Engineers, U. S. A.
Division Engineer

RECD. OFFICE CHIEF OF ENGRS. SEP 1 1897

FORTIFICATIONS AT MOUTH OF COLUMBIA RIVER.
RIVER AND HARBOR IMPROVEMENTS IN OREGON.

CAPTAIN W. L. FISK,
CORPS OF ENGINEERS, U. S. A.

UNITED STATES ENGINEER OFFICE,
P. O. DRAWER 50.
PORTLAND, OREGON.

Nov. 8, 1898

'98 Def. 797

Brig. Gen. John M. Wilson,
Chief of Engineers, U.S.A.,
Washington, D.C.

General:-

The last carriage for Mortar Battery at Fort Stevens, was received there Nov. 3, is mounted and the concrete platform is expected to be finished by the 15th instant. This will complete all construction work and orders for transfer of the Mortar Battery to the Commanding Officer, Post of Fort Stevens, if such are necessary, are requested as soon as possible in order to be able to dispense with services of watchman.

Very respectfully,

Your obedient servant,

W. L. Fisk.
Major, Corps of Engineers, U.S.A.

20274
16

Portland, Oreg.,
Nov. 8, 1898.

Fisk,
Maj. W. L.

It is expected that all constr'n work on the mortar battery at Ft. Stevens will be completed by Nov. 15, 1898.

Regs. orders to transfer the mortar battery to the Cond'g Officer, Ft. Stevens.

Letter to Secy of War Nov. 16 1898.

Primary Battery File

National Archives, Washington D.C.

Record Group 77

Correspondence of the Chief of Engineers

Entry 103

File, Fort, Battery:

86410

Ft. Stevens

Project to Rebuild
Btty Clark 1912-14

Hdqrs.Arty Dist.of the Columbia,
Ft.Stevens, Ore., Oct. 9, 1912.

From: The Commanding Officer,

To: The District Engineer Officer,
321 Custom House, Portland,Oregon.

Subject: Enlarging Pits, Battery Clark.

1.. Battery Clark, consisting of eight 12-inch B.L.Mortars constitutes the most important single element of the coast defenses of this district,but its usefulness in actual hostilities would be greatly limited by the excessive time required to load and lay the piece. This is due to the small size of the pits which will not permit loading except in positions approximately normal to the longer axis of the battery. As the waters covered by this battery extend through an angle of approximately 300 degrees, it can be readily seen that much valuable time may be lost in traversing from the loading position to the firing position,and vice versa. Furthermore the difficulty in passing the two rear mortars with the trucks when loading the forward mortars has been the cause of several minor accidents which have caused more or less damage and might cause serious delays.

2.. During the recent inspection of the armament by the Chief of Coast Artillery this matter was brought to his attention. He stated that the latest type of mortar batteries consisted of pits of 2 mortars each and that, although the necessity of more room in these pits was apparent, he believed that it would be better to wait until such time as another battery was built and then transfer two mortars from each pit to the new battery, then to change the positions of the two remaining mortars to the center lines. This arrangement would give ample space for loading from any position.

JOHN M. PAGE
Captain, C.A.C.

RECEIVED NOV 16 1912

Def. 799/33

UNITED STATES ENGINEER OFFICE
SECOND DISTRICT
321 CUSTOM HOUSE
PORTLAND, OREGON

JFMc-LEA

October 11, 1912.

From: Major J. F. McIndoe.

To: The Chief of Engineers.

Subject: Enlargement of pits, Battery Clark, Fort Stevens, Ore.

1. Referring to letter from the Office of the Chief of Engineers, dated Aug. 13, 1912, relative to the enlargement of the pits of Battery Clark, Fort Stevens, Oregon, reference is invited to my fortification estimate data sheets, in which the estimated cost is given as $50,000, not $5,000 as stated in E.D. 86410.

2. Upon receipt of above letter I took up with the Post Commander (Lt.Col.G.W.S.Stevens) the matter of enlarging the pits, asking for his views as to the necessity, advisability and urgency of undertaking this work at this time. In the data sheets revised in February, 1912, the enlarging of the pits was regarded as the least urgent of the modernizing work. He stated "I consider the following the order in which the work is most necessary taking your numbers: 1, 2, 3, 5, 6, 7, 8, 9, 4. No. 10- 'Lumber for projectile skids' is of course easy of solution. I think 3" x 4" pine good enough and that oak is unnecessary. No. 11- 'Enlarging the pits' is, I think, very important and I would of course like it done as soon as it can be consistently."

3. In order that a full statement of all facts bearing upon this question could be presented for the information of the Chief of Engineers, the Battery Commander (Capt. Fage) was requested to furnish me a statement of the difficulties and dangers, if any, that were met in serving the mortars in the old pits due to their restricted size. A copy of his letter dated Oct. 9, 1912, is herewith.

4. From any facts I have been able to ascertain from the officers at Fort Stevens, I know of no reason for changing the order of importance of the items of modernizing work as given

in the data sheets and I am not prepared to state that the enlargement of the pits at Battery Clark is advisable at this time.

5. Detailed plans of the work of enlargement will not be prepared until further instructions are received.

J. F. McIndoe
Major, Corps of Engineers.

Inclo. 32 accomp'g.

81640/1 1st ind. ED/PDJ

Office C. of E., November 7, 1912, To MAJOR McINDOE,

1. For the purpose of comparison it is requested that there be prepared alternative preliminary plans and estimates for the reconstruction of Battery Clark as follows: (a) enlarging the pits, for four mortars each, so as to give adequate room for efficient service and (b) adding two additional pits for two mortars each to the present battery, reducing the number of mortars in the present pits to two each.

2. For your information, in connection with (b) above, there are sent under separate cover a set of blue prints of a mortar battery, two guns to a pit, proposed for the defenses of the Panama Canal. When they shall have served their purpose these prints should be returned to this office. In the meantime they should be considered as confidential.

By order of the Acting Chief of Engineers:

Robert S. Ridlon
Captain, Corps of Engineers.

Inclo. 2 accomps.,
(31. Ps. of 71048/153, 154 & 270-277 & 425) in sep. roll by regd. mail.

RECEIVED NOV 18 1912

Def.799/33. 2d Ind. JFMc-LEA
U.S.Eng.Office,2d Dist.,Portland,Ore.,Feb.11,1913-To the C.of E.

1. Returned with preliminary plans and estimates for the reconstruction of Battery Clark. It is estimated that enlarging the pits for four mortars each would cost approximately $50,000 and that adding two additional pits for two mortars each and reducing the number of mortars in the present pits to two each would cost about $180,000.

2. Details of these estimates are given in accompanying report.

3. The blueprints referred to in par. 2 of 1st indorsement are returned.

J. F. McIndoe
Major, Corps of Engineers.

15 inclos.
(32 & 46 accompg.
43 & 45 & 11 bps. unmarked
in sep.roll by reg.mail.)

71048/153, 154, 270-277 + 425 + 3 add'l accompg.

REC'D, OFFICE CHIEF OF ENGRS. FEB 18 1913

86410/1 3rd Ind. EB/TTF

Office C. of E., February 24, 1913 - To CHIEF OF COAST ARTILLERY.

1. The above mentioned plans and estimates were prepared under instructions from this office, based upon correspondence indicating the desirability of remodelling Battery Clark, Fort Stevens. As to such desirability there appears no doubt, but since available funds are insufficient to undertake work of this magnitude, no action should be taken at this time and the papers should be filed for future reference.

2. Incidentally, the estimates in this case show the relatively high cost of batteries designed for two mortars per pit.

3. It is requested that these papers be returned to this office for file.

W. Lee Bixby
Chief of Engineers, ~~U.S.Army.~~

Bl. Ps. of 71048/153, 154 & 270-277 & 425,
and Inclos. 86410/2-5 accompg.

5

RECD. FEB 26, 1913 C.A.DIV.

5339
11

4th Indt.

War Dept., O.C.S., C.A.D., Feb. 28, 1913,- To Chief of Engineers.

The Chief of Coast Artillery concurs in the view expressed by the Chief of Engineers in the 3d indorsement (this page) that no action should be taken at this time in regard to remodeling Battery Clark, Fort Stevens.

E. M. Lewis,
Chief of Coast Artillery,
Assistant to the Chief of Staff.

15 incls:

RECD. OFFICE CHIEF OF ENGRS. FEB 28 1913

UNITED STATES ENGINEER OFFICE
SECOND DISTRICT
321 CUSTOM HOUSE
PORTLAND, OREGON

Def.799/46. JFMc-LEA

February 11, 1913.

From: Major J. F. McIndoe.

To: The Chief of Engineers.

Subject: Reconstruction Battery Clark, Fort Stevens, Ore.

1. In compliance with instructions contained in 1st indorsement dated Office Chief of Engineers Nov. 7, 1912 (81640/1), the following report is submitted with preliminary plans and estimates of cost of reconstructing Battery Clark, Fort Stevens, Oregon.

2. Battery Clark was completed in 1899 and was built in accordance with plans which accompanied letter dated August 3, 1897, from Captain W. L. Fisk, Corps of Engineers, to the Chief of Engineers. Changes in the ammunition delivery or trolley system and the addition of concrete hoods were made in 1904.

3. As suggested, alternative plans for the reconstruction of the battery have been prepared as follows: (a) enlarging the pits for four mortars each, so as to give adequate room for efficient service and (b) adding two additional pits for two mortars each to the present battery, reducing the number of mortars in the present pits to two each.

4. In preparing the preliminary plans for enlarging the pits for four mortars, the type drawings for a battery of 8 12-inch mortars on model 1896 carriages (Supplement to Mimeograph No. 27) have been followed as far as possible. On the accompanying blueprint the present battery is indicated by a broken line, the proposed reconstruction and undisturbed old work by a solid line, and the embankment and concrete to be removed by cross hatching.

5. A reconstruction of the shellrooms, magazines or interior rooms of the battery is not contemplated under plan (a). To increase the width of the present pits so as to conform practically to the type drawings, it would be necessary

to remove the earth fill and concrete retaining walls above and on each side of the traverse or long gallery between the pits, the present storage battery room and latrine, the concrete hoods over the ammunition delivery and the concrete walls and roof of gallery in rear of traverse. A change in the trolley rail system at delivery terminal, a modification of the drainage and water supply systems and electric conduits, the construction of about 100 linear feet of concrete parapet wall, an extension of the traverse or long gallery about 15 feet, a concrete hood over each ammunition delivery and new mortar wells, will be necessary under this plan of reconstruction. A new location for storage battery room and latrine is shown on the blueprint to the rear of the traverse as recommended in the Supplement to Mimeograph No. 27.

6. The distance between the centers of the left hand mortars in Pit "A" and the right hand mortars in Pit "B" under the different plans, is as follows:

Distance as shown on type drawings, ...	107 feet
Distance as constructed, ...	100 feet
Distance under suggested enlargement of pits,	61 feet
Distance as shown on proposed mortar battery Panama Canal plan, ...	65 feet

The distance from the center of the nearest mortar to the booth in the present battery is approximately 42 feet, under plan (a) 29 feet, and as shown on the type drawings 51 feet. Should the close proximity of the mortars under plan (a) render the present booths unserviceable the construction of new ones would be necessary.

7. The preliminary plan and estimate do not contemplate any change in the present method of handling ammunition by trolley and provision therefore has not been made for delivery tables.

8. The estimated cost of the reconstruction under plan (a) shown on the blueprint is as follows:

6,000 cu.yds. of excavation at $0.50, ...	$ 3,000.00
4,000 cu.yds. of fill, at $0.50, ...	2,000.00
900 cu.yds. of concrete to be removed at $10, .	9,000.00
1,200 cu.yds. of new concrete at $12, ...	14,400.00
I beams, anchor bolts, ringbolts, angle irons, steel doors, etc., ...	5,500.00
Drainage, water supply and electric conduits, . .	3,000.00
New storage battery room and latrine, ...	3,000.00
Waterproofing, plastering, etc., ...	1,000.00
Miscellaneous machine shop and blacksmith shop work, moving & resetting base rings,&c,	3,000.00
	$41,900.00
Engineering, contingencies, etc., ...	8,100.00
	$50,000.00

The above estimate does not include the dismounting, mounting or moving of the mortars by the Engineer Department and the item for engineering, contingencies, etc., has been added to cover the increased cost usual in this kind of work over original construction.

9. The preliminary plans for reconstruction in accordance with plan (b) conform in general outline with the plans of a mortar battery, two guns to a pit, proposed for the defenses of the Panama Canal, while the dimensions of the shellrooms and magazines are practically the same as the rooms in the present battery. On the accompanying blueprint the present battery is indicated by a broken line, the proposed reconstruction and undisturbed old work by a solid line, the embankment and concrete to be removed by cross hatching and the pits are lettered A, B, C and D.

10. The width of each pit under the suggested plan (b) is 72 feet. The width of Pit "A" of the present battery is 40 feet. This can be increased to 69'6", which would conform practically with the type drawings for a battery of 8 12-inch mortars on U. S. Carriage Model 1896, Supplement to Mimeograph No. 27, and would give adequate room for efficient service. To increase the width of this pit to 72 feet would involve considerable work and expense, which is not deemed necessary or essential. To modify pits "A" and "B" of the present battery under plan (b), it would be necessary to remove the embankment fill and concrete retaining walls above and on each side of the traverse between the pits, the present storage battery room and latrine located in rear of traverse, the concrete hoods over the ammunition delivery, the concrete walls and roof of gallery in rear of traverse, reduce the length of traverse about 15 feet, reconstruct the traverse at end of Pit "B", and construct about 100 feet of concrete parapet wall in Pits "A" and "B".

11. The present plotting room located to the rear and right of Pit "A" would be replaced, under plan (b), with two rooms, one for Pits "A" and "B" and one for Pits "C" and "D", located in rear of the traverse. The location of the booths for Pits "C" and "D" respectively, as shown on the blueprint conform with the present battery and also with the type drawings to Supplement to Mimeograph No. 27. In the traverse at the end of Pit "D", sufficient space is available for Officers Room, Guard Room, Latrines, Storage Battery Room and Storerooms. A change in the trolley rail system would be necessary, also a general modification of the drainage and water supply systems and electric conduits.

12. The parapet fill or embankment would exceed the excavation by about 15,000 cubic yards and the most accessible point from which the material could be obtained is the sand hills in the vicinity of Battery Russell. The railroad built

by the Engineer Department in connection with the construction of Battery Russell passes within 250 feet of the present battery and could be used for this purpose. The track and road bed would need, however, considerable repairs as very little maintenance work has been done for some years and the construction of several hundred feet of trestle would be necessary.

13. For consideration as to whether the battery under plan (b) would be detrimental to the defensive structures, namely B_3' and B_4', in the vicinity, it is noted that the center of Pit "B" is approximately 550 feet and 720 feet distant respectively from B_3' and B_4', while the center of Pit "D" would be about 400 feet and 500 feet distant from the same stations.

14. The estimated cost of reconstruction under plan (b) is as follows:

20,000 cu.yds. of excavation at $0.40, ...	$ 8,000.00
35,000 cu.yds. of fill at $0.50, ...	17,500.00
2,500 cu.yds. of concrete to be removed at $10, .	25,000.00
8,000 cu.yds. of new concrete at $12, ...	96,000.00
I beams, trolley rails, anchor bolts, ring bolts, steel doors, etc., ...	5,000.00
	$151,500.00
Repairs to railroad track and building trestle, .	5,000.00
Drainage and water supply system and conduits, . .	4,000.00
Waterproofing, plastering, etc., ...	2,000.00
	$162,500.00
Engineering, contingencies, etc., ...	17,500.00
T O T A L, ...	$180,000.00

The above estimate does not include the dismounting, mounting or moving of the mortars by the Engineer Department.

J. F. McIndoe
Major, Corps of Engineers.

JFMc-LEA

Def.799/33. 2d Ind.

U.S.Eng.Office,2d Dist.,Portland,Ore.,Feb.11,1913-To the C.of E.

1. Returned with preliminary plans and estimates for the reconstruction of Battery Clark. It is estimated that enlarging the pits for four mortars each would cost approximately $50,000 and that adding two additional pits for two mortars each and reducing the number of mortars in the present pits to two each would cost about $180,000.

2. Details of these estimates are given in accompanying report.

3. The blueprints referred to in par. 2 of 1st indorsement are returned.

J. F. McIndoe

Major, Corps of Engineers.

15 inclos.
(32 & 46 accompg.
43 & 45 & 11 bps. unmarked
in sep.roll by reg.mail.)

1513.

HEADQUARTERS, COAST DEFENSES OF COLUMBIA.

Fort Stevens, Oregon,

August 19, 1913.

From: The Commanding Officer.

To: The Commanding Officer, Pacific Coast Artillery District.

Subject: Irregularities and defects in these Coast Defenses.

can eff

The following irregularities in these coast defenses are reported for your information and with a view of obtaining the necessary action for remedy.

(a) At Battery Clark, eight 12" mortars, serious difficulties are encountered, due to the present construction of the battery. First, the pits are too small, and secondly, the parapet is not covered by an apron for a sufficient height. The first defect makes it almost impossible to serve the four mortars so as to permit of the authorized rate of fire. The interval between the mortars and the walls of the pits is barely sufficient to admit of the passage of the shot trucks, from front to rear. This even, can only be accomplished when mortars Nos. 1 and 3 are traversed to a certain position - thereby causing a delay. There is not sufficient interval between the mortars to allow the passage of two shot trucks, without interference, while serving mortars Nos. 2 and 4. During the confusion and excitement of an engagement, this congested arrangement will undoubtedly prove to be a serious menace, and render this battery less efficient than would pertain if this defect was remedied. It is recommended that mortars Nos. 1 and 3, of each pit at Battery Clark, be moved to the rear at least thirty feet, and that the loading platform be lengthened by the same amount. This alteration in the location of the mortars in question would correct the present difficulties.

(b) Due to the fact that the apron does not cover the entire interior slope and extend over a portion of the interior crest of the pit, there is an immense amount of sand that falls into the pit after a single shot is fired. If a salvo were fired, it is anticipated that even more sand would be precipitated. This dirt gets into the breech mechanisms and consequently causes delays while it is being removed - if not removed, serious difficulties may be encountered. Obviously, this condition is most undesirable. Upon the occasion of target practice of the battery in 1912, half a (two wheeled) cart load of sand and dirt that had fallen, was removed from the pit. The slopes of the battery were thoroughly

wetted before firing began, but the parapet is of sand, and water has but small effect in making sand cohesive. The interior slopes are well covered with coarse grass, but even this does not prevent the blast from tearing loose the sand, and precipitating it into the pit. The remedy suggested is, to have the present apron extended until the entire interior and superior slopes are covered. The alternative would be, to remove that portion of the parapet which rises above the horizontal plane on a level with the top of the apron as it now exists, and then extend the apron so as to cover the new superior slope. Due to its location, it is not thought that the lowering of the parapet of Battery Clark will materially decrease the amount of protection afforded by the parapet as it is at present.

2. Battery Clark is at present the only mortar battery in these coast defenses, and still further, it is one of three mortar batteries that can effectually reach an enemy's ships when they are within effective range and in a position to direct enfillade fire at the West Battery. This last named battery, in reality consists of four batteries, comprising six 10" guns and two 6" guns. Along the same line of batteries, but farther removed, are two more batteries, comprising two 6" guns and three 3" guns. In view of these circumstances it is clearly an urgent necessity to render Battery Clark as effective as conditions, at their best, will permit.

3. In view of the extensive alterations proposed, this matter has not been taken up with the District Engineer Officer, as it was clearly a matter to be first placed before the District Commander for consideration.

RECEIVED AUG 27 1913 HDQRS. PAC. C. A. DIST.

Oscar J. Straub
Lieut. Col., C. A. C.

995 1st Ind.

Hq.Pacific C.A.Dist., Ft. Miley, Cal., Sept. 4, 1913 - To the Comdg.Gen., West.Dept.

1. Attention in this connection is invited to 5th Ind. from these headquarters on A.G.O. 2058567, 5339/12, C.A.D., recommending a mortar battery for Fort Canby.

2. At present, due to the construction of the jetties, Battery Clark is the only battery of the primary armament of any value in the Coast Defenses of Columbia bearing on the entrance to the river.

3. If the mortar battery is not to be installed at Fort Canby in the immediate future, improvements for Battery Clark should be undertaken at once.

4. It is suggested that the battery might be altered more economically by enlarging the pit by cutting off the corners sufficient to permit the trucks for Nos. 2 and 4 to pass on the outside of Nos. 1 and 3.

5. If the mortar battery is to be installed at Fort Canby at once, the modifications of Battery Clark are not so pressing, but with the issue of the lighter projectile, this battery should be of sufficient importance to warrant placing it in proper condition for effective service, and this should be done as soon as practicable.

John P. Wisser
Brig.Gen., Comdg.

RECEIVED SEP 6 - 1913 HEADQUARTERS WESTERN DEPT.

2d Ind.

3112.
Hq.West.Dept., San Francisco, Cal., Sept. 6, 1913.
To The Adjt. Gen. of the Army, Washington, D. C., concurring in the recommendation of the District Commander. Communication 2058567 A.G.O. quoted in 1st indorsement, page 3, was returned to the War Department Aug.5, 1913.

Arthur Murray
Major General,
Commanding.

Received A.G.O. SEP 12 1913 1245

2077829 3d Ind.

A. G. O., Sept. 15, 1913 - To the Chief of Staff, in connection with papers (2058567-A.G.O.), charged to him on Aug. 12, 1913.

5 RECD. SEP 15 1913 C.A.DIV.

5339/13. 4th Ind.

War Dept., O.C.S., C.A.D., Sept. 16, 1913.- To Chief of Engineers.

5339/12 & incl. 1 accpg.

86410/17 5th Ind. EB/FF

Office C. of E., November 5, 1913 - To the CHIEF of COAST ARTILLERY.

1. Attention is invited to the report of the District Engineer Officer on the accompanying paper.

2. This correspondence involves two questions, viz:- (a) the improvement of Battery Clark (eight 12-inch B. L. M.) at Fort Stevens, Ore., and (b) the necessity for a battery of eight 12-inch B. L. M., at Fort Canby, Ore., as provided in the present approved project for the defenses of the mouth of the Columbia River.

3. (a) Battery Clark is of the earliest design with contracted pits for four mortars each, and is unsuited to efficient service under present conditions as to desired rate of fire, and in this correspondence various suggestions for its improvement are made, in addition to a request for the remedying of trouble from sand falling from the parapets into the pits. This battery has been several times under discussion as to its efficiency in recent years, and tentative plans for its improvement have been prepared. From general knowledge of the needs of the service, and of the defects of this old type and from experience elsewhere in improving batteries of this type, this office is of the opinion that satisfactory results can be had only by a radical remodelling and modernizing of the battery, and in this respect agrees with the District Engineer Officer. Along the line of this opinion it is believed that funds devoted to any less radical measures will not produce results commensurate with their cost. If this view is concurred in by the Chief of Coast Artillery, plans and estimates for modernizing this battery on the basis, both of four guns and of two guns per pit, will be prepared with a view to submitting estimates therefor to Congress.

4. The difficulty with regard to sand can best be corrected as suggested by the District Engineer Officer by removing so much of the sand parapet as extends above the top of the present apron. This will not materially affect the protection furnished by the parapet and can be done at a cost of $2250, for which funds can be provided. Moreover, since a remodelling of the battery will involve the removal of much of the existing parapets, this expenditure will largely apply towards subsequent work to that end.

5. (b) This office agrees fully with the views of the District Engineer Officer, the Coast Artillery Commanders and the Commanding General, Western Department, that the mortar battery included in the existing project for the defenses of the mouth of the Columbia River, should be continued in that project. If desired by the Chief of Coast Artillery, plans and estimates of the cost of the battery on the basis of two guns per pit will be prepared. Since the general location of the battery has been decided upon, the determination of the precise location on the ground is largely an engineering and construction question, to be decided on the basis of construction costs, due regard being had to the military necessities of the case, and the occupation of the reservation by existing structures. If plans are to be prepared, the District Engineer Officer should be directed to make the necessary preliminary studies to determine a suitable location, and to submit the results to this office for the action of the War Department.

Chief of Engineers, U. S. Army.

3 BACK NOV 5 1913 C.A.DIV.
1 Inc & "12" with 1 Inc.

Inclos. 18, 19 and 20 accompg.

6th Ind.

5339/13.

War Dept., O.C.S., C.A.D., Nov. 14, 1913.- To the Chief of Engineers, U.S.A.

1. In view of the conditions described by the Commanding Officer, Coast Defenses of the Columbia (par:1(b), page 1), the Chief of Coast Artillery is of the opinion that the difficulty at Battery Clark with regard to sand should be remedied without delay, reference being made to the statement of the Chief of Engineers in par.4, 5th Indorsement (this page), that this defect could be remedied at a cost of $2250, and that funds therefor are available.

2. The Chief of Coast Artillery is further of the opinion that the District Engineer, in accordance with the suggestion of the Chief of Engineers in par.5, 5th Indorsement (this page), should make the necessary preliminary studies to determine a suitable location for a mortar battery at Fort Canby, with a view of submitting the results for the action of the War Department.

Chief of Coast Artillery,
Assistant to the Chief of Staff.

1 incl. & "12" with 1 incl. accpg.

WAR OFFICE CHIEF OF ENGINEERS NOV 15 1913

AMD/BHB

7th ind.

86410/17

Office C. of E., November 17, 1913 - To the District Engineer Officer, SECOND DISTRICT, PORTLAND, OREG.

1. The sand parapet above the present concrete apron of Battery Clark should be removed as proposed by the District Engineer Officer and recommended by the Chief of Coast Artillery. To cover the cost of this work the sum of $2,250 is hereby allotted from the appropriation for "Preservation and Repair of Fortifications" act of February 13, 1913.

2. It is requested that necessary investigations and studies be made, and that recommendations for the site of a mortar battery at Fort Canby be submitted with a statement of the reasons for the selection of the site recommended.

By order of the Acting Chief of Engineers:

Captain, Corps of Engineers.

Inclos. 18-20 accompg.

Rec'd. Dist. Eng'r Office, Portland, Ore. NOV 22 1913

8th Ind.

Def. 799/52
U.S.E.O., 2d Dist., Portland, Ore., March 16, 1914. - To C. of E.

1. Returned.

2. Work is in progress on the removal of the sand parapet of Battery Clark.

3. On the prints herewith the new mortar battery locations recommended by Major (now Lieut.Col.) Straub and Colonel Ludlow are indicated by the letters "B" and "A" respectively. Attention is asked to accompanying letter from the Coast Defense Commander (Colonel Ludlow) dated January 22, 1914 and to 2nd indorsement thereon, in which Colonel Ludlow explains the reasons on which his recommendation is based. The same paper (1st indorsement) mentions the advantages of site "B" over site "A", from the point of view of economy of construction. The tactical advantages claimed for site "A" appear to be predicated upon the assumption that there will be no great change in the position of the bar channel. Fixity of position is not to be expected of this channel.

4. I recommend a site sufficiently to the east of (down the hill from) "B" to enable the battery to be built at about wharf level. Such a site will afford a satisfactory field of fire, is the site on which a battery can be constructed at least cost; and is convenient to the post wharf.

Inclos 53, 54, 59 and add'l inclos 60 + 61. accomp'g
(Inclos 60 + 61. each in duplicate)

Lieut.Col. Corps of Engineers.

6

Through- The Division Engineer
Northern Pacific Division

9th Ind.

P. 235

U. S. Engineer Office, Nor. Pac. Div., San Francisco, Cal., March 19, 1914,- -
To the Chief of Engineers, U. S. Army.

1. Concurring in the views of the District Engineer Officer.

Thos H Rees
Lieut. Col., Corps of Engineers,
Division Engineer.
P

5 Incls.
(2 in dupl.)

MAR 26 1914

EB/BHB

86410/17

10th ind.

Office C. of E., March 26, 1914 - TO THE CHIEF OF STAFF.

1. Attention is invited to the remarks in the 8th indorsement, (page 6) and in the paper therein referred to, regarding the site of the proposed battery. The District Engineer Officer and the former Coast Defense Commander agree in recommending Site "B". The present Coast Defense Commander recommends Site "A". It is not believed that the tactical advantages suggested by the latter in favor of site "A" are sufficient to counterbalance the disadvantages of that site.

2. It is recommended that the recommendation contained in paragraph 4, 8th indorsement, (page 6) be approved, and if approved, the District Engineer Officer will be instructed to prepare preliminary plans and estimates for the battery both with and without a parados for closing it in rear.

Dan C Kingman
Chief of Engineers, U.S. Army.
TRB

Inclos. 18-24 accompg.

4 BACK MAR 27 1914 C.A.DIV.
5 Ins & "17" with 1 Inc accomp.

OFFICE CHIEF OF STAFF
REC'D MAR 27 1914

WAR DEPARTMENT
OFFICE OF THE DISTRICT ENGINEER
SECOND DISTRICT
PORTLAND, OREGON.

ADDRESS REPLY TO
THE DISTRICT ENGINEER OFFICER,
321 CUSTOM HOUSE

REFER TO FILE No. Def. 805/22

June 19, 1914.

From: The District Engineer Officer.

To: The Chief of Engineers, U. S. Army.

Subject: Rearrangement of Battery Clark, Fort Stevens.

1. Following is reply to so much of Department letter of May 14, 1914 (86410/17), as relates to the "rearrangement of Battery Clark, Fort Stevens, for the mounting in each pit of two mortars of the latest type." Separate reply will be made to that part of Department letter of May 14, which refers to proposed mortar battery at Fort Canby.

2. With Department letter referred to were received - "New Type plans for mortar battery, two guns per pit" dated Norfolk, Va., May 2, 1914.

3. Under date of February 11, 1913, the then district officer submitted two designs for the modification of Battery Clark, the estimated cost of carrying out these plans being $50,000.00 and $180,000.00, respectively. One of these plans shows 4 mortars in each remodeled pit and the other plan 2 mortars in each remodeled pit. Both plans resemble the new type plans of May 2, 1914, in having two mortars placed side by side in the direction of the length of the battery.

4. The May 2, 1914, plans show the middle gallery 17 feet wide and side galleries 13 feet wide, two mortars being served through the middle gallery and one through each of the side galleries. To make the middle gallery in either of Major McIndoe's plans 17 feet wide would limit the thickness of the walls of the gallery to 2 feet, which is insufficient. In view, then, of the recently imposed requirement that a gallery serving two mortars must be 17 feet wide, Major McIndoe's plans for remodeling Battery Clark by widening each pit toward the center line of the battery must be given up.

5. There is submitted herewith a design in which two mortars are shown in each pit of Battery Clark, the mortars in each pit being placed one behind the other. The middle gallery is remodeled and made 17 feet wide; the side galleries are 12 feet wide. Only by this arrangement of the mortars in each pit can any considerable part of Battery Clark be used unchanged. The present

traverse could be remodeled as contemplated by the plan herein recommended, and the right pit widened to the right and the left pit to the left, by removing the present flank rooms and building new ones; or the rooms at one flank (say the right flank) could be retained, and the traverse and the left flank rooms removed and a new traverse and new left flank rooms built further to the left. In these plans only the present powder and shell rooms would be used, and either plan would cost about as much as building a new battery.

6. The estimated cost of a new two-pit battery is about $160,000, as follows:

Concrete	10,000 cu.yds. at $10.00,	$100,000.
Embankment	40,000 " " .50,	20,000.
Trolley rails, anchor bolts, steel doors, etc.,		10,000.
Drainage, sewers, water supply, electric conduit,&c.,		6,000.
Waterproofing, plastering, etc.,		2,500.
Shot tables, indicating device, etc.,		3,000.
One 25-k.w. set (reserve)		4,000.
		145,500.
Engineering, contingencies, etc., 10%,		14,550.
		$160,050.

7. The estimated cost of the modified battery shown on the tracing herewith is about $84,000, as follows:

Earth excavation,	5,000 cu.yds. at $ .50	$ 2,500.
Earth fill	5,000 " " .50	2,500.
Concrete to be removed,	1,700 cu.yds. at $10.00,	17,000.
New concrete	2,100 " " 12.00,	25,200.
I beams, anchor bolts, steel doors, etc.,		10,000.
Drainage & water supply systems, electric conduits,&c,		4,500.
Waterproofing, plastering, etc.,		1,500.
Miscellaneous machine shop & blacksmith work,		2,500.
One 25-k.w. set (reserve)		4,000.
		69,700.
Engineering, contingencies, etc., 20%,		13,940.
		$ 83,640.

8. There is also herewith tracing showing Battery Clark as it is today, change having been made in the parapet of this battery since drawings were last submitted. By placing one of these drawings over the other, it will appear that the changes recommended involve -

(a) Removing the concrete gallery between the pits, also the storage battery room, latrine and concrete hoods in rear of the traverse; reconstructing the gallery with an inside width of 17 feet and building a new hood in rear of the traverse.

(b) Cutting doorways between the inner ends of the magazines and the shell rooms.

(c) Widening to the full width of the rooms, the old doorways

between shell, guard and store rooms, and reconstructing the store rooms for the convenient transfer of projectiles from trolleys to trucks.

(d) Removing a portion of the present mortar platforms and constructing new ones, involving a rearrangement of the drainage, sewerage, water supply systems, and electric conduits.

(e) Constructing a new plotting house in rear of the battery as per new type plans, and constructing storerooms, latrines, etc., on either side of the new plotting house. The present plotting room could be used as an officers' room.

Lieut. Col., Corps of Engineers.

Inclos. 20 & 21 (tracings)
accompg., in sep.roll.

86410/28 -1st Ind.- RRR-FF
Office C. of E., July 9, 1914 - TO THE CHIEF OF STAFF.

1. Referring to indorsement, dated May 6, 1914, of the Coast Artillery Division, Office of the Chief of Staff, on E.D.86410/17 (C.A.D.5339/13), there are submitted herewith plans and estimates for the remodeling of Battery Clark, Fort Stevens, Oregon.

2. The reconstruction contemplated by the accompanying plans appears to this office to be too extensive and costly for the benefits to be derived, and it is thought if this battery is to be remodeled to provide for 4 mortars only, the work should be done at considerably less cost.

3. The estimates submitted include a 25-k.w. set, the cost of which is not ordinarily included in costs for battery reconstruction, such being provided by another appropriation, and the omission of this item would reduce the estimated cost of reconstruction as submitted by the District Engineer Officer to about $80,000.

4. Some reductions might also be possible in the estimate for other items which appear to be liberal, but it is not thought that the total cost of the work proposed will fall much below that indicated above.

5. It is, accordingly, believed that certain features of the proposed reconstruction should be eliminated to bring the work within reasonable limit of cost, and an expression of opinion is, accordingly, requested as to what items of those given in Par.8 of the preceding communication might

be omitted.

6. The widening of the central gallery to 17 feet will be an expensive item, and it is thought in view of the additional facilities for ammunition service proposed on the flanks of the battery that the old gallery width might be retained.

7. Early action is requested in view of the necessity for securing revised estimates promptly should modification of the proposed plans be decided on.

Inclos. 29 & 30 accompg.

Chief of Engineers, U. S. Army.

RECD. JUL 10 1914 C.A.DIV.

5339/12-3 2d Ind.

War Dept., O.C.S., C.A.D., July 18, 1914. - To Chief of Engineers.

2 Incls.

GENL. OFFICE CHIEF OF ENGRS. JUL 20 1914

86410/28 3d Ind. RRR-FF

Office C. of E., July 24, 1914 - To the District Engineer Officer, SECOND DISTRICT, PORTLAND, OREGON.

1. Attention is invited to the 1st indorsement above, pages 3 and 4.

2. The Chief of Coast Artillery has informally indicated his assent to the maintenance of the central gallery in its present width and his desire that shell tables shall be provided at the rear, to receive projectiles from the trolleys and deliver them to the trucks. It appears that it should be practicable to provide for installation of four such tables at the central traverse and for one at each flank. Shell tables, differing but slightly in design from that shown on drawing published with supplement to Mimeograph No. 27, Sheet 3, are now being purchased under contract for $226.75 each.

3. The shell-room width of 11 feet is insufficient to provide for a double row of projectiles; assuming storage of a single row against the front wall, the trolley track at that side of room should be moved out to a distance not less than 3-1/2 feet from the wall. It is thought that loops should be provided, and frogs, approximately as indicated in pencil on the tracing, inclosure 29.

4. Study should be made as to clearances needed for ammunition service as described in paragraph 2 above, with reference to the matter of head-room. It is believed here that head-room of at least 7 feet 3 inches is necessary, apparently involving a lowering of the floor in rear corridors and in mortar pits.

5. There appears to be no reason for making the distance from the front wall of pit to the center of the front mortar well more than 20 feet if it involves additional cost.

6. In view of the above, you are requested to submit a revised plan and estimate at the earliest practicable date.

By command of the Chief of Engineers:

Inclos. 29 & 30 in sep. roll.

Captain, Corps of Engineers.

RECD. U.S.E.O. JUL 28 1914 PORTLAND OREG.

Def. 805/22 4th Ind. McK/T

U.S.E.O., 2d Dist., Portland, Oreg., August 5, 1914.- To C. of E.

1. Returned.

2. The wishes of the Department are not clear to me in certain particulars. On inclosures E.D. 29 and 30, when they were received back, were certain pencil lines for which I have substituted ink dotted lines for fear the pencil lines might be erased. On Inclosure 29 the pencil lines indicated changes desired in the trolley tracks in the shell rooms. On inclosure 30 the pencil lines indicated two tables, certain changes in the trolley tracks and an opening to be cut in a 4-foot wall, at the rear of the traverse, and (possibly) certain changes to be made in the masonry walls at the left of the left pit. I request to be informed whether the storerooms at the left flank of the left pit and the right flank of the right pit, respectively, are to be enlarged as shown by the pencil (dotted ink) lines on inclosure 30 or as shown on inclosure 29. In either case the desired position of the shell tables at the flanks of the battery is not understood. I would also ask whether the plotting house shown on inclosure 29 (taken from new type plan of May 2, 1914) is to be built.

Lieut. Col., Corps of Engineers.

2 Inclos., 20 & 21, accompg.

RECD. CAPTAIN CHIEF OF ENGRS. AUG 10 1914

86410/28 5th Ind. EB-FS

Office C. of E., August 15, 1914 - To The District Engineer Officer, SECOND DISTRICT, PORTLAND, ORE.

1. All pencil lines on inclosure 30 should have been erased before its return to the Portland office. They were left inadvertently, are not referred to in the 3rd indorsement above, and are not to be considered.

2. This office has not reached a definite conclusion as to the best positions for the shell tables desired by the Chief of Coast Artillery, and requests recommendation in this connection. As to the treatment of the central traverse, a suggestion for consideration is illustrated on the accompanying small blue-print; it is not intended, however, that it be incorporated in the design unless study by the District Engineer Officer should support it as being satisfactory.

3. The plotting house, with adjacent rooms, shown on inclosure 29, should be retained in the design, but segregated in the estimates.

4. The numbering of the mortars on tracing 86410/29 should be changed, using a separate series of numbers for each pit, and assigning number 1 to the rear mortar in each pit.

5. In connection with the ammunition service, attention is invited to circular letter from this office dated November 4, 1913, concerning the Chisholm and Moore trolley and frog, (E.D.62613). (W 779/46)

By command of the Chief of Engineers:

Colonel, Corps of Engineers.

Inclos. 29-30 & copy of inclo. 35 in sep. roll.

Rec'd. Back Eng'r Office, Portland, Ore. AUG 19 1914

Def.805/22 6th Ind. McK-T

U.S.E.O., 2d Dist., Portland, Ore., Dec. 16, 1914.- To C. of E.

1. Returned.

2. Revised plan (tracing) is herewith. By comparing this with drawing E.D.86410/30, showing present condition at battery, it will appear that in addition to the changes described in (b) (c) (d) and (e), Par. 8, above letter, the following are involved:-

(f) Removing a portion of concrete wall between the corridor and the storage battery room and latrine, and a portion of the rear wall of the storage battery room and the latrine.

(g) Placing 4 shell tables at the rear of the traverse, and building a concrete hood over two of these tables.

(h) Placing a shell table in the modified store room to the right of Pit A and one in the modified store room to the left of Pit B.

(i) Rearranging the trolley system.

(j) Lowering of platforms in both pits and lowering of floor in rear corridor and adjacent rooms so as to give a head room of 7'3".

3. Two locations for plotting house are shown. In the first (full line) the typical design of plotting house is used. This requires the plotting house to be placed 83 feet back of Mortar No. 1, which is 48 feet more than distance given on typical drawing. In the second the plotting house is shown 45 feet back of Mortar No. 1 which is the minimum distance possible on account of roadway needed between rear of traverse (concrete hood) and front of plotting house. In this location plotting rooms are necessarily separated by a distance of 34 feet in order to enable observers to see into pits. Space between plotting rooms is occupied by store rooms which in other location are placed on flanks of plotting rooms.

4. Estimated cost of changes and additions (not including plotting houses, etc.):

Earth excavation,	5,000	cu.yds.	at .50,	$2,500.
Earth fill,	5,000	"	" .50,	2,500.
Concrete to be removed,	700	"	" 10.,	7,000.
New concrete,	1,000	"	" 12.,	12,000.
I-beams, trolley rails, anchor bolts, steel doors, etc.,				6,000.
Shell tables and hoists,				4,500.
Drainage, water supply system, electric conduits,				2,500.
Waterproofing, plastering, etc.,				1,500.
Miscellaneous machine shop and blacksmith work,				2,500.
				41,000.
Engineering, contingencies, etc., 20%,				8,000.
				$49,000.

5. Estimate of cost of plotting houses, etc.:-

Concrete	700	cu.yds. at 10.,	$ 7,000.
I-beams, steel doors, etc.,			2,500.
Drainage, water supply system, electric conduits,			1,500.
Mechanical indicating apparatus,			1,000.
Plastering, etc.,			1,000.
Grading, etc., of site,			500.
			13,500
Engineering, contingencies, etc., 10%,			1,350.
			$14,850.