



THE MASONRY WALLS OF FORT WASHINGTON

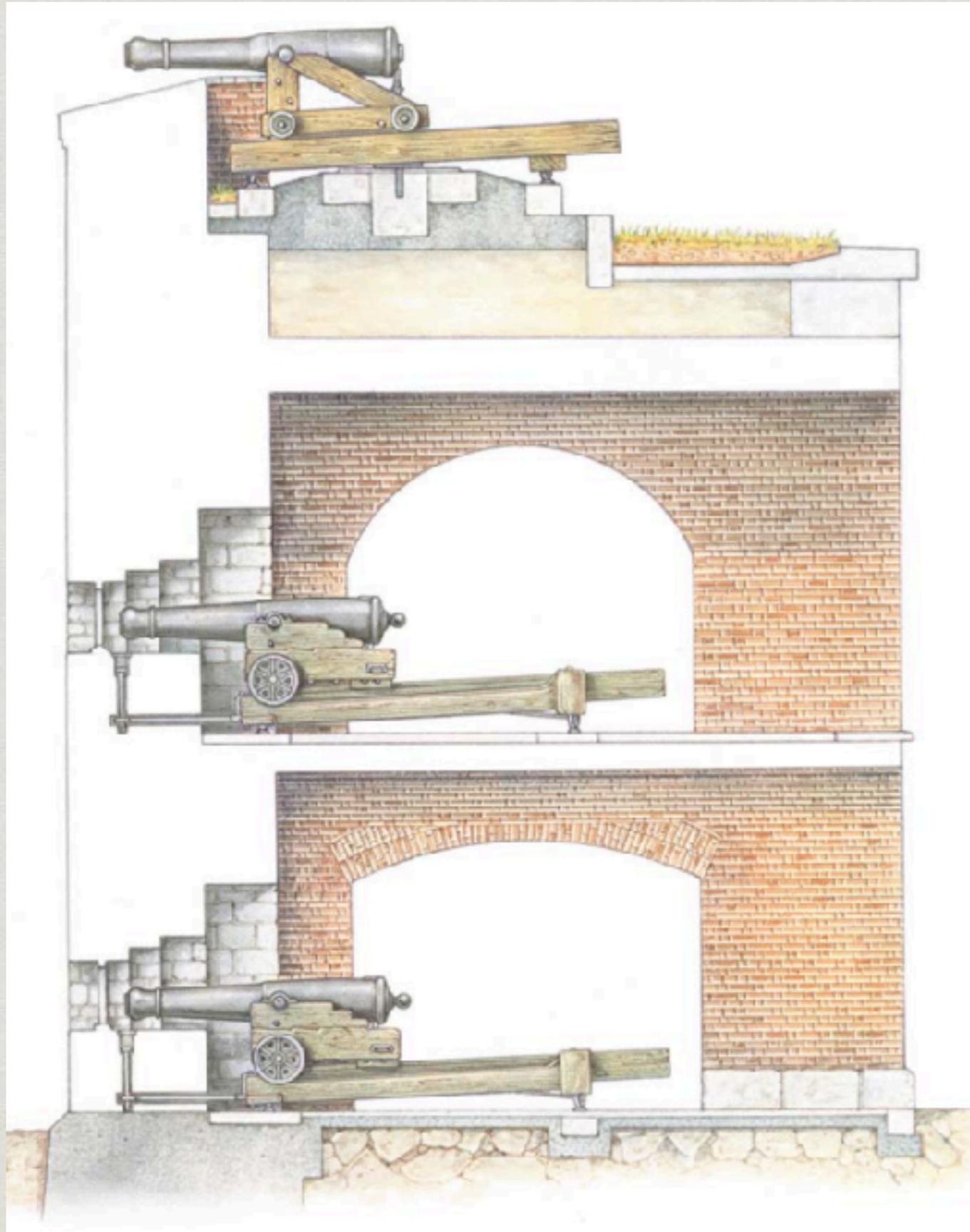
BY DOUG BOND, PE FOR THE
SOCIETY FOR THE PRESERVATION OF HISTORIC CEMENTS

Construction

- * Fort Warburton Constructed 1808, Destroyed 1814 by American troops retreating after burning of Washington
- * James Monroe requested Major Pierre L'Enfant 1815 to design and construct Fort Washington
- * Lt. Col Walker Armistead of Corps of Engineers 1815
- * Major parts completed in 1824, enhancements until 1840s
- * Major part of Washington Defense in Civil War with few modifications
- * Construction of late 19th century fortifications outside of earlier masonry fort

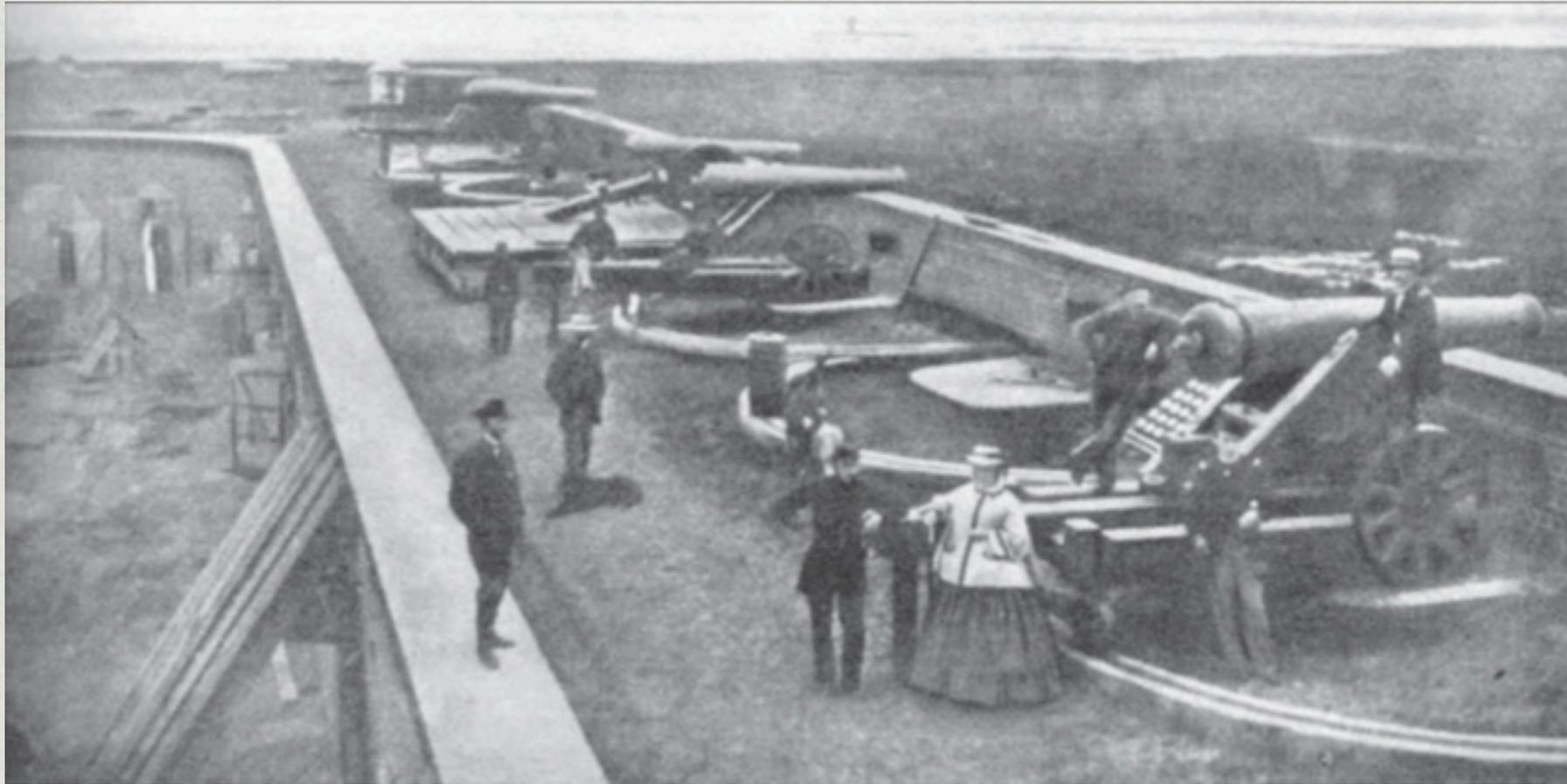
Coastal Fortifications in the US - Some Background

- * First fortifications started in 1794 at strategic harbors due to concerns over the French Revolutionary War
- * 1794-1804 First System of Coastal Artillery
- * 1807-1814 Second system of Coastal Artillery
- * 1817-1867 Third system of Coastal Artillery
- * Designs based on French military engineering



Third system had multiple layers of gunnery with masonry casemates and topside guns

Fort Pulaski - Civil War



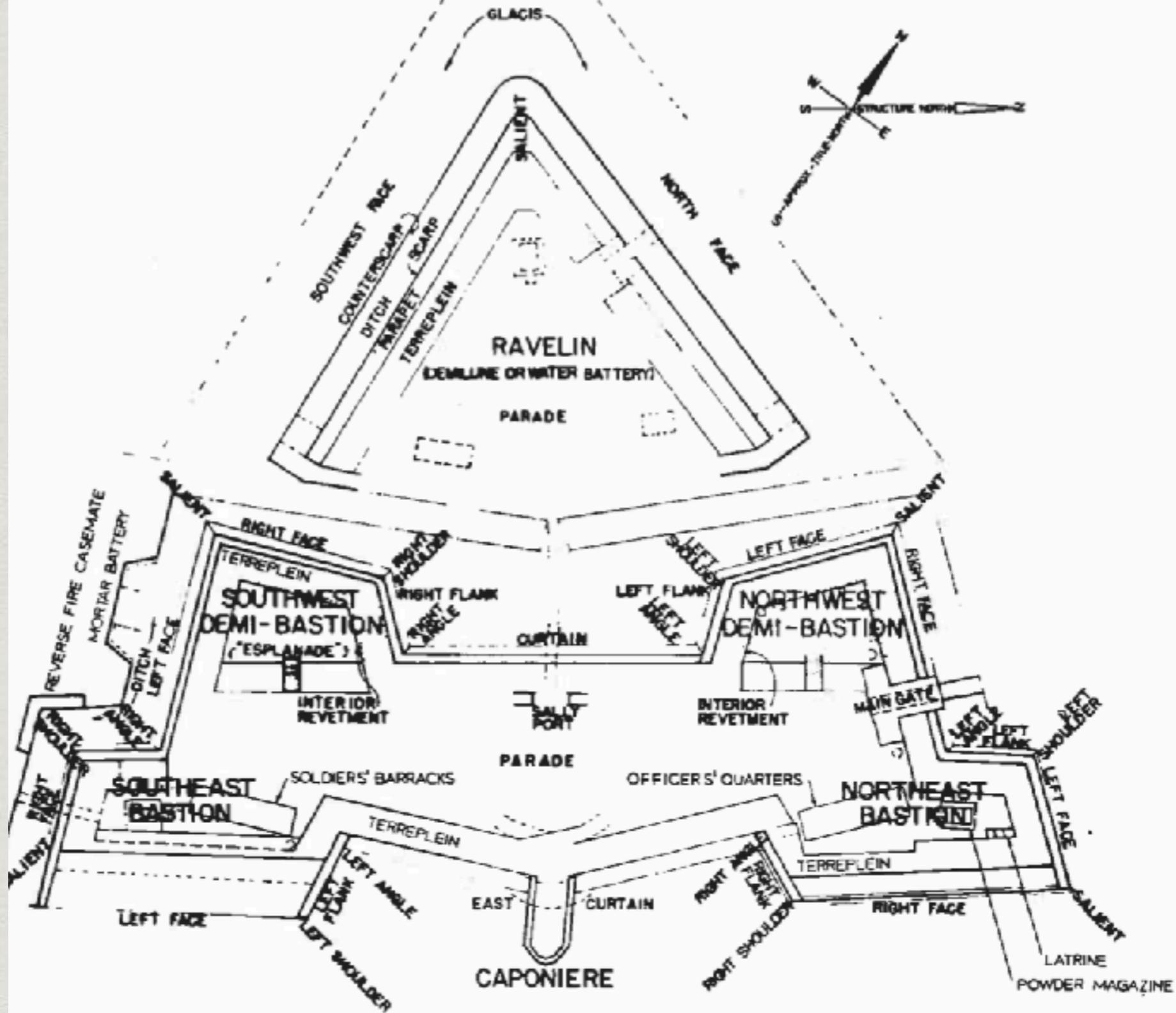
Fort Monroe - Civil War

Fort Sumter 1863



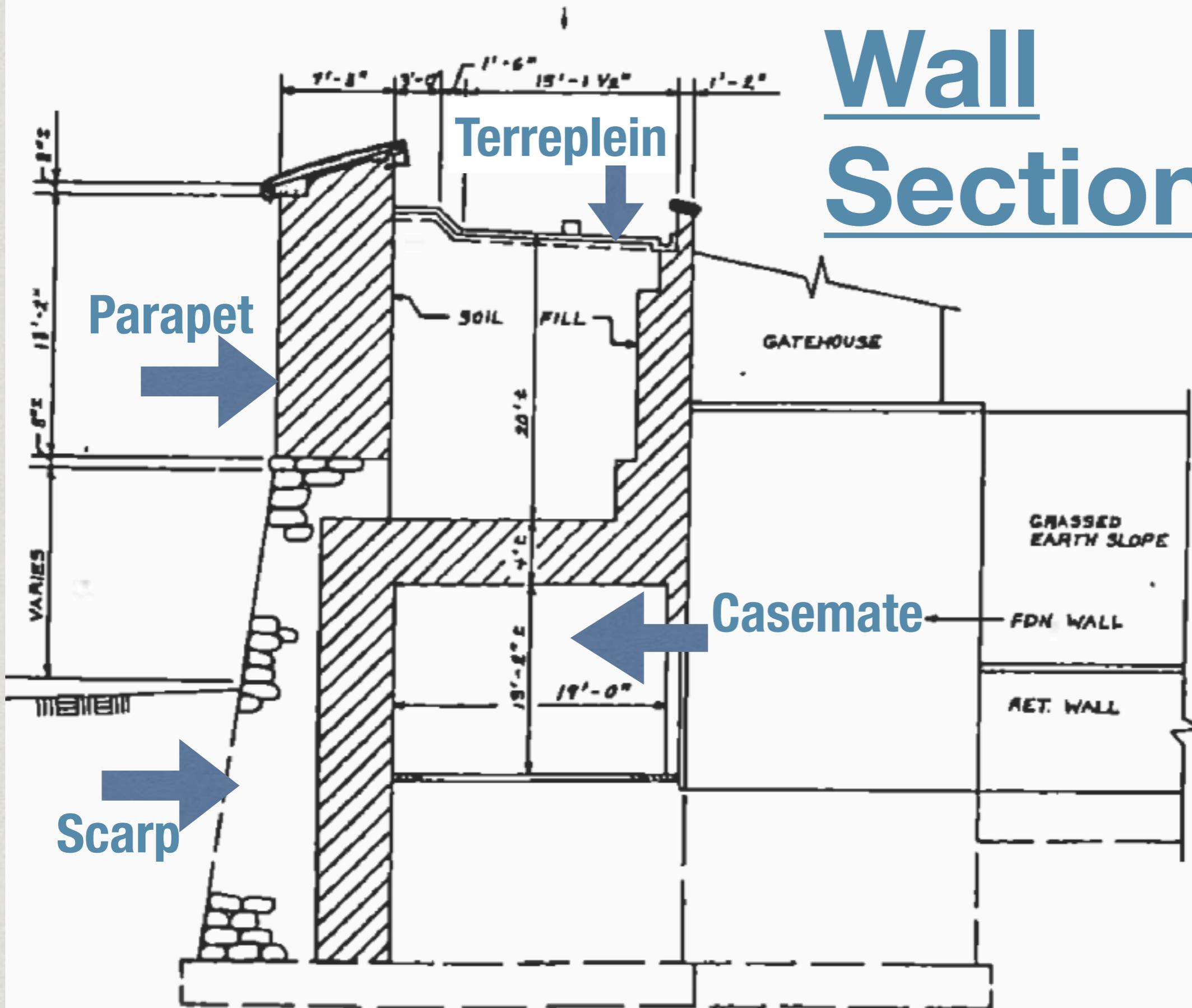
Effects of Rifled Artillery and Heavy Mortars

Fort Washington - Terminology



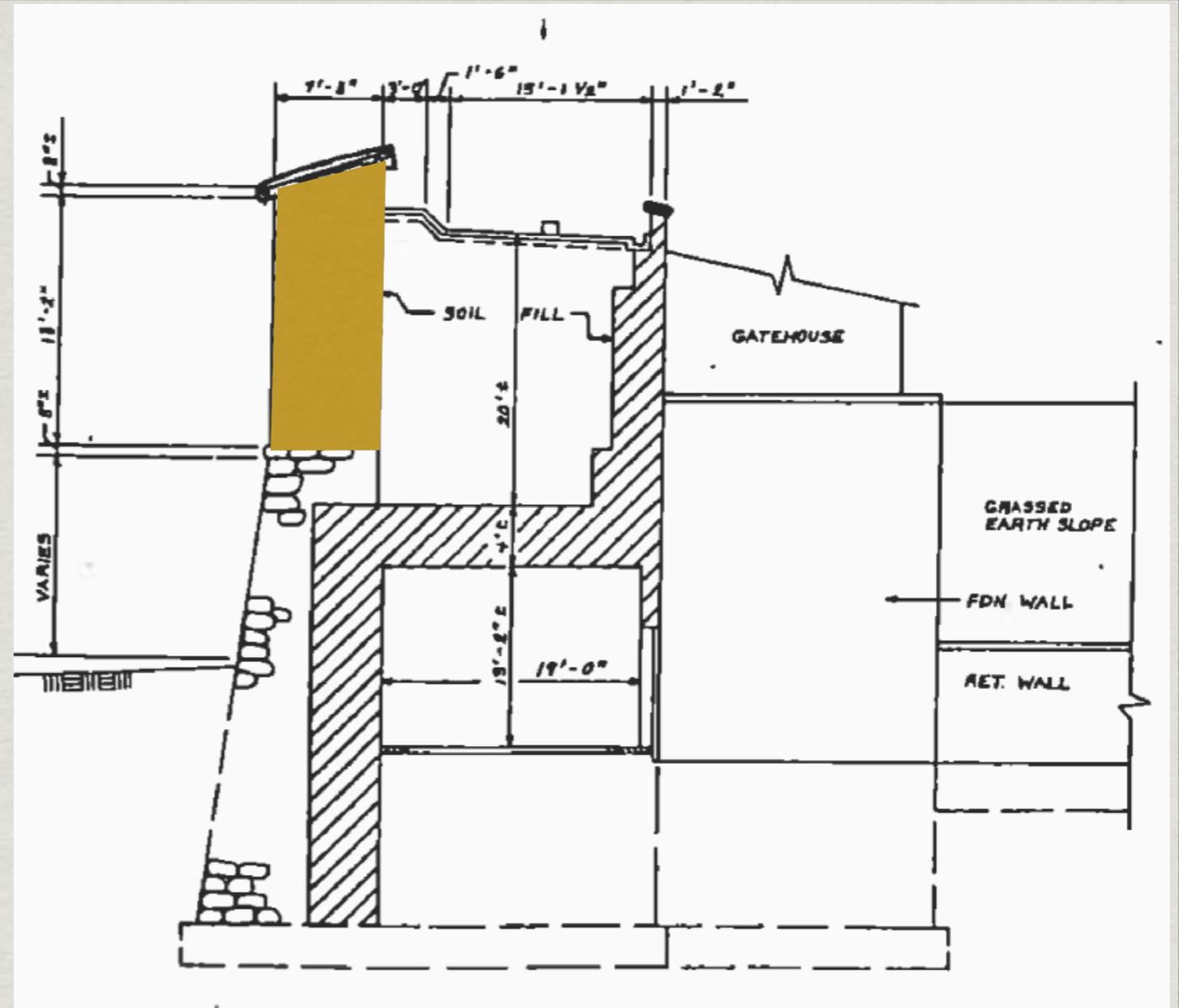


Wall Section



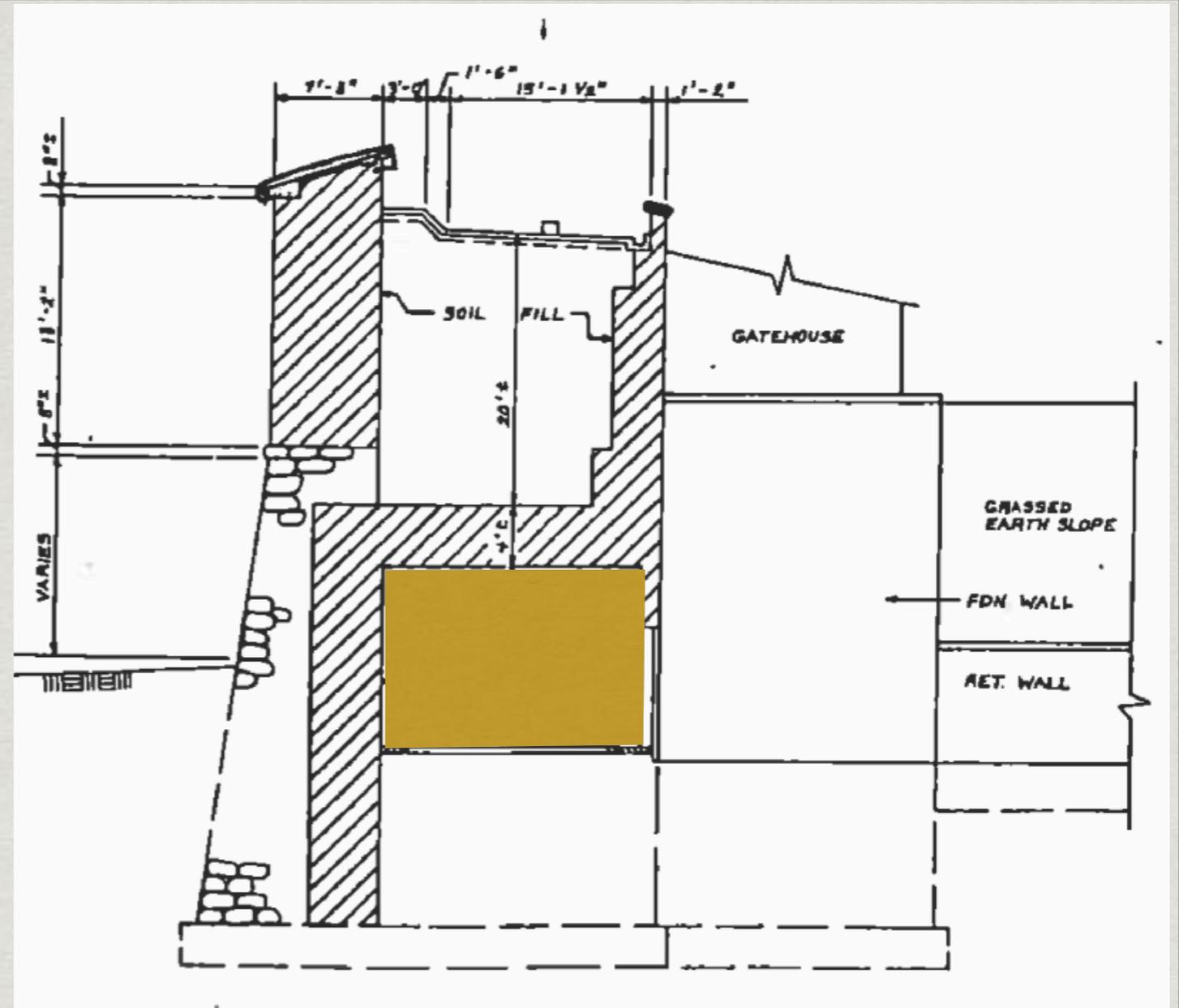
Parapets

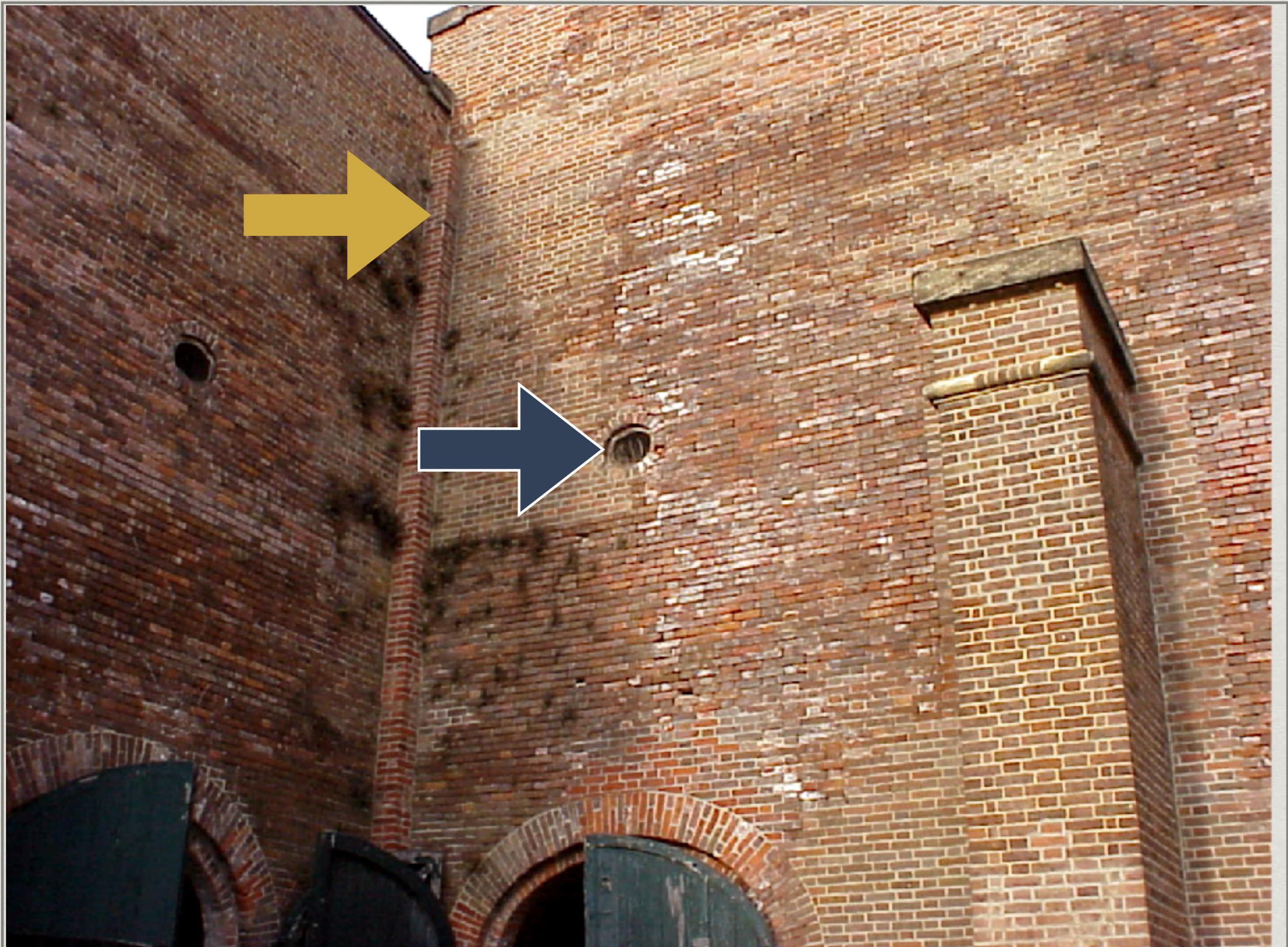
- 7'-6" thick
- Flemish Bond
- Vertical
- Outward sloped top
- Stone edges



Casemates

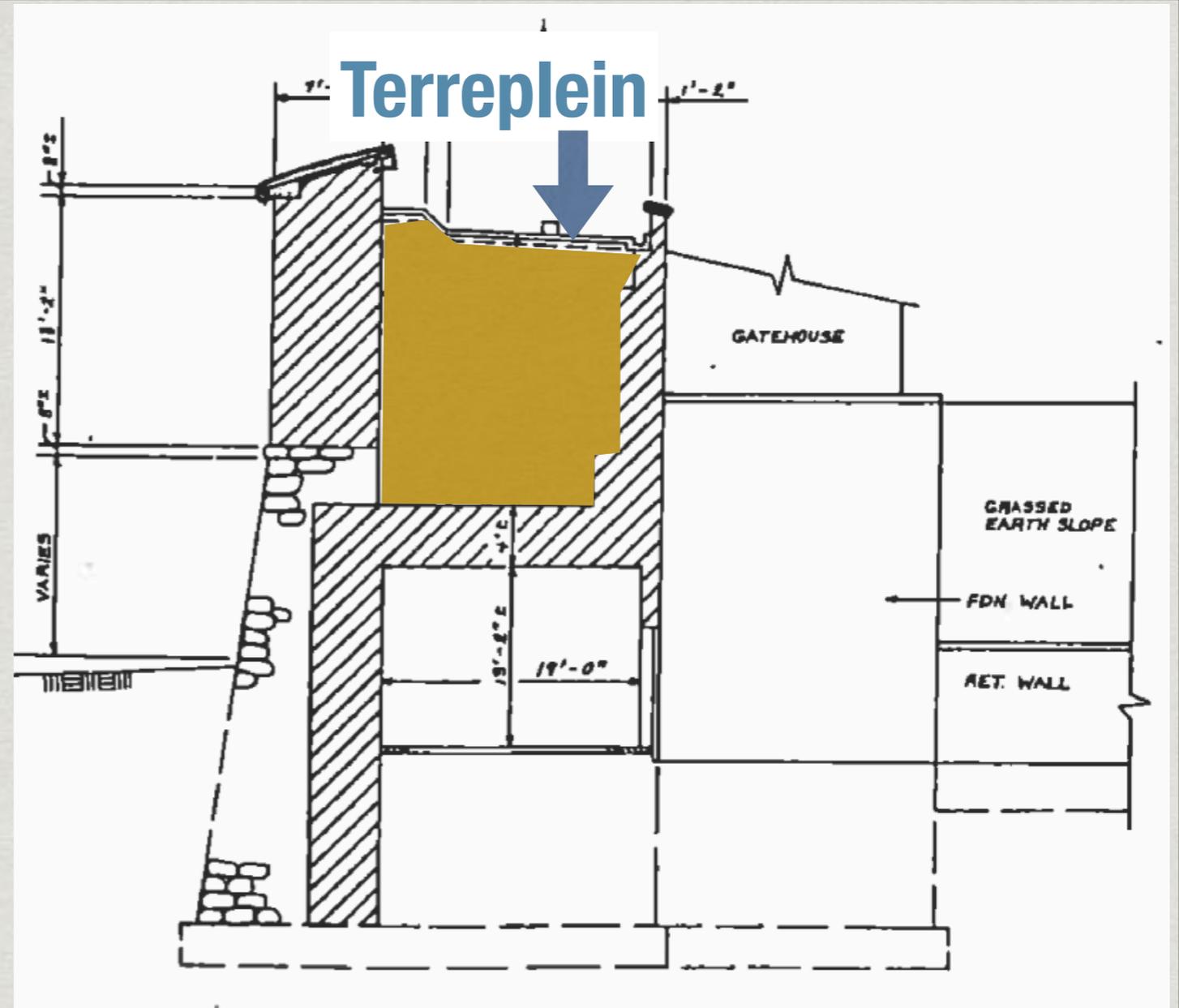
- Have Gun ports
- Constructed of Brick on stone foundations
- 15 feet x 22 feet plan
- Brick Vaults radius of 7'-6" rise, 4 ft thick
- Brick work running bond





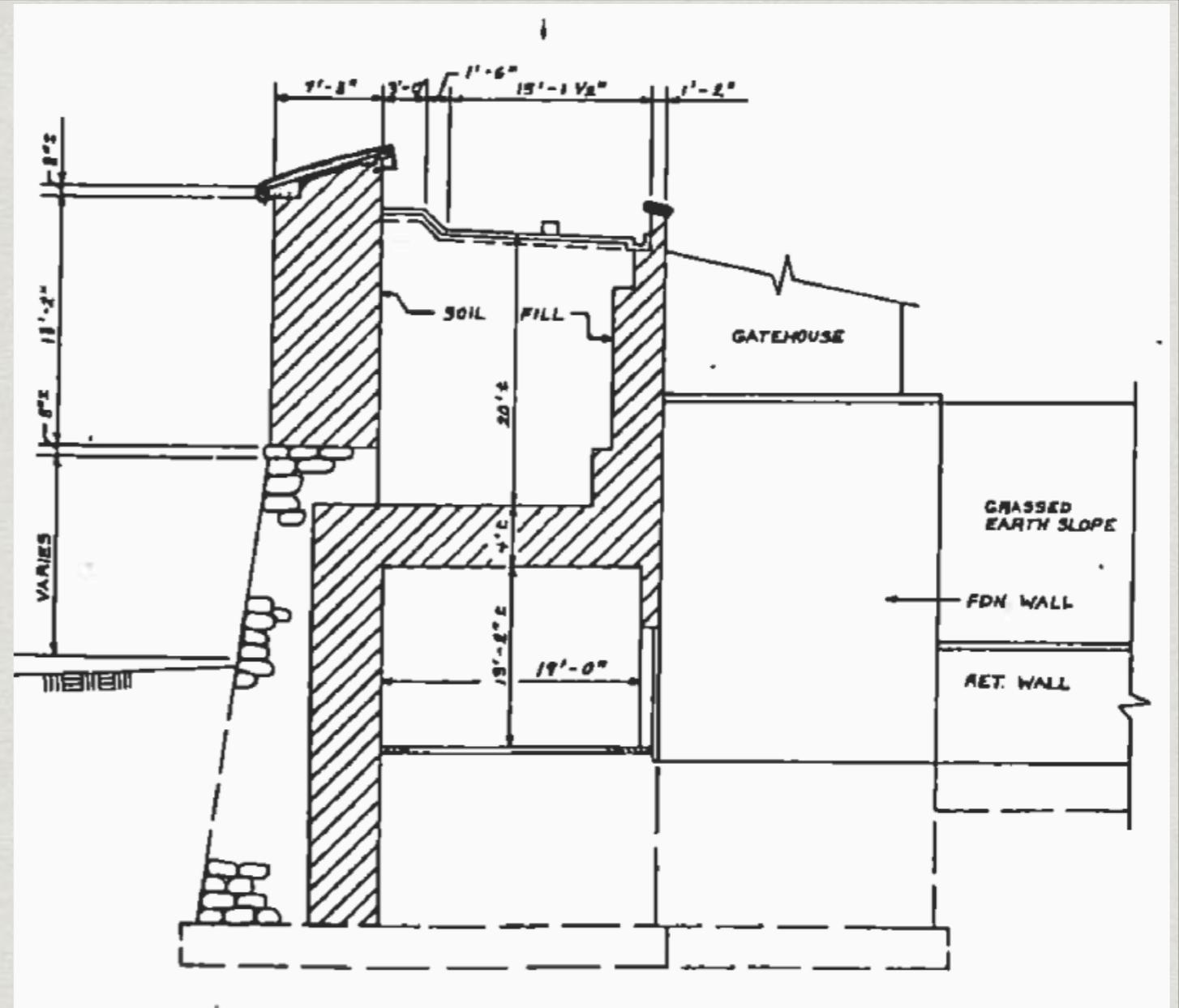
Terreplein

- Upper Gun placements
- Earth fill on casemate brick vaults
- Sloped to drain to brick gutters along interior revetment walls, then to brick downspouts (1846)



Mortar

- Assumed to be the same for stone and brick
- Lime mortar for bedding
- Hydraulic Cement for pointing



AMBRIC TESTING AND ENGINEERING ASSOCIATES OF VA., INC.

RLC 12/19/77

REGISTERED ENGINEERS
• INSPECTORS •



TESTING LABORATOR
• CHEMISTS •

8950 LITTLE FALLS ROAD
ARLINGTON, VIRGINIA 22213
703-554-4048

In all probability the cement is natural cement

Respectful

F. W.

fact no
3000-7-905

Report No. V-644

2 December

Roubin & Janeiro, Inc.
2820 Old Lee Highway
Fairfax, Va., 22030

RE
SU
ACT

Re: Fort Washington, Maryland

Gentlemen:

We report our analysis of mortar samples from the reference project.
Samples numbered as follows:

Sample No.	Location
1	Right face S.E. bast stone pointing
2	Reverse fire case brick pointing
3	Reverse fire case stone pointing
4	Right face S.E. bast brick setting
5	Right face S.E. bast brick pointing
6	Reverse face brick roof vault

CHEMICAL ANALYSIS

Sample Nos.	1	2	3	4	5	6
% by weight						
Sand	57.54	41.87	70.37	84.93	58.9	2.29
Cement	24.05	32.46	10.30	3.59	22.0	2.14
Line	18.41	25.69	19.33	11.48	19.1	16.57
% by volume						
Sand	49.71	34.30	59.54	76.45	53.0	55.90
Cement	18.47	23.64	7.75	2.87	10.01	1.64
Line	31.81	42.06	32.71	20.68	36.25	28.49

SIEVE ANALYSIS

Sieve Size	% Passing		% Passing		% Passing	
4	100	100	100	100	100	100
8	63.9	70.0	68.5	79.0	79.0	89.7
16	48.8	45.6	77.8	59.9	59.9	76.2
30	35.3	29.0	58.8	37.7	37.7	56.5
50	13.7	13.1	15.0	11.9	11.9	12.9
100	4.7	3.0	4.2	2.5	2.5	2.1
200	1.8	2.1	2.0	0.7	0.7	1.4

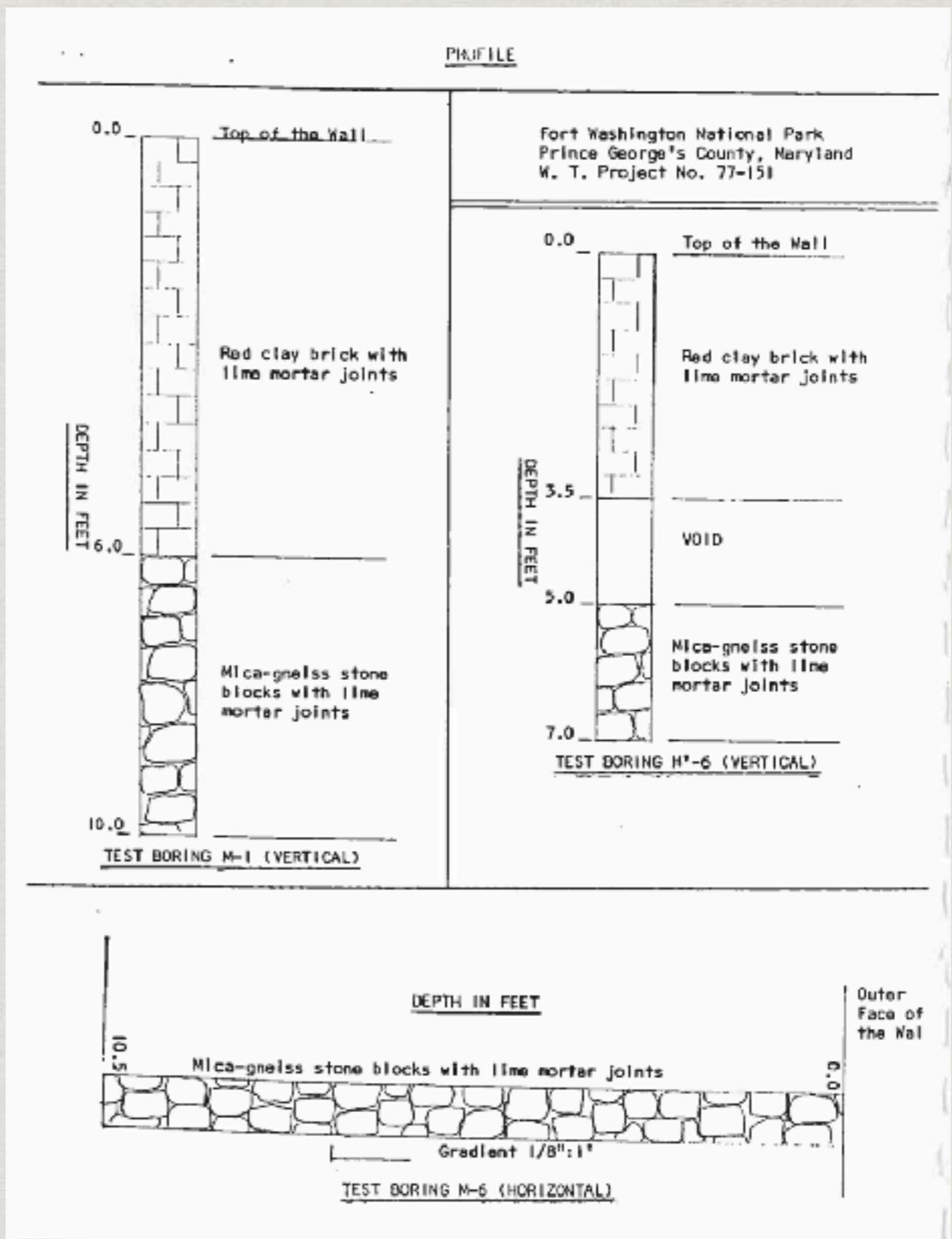
In all probability the cement is natural cement

Respectfully submitted,

F. W. Williams

F. W. Williams, P. E.

Wall Construction Verified by Cores



Causes of Masonry Deterioration

- * Moisture Intrusion
- * Leaching of lime mortar
- * Freeze Thaw
- * Vegetation

1976-1982 Historic Structures Report

- **Bulges in the brick noted Northwest Demi-Bastion**
- **Believed primarily due to Freeze-Thaw**
- **Repairs made to the brickwork on top of the parapet**
- **Recommended repairs included removal of vegetation, pointing, and grouting**



2/8:6/76

SUPERIOR SLOPE OF THE PARAPET.
Curtain. Brickwork repair in progress.

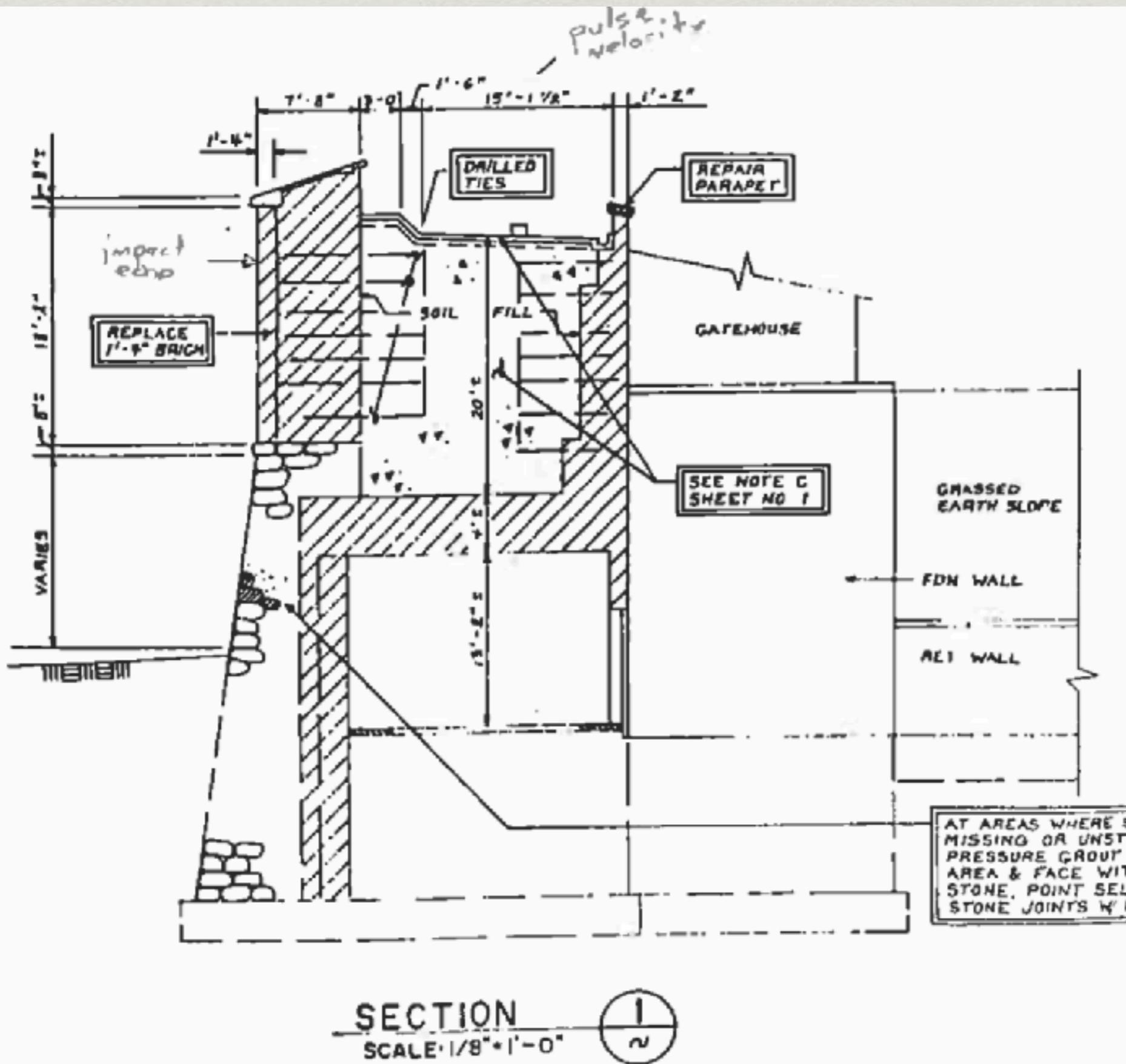
1985 Report



Close up of area of vegetation, the light colored brick & brick below were removed, entire brick structure behind has no sound mortar, only sand with hair remains of original mortar.



1985 Report

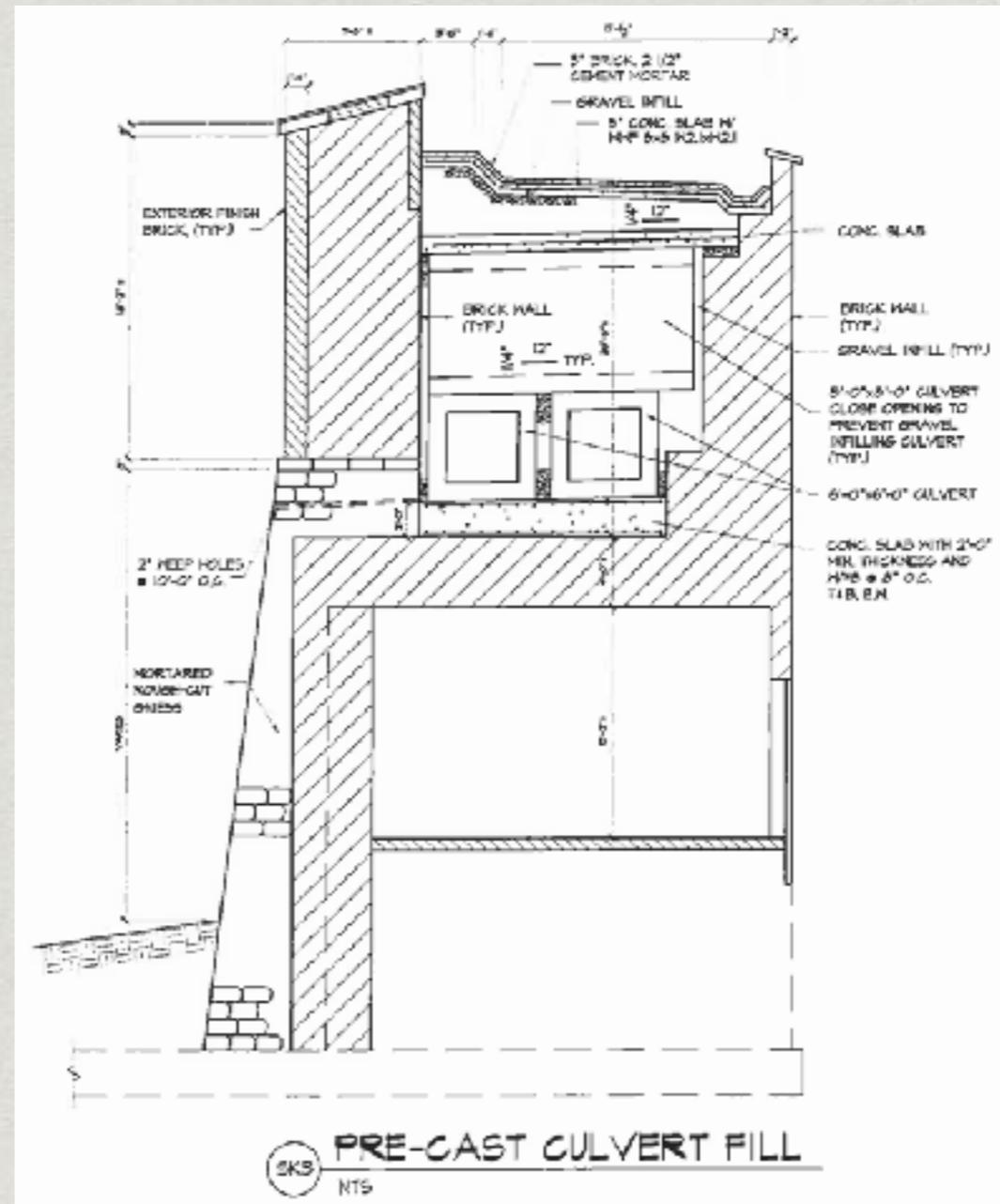
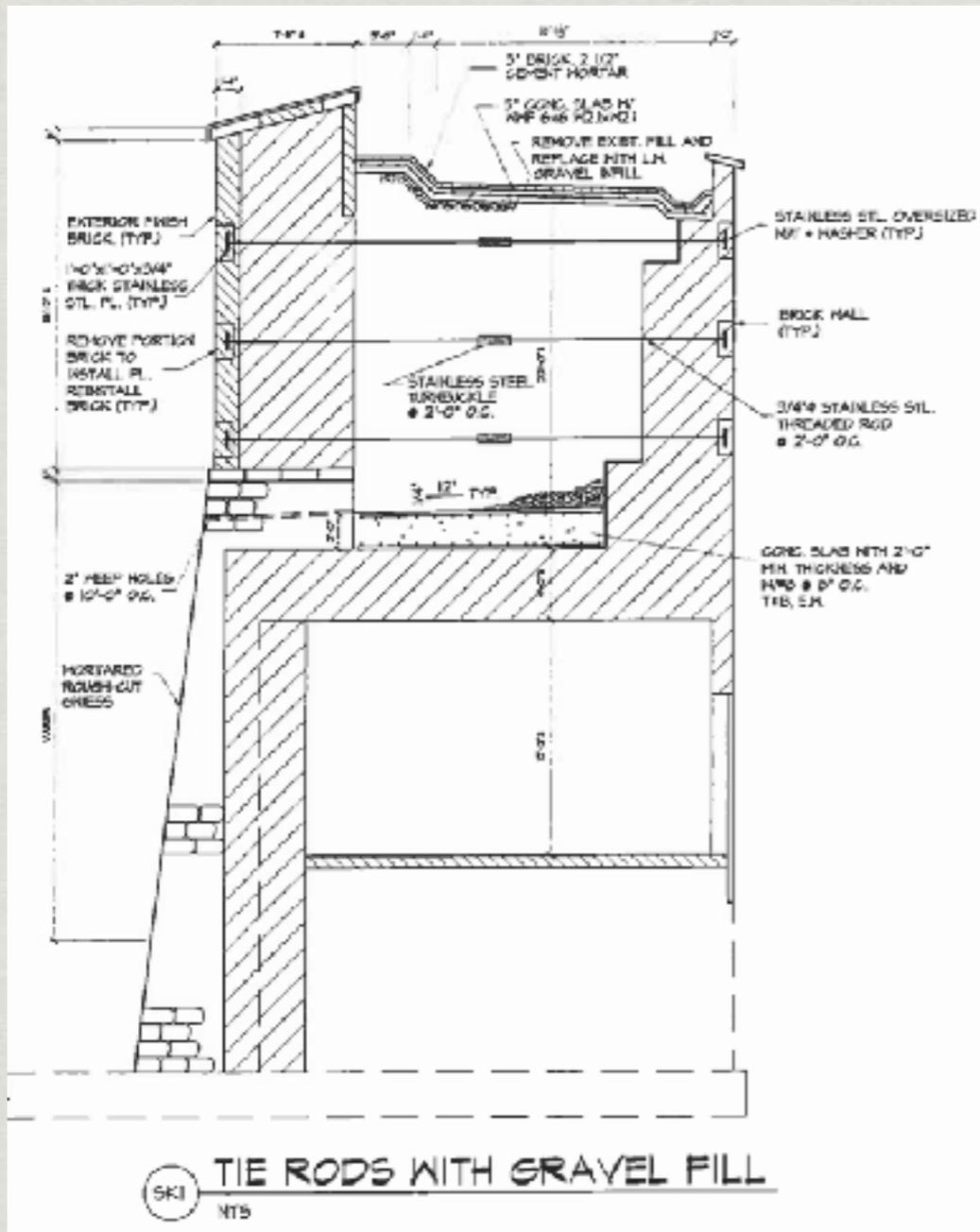


1999

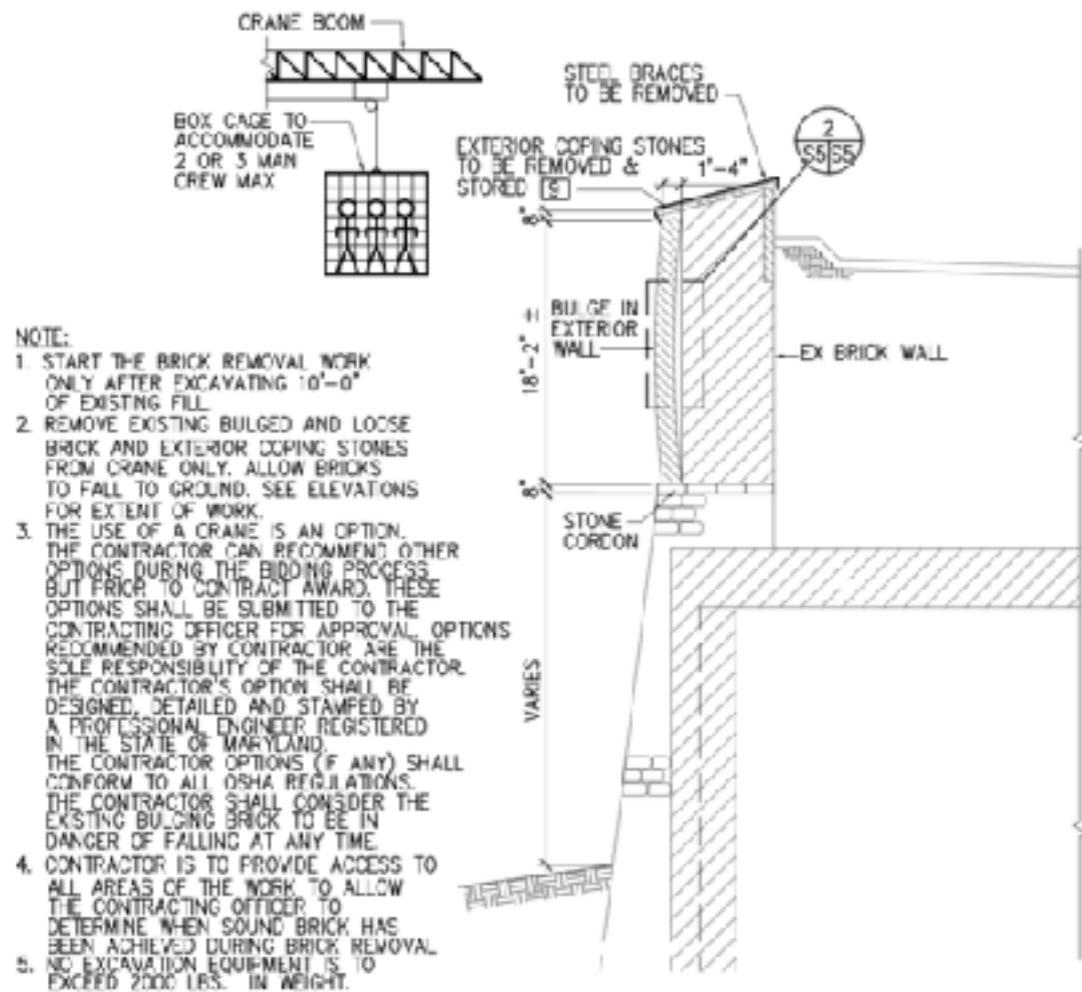




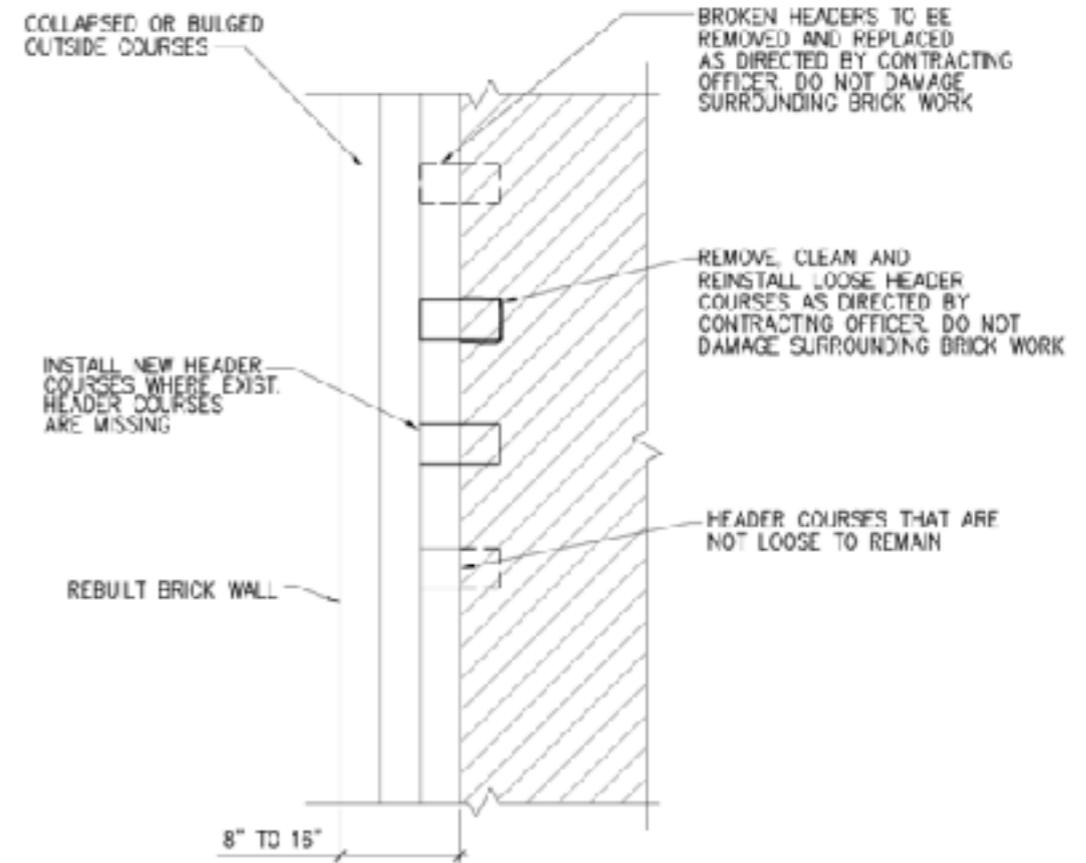
1999 Stabilization Options



2001



1 EXTERIOR BRICK DEMOLITION PROCEDURE
SCALE: 1/8"=1'-0"



2 BRICK HEADER REPAIR DETAIL
SCALE: N.T.S.

Conditions today











Thanks for Participating!

