

THESE

Foundations

Civil engineering

Structural engineering



NEW UNITED STATES COURT HOUSE
NEW YORK, NEW YORK

DATA COVERING THE FINE FOUNDATION WORK
(NEW) UNITED STATES COURT HOUSE
NEW YORK, NEW YORK

Thesis for the degree of C. E.

Nels Hansen

1936

THESIS

TABLE OF CONTENTS

INTRODUCTION

	PAGE
Purpose of Presenting the Thesis.....	1-2
Location of (NEW) UNITED STATES COURT HOUSE....	2
Architect.....	2-3
Plans.....	3
Specifications.....	4
Description of Site.....	4-5

DRIVING OF FIRST FEW CONTRACT FILES

Driving and Inspection of the Files.....	6-7
Load Tests on some of the Files.....	8

TEST FILES

Types of Test Files.....	10-11
Test File Data.....	11-12-13
Change in Contract.....	14

RESULTS OF THE PILE DRIVING

Preparations for the Pile Driving.....	15-16
Pile Driving.....	16-17-18
Pier 238.....	18-19-20
Piers 212-213.....	21
Results of the Pile Driving.....	21-22-23

CONCLUSION

24-25-26

List Covering the Data on Test Files, refers to pages T-1 to T-15 inclusive.....	27-28
List of Photographs taken during the progress of the Foundation Work.....	29

TABLE OF CONTENTS

	PAGE
Table of Bearing Values of Piles for Different Penetrations.....	T
Load Tests of Piles.....	T-1-2-14-15
Penetration Logs of Test Files....	T-3 to T-12
Average Lengths of the Different Types of Test Files.....	T-13
File Records of some Piers.....	P-1 to P-10
Penetration Logs of Piles in some Piers...	P-11 to P-14
Average lengths of piles in some Piers.....	P-15
Results of Load Tests on Piles.....	P-16
Specifications.....	S-1, S-2, S-3

APPENDIX

- Sk-1, Detail of Pipe Pile and Precast Concrete Pile
- Sk-2, Detail of Standard Raymond Concrete Pile and Step-Tapered Raymond Concrete Pile
- Sk-3, Plan of Pier 238, Shows Pile No., order driven, and length of piles.
- Sk-4, Part Plan of Piers 212-213, Shows location of Short Piles, Results of Soil Borings and a schedule showing the lengths of piles
- Sk-5, Graph, Showing penetration of various Types of Piles
- Drwg. No. X-2, Sketch Showing Plan and Sections of Test Borings
- Drwg. No. 400, Foundation Plan, United States Court House

INTRODUCTION

The object in writing this thesis is to describe the type of foundation, the difficulties that were encountered in the driving of steel tube piles (cast-in-place); and to present complete data on test piles in connection with the foundation work of the (New) United States Court House, New York City.

It is not my intention to present any rules or formulas to be used as a guide for similar foundation work. My purpose is to describe the progress of the pile driving operations, the changes that were made necessary due to soil conditions, and to treat this thesis along the following lines:

1. Driving of the first few contract piles indicated that the design of piles as specified was not adapted to the soil conditions of the site.
2. The driving of various types of test piles to test the nature of the soil and to determine the type of pile to use.
3. Complete records of the results of driving test piles.
4. Change in the contract based on the results of the test piles.
5. Special conditions that were encountered in the driving of piles.
6. Final results of the pile driving in various locations on the site.
7. Conclusions regarding the data covering the pile foundations.

I was assigned by the United States Treasury Department, Washington, D. C. as Construction Engineer to supervise the work of the Foundation Contract for the (New) United States Court House, New York City.

The data covering the various types of test piles, load tests, and records of the pile driving operations of the foundations for the (New) Court House, provided such and interesting record of the events of the pile foundation work that I have arranged the data in the form of this thesis.

In 1931 Congress authorized the Secretary of the United States Treasury Department to construct certain Public Buildings in various states and the Treasury Department set a limited cost of \$8,250,000 for the (New) United States Court House, New York City, as one of the buildings.

The present United States Court House which is located near the historic City Hall, Borough of Manhattan, in New York City, was built shortly after the Civil War. It has become obsolete and does not meet present day requirements. The (New) United States Court House is located at Foley Square and Pearl Street, a short distance from the City Hall.

Cass Gilbert, was the architect for the (New) Court House and by contract with the Treasury Department was authorized to prepare all drawings and specifications for the foundations and the super-structure. The building was designed as shown by the frontispiece of this thesis. The tower section of the building is thirty-seven stories high, and the lower section six stories high above street level. The building has

a steel skeleton framework, and is faced with granite.

The architect anticipated that there would be difficulties in connection with the foundation work for the New Court House because in the early days of New York, part of Collect Pond extended over a portion of the north western part of the site, and the surrounding area consisted of marshy ground of uncertain conditions; however as the city grew this area became made ground and all signs of the pond and marsh disappeared, and buildings and streets were built on this area at one time or another.

Drawing X-2 shows in detail the nature of the soil for various depths at different locations of the site. Some test borings were taken to a depth of 200 ft below grade level, and no rock was encountered at that depth. The soil consisted of sand and gravel stratas of various densities.

The Foundation Plan Drawing No. 400 shows the spacing of the piles, the size of the footings, and reinforcing bars. The typical footing detail shows the pile cut off, the concrete pile cap and location of the reinforcing bars.

The tower section of the building is supported by foundations that cover the full area of the base of the tower and consist of piles 3 ft on centers (about 2000 of them) which are covered by reinforced concrete mats.

The six story part of the building is supported by isolated footings that consist of pile clusters which are covered by concrete pile caps.

In general the ground water level was about 2 to 4 ft

below pile cut offs. At the elevator pits the pile cut offs were 4 to 5 ft below water level. These areas were sheet piled in order to permit work below ground water level. Pumps were used to keep the water level below pile cut offs at the elevator pits during the construction work.

Pages S-1, S-2 and S-3 cover the specifications for the Cement, the Aggregates and the Mixtures, the Concrete Pile Foundations, and describe in detail full requirements of the above materials and of the piles.

All piles were specified to be cast-in-place steel tube piles of 12 in. inside diameter, of not less than 3/8 in. wall thickness, and each pile was to have a tight fitting steel shoe or point. The estimated average length for all the piles was to be 30 ft from tip to cut-off.

This type of pile was considered satisfactory to safely support the load within this length of pile..

Lump sum bids were required for the excavation and foundation work, and the contract was let to the lowest bidder, George J. Atwell Foundation Corporation of New York City.

The architect estimated that the excavation and foundation work would cost about \$1,000,000. At the completion of this work the cost was approximately \$800,000.

The old buildings on the site were removed to general grade level, and photograph No. 2 is a view of the site at the time the foundation contract was let. Grade level did not indicate in any way the extent of old foundations. An interesting part of the work in connection with the foundation contract

was the removal of these obstructions which consisted of heavy concrete walls, steel girders, grillage beams, and wood piles. Air drills, dynamite, and pile pullers were used to remove this material. Photographs No. 10-26-35-37-38-40 show the obstructions.

These obstructions were removed by George J. Atwell Foundation Corporation. This work which became part of their contract was done on a cost plus basis as an estimate of the cost was impossible because these obstructions were uncovered only as the excavation work progressed.

Excavating was started along the northern portion of the site and carried down to pile cut-off level. The piers 93 and 94 were staked out to show the location of the piles and preparations were made to drive piles to test the soil at this location.

DRIVING OF THE FIRST FEW CONTRACT PILES

The specifications required the piles to be steel tubes of not less than 12 in. inside diameter and of 3/8 in. wall thickness with cast steel shoe fitting the tube so tight that no water could enter it. Piles twenty to forty feet long were to have no more than one splice or sleeve. The estimate for the average length of all piles was 30 ft long from tip to cut off. There was a total of 4180 piles.

The piles were to be driven to a final penetration that would safely support 36 tons, which was equal to a penetration of 5/16 in. per blow or (9 blows per 3 in. penetration), (38 blows per ft penetration).

On page S-1 is stated the formula to determine the bearing values of piles. On page T is a table of various bearing values for piles based on the penetration per blow, also for the number of blows per in., per 3 inches, and per ft penetration of the pile. These bearing values have been derived from the formula for various penetrations.

The first pile driving was started in piers 93 and 94 using pipe tube lengths of 30 ft. A steel shoe was placed on a 30 ft section of tube and driven into the soil to cut-off. The soil offered very little resistance to this 30 ft pile section therefore an additional 30 ft tube was added to this pile and driven to cut-off making 60 ft of pile in the ground. Even at this depth the soil did not have enough bearing value to support a 36 ton load according to the formula.

Additional piles were driven to a depth of 60 ft intend-

ing to compress the soil and in that way obtain the required bearing value, but the soil did not compress to the extent of having a safe bearing value, therefore it was not considered advisable to drive any piles to less than the safe bearing load of 36 tons.

The remainder of the piles in these two piers were driven to the required bearing value and the lengths of these piles varied between 65 to 94 ft. These piles exceeded the estimated average length of 30 ft by as much as 100 to 200 per cent.

During the driving of the piles in piers 93 and 94 it was noticed that there was no upheaval of the soil but a slight settlement between the piles.

After standing a day or so some of the piles had a head of water in them, while other piles remained perfectly dry. An inspection was made of the dry piles by using a mirror to reflect the light from the sun down into the pile. On dark and cloudy days an electric light with a shade was lowered into the pile.

This inspection showed that the various sections of the piles were out of line with the adjacent sections (referred to as kinked piles) and that the whole pile was out of plumb.

The soil had become compressed due to the driving of the piles. Therefore when additional piles were driven thru the varying densities of compressed soil the dense soil forced the bottom sections of the piles out of line and away from the adjacent piles. The splice or sleeve did not form a rigid

connection and the pile kinked at each joint or section of the pile.

Some of the piles that contained a head of water leaked so badly that it was impossible to pump the water out of the piles to inspect them. Other piles were pumped dry, inspected, and were found to be kinked and out of plumb to a greater extent than the dry piles and that the piles leaked at the sleeves.

Load tests were made to determine the bearing values of some of the piles that were not driven to the required penetration and on piles that were badly kinked and out of plumb.

Pages T-1 and T-2 show the results of the load tests on some of the piles in piers 93 and 94. Under the column of "bearing value" is the bearing value of the pile according to the blows per inch. The column "settlement under load" is the settlement under loadings of 30-60 and 100 T. The specifications allowed 1/2 in. settlement under 60 tons test load for a 36 ton bearing value.

Under "remarks" is stated the condition of each pile. The first two piles were driven by a Vulcan Hammer No. 2, which was too light in weight to use in driving the piles. All other piles were driven by a Vulcan Hammer No. 1 of 5000 pound weight.

The short pile #1 pier 93 did not show as satisfactory results under load test as the long piles even with the higher bearing value of 100 kips.

The pile driving and the load tests in piers 93 and 94 indicated a soil of loose formation with a high percentage

of voids and a high water content. The soil, to a depth of 40 to 60 ft did not have much resistance to a straight pile during the driving, but after the pile stood, it developed a frictional resistance with the soil and showed a high load test. The short pile built up a point or bulb resistance (bearing) that would dissipate as the pile stood and the soil at the point would relieve itself on account of the voids and water.

The results obtained by an inspection of the piles and the overrun in the lengths over the estimated length of 30 ft showed that the type of pile specified did not quite meet the conditions of the soil. It was decided to drive test piles to determine the type of pile to use for the foundations.

TEST PILES

Test piles were driven at various locations on the site and the following types and sizes of piles were used:

1. Pipe piles, 12"-16"-18" diameter of 3/8" wall thickness, with cast steel shoe or point.
2. Precast Concrete Piles, Tapered.
3. Standard Raymond Concrete Piles, Tapered.
4. Step Tapered Raymond Concrete Piles.

Sk-1. Detail of Pipe Pile and Precast Concrete Pile.

Sk-2. Detail of Standard Raymond Concrete Pile and Step-Tapered Raymond Concrete Pile.

Pages 13, 14. List covering the data on test piles.

The Standard Raymond Pile consisted of steel shells, (spirally reinforced) and a boot placed over a collapsible mandrel. This mandrel incased in steel shells and boot, was driven to a proper penetration. The mandrel was collapsed and withdrawn, leaving the shells and boot in the ground. The shell was inspected; if found dry and satisfactory it was filled with concrete up to pile cut-off.

The shells come in lengths of about 8 ft and of different gauges of metal and of wire spirals (see page T-6 for different gauges)

Different gauges of shells were used, depending on the nature of the soil the piles were required to penetrate. Where there was coarse sand or gravel, a gauge of shell was used that would resist the cutting action of the soil, and prevent the sand or water from entering the pile shell to the

detriment of the concreting.

The Raymond Step Tapered Pile consisted of heavy corrugated shells placed on a non-collapsible core, which was driven to a proper penetration; then the core was withdrawn and the shell filled with concrete to cut-off. This pile was made up of shell lengths of 8 ft sections with an increase of 1 in. in diameter per section of shell.

The Precast Concrete Piles were cast in 40 ft lengths, in wood forms and allowed to set for twenty-eight days before being driven.

The test piles were driven to a proper penetration, and that portion of each pile extending above the cut-off was removed. The pipe and shell piles were filled with concrete to pile cut-off.

In driving a few of the Raymond Piles, it became evident which lengths of shells to use in order to reduce the waste of shells above cut-offs. For the Precast Concrete Piles that were made up in fixed lengths, tests had to be made to determine a length of pile suited to the soil and not have unnecessary waste of pile extending above the cut-off.

Pages T-2 to T-13 are the penetration logs of the test piles that were driven at various locations of the site and are indicated on the Foundation Plan in this form. ●

Page T indicated the bearing values in pounds for various number of blows per inch, per 3 inch and per foot penetration of pile.

In the penetration log of a pile the first column indicates depth and opposite is given the number of blows

1

per foot for that depth of pile. Each foot of pile was marked off and a count was made of the number of blows for each foot of penetration.

The soil did not have much resistance to a straight pile for the first 40 to 60 feet as shown by pages T-3, T-4 for 12 in. piles.

In pier No. 47, pile No. 10 reached a safe bearing penetration at 40 ft.

In pier No. 93, pile No. 1 and 10 were the last piles driven, and are along side of one another. The 12 in. pile was driven first to a depth of 62 ft; to a safe bearing penetration. The 18 in. pile reached a safe bearing penetration at a depth of 17 ft. Pile No. 1-18 in. is referred to on page 4. In pier 238, pile No. 44 reached a safe bearing penetration at 76 ft and was driven to a depth of 103 ft. The penetration of the pile shows the various densities of the soil.

In driving the straight pipe pile, the bearing value varied as the pile penetrated the various stratas of soil. The bearing values increased or decreased with the nature of the soil and was noticeable with the 12 in. pipe piles, which tended to build up a safe bearing value below a 40 ft penetration. See pages T-3, T-4 for results.

For a straight pile, it is sometimes advisable to over drive the pile; that is, to drive the pile beyond the required bearing value in order to determine the value of the underlying stratas of soil and make sure the pile rests

on a firm bearing soil.

Some pipe piles in piers 83, 96, and 238 of the 12 and 16 in. sizes were driven to a depth of about 30 ft, to less than the required bearing value. These piles under a load test showed a settlement of several inches for the 12 in. and for the 16 in. over 1 inch. This showed a soil in which the point bearing value should not be considered for the first 30 ft. See pages T-14, T-15 for the load tests on 30 ft piles.

During the driving of the Standard Raymond Piles (tapered) and the Precast Concrete Piles (tapered) the soil was compressed along the sides of the piles. This built up a frictional resistance that provided the bearing value for the piles. In this soil the point bearing value was negligible.

The lengths of the tapered piles averaged from 20 to 22 feet for a safe bearing load. In driving a tapered pile in this soil, the bearing value builds up fast, and in over-driving, the penetration decreases very fast and the pile comes to refusal.

The penetration ranged from 30 to 34 ft for the step-tapered piles, and being of a small taper, developed into a frictional pile of a longer length than the tapered pile.

Two of the precast test piles were pulled out and photograph No. 68 shows one that came in contact with a boulder or some obstruction and was damaged. These piles were pulled out to see what effect the driving had on the piles and showed no defects except for the one broken pile.

There were certain conditions of the site to take into account in determining the type of pile to use.

The subway extends along the site at a depth of 20 feet below the cut-offs of the piles.

There is a possibility of future subway or sewer work adjacent to the site and at such a depth below street grades that a length of pile was considered that would reach a depth so as not to be disturbed by this form of construction work.

It was decided that the combination of 12 and 16 in. pipe piles would be best adapted to meet all the conditions of the site, and put the bearing down at a depth out of danger of being disturbed.

The contract was revised on an estimate that the remaining 4,108 piles would be 50% - 12 in. piles, 46 ft long, and 50% - 16 in. piles, 38 ft long.

At the completion of the pile driving there were:

3,152 - 12 in. piles, average length 46.52 ft.

956 - 16 in. piles, average length 55.25 ft.

The contract was based on a unit cost of \$2 a ft. for 12 in. piles and \$3.80 a ft. for 16 in. piles.

An adjustment was made in the contract covering the overrun of the 12 in. piles and under run of the 16 in. piles.

RESULTS OF THE PILE DRIVING

After the change in the contract, preparations were made for the pile driving operations. Stiff leg derricks were used with leads that could handle pipe lengths up to 40 and 50 ft. These standing leads rested on sills and were held in position by guy lines; the leads were easily moved after the driving of each pile. The length of the boom and the height at which the derrick was set determined the area that the leads could reach and drive piles. It became necessary to shift these derricks to new locations to drive additional piles.

Crane rigs, equipped with leads, that could be moved about under the rigs own power were also used and could handle pipe lengths up to 40 ft.

Photograph No. 93 shows the two types of rigs used.

The Warrington-Vulcan No. 1 single acting hammers were used. The weight of the ram was 5000 lbs. and had a drop of 3 feet, the speed of the hammer was 60 blows per minute. The best results in driving piles were obtained by keeping the speed of the hammers between 55 and 60 blows per minute. If the speed dropped below 50 blows per minute there was a noticeable drop in the penetration of the pile, which affects the load bearing value of the pile.

A complete record was kept of each pile driven and recorded as follows:

			Last No.						
Pier	Pile	Date	Blows	Insp.	(Pile Length)		Date	Insp.	
No.	No.	Driven	Per 3"	by	12" 16"	Concreted		by	

A convenient method of noting the penetration of a pile was to mark 3 in. spaces on the leads and a mark on the pile, then count the blows for each 3 in. of penetration as the pile was nearing the safe bearing value. This required 9 to 10 blows per 3 in. penetration for 36 ton bearing value.

Before concreting the piles were inspected to see that they were dry and in a satisfactory condition. Any water or mud that seeped into the pile was pumped out before concreting.

The points and sleeves were made to fit snug in order to remain water tight. The piles were always concreted as soon as possible, so as not to stand over night, as the water pressure would cause leaks when left without concreting in many cases. Transit mix concrete was used thereby eliminating the need of a concrete plant at the site. This method proved very satisfactory.

In the driving of the 12 and 16 in. piles, it was a question as to which pile would be best suited to use for that location. The northern portion of the site showed a deeper penetration than the eastern and southern portions. A 16 in. pile was tried out first in the isolated piers, and as long as the piles were over 40 ft in length, 16 in. piles were used. It was noticed that the first few in a pier would reach a depth of 60 to 80 ft then as additional piles were driven about 40 ft was sufficient. Then 12 in. piles were driven and the same result was obtained as additional ones were driven.

It seemed that the first few piles driven compressed the soil after reaching a good depth so that the additional ones driven in that pier could be shorter. Adjacent piles showed entirely different results in the hammer resistance (blows per 3 in.).

For the first few piles driven in a pier, the soil did not offer much resistance in the various strata. Then as more piles were driven, particularly in piers on the northern portions of the site, the soil was compressed in the top stratas of 15 to 30 ft below cut-off and it required extra hard driving to penetrate these stratas, requiring from 50 to 100 or more blows to a foot and then decreasing in some cases to 5, 6, 7 blows per 3 in. penetration.

The first group driving of piles was in pier 244 and 245. A safe bearing penetration was reached for some piles at lengths of 25 to 35 ft, then by a little over driving of these piles they would break through the strata and the penetration would be more than a safe bearing value. When all the piles had been driven in these piers, the piles that were less than 25 to 35 ft long were re-driven. In some cases the pile started off at more than the safe load penetration at the first hammer blow, while other piles required over driving to start the pile and penetrate to another strata of safe bearing value.

It seemed that for the short piles, a bulb resistance was built up and while the pile rested, this bearing value would disappear due to the voids in the soil and the water.

It was necessary to get a good depth for the first piles

driven in a pier and over drive the others to a good depth to compress the soil; so that the last piles driven rested on the compressed soil between the long piles, and the whole group acted as a unit.

A 45 degree point was used on the end of the piles and where there was hard driving, a 60 degree point was tried out on short piles and driven to refusal. Some additional depth was obtained by using a 60 degree point but not enough to warrant their use.

Pier 238

Test pile No. 44 in pier 238 was driven to a depth of 103 ft, the penetration log page T-3 and T-4 shows the blows per foot for each foot of this pile and at a depth of 76 ft reached a safe bearing value of 36 tons according to the hammer resistance.

Page 20 is a pile record of pier 238 and shows the order in which the piles were driven.

Piles in piers 244 and 232 were driven previous to the piles in piers 238 and 239.

Sk-3 is a plan of pier 238, showing the pile number, order driven and the lengths of the pile.

The driving of piles in this pier compressed the soil to the extent indicated by the lengths shown in the pile record.

Piles 33, 42, 51, 15 and 6, were over-driven to obtain the lengths as given for these piles, the remainder of the piles driven in this pier were driven between already driven piles, with the results as shown by the short piles.

After standing more than two weeks, it was decided to re-drive the piles No. 6, 8, 22, 31, 40 and 49 and to note the additional penetration. In each case it required considerable over-driving to obtain the additional penetration. The additional lengths of these piles and the penetrations were as follows:

Pier 238

Final blows per 3" before re-driving	File No.	Additional lengths	No. Blows per 3" at start of re-driving	Minimum No. blows per 3"	Maximum No. blows per 3"
125	8	12'8"	74	60	250
70	6	30'7"	14	16	250
300	40	1'3"	40	40	140
refusal	31	8'6"	16	16	200
300	22	0'9"	80	80	140
refusal	49	35'1"	30	12	72

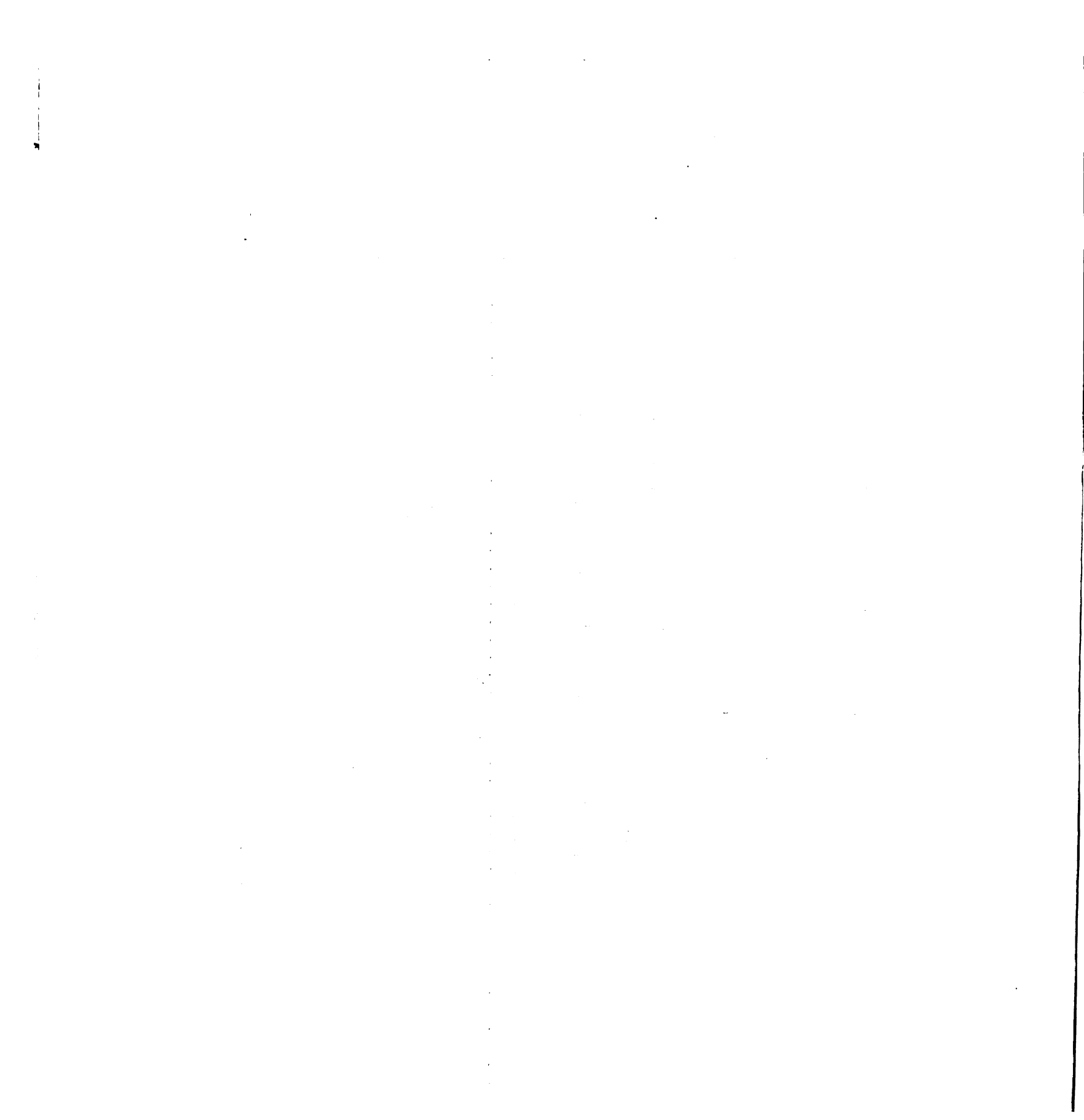
The first column indicates the final blows before re-driving and the fourth column indicates the number of blows at start of re-driving and shows that this bulb resistance is reduced as the piles stand.

According to these results the re-driving of short piles did not indicate that much was gained by the additional lengths of the short piles, if a good penetration was obtained by the first piles that were driven in a pier.

File No. 30, 12'-2" long was tested with a 60 ton load and showed a settlement of 1/8 in.

FOUNDATION WORKFILE RECORDPIER NO. 238

Order Driven	File No.	Date Driven	Last No. blows per 3"	Inspec- ted by	File length 12"	16"
		1933				
1	50	4-3	25	JTD	55'0"	
2	41	"	Refusal	"	14'11"	
3	32	"	80	"	21'3"	
4	23	4-4	16	JTD-AN	56'2"	
5	14	"	200	AN	45'7"	
6	5	"	175	"	25'1"	
7	53	"	12	"	55'10"	
8	47	"	11	JTD-AN	81'9"	
9	38	"	14	AN		41'0"
10	35	"	10	AN-JTD	101'9"	
11	29	"	22	JTD		58'7"
12	26	"	11	"	102'5"	
13	20	"	20	JTD-AN		52'9"
14	17	"	60	AN		39'9"
15	11	"	65	"	37'11"	
16	8	"	125	JTD	19'1"	
17	2	"	120	JTD-AN	13'8"	
18	52	"	35	AN	60'10"	
19	43	"	70	"	33'6"	
20	34	"	Refusal	AN-JTD	18'10"	
21	25	"	250	JTD	16'4"	
22	16	"	Refusal	"	16'8"	
23	7	"	"	"	13'5"	
24	48	"	35	JTD-AN	28'4"	
25	46	4-6	14	"	106'2"	
26	37	"	10	"	104'10"	
27	54	"	12	"	109'7"	
28	28	"	33	AN	40'11"	
29	19	"	120	"	20'6"	
30	10	"	200	AN-JTD	23'3"	
31	1	"	500	JTD	14'6"	
32	45	"	181	"	63'1"	
33	36	"	12	JTD-AN	86'10"	
34	27	"	20	AN	58'11"	
35	18	"	22	JTD	55'5"	
36	9	"	350	AN	93'7"	
37	24	"	20	AN-JTD	59'6"	
38	33	4-7	35	JTD	50'9"	
39	42	"	Refusal	"	14'6"	
40	51	4-10	"	"	11'7"	
41	15	"	21	"	57'11"	
42	6	"	70	JTD-AN	20'9"	
43	39	"	Refusal	JTD	12'4"	
44	30	"	600	"	12'2"	
45	21	"	400	"	12'8"	
46	12	"	1000	"	11'11"	(Continued on
47	3	"	Refusal	"	13'3"	sheet No. 2)



FOUNDATION WORK20
#2PILE RECORDPIER NO. 238

-2-

Order Driven	Pile No.	Date Driven	Last No. blows per 3"	Inspec- ted by	Pile length	
					12"	16"
1933						
48	49	4-10	Refusal	AN	11'10"	
49	40	"	300	"	11'7"	
50	31	"	Refusal	"	9'9"	
51	22	"	300	"	12'9"	
52	13	"	Refusal	"	10'9"	
53	4	"	"	"	13'2"	
Total footage					1943'1"	192'1"
Average length					40'	48'
1932						
44	9-28	16	HRE	106'11"	(Pile No. 44 is a test pile; footage not included in total above).	

Sk-3, Plan of Pier-238, giving the pile number, order they were driven and the lengths for the piles.

Piers 212 and 213

In piers 212 and 213 the pile driving was started at the column center, driving toward the center between the columns. The short piles shown in the schedule on print Sk-4 were the last piles driven in these piers and were driven to refusal. The long piles in the same schedule were adjacent to the short piles on each side and are shown by the part plan of these piers.

On print Sk-4 is a report of soil borings between piles (15 and 18), (16 and 17) which were made by sinking a small pipe into the soil by using a weight of 280 pounds with a hammer drop of 2 ft. It shows the blows per foot for a depth of 30 ft, the extent the soil had been compressed by the driving of the short piles, and the extent the soil had been compressed below the short piles adjacent to the longer piles.

In driving the 12 and 16 in. piles in the pile clusters, various methods were tried out to see which would provide the better penetration. The driving of piles in alternate rows first allowed these piles to obtain a good penetration and these piles compressed the soil to such an extent that in driving between the long piles, a short penetration was obtained for the last piles driven.

It was found that the best results were obtained in the pile clusters by driving the first piles under the column centers, then working towards the outside of the pile clusters.

In the tower sections of the foundation pile driving was

started under the column centers, the meeting points were half way between column centers, with the result that in each case the long piles were under the column centers and the short piles occurred at points midway between column centers. There are about 2000 piles in the tower foundations. During the driving of these piles there were no signs of any upheaval of the soil between the piles or any indications at the surface showing a displacement. This indicated the soil contained a high percentage of voids and had a high water content.

The driving of piles in piers of the northern portion of the site showed various stratas of soil of varying densities. The soil was easily compressed and resulted in a wide range of pile lengths in the same pier; particularly the isolated pier 90, and piers where there were many piles in a group.

The soil of the eastern and southern portion of the site was of a uniform density. The piles in penetrating this soil reached the required bearing value gradually. The lengths did not vary greatly from the average length for a pier.

Page P-15 shows the average lengths for the 12 in. and 16 in. diameter pipe piles in piers at various locations on the site.

Page P-16 is a record of load tests on piles picked at random to be tested, as required by the specifications (paragraph 109). A platform was made to fit the top of the pile and cast iron weights about 12" x 12" x 4' weighing 2000 lbs. each were used.

The following is a list of some piers and a complete pile record of the piles in these piers.

<u>Page</u>	<u>Piers</u>	<u>Page</u>	<u>Piers</u>
P-1	19	P-6	88
P-2	40	P-7	90
P-3	41	P-8	100A-100B
P-4	60	P-9	117
P-5	85	P-10	124

The following is a list of piles of which a penetration log was taken and the first pile driven in that pier.

<u>Page</u>	<u>Pier No.</u>	<u>Pile No.</u>
P-11-12	19	7
P-11-12	41	10
P-11-12	60	11
P-11-12	88	11
P-11-12	100B	2
P-13-14	117	15
P-13	124	5
P-13-14	200	43
P-13-14	220	32
P-13-14	224	33

CONCLUSION

By the driving of piles in piers 93 and 94 the soil was easily displaced therefore the piles reached a depth of 65 to 94 ft for a safe bearing value. The soil consisted of sand in a loose formation, saturated with water. On account of the voids and water the sand was in suspension and easily displaced.

While the straight pile was being driven and in motion it was possible to penetrate the soil to a considerable depth, then as the pile stood the sand and water settled around the pile, thereby developing additional bearing value above the value indicated by the hammer resistance.

The piles supporting the tower section are 3 ft on centers (2000 of them) covering an area of 130 by 130 ft. The soil displaced by the driving of the piles was absorbed and compressed between the piles without showing any displacement of the soil at the surface. This condition of the soil indicated the large amount of voids and water contained therein.

The soil in general offered little resistance to the first piles driven in a cluster or group for a depth of 30 to 40 ft, beyond this depth the soil varied at different locations of the site. SK-5 Graph showing penetration of piles and (pages P-11 and P-13), penetration logs of piles show this condition with reference to the straight piles.

Loads tests on straight piles driven to a depth of 30 ft showed a settlement under the required test loads.

Straight piles driven to less than the required bearing

value, and to a depth of 60 ft showed under the test load a safe bearing value.

The tapered piles had a small penetration in this soil. The piles built up a bearing value along the sides of the piles referred to as skin friction bearing. The piles developed the required bearing value in the first 20 to 25 ft of soil.

The nature of the soil and the possibility of future subway or sewer construction work adjacent to the site made it necessary to consider a foundation that would not be affected by adjoining excavation or construction work. It was considered that the combination of the 12 and 16 inch pipe piles were best suited to meet the conditions affecting the site.

The 12 in. and 16 in. piles penetrated the soil and placed the bearing of the pile foundation at a safe depth below anticipated construction work adjacent to the site.

Pipe lengths of 30 to 50 ft long reduced the number of splices and also eliminated kinked piles.

Pages P-1 to P-10 inclusive provide a complete record of the 12 and 16 inch piles in some of the piers at different locations of the site. These piers indicate the average conditions of the piles for the piers in these locations.

Page P-15 shows the average lengths of the piles in some

of the piers at various locations of the site. The lengths of these piles indicate the average lengths for the piers in these locations.

The piles in the isolated piers were capped by concrete (reinforced) to distribute the column load over the full area of the pile cluster. The concrete caps are shown on photographs No. 87, 91 and 95.

Drawing No. 400 Foundation Plan shows part of the tower section supported by three concrete mats. The outside mats contain two plate girders. The concrete mats are 9 ft thick reinforced with steel bars top and bottom so as to distribute the column loads over the pile foundation. Photographs No. 99 and 104 show the top reinforcing steel of the mats.

At the completion of the foundation work it was considered that the combination of the 12 and 16 inch pipe piles met all the conditions of the site and penetrated the soil to a safe depth that provided a safe foundation for the structure designed for the site.

LIST COVERING THE DATA ON TEST FILES

Page T.

Table of bearing values in pounds for piles and formulae noted on same page.

Page T-1, T-2.

Piers 93, 94: Load tests of some piles in piers 93 and 94, that were not driven to a safe bearing of 72000 lbs. and were badly kinked. Tested under 30 - 60 - 100 ton load.

Page T-3, T-4.

Piers 47, 93, 96 and 236:

Record of 1 - 18", 5 - 12" dia. pipe piles.

2 piles were driven to a depth of 31' and to less than the safe bearing of 72000#. See load test page T-15.

Page T-5.

Pier 245: Record of 12" - 16" - 18" dia. pipe piles.

Page T-6.

Pier 83: Record of 2 - 16" dia. pipe piles.

One 16" pile driven to 30' and to less than a safe bearing value. See load test, page T-14.

Record of a Standard Raymond File.

Table of gauges for shells and wire for different Standard Raymond File shells.

Page T-7.

Piers 208, 214:

Record of 1 - pre-cast concrete pile.

Record of 1 - 16" dia. pipe pile.

Record of 2 - Standard Raymond Files.

Page T-8.

Pier 249:

Record of 2 - Standard Raymond Files.

Record of 1 - pre-cast concrete pile.

Record of 2 - 16" and 1 - 18" dia. pipe pile.

One 16" pile driven to less than a safe bearing value. See load test, page T-14.

Page T-9.

Piers 225, 231:

Record of 3 - Standard Raymond Files.

Record of 2 - pre-cast concrete piles.

Record of 1 - 16" and 1 - 18" dia. pipe pile.

Notes covering some of the conditions of these piles.

Page T-10.

Pier 225:

Record of 2 - Standard Raymond Files.

Notes regarding piles and conditions.

LIST COVERING THE DATA ON TEST FILES

-2-

Page T-11.

Fiers 224, 230:

Record of 1 - Step-tapered, Raymond File.

Record of 12" - 18" dia. pipe pile.

Page T-12.

Fier 87:

Record of 12" - 16" - 18" dia. pipe piles.

Record of 3 - Step-tapered, Raymond Files.

Page T-13.

Average length for the different test piles

driven, 6 - 12", 6 - 16", 6 - 18" dia. pipe piles.

4 - pre-cast concrete piles.

10 - Standard Raymond Files.

4 - Step-tapered, Raymond Files.

Page T-14.

Fiers 83, 208, 249:

Load tests on 2 - Standard Raymond Files.

Load tests on 2 - pre-cast concrete piles.

Load tests on 3 - 16" dia. pipe piles.

2 - 16" pipe piles were driven to less than
safe bearing value.

Page T-15.

Fiers 96, 230, 238, 245:

Load test on 1 - Step-tapered, Raymond File.

Load test on 2 - 12" dia. pipe piles.

Load test on 1 - 16" dia. pipe pile.

2 - 12" pipe piles were driven to less than
safe bearing value.

PHOTOGRAPHS TAKEN DURING THE PROGRESS
OF THE FOUNDATION WORK

- #2 View taken at start of foundation contract.
- #10 View showing steel girders resting on grillage beams, encased in concrete.
- #38 Later view taken at #10, showing wood piles that supported grillage beams; Northwestern portion of site.
- #26-35-37-40 View of Eastern portion of site, showing heavy concrete vaults, heavy foundations, and grillage beams that were removed.
- #68 Concrete Test Piles that were pulled out after being driven.
- #70 View taken at the time the contract was being revised to use 12" and 16" piles.
- #74 View showing pile driving operations, two stiff leg derricks with standing leads and three crane rigs with attached leads.
- #87 View shows the top of piles covered with steel points until ready to be concreted; also shows concrete pier caps.
- #91 View shows piles concreted and concrete pier caps.
- #93 View shows a crane rig and a derrick with standing lead in fore ground.
- #95 View of the piles in the tower mat section.
- #99-104 View showing the reinforcing bars in the tower mat section. There are reinforcing bars in the top and bottom of the 9'0" deep concrete mat sections. Transit mix concrete and batch mix was used for the footings.
- #105 View was taken at the completion of the foundation contract.

Note- #17 and #84 are views taken during the super-structure contract.

$$P = \frac{2WH}{S + 0.1}$$

W = 5000#)
H = 3 ft.) Vulcan Hammer #1

S = Penetration in inches per blow

P = Bearing in pounds

Penetration Per blow		Number of blows			Bearing in Pounds
		Per inch	Per 3 inches	Per foot	
1"	1.0"	1	3.0	12	27,000
$\frac{7}{8}$ "	.875"	1.14	3.4	14	31,000
$\frac{3}{4}$ "	.750"	1.33	4.0	16	35,000
$\frac{5}{8}$ "	.625"	1.6	4.8	19	41,000
$\frac{9}{16}$ "	.562"	1.78	5.3	21	45,000
$\frac{17}{32}$ "	.531"	1.88	5.6	23	48,000
$\frac{1}{2}$ "	.500"	2.0	6.0	24	50,000
$\frac{15}{32}$ "	.468"	2.14	6.4	26	53,000
$\frac{7}{16}$ "	.437"	2.3	6.9	28	56,000
$\frac{13}{32}$ "	.406"	2.46	7.4	30	59,000
$\frac{3}{8}$ "	.375"	2.67	8.0	32	63,000
$\frac{11}{32}$ "	.343"	2.92	8.8	35	68,000
$\frac{5}{16}$ "	.312"	3.2	9.6	38	73,000
$\frac{9}{32}$ "	.281"	3.56	10.7	43	79,000
$\frac{1}{4}$ "	.250"	4.0	12.0	48	86,000
$\frac{7}{32}$ "	.218"	4.6	14.0	55	94,000
$\frac{3}{16}$ "	.187"	5.35	16.0	64	105,000
$\frac{5}{32}$ "	.156"	6.42	19.0	77	117,000
$\frac{1}{8}$ "	.125"	8.0	24.0	96	133,000

NEW YORK, N.Y. CT. HS. (NEW)

PILE TEST RECORD IN PIER 93.

(All piles 12" pipe, 3/8" thick except No. 1)

File No.	Length	No. Sects.	blows per in.	Bearing Value			Settlement under load (tons)			Remarks
				No.	Value	In Kips	30	60	100	
1	17'6"	1	5.4	100 ^k	1/8"	1/4"	2-5/16"	2"	2"	18" Ø Pipe. 100 T 3:30 P.m. Nov. 19 to 8:00 A.M. Nov. 21.
5	67'4"	3	3.3	75 ^k	1/16"	3/16"	3/4"	1/2"	1/2"	Pile o.o.p. 12" 3 Bot. sect. kinked 9" 3
12	85'1"	5	2.3	54 ^k	3/32"	3/16"	1/2"	5/16"	1/4"	Top sect. plumb File kinked 18" 3
18	44'8"	2	1	27 ^k	3/16"	5/16"	At 80 T 3-3/16"	3-1/8"	3-1/8"	File o.o.p. 12" 11 Bot. sect. kinked 3-1/2" at 80 T platform resting on adjacent pile.

Under remarks-- o.o.p.S, indicates out of plumb South.

Section kinked-- indicates the pile had kink at the sleeve and was out of line with the other sections.

NEW YORK, N.Y. CT. HS. (NEW)

PILE TEST RECORD IN PIER 94.

(All piles 12" pipe, 3/8" thick.)

Pile No.	Length	Sects.	No. blows per in.	Actual Bearing Value In Kips	Settlement under load (tons)			Perma- nent Set	Remarks	
					30	60	100			
					Load Removed					
2	49'1"	2	1.3	34 ^k	1/32"	1/16"	--	0	--	Top sect. out of plumb 5" S Bot. sect. kinked 4" S.
3	61'10"	2	2.3	54 ^k	1/8"	3/16"	5/8"	1/2"	1/2"	Top sect. o.o.p. 6" S Bot. sect. kinked 5" S
8	60'11"	2	2.2	54 ^k	1/32"	3/32"	--	1/16"	1/16"	Pile full of water.
13	65'0"	3	6	62 ^k	1/16"	1/8"	--	1/16"	--	Pile o.o.p. 12" S 3" kink SW Vulcan Hammer No. 2.
15	60'11"	2	5	54 ^k	3/16"	7/16"	3/4"	--	11/16"	Pile o.o.p. 12" SW kinked 4" Vulcan Hammer No. 2.
18	61'0"	3	2	50 ^k	3/32"	11/32"	At 89T 1-3/16"	1"	1"	Bot. sect. kinked 12" A at 89T platform was resting on adjacent pile.
19	61'0"	2	4	47 ^k	1/16"	1/8"	3/4"	--	--	Driven by Vulcan No. 2 10 blows /" required. Top sect. o.o.p. 5" N. Bot. sect. kinked 3".

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIERS NOS. 47, 93, 96, AND 238.

Foot Driven	Pier 47 Pile 10 12"	Pier 93 Pile 1 18"	Pier 93 Pile 10 12"	Pier 96 Pile 21 12"	Pier 238 Pile 26 12"	Pier 238 Pile 44 12"	Remarks
- - - Blows per foot - - -							
1	2	0	3	2	0	1	
2	2	5	8	4	0	1	
3	2	15	9	5	2	2	
4	2	20	12	8	3	2	
5	2	25	12	9	4	3	
6	2	27	14	10	6	3	
7	3	28	14	12	6	4	
8	3	29	14	13	7	4	
9	5	30	15	13	9	5	
10	6	34	16	12	9	8	
11	6	33	17	10	10	9	
12	8	34	15	12	9	8	
13	8	37	14	12	10	9	
14	8	34	14	14	11	9	
15	9	36	17	13	10	9	
16	10	46	22	13	11	9	
17	11	65	22	13	11	8	
18	12		23	13	13	7	
19	13		25	13	14	8	
20	12		25	14	15	9	
21	12		24	15	15	11	
22	13		23	13	15	12	
23	13		24	13	16	13	
24	12		26	13	16	14	
25	12		32	13	17	16	
26	12		32	14	17	16	
27	12		31	14	17	17	
28	13		34	17	15	18	
29	14		34	19	15	18	
30	15		32	21	15	20	
31	18		32	19	17	20	
32	22		32		17	22	
33	30		31			24	
34	35		24			24	
35	38		21			24	
36	37		19			25	
37	35		20			25	
38	35		22			23	
39	37		22			22	
40	40		22			23	
41	43		21			26	
42	46		22			28	
43	40		24			28	
44	40		27			26	
45	34		27			25	
46	35		30			22	
47	30		27			22	
48	31		24			24	
49	34		25			26	
50	35		26			27	
51	34		27			30	

(continued)

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVEN
IN PIERS NOS. 47, 93, 96, AND 238.

Foot Driven	Pier 47 Pile 10 12"	Pier 93 Pile 10 12"	Pier 238 Pile 44 12"
- - - Blows per foot - - -			
53	38	29	25
54	48	30	26
55	58	31	25
56	68	31	25
57	61	33	22
58	60	35	22
59	62	34	24
60	83	34	25
61	100	37	32
62		45	34
63		51	30
64		59	24
65		59	25
66		59	26
67			24
68			25
69			26
70			27
71			28
72			33
73			32
74			35
75			35
76			40
77			40
78			40
79			40
80			46
81			45
82			43
83			40
84			33
85			38
86			30
87			30
88			31
89			32
90			31
91			33
92			31
93			33
94			35
95			36
96			39
97			41
98			44
99			49
100			53
101			60
102			61
103			62

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIER NO. 245.

<u>Foot Driven</u>	<u>Pile #17 16" Pipe (steel)</u>	<u>Pile #24 12" Steel Pipe</u>	<u>Pile #29 18" Steel Pipe</u>	<u>Remarks</u>
	- Blows per foot -			
1	0	0	0	Piles driven with #1 Vulcan Hammer from swinging leads.
2	4	2	5	
3	5	2	7	
4	6	4	7	
5	7	4	8	
6	7	5	9	
7	8	4	10	38 blows to the
8	10	4	10	foot indicates
9	9	4	12	36 tons bearing
10	9	5	13	capacity.
11	10	5	13	
12	10	6	12	Order in which
13	11	6	13	piles were driven
14	11	6	13	#17, #29, #24.
15	12	6	14	
16	12	6	15	
17	11	6	16	
18	13	7	16	
19	14	8	19	
20	16	9	24	
21	16	12	25	
22	19	13	26	
23	20	14	32	
24	24	16	35	
25	26	17	41	
26	28	18	47	
27	30	18		
28	33	20		
29	36	22		
30	39	24		
31	42	24		
32		25		
33		26		
34		26		
35		28		
36		29		
37		30		
38		30		
39		33		
40		32		
41		27		
42		29		
43		29		
44		29		
45		28		
46		31		
47		38		
48		47		
49		54		
50				

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIER NO. 83.

<u>Foot Driven</u>	<u>File #2 16" Steel Pipe</u>	<u>File #4 Raymond Concrete "A"</u>	<u>File #7 16" Steel Pipe</u>	<u>Remarks</u>
	- - - Blows per foot - - -			
1	0	1	0	File #7 - not concreted.
2	2	1	5	
3	5	2	9	
4	10	3	10	File #4 - tested with 60T load showed permanent set of 17/32".
5	13	4	13	
6	12	10	14	
7	15	13	15	
8	17	17	14	File #7 driven 30' tested with 46T load showed set of 1-3/8".
9	15	25	12	
10	18	29	14	
11	18	25	12	
12	22	26	13	Piles driven with Raymond rig.
13	20	36	15	
14	19	42	17	
15	19	61	15	
16	18	72	16	Order in which piles were driven: #4, #2, #7.
17	24		15	
18	26		13	
19	26		13	
20	28		13	
21	30		13	
22	28		14	
23	24		15	
24	23		16	
25	23		16	
26	24		17	
27	26		17	
28	26		18	
29	27		19	
30	27		25	
31	25			
32	25			
33	25			

RAYMOND CONCRETE PILE SHELLS.

		Bottom				Top
		Section	Section	Section	Section	Section
	Type	1	2	3	4	5
34	24					
35	25					
36	25					
37	26					
38	30	A	1/16	0/16	00/16	0/18
39	29	B	1/18	0/18	0/18	0/18
40	31	C	1/20	1/22	1/24	1/24
41	31	D	3/22	3/24	3/24	1/24
42	30					
43	30					
44	32					
45	34					
46	41					

1 = gauge of wire
16 = gauge of shell

PENETRATION LOG OF TEST PILES DRIVENIN PIERS NOS. 208 AND 214.

Foot Driven	Pile #18 Pier #208 Pre-cast Concrete #5	Pile #26 Pier #208 Raymond #16 gauge "A"	Pile #1 Pier #214 16" Pipe	Pile #20 Pier #214 Raymond #16 gauge	Remarks
					- - - Blows per foot - - -
1	0		0	0	File #18 - steel follower was used between the hammer and concrete pile; also a wood cushion between follower and pile.
2	0		2	0	
3	4		2	0	
4	9		5	1	
5	8		8	1	Wood cushion protected concrete pile from damage during driving.
6	8		10	1	
7	12		10	2	
8	16		14	3	
9	18		13	4	Files were driven with Raymond rig.
10	19		16	7	
11	19		15	11	
12	19	22	15	11	
13	20	26	19	16	Order in which piles were driven: #20, #26, #1, #18.
14	20	32	22	23	
15	19	37	23	23	
16	21	43	24	25	
17	21	46	22	32	
18	28	50	19	37	
19	32	55	19	46	
20	38		18		
21	46		18		
22	51		16		
23	58		16		
24	for 9" 47		15		
25			17		
26			16		
27			17		
28			15		
29			17		
30			16		
31			17		
32			16		
33			17-		
34			17		
35			18		
36			19		
37			24		
38			29		
39			30		
40			30		
41			31		
42			36		
43			37		
44			41		

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIER NO. 249

Foot Driven	Pile #45 Raymond Concrete "C"	Pile #31 Raymond Concrete "B"	Pile #33 16" Steel Pipe	Pile #43 18" Steel Pipe	Pile #32 16" Steel Pipe	Pile #44 Pre-cast Concrete #2	Remarks
	- - - Blows per foot - - -						
1	0	0	0	0	0	0	Piles driven
2	0	0	6	10	11	8	in order as
3	1	-	7	14	11	7	listed on
4	2	-	7	13	10	7	sheet with
5	4	-	8	11	9	8	Raymond rig.
6	6	-	19	12	9	9	
7	8	-	11	14	10	10	Pile #44 -
8	10	-	10	13	10	10	steel follow-
9	10	-	11	14	11	11	er was used
10	12	-	13	15	10	13	between hammer
11	14	15	12	16	11	14	and concrete
12	16	16	14	15	11	16	pile; also a
13	19	19	15	16	11	17	wood cushion
14	23	23	16	15	12	19	between follow-
15	25	26	19	17	11	20	er and pile.
16	27	30	19	16	12	21	
17	31	33	20	18	13	23	Wood cushion
18	37	38	20	18	14	26	protected
19	40	44	22	18	16	29	concrete pile
20	43	52	24	25	15	32	from damage
21	44	60	26	35	17	35	during driving.
22	46		26	32	18	39	
23	48		29	31	19	47	Piles driven
24	51		31	33	21	51	with Raymond
25	56		29	32	22		rig.
26	59		29	33	22		
27			30	32	21		Pile #32
28			23	31	21		driven to
29			23	31	22		depth of 32'
30			30	29	22		is to be
31			32	33	24		tested under
32			32	34	24		load.
33			33	35			
34			31	37			
35			30	42			
36			29	For 7" 26			
37			29				
38			30				
39			33				
40			37				
41			40				
42			45				
43			47				
44			49				
45			For 6" 27				

NEW YORK, N.Y. CT. H3. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIERS NOS. 225 and 231.

Foot Driven	Pier #225			Pier #231			Remarks	
	File #37 Ray- mond "C"	File #38 Ray- mond "B"	File #48 Ray- mond "D"	File #5 18" Pipe	File #6 16" Pipe	File #7 Pre- Cast Con- crete #6		File #18 Pre- Cast Con- crete #3
	- - - Blows per foot - - -							
1	0	-		0	-	0	0	<u>File #37</u> - Inspected Nov. 25, 1932. Pile was full of water and about 5'0" of sediment.
2	4	-		2	-	2	4	
3	5	-		12	-	7	5	
4	5	-		12	11	7	5	
5	6	-		11	10	6	4	<u>File #38</u> - Full of water - about 7'6" of sediment.
6	-	-		9	8	7	5	
7	-	-		11	9	9	7	
8	11	8		13	12	10	11	
9	11	8		15	13	11	11	<u>File #48</u> - Redriven Nov. 25, 1932 with Gauge "A". Full of water, and about 5'6" of sediment.
10	16	8		15	13	12	13	
11	16	9		13	15	12	17	
12	20	12		19	16	14	18	
13	25	12		22	16	18	20	<u>File #6</u> - Out of plumb 6" to 8" S. Kinked to N. Full of water; leaking badly. About 20'0" of sediment.
14	30	-	22	27	18	22	22	
15	29	-	32	27	21	23	27	
16	22	24	32	23	35	27	32	
17	30	23	34	29	36	27	33	<u>File #7</u> - Developed horizontal crack at 19'6" mark during driving.
18	39	28	34	33	28	29	33	
19	41	29	39	36	29	30	39	
20	54	35	52	33	28	42	39	
21 (For 9")	42	44	40	27			40	Note:- Steel follower used between hammer and concrete piles #7 and #18. No wood cushion used on these piles. Top of pile crushed by hammer blows and crushed concrete acted as cushion.
48								
22	54	53	40	-			40	
23	(For 8½")	53	43	33				
	39							Files driven with Raymond rig.
24				42	36			
25				44	34			
26					32			
27	<u>File #6</u> - It was con-				31			It was considered that Piles Nos. 6, 37, 38 and 48, are no good.
28	sidered the seam in				28			
29	the pipe opened up in				26			
30	driving and allowed				27			
31	the fine sand and				29			<u>Piles Nos. 37, 38 and 48</u> It was hard to tell how the fine sand and water entered these piles, - whether by the joints or due to gravel puncturing the shell.
32	water to enter the				27			
33	pipe.				30			
34					33			
35					36			It was considered that Piles Nos. 6, 37, 38 and 48, are no good.
36					40			
37					42			
38					42			
39					47			
40								

It was considered that Piles Nos. 6, 37, 38 and 48, are no good.

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIER NO. 225.

<u>Foot</u> <u>Driven</u>	<u>File #26</u> <u>Ray. "A"</u>	<u>File #28</u> <u>Ray. "A"</u>	<u>Remarks</u>
- - - Blows per foot - - -			
1	2	0	
2	7	8	
3	6	8	
4	4	5	
5	7	8	
6	10	11	On account of the lighter gauge shells being torn or punctured and filling with sand and water, it was decided to drive two additional Raymond piles, using type "A" shell of heavier gauge in pier 225.
7	12	12	
8	12	13	
9	13	13	
10	17	17	
11	16	21	File #28 was driven and had a bad leak and filled with sand and water; was redriven, using extra shells, was out of plumb, and small amount of sand and water came in; was pumped out and concreted.
12	22	31	
13	26	45	
14	28	44	
15	31	39	
16	33	38	File #26 was driven with two bottom sections. Pile turned out to be satisfactory and was concreted.
17	40	42	
18	40 For 6"	26	
19	44		
20 For 6"	25		

Pier 231:

The two concrete piles in Pier 231 were pulled out. One showed no effects from the driving; the other was fractured and bent from coming in contact with boulder or obstructions (see photograph of piles); cracks and bent section at butt was done in pulling the piles.

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST PILES DRIVENIN PIERS NOS. 224 AND 230.

Foot Driven	Pier 224	Pier 230	Pier 230	Remarks
	Pile #34	Pile #8	Pile #1	
	18"	12"	Step-tapered	
	- - - Blows per foot - - -			
1	0	0	0	These three piles turned out satisfactorily.
2	-	4	0	
3	7	-	-	
4	8	-	6	Test load is to be put on Pile #1, Raymond step- tapered.
5	10	7	8	
6	13	8	11	
7	15	-	12	
8	17	11	12	
9	20	12	18	
10	20	12	21	
11	20	12	22	
12	20	11	20	
13	21	11	20	
14	23	11	22	
15	24	14	22	
16	24	14	22	
17	31	15	23	
18	32	17	24	
19	31	21	28	
20	30	21	27	
21	46	21	27	
22	40	18	26	
23	39	18	24	
24	46	18	25	
25		17	29	
26		18	32	
27		17	32	
28		17	32	
29		17	34	
30		18	35	
31		18	36	
32		18	39	
33		18	43	
34		20	48	
35		21		
36		23		
37		26		
38		29		
39		--		
40		35		
41		36		
42		36		
43		33		
44		35		
45		34		
46		--		
47		44		
48		41		
49		29		
50				

For 9"

NEW YORK, N.Y. CT. HS. (NEW)

PENETRATION LOG OF TEST FILES DRIVENIN PIER NO. 87.

Foot Driven	File #11 18"	File #12 R.S.T.	File #6 R.S.T.	File #15 R.S.T.	File #16 16"	File #7 12"	Remarks
							- - - Blows per foot - - -
1	0	0	0	0	0	0	File #6:
2	0	0	0	0	0	-	Head block
3	-	2	-	0	-	3	changed be-
4	6	4	7	7	10	6	tween 28th
5	10	6	7	9	16	7	and 29th
6	10	7	8	10	17	9	foot of
7	10	8	8	12	23	8	driving.
8	9	8	9	11	26	9	
9	10	11	8	12	28	9	File #7:
10	11	9	9	12	31	10	Splice at
11	11	9	10	15	31	9	43rd foot.
12	11	11	9	15	32	10	
13	11	14	11	16	37	10	File #12:
14	13	13	12	17	40	12	Stood open
15	16	14	12	19	42	13	over night.
16	21	15	14	16	40	13	Had small
17	25	19	14	17	40	14	amount of
18	24	19	13	16	35	14	water and
19	26	18	15	15	36	14	mud in the
20	25	18	14	18	35	13	bottom from
21	--	19	15	19	--	13	standing.
22	53	21	15	20	34	13	All of these
23	49	24	17	21	32	13	piles were
24	51	27	20	20	32	13	satisfactory
25		26	20	25	32	13	and were
26		27	22	26	32	13	concreted.
27		26	25	30	30	13	
28		30	30	33	30	13	
29		34	50	32	30	12	
30		38	55	38	31	12	
31		43	72	45	30	12	
32	For 7"28			53	31	12	
33				65	33	13	
34					33	14	
35					33	14	
36					34	13	
37					40	12	
38					42	12	
39					44	12	
40					45	15	
41						16	
42						19	
43						22	
44						35	
45						37	
46						40	
47						47	
48						44	

(R.S.T. = Raymond Step Tapered)

NEW YORK, N.Y. CT. HS. (NEW)

AVERAGE LENGTHS FOR THE DIFFERENT TYPES
OF TEST PILES DRIVEN

<u>12"</u> <u>38 blows</u> <u>per foot</u>	<u>16"</u> <u>38 blows</u> <u>per foot</u>	<u>18"</u> <u>45 blows</u> <u>per foot</u>	<u>Pre-cast</u> <u>48 blows</u> <u>per foot</u>	<u>Raymond</u> <u>48 blows</u> <u>per foot</u>	<u>Raymond</u> <u>step-</u> <u>tapered</u> <u>48 blows</u> <u>per foot</u>
62 ft.	28 ft.	25 ft.	22 ft.	15 ft.	34 ft.
76	44	16	23	19	32
40	46	35	21	18	30
46	40	25	21	23	32
46-	36	24	4) 87	20	4) 128
46	37	24	21 ft.	22	32 ft.
6) 316	6) 231	6) 149		20	
53 ft.	38 ft.	25 ft.		22	
				18	
				20	
				10) 197	
				19.7 ft.	

LOAD TESTPILE TEST RECORD IN PIERS 83, 208, ~~208~~, and 249.

12"Ø, 16"Ø and 18"Ø are Steel Pipe Piles, 3/8" thick.
 Ray.-"A", "B", "C", "D", indicates Raymond Concrete Pile.
 P.C. #1 to 6, indicates Precast Concrete Piles.

Pier Pile No. No.	Type	Length	No. Sects.	Actual		Bearing Settlement under load (Tons)			Settlement after load removed	Remarks
				inches	last inch	Value In Kips	30	45 60 over-load		
83	2	16"Ø	3	3.4		76 ^k	0	3/32" 1/8" 70T 90T 3/16" 7/16"	5/16"	
83	4	Ray. "A"	6			112 ^k	1/8"	5/16" 5/8" --	17/32"	
83	7	16"Ø	1	2		50 ^k	3/16" 1-3/8"	-- --	1-3/16"	This pile driven to 30'0" (not concreted. To be driven to required bearing.
208	18	P.C. #5		5.3		103 ^k	3/32" 1/8"	5/32" --	(load not removed)	
208	26	Ray. "A"		5		100 ^k	1/8" 3/16" 3/8"	70T 90T 3/8" 2-1/8"	1-15/16"	
249	32	16"Ø		2		50 ^k	1/16" 3/16" 3/8"	-- --	3/16"	Pile driven to 32'0".
249	44	P.C. #2		4.25		89 ^k	3/32" 1/8"	1/8" --	1/16"	

LOAD TEST

PILE TEST RECORD IN PIERS 96, 230, 238 AND 245.

12"Ø and 16"Ø are Steel Pipe Piles, 3/8" thick.

"Ray. step tapered" indicates Raymond Step Tapered Pile.

Pier Pile No.	No.	Type	Length	Sects.	No.	Actual blows last inch	Bearing Value	Settlement under load (Tons)	Settlement after load removed	Remarks	
							30	45	60		
96	21	12"Ø	31'0"	1	4.6	42 ^k	1/8"	--	10-5/8"	10-3/8"	Pile driven to 30'0"
230	1	Ray. step tapered	34'10"		4	85 ^k	1/8"	5/16"	11/32"	1/4"	
238	26	12"Ø/	32'0"	1	1.4	37 ^k	5/16"	7/8"	5-3/4"	5-5/8"	Pile driven to 32'0"
245	17	16"Ø	32'9"	2	3.5	77 ^k	1/16"	9/32"	13/32"	3/16"	60° Ft.

FOUNDATION WORKFILE RECORD.PIER NO. 19.

<u>File No.</u>	<u>Date Driven</u>	<u>Last No. blows per 3"</u>	<u>Inspec- ted by</u>	<u>File length 12"</u>	<u>16"</u>	<u>Date con- creted 1933</u>	<u>Inspec- ted by</u>
1	1933 2-24	17	EGD		50'10"	2-28	EGD
2	"	18	JSA	49'0"		"	"
3	"	15	"	52'1"		"	"
4	"	12	EGD		51'3"	"	"
5	"	21	JSA		44'8"	"	"
6	"	15	EGD	51'0"		"	"
7	"	18	"	62'7"		"	"
8	"	15	"	47'0"		"	"
9	"	19	"	48'8"		"	"
10	"	15	"	51'10"		"	"
11	"	14	"	51'4"		"	"
12	"	11	"	51'10"		"	"
13	"	14	"		59'7"	"	"
14	"	15	"	54'0"		"	"
15	"	10	"	49'6"		"	"
16	"	17	"		49'10"	"	"

Total footage	568'10"	256'2"
Average	51'9"	51'3"

FOUNDATION WORKFILE RECORDPIER NO. 40

<u>Pile</u> <u>No.</u>	<u>Date</u> <u>Driven</u> <u>1933</u>	<u>Last</u> <u>No.</u> <u>blows</u> <u>per 3"</u>	<u>Inspec-</u> <u>ted by</u>	<u>Pile length</u> <u>12"</u> <u>16"</u>	<u>Date</u> <u>con-</u> <u>creted</u> <u>1933</u>	<u>Inspec-</u> <u>ted by</u>
1	6-5	15	JSA	51'4"	6-7	RJG
2	"	11	"	52'3"	"	"
3	"	17	"	61'1"	"	"
4	"	10	RJG	65'8"	"	"
5	"	10	"	116'7"	"	"
6	"	10	JSA	72'10"	"	"
7	"	10	"	66'4"	"	"
8	"	16	"	59'0"	"	"
9	"	12	"	55'6"	"	"
10	"	13	"	56'1"	"	"
11	"	10	RJG	110'3"	"	"
12	"	11	"	63'11"	"	"
Total footage				278'2"	552'8"	
Average				92'9"	61'5"	

FOUNDATION WORKPILE RECORDPIER NO. 41

<u>File</u> <u>No.</u>	<u>Date</u> <u>Driven</u> <u>1933</u>	<u>Last</u> <u>No.</u> <u>blows</u> <u>per 3"</u>	<u>Inspec-</u> <u>ted by</u>	<u>File</u> <u>length</u> <u>12"</u> <u>16"</u>	<u>Date</u> <u>con-</u> <u>creted</u> <u>1933</u>	<u>Inspec-</u> <u>ted by</u>
1	4-20	25	HRE	56'6"	4-24	HRE-EMD
2	4-19	18	EMD	57'8"	"	"
3	4-20	16	HRE	76'1"	"	"
4	"	13	EMD		54'0"	"
5	4-19	20	HRE		58'5"	"
6	"	19	EMD		58'2"	"
7	4-20	18	HRE	56'1"	"	"
8	4-19	18	EMD	56'4"	"	"
9	"	18	"		58'5"	"
10	"	15	HRE	76'10"	"	"
11	4-20	16	"		57'7"	"
12	"	10	"	82'3"	"	"
13	"	12	EMD	57'0"	"	"
14	"	12	"	59'9"	"	"

Total footage 578'6" 286'7"

Average 64'3" 57'4"

FOUNDATION WORKFILE RECORDPIER NO. 60

File No.	Date Driven 1933	Last No. blows per 3"	Inspec- ted by	File length 12" 16"	Date con- creted 1933	Inspec- ted by
1	2-28	10	EGD	60'7"	3-1	EGD
2	"	10	"	62'3"	"	"
3	"	12	"	64'9"	"	"
4	"	10	"	61'11"	"	"
5	"	10	"	55'1"	"	"
6	"	10	RJG	53'7"	"	"
7	"	10	"	44'2"	"	"
8	"	11	EGD	61'4"	"	"
9	"	11	"	59'2"	"	"
10	"	21	"	36'3"	"	"
11	2-27	13	RJG	63'6"	"	"
12	2-28	9	EGD	54'8"	"	"
13	2-27	11	"	54'7"	"	"
14	2-28	21	"	29'5"	"	"
15	"	16	"	49'9"	"	"
16	2-27	11	"	60'1"	"	"

Total footage 766'9" 104'4"

Average 54'9" 52'2"

FOUNDATION WORKPILE RECORDPIER NO. 85

<u>Pile</u> <u>No.</u>	<u>Date</u> <u>Driven</u>	<u>Last</u> <u>No.</u> <u>blows</u> <u>per 3"</u>	<u>Inspec-</u> <u>ted by</u>	<u>File length</u> <u>12"</u> <u>16"</u>	<u>Date</u> <u>con-</u> <u>creted</u>	<u>Inspec-</u> <u>ted by</u>
	1933				1933	
1	3-13	20	EMD	32'7"	3-16	HRE
2	"	60	"	30'4"	"	"
3	"	20	HRE	36'2"	"	"
4	"	15	"	79'6"	"	"
5	"	13	"	40'7"	"	"
6	"	14	EMD	80'5"	"	"
7	"	14	"	39'7"	"	"
8	"	16	"	40'11"	"	"
9	"	18	HRE	35'3"	"	"
10	"	18	"	37'2"	"	"
11	"	14	EMD	40'1"	"	"
12	"	20	HRE	33'7"	"	"

Total footage 226'5" 298'9"

Average 56'7" 32'4"

FOUNDATION WORKFILE RECORDFILE NO. 88

<u>File No.</u>	<u>Date Driven</u>	<u>Last No. blows per 3"</u>	<u>Inspected by</u>	<u>File length</u>		<u>Date con-creted</u>	<u>Inspected by</u>
	1933			<u>12"</u>	<u>16"</u>	1933	
1	3-3	14	EMD		79'8"	3-6	HRE
2	"	12	HRE		84'11"	"	"
3	"	13	EMD		78'7"	"	"
4	"	15	HRE		81'0"	"	"
5	"	30	EMD	32'8"		"	"
6	"	40	HRE		35'6"	"	"
7	"	35	EMD	33'0"		"	"
8	"	15	"	23'8"		"	"
9	"	15	"		79'2"	"	"
10	"	15	"		81'1"	"	"
11	"	14	HRE		83'11"	"	"
12	"	16	EMD		82'8"	"	"
Total footage				89'4"	686'6"		
Average				29'10"	76'3"		

FOUNDATION WORKPILE RECORDPIER NO. 90

File No.	Date Driven	Last No. blows per 3"	Inspected by	File length 12"	File length 16"	Date completed	Inspected by
						1933	
1	3-8	11	EMD	72'0"		3-13	HRE
2	3-7	10	"		89'0"	"	"
3	"	12	HRE		108'10"	"	"
4	"	13	EMD		111'6"	"	"
5	3-6	13	"		112'0"	3-10	"
6	"	11	HRE		117'8"	"	"
7	3-7	12	EMD		36'2"	"	"
8	"	17	"	47'10"		3-13	"
9	"	50	HRE	44'8"		"	"
10	3-8	19	EMD		37'3"	"	"
11	"	10	HRE	64'2"		"	"
12	3-7	100	EMD	17'10"		"	"
13	"	15	HRE	51'8"		"	"
14	"	40	EMD		29'5"	3-10	"
15	3-6	15	"		50'0"	"	"
16	"	12	"		120'4"	"	"
17	3-7	18	"		30'11"	"	"
18	3-6	10	HRE		70'10"	3-13	"
19	3-7	120	EMD	34'2"		"	"
20	"	10	"		36'3"	"	"
21	3-6	10	"		75'4"	"	"
22	"	12	"		72'3"	"	"
23	"	9	HRE		38'11"	3-10	"
24	"	12	EMD		70'2"	"	"
25	"	15	"		98'5"	"	"

Total footage -

332'4"

1305'3"

Average length

47.4'

72.5'

FOUNDATION WORK

P-8

FILE RECORDPIER NO. 100A

File No.	Date Driven 1933	Last No. blows per 3"	Inspec- ted by	File length		Date con- creted 1933	Inspec- ted by
				12"	16"		
1	3-7	14	JTD		59'2"	3-14	HRE
2	"	12	"		56'6"	"	"
3	"	13	"		47'7"	"	"
Total footage					163'3"		
Average					54'5"		

PIER NO. 100B

File No.	Date Driven 1933	Last No. blows per 3"	Inspec- ted by	File length		Date con- creted 1933	Inspec- ted by
				12"	16"		
1	5-3	20	JTD		37'0"	5-5	HRE
2	"	16	"		58'10"	"	"
3	"	15	"		42'10"	"	"
4	"	12	"		47'4"	"	"
Total footage					186'0"		
Average					46'6"		

FOUNDATION WORKPILE RECORDPIER NO. 117

File No.	Date Driven 1933	Last No. blows per 3"	Inspec- ted by	File length 12" 16"	Date con- creted 1933	Inspec- ted by
1	5-15	50	HRE	40'5"	5-17	EMD-HRE
2	"	50	EMD	40'8"	"	"
3	"	40	HRE	39'2"	"	"
4	"	28	"	40'1"	"	"
5	"	13	"	42'0"	"	"
6	"	20	EMD	43'8"	"	"
7	5-12	15	"	67'11"	"	"
8	"	11	"	59'8"	"	"
9	"	13	HRE	64'11"	"	"
10	"	15	"	39'11"	"	"
11	"	12	"	42'7"	"	"
12	5-15	Refusal	"	28'3"	"	"
13	"	50	"	35'3"	"	"
14	"	20	"	42'4"	"	"
15	5-12	11	"	61'0"	"	"

Total footage 647'11" 39'11"

Average 46'3" 39'11"

FOUNDATION WORKFILE RECORDFILE NO. 124

<u>File</u> <u>No.</u>	<u>Date</u> <u>Driven</u> <u>1933</u>	<u>Last</u> <u>no.</u> <u>blows</u> <u>per 3"</u>	<u>Inspec-</u> <u>ted by</u>	<u>File length</u> <u>12"</u> <u>16"</u>	<u>Date</u> <u>con-</u> <u>creted</u> <u>1933</u>	<u>Inspec-</u> <u>ted by</u>
1	6-12	19	JTD	36'5"	7-6	RJG
2	"	15	JSA-JTD	35'10"	6-27	"
3	"	27	JSA	37'0"	"	"
4	"	20	"	35'6"	"	"
5	"	17	JTD	39'9"	"	"
6	"	20	JSA	36'11"	"	"
7	"	13	"	35'7"	6-28	"
8	"	18	JTD	37'5"	"	"
9	"	25	JSA	35'6"	"	"
10	"	20	"	34'7"	"	"
11	"	19	JTD	37'8"	"	"
12	"	18	JSA	35'6"	"	"

Total footage 437'8"

Average 36'6"

PENETRATION LOG OF PILES DRIVEN IN
PIERS NOS. 19, 41, 60, 88, AND 100-B

<u>Foot</u> <u>Driven</u>	Pier 19 Pile 7 12"	Pier 41 Pile 10 12"	Pier 60 Pile 11 12"	Pier 88 Pile 11 16"	Pier 100B Pile 2 16"
	- - - Blows per foot - - -				
1	3	-	-	-	-
2	2	6	-	-	-
3	3	6	-	6	-
4	3	6	-	8	2
5	3	7	-	10	3
6	4	9	-	11	5
7	4	9	-	13	6
8	5	9	-	13	4
9	6	10	-	13	4
10	6	9	-	15	5
11	6	9	-	14	7
12	6	11	-	16	6
13	6	10	6	17	7
14	6	11	-	18	11
15	7	11	6	18	14
16	7	12	7	20	16
17	8	13	7	21	17
18	8	13	7	21	18
19	10	13	7	21	19
20	9	13	8	22	19
21	11	13	8	23	21
22	11	12	8	13	16
23	11	12	8	13	16
24	12	12	9	19	15
25	12	10	9	19	16
26	13	12	9	19	16
27	13	12	20	17	16
28	13	14	27	22	18
29	13	12	38	21	20
30	13	9	42	21	18
31	15	8	40	23	18
32	14	6	42	23	16
33	14	6	37	26	16
34	15	7	33	27	15
35	15	6	28	30	14
36	15	7	25	33	14
37	15	8	22	--	15
38	15	10	21	40	16
39	16	--	13	40	19
40	16	--	16	35	23
41	20	--	13	36	26
42	20	19	--	33	25
43	24	18	--	43	26
44	30	17	25	41	27
45	35	19	32	43	27

(Continued on next sheet)

-2-

PENETRATION LOG OF PILES DRIVEN IN
PIERS NOS. 19, 41, 60, 88, AND 100-B

<u>Foot</u> <u>Driven</u>	<u>Pier 19</u> <u>Pile 7</u> <u>12"</u>	<u>Pier 41</u> <u>Pile 10</u> <u>12"</u>	<u>Pier 60</u> <u>Pile 11</u> <u>12"</u>	<u>Pier 88</u> <u>Pile 11</u> <u>16"</u>	<u>Pier 100B</u> <u>Pile 2</u> <u>16"</u>
	- - - Blows per foot - - -				
46	35	23	34	43	27
47	39	26	35	42	27
48	45	26	34	32	26
49	54	29	36	33	25
50	54	28	39	33	24
51	50	--	38	30	34
52	51	--	41	29	35
53	45	30	42	26	33
54	34	31	44	26	43
55	34	31	46	26	49
56	33	44	42	22	46
57	43	51	--	23	50
58	43	45	42	23	66
59	46	58	43	20	65
60	50	45	49	18	75
61	60	44	55	18	65
62		42		17	
63		45		17	
64		42		18	
65		31		20	
66		26		27	
67		32		29	
68		--		29	
69		--		--	
70		40		27	
71		38		27	
72		37		29	
73		39		30	
74		57		32	
75		57		34	
76		60		41	
77				44	
78				46	
79				50	
80				56	
81				56	

PENETRATION LOG OF PILES DRIVEN IN
PIERS NOS. 117, 124, 200, 220, AND 224

<u>Foot</u> <u>Driven</u>	<u>Pier 117</u> <u>File 15</u> <u>12"</u>	<u>Pier 124</u> <u>File 5</u> <u>12"</u>	<u>Pier 200</u> <u>File 43</u> <u>12"</u>	<u>Pier 220</u> <u>File 32</u> <u>16"</u>	<u>Pier 224</u> <u>File 33</u> <u>16"</u>
	- - - Blows per foot - - -				
1	-	-	-	-	8
2	-	2	-	7	9
3	-	3	-	6	10
4	-	4	-	8	10
5	3	4	-	8	14
6	3	4	-	8	17
7	3	5	-	11	23
8	3	7	-	15	21
9	4	10	-	15	22
10	3	10	10	11	22
11	4	13	11	9	22
12	7	17	12	6	21
13	9	21	14	6	24
14	12	26	14	9	22
15	12	29	15	11	21
16	15	30	15	11	21
17	13	33	15	13	23
18	15	33	16	14	25
19	16	34	17	14	28
20	16	35	20	20	30
21	--	36	23	22	35
22	--	36	22	21	--
23	22	36	23	21	30
24	27	34	22	21	27
25	25	34	22	18	--
26	29	32	23	19	26
27	34	31	24	19	29
28	33	32	24	21	26
29	33	39	25	--	29
30	31	39	26	24	32
31	--	40	28	22	42
32	35	46	29	25	46
33	33	43	29	25	46
34	36	49	31	25	43
35	39	53	35	25	50
36	42	55	38	23	42
37	42	55	44	23	46
38	44	67	--	22	47
39	48	70	--	23	49
40	49	69	69	33	49
41	--	.	68	37	49
42	--	.	68	33	44
43	76	.	53	30	41
44	84	.	41	27	42
45	73	.	34	25	42

(Continued on next sheet)

-2-

PENETRATION LOG OF FILES DRIVEN IN
PIERS NOS. 117, 124, 200, 220, AND 224

<u>Foot</u> <u>Driven</u>	Pier 117 File 15 12"	Pier 200 File 43 12"	Pier 220 File 32 16"	Pier 224 File 33 16"
	- - - Blows per foot - - -			
46	73	32	23	47
47	62	28	25	43
48	52	30	25	44
49	47	32	26	47
50	48	34	22	51
51	45	27	23	53
52	46	28	23	65
53	45	26	22	63
54	42	27	22	70
55	46	32	20	
56	46	37	21	
57	45	36	25	
58	46	32	--	
59		32	--	
60		31	43	
61		36	46	
62		39	46	
63		39	49	
64		39	40	
65		40	38	
66		40	44	
67		40	43	
68		43	46	
69		47	52	
70		52	54	
71		66	53	
72		53	51	
73		53	45	
74		46	44	
75		44	47	
76		51	43	
77		72		
78		75		
79		90		
80		140		

AVERAGE LENGTH FOR THE PILES IN
THE FOLLOWING PIERS

<u>Pier No.</u>	<u>12" Piles Length In feet</u>	<u>16" Piles Length In feet</u>
1	56.1'	- - -
19	51.7'	53.2'
40	92.7'	61.4'
41	64.2'	57.3'
60	54.9'	52.1'
85	56.6'	37.3'
88	29.8'	76.3'
89	65.6'	67.0'
90	47.4'	71.9'
91	84.0'	75.7'
98	63.2'	53.3'
100A.	- - -	54.4'
100B.	46.2'	46.5'
117	46.2'	39.9'
118	43.2'	- - -
120	38.7'	- - -
124	36.5'	- - -
129	39.8'	- - -
132	43.0'	- - -
200	44.6'	57.6'
206	40.3'	- - -
220	37.7'	68.3'
223	39.3'	51.4'
231	36.9'	- - -
249	50.1'	- - -

RECORD OF LOAD TESTS ON PILES.

File No.	Pier No.	Size	Length	Final blows per 3	Settlement in feet			After Remov.
				inches	30 Ton	45 Ton	60 Ton	
2	31	12"	62'- 7"	12	.005	.007	.007	.007
17	100	12"	15'- 2"	100	.005	.015	.022	.022
8	101A	16"	19'- 9"	120	.015	.020	.027	.017
4	98	12"	37'-10"	15	.010	.017	.034	.025
33	245	12"	45'- 9"	14	.009	.019	.022	.003
17	245	16"	32'- 9"	14	.006	.008	.015	.005
30	238	12"	12'- 2"	200	.011	.019	.030	.010
5	200	12"	30'- 1"	120	.008	.011	.015	.006
2	123	12"	39'- 1"	21	.007	.012	.016	.003
16	4	12"	41'- 5"	24	.013	.021	.024	.010

Specification, S-1

ADDENDUM NO. 6 TO THE SPECIFICATION DATED MARCH 30, 1932,
FOR EXCAVATIONS AND FOUNDATIONS OF THE UNITED STATES COURT HOUSE (NEW)
AT NEW YORK, N. Y.

TREASURY DEPARTMENT, OFFICE OF
THE SUPERVISING ARCHITECT, WASHINGTON,
D. C., MAY 4, 1932.

BIDDERS ARE INFORMED THAT THE ABOVE NAMED SPECIFICATION IS HEREBY
MODIFIED AS FOLLOWS:

PARAGRAPHS 107 AND 108 SHALL BE OMITTED AND THE FOLLOWING
PARAGRAPHS SUBSTITUTED THEREFOR:

107. THE CONTRACTOR SHALL FURNISH THE SUPERVISING ARCHITECT
THROUGH THE CONSTRUCTION ENGINEER A DESCRIPTIVE CATALOG OF THE STEAM
HAMMER HE PROPOSES TO USE AND A STATEMENT GIVING THE WEIGHT OF THE
RAM PLUS THE TOTAL EFFECTIVE STEAM PRESSURE (IF ANY) ON THE PISTON.

108. BEARING VALUES.--THE SAFE BEARING VALUES SHALL BE DETERMINED
BY THE FOLLOWING FORMULAE:

P EQUALS $2WH$ DIVIDED BY S PLUS 0.1 FOR SINGLE ACTING
STEAM HAMMERS.

P EQUALS $2H (W \text{ PLUS } AP^1)$ DIVIDED BY S PLUS 0.1 FOR
DOUBLE ACTING STEAM HAMMERS.

IN WHICH:

P EQUALS SAFE BEARING POWER IN POUNDS,

W EQUALS WEIGHT IN POUNDS OF STRIKING PARTS OF HAMMERS,

H EQUALS HEIGHT OF FALL IN FEET,

S EQUALS THE AVERAGE PENETRATION IN INCHES PER BLOW FOR
THE LAST 10 TO 20 BLOWS.

A EQUALS AREA OF PISTON IN SQUARE INCHES.

P^1 EQUALS STEAM PRESSURE IN POUNDS PER SQUARE INCH AT HAMMER.

BIDDERS MUST ACKNOWLEDGE ON THE FORM OF BID THE RECEIPT OF THIS
ADDENDUM.

JAS. A. WETMORE,
ACTING SUPERVISING ARCHITECT.

BM

34. PORTLAND CEMENT.--PORTLAND CEMENT SHALL COMPLY WITH FEDERAL SPECIFICATION No. SS-C-191, EXCEPT THAT THE 23 DAY TEST WILL BE WAIVED.

35. ALL CEMENT SHALL BE TESTED AND PASSED AT THE MILL BY A GOVERNMENT INSPECTOR, OR SHALL BE TAKEN FROM GOVERNMENT TESTED AND SEALED BINS. EACH SHIPMENT SHALL BE CERTIFIED BY A GOVERNMENT INSPECTOR THAT THE CEMENT COMPLIES WITH FEDERAL SPECIFICATION, AND SHALL BE SEALED OR TAGGED OR OTHERWISE IDENTIFIED AS CERTIFIED MATERIAL.

36. THE CONTRACTOR SHALL NOTIFY THE SUPERVISING ARCHITECT RELATIVE TO THE AMOUNT, BRAND AND MAKE OF CEMENT HE INTENDS TO USE AND THE PLACE OF PRIMARY SHIPMENT IN AMPLE TIME FOR THE SUPERVISING ARCHITECT TO ARRANGE FOR INSPECTION AND CERTIFICATION OF SHIPMENTS. ALL CEMENT OF ITS KIND SHOULD BE OBTAINED FROM THE SAME PLACE TO AVOID POSSIBLE DELAY DUE TO THE ADDITIONAL TIME REQUIRED FOR MAKING INSPECTIONS AT SEVERAL PLACES.

37. FEDERAL SPECIFICATIONS SS-C-191 PROVIDES THAT CEMENT REMAINING IN STORAGE PRIOR TO SHIPMENT FOR A PERIOD GREATER THAN SIX MONTHS AFTER TEST SHALL BE RETESTED.

38. TESTS AND INSPECTION WILL BE MADE AT GOVERNMENT EXPENSE. AFTER A CEMENT HAS BEEN APPROVED, NO CHANGE IN BRAND OR MAKE WILL BE PERMITTED FOR THIS CONTRACT UNLESS THE MANUFACTURERS CANNOT MAKE SATISFACTORY DELIVERY.

39. CEMENT SHALL BE DELIVERED IN THE ORIGINAL PACKAGES AND KEPT DRY UNTIL USED.

90. SAND.--SAND SHALL BE SHARP, CLEAN, AND WELL GRADED IN SIZE. IT SHALL BE FREE FROM ORGANIC MATTER. WHEN DRY, AT LEAST 97% SHALL BE RETAINED ON A No. 100 SIEVE AND 80% ON A No. 50 SIEVE. SAND FOR CONCRETE SHALL PASS A No. 4 SIEVE AND AT LEAST 10% SHALL BE RETAINED ON A No. 10 SIEVE. THE APPROVED SAMPLE OF SAND SHALL BE KEPT AT THE OFFICE ON THE SITE, AND SAND USED SHALL BE EQUAL TO AND AS CLEAN AS SAMPLE. COVER IN FREEZING WEATHER, AND DO NOT USE SAND HAVING SNOW OR ICE MIXED IN.

90-A. A SAMPLE OF THE SAND TO BE USED IN CONNECTION WITH ALL CONCRETE WORK SHALL BE SUBMITTED TO THE ARCHITECT FOR HIS APPROVAL BEFORE ANY OF THE CONCRETE WORK IS EXECUTED.

91. AGGREGATE.--AGGREGATE SHALL BE CLEAN, HARD GRAVEL OR BROKEN STONE THAT WILL BE RETAINED ON A 1/4" SCREEN AND SHALL BE WELL GRADED IN SIZE FROM FINE TO COARSE. SIZES SPECIFIED FOR AGGREGATE ARE THE MAXIMUM ACCEPTABLE AND REPRESENT STANDARD SCREEN SIZES.

92. WATER.--WATER SHALL BE FRESH, CLEAN AND FREE FROM ALKALI.

93. MIXTURES.--PROPORTIONS SPECIFIED ARE IN EQUAL PARTS BY VOLUME. ONE SACK OF PORTLAND CEMENT (94 POUNDS NET) SHALL BE CONSIDERED EQUAL TO ONE CUBIC FOOT. ALL CEMENT SHALL BE PORTLAND CEMENT.

94. CONCRETE MIXTURES SHALL BE AS FOLLOWS: CLASS "A" - ONE (1) OF CEMENT, TWO (2) OF SAND AND FOUR (4) OF AGGREGATE.

CONCRETE PILE FOUNDATIONS

95. SCOPE OF WORK.--THE WORK REQUIRED IN THIS SECTION OF THE SPECIFICATIONS SHALL INCLUDE THE FURNISHING OF ALL LABOR AND MATERIAL, TOOLS, POWER AND EQUIPMENT FOR THE COMPLETE INSTALLATION IN PLACE OF ALL CONCRETE PILES, AS SHOWN ON DRAWINGS NOS. 400 AND 401, AND ALL OTHER WORK AND MATERIAL AS HEREINAFTER SPECIFIED.

96. MATERIALS.--MATERIALS AND PROPORTIONS FOR CONCRETE ARE SPECIFIED UNDER "CEMENTS, AGGREGATES AND MIXTURES". REINFORCING METAL SHALL COMPLY WITH FEDERAL SPECIFICATION NO. 350A AND SHALL BE TYPE "A" GRADE "2" AND CLASS "A". METAL SHALL BE CLEAN AND FREE FROM SCALE AND FLAKE RUST WHEN PLACED.

97. CONCRETE.--A MINERAL ADMIXTURE THAT HAS BEEN IN GENERAL USE FOR AT LEAST THREE YEARS FOR INCREASING THE WORKABILITY OF CONCRETE MAY BE USED IF THE BRAND, MAKE AND PROPORTIONS RECOMMENDED ARE FIRST SUBMITTED TO AND APPROVED BY THE SUPERVISING ARCHITECT.

98. ALL CONCRETE SHALL BE CLASS "A" WITH $\frac{3}{4}$ " MAXIMUM AGGREGATE. NO FROZEN, CAKED OR LUMPY MATERIALS SHALL BE USED. MATERIALS FOR EACH BATCH SHALL BE ACCURATELY MEASURED AND THOROUGHLY MIXED UNTIL EVENLY DISTRIBUTED THROUGHOUT. THE CONCRETE SHALL BE THOROUGHLY RODDED, TAMPED OR WORKED INTO PLACE TO REMOVE ALL VOIDS.

99. THE CONCRETE SLUMP SHALL BE NOT LESS THAN 4" NOR MORE THAN 6" WHEN TESTED ACCORDING TO TENTATIVE STANDARD D-138 OF THE AMERICAN SOCIETY OF TESTING MATERIALS. SLUMP TESTS SHALL BE MADE DAILY UNDER THE DIRECTION OF THE CONSTRUCTION ENGINEER.

100. WATER HEAD.--IF A HEAD OF WATER IS FOUND TO EXIST IN THE TUBE WHICH, IN THE OPINION OF THE CONSTRUCTION ENGINEER, MIGHT INJURE THE CONCRETE, METHODS APPROVED BY THE CONSTRUCTION ENGINEER SHALL BE PROVIDED TO REMOVE THIS DANGER.

101. REINFORCING.--ALL PILES THAT ARE SPLICED SHALL HAVE A $\frac{5}{8}$ " REINFORCING BAR EMBEDDED IN CENTER, RUNNING FROM TIP TO CUT-OFF.

102. FILES.--ALL PILES SHALL BE CAST-IN-PLACE STEEL TUBE PILES, SUBJECT TO THE FOLLOWING CONDITIONS:

103. THE STEEL TUBE SHALL HAVE NOT LESS THAN 12" INSIDE DIAMETER AND NOT LESS THAN $\frac{3}{8}$ " WALL THICKNESS. EACH TUBE SHALL HAVE CAST STEEL SHOE FITTING THE TUBE SO TIGHT AS TO PERMIT NO WATER TO ENTER SAME. PILES 20' OR LESS IN LENGTH SHALL BE WITHOUT SPLICES. PILES 20' TO 40' LONG SHALL HAVE NO MORE THAN ONE SPLICE. SPLICES SHALL BE SO DESIGNED AS NOT TO REDUCE STRENGTH OF THE PILE AND SHALL BE WATERTIGHT. THE ESTIMATE FOR THE AGGREGATE LENGTH OF THE TOTAL NUMBER OF PILES SHALL BE BASED ON THE ASSUMPTION THAT THE AVERAGE LENGTH OF ALL THE PILES WILL BE 30' FROM TIP TO CUT-OFF.

104. SHORT PILES.--NO PILE SHALL BE LESS THAN 12' LONG FROM TIP TO CUT-OFF. ONLY ONE SUCH PILE WILL BE PERMITTED IN ANY ONE GROUP OF 20 PILES AND IT SHALL BE DRIVEN TO A FINAL PENETRATION THAT WILL SUPPORT 45 TONS. IF, IN ANY ONE GROUP, A PILE 15' LONG OR OVER DOES NOT DEVELOP A 45 TON RESISTANCE, DRIVING SHALL BE CONTINUED

UNTIL THE PILE DEVELOPS A 45 TON RESISTANCE, AND THE TOP OF PILE SHALL THEN BE CUT OFF TO THE LEVEL OF ADJACENT PILE TOPS IN THAT GROUP. OTHER PILES BETWEEN THE MINIMUM 12' LENGTH AND 15' LENGTH MAY BE USED IN ANY ONE GROUP; PROVIDED THAT EACH ONE SHALL BE DRIVEN TO A 45 TON RESISTANCE. SUCH ADDITIONAL SHORT PILES IN ANY ONE GROUP WILL BE ALLOWED ONLY BY SPECIAL CONSENT TO THE CONSTRUCTION ENGINEER.

105. DEFECTIVE PILES.--PILES THAT ARE DEFECTIVE FOR REASONS LISTED BELOW SHALL BE WITHDRAWN AND THE HOLES FILLED WITH GRAVEL, TAMPED SOLID. IF IT BE IMPOSSIBLE TO WITHDRAW THE DEFECTIVE PILE, A COMPENSATING PILE SHALL BE DRIVEN AS NEAR AS PRACTICABLE TO THE DEFECTIVE PILE, AND THE DEFECTIVE PILE SHALL BE CUT OFF BELOW THE LEVEL OF THE FOOTINGS AND FILLED WITH CONCRETE. A NEW PILE CAPPING SHALL THEN BE DESIGNED BY THE CONTRACTOR TO MEET THIS CONDITION AND THE DESIGN SUBMITTED TO THE CONSTRUCTION ENGINEER FOR HIS APPROVAL OR MODIFICATION. IN NO CASE WILL THE CONTRACTOR BE ALLOWED PAYMENT FOR WITHDRAWN, BROKEN, INJURED, OR DEFECTIVE PILES OR TUBES, NOR FOR ANY PORTION OF ANY PILE REMAINING ABOVE THE CUT-OFF LINE, NOR FOR PILE CAPS MODIFIED BECAUSE OF DEFECTIVE PILES OR PILE DRIVING. THE FOLLOWING PILES SHALL BE CLASSED AS "DEFECTIVE" AND SHALL BE WITHDRAWN AND/OR REPLACED AS SPECIFIED ABOVE:

- (A) ~~ANY PILE THAT HAS BEEN DRIVEN ITS FULL LENGTH AND DOES NOT DEVELOP THE REQUIRED BEARING CAPACITY.~~
- (B) ANY TUBE THAT IS DIVERTED FROM ITS PROPER POSITION EITHER AT TOP OR BOTTOM.
- (C) ANY PILE DAMAGED OR DEVELOPING DEFECTS OF ANY KIND DURING COURSE OF DRIVING.
- (D) ANY PILE NOT DRIVEN OR PLACED IN ITS CORRECT POSITION.

106. DRIVING.--NO PILES SHALL BE DRIVEN UNTIL AFTER THE EXCAVATION IN THE RESPECTIVE AREAS THEY ARE TO OCCUPY HAS BEEN COMPLETED. THEY SHALL BE DRIVEN VERTICALLY WITHIN 3" OF THE LOCATION SHOWN, NOT MORE THAN 1/8" PER FOOT FROM VERTICAL AND THE TOPS BROUGHT TO OR CUT OFF AT WITHIN 2" OF THE ELEVATION INDICATED. PILES NOT OTHERWISE NOTED ON THE DRAWINGS SHALL BE DRIVEN TO A FINAL PENETRATION WHICH WILL SAFELY SUPPORT THIRTY-SIX (36) TONS, AS DETERMINED BY THE FORMULA HEREIN SPECIFIED. ALL PILES SHALL BE DRIVEN IN THE PRESENCE OF THE CONSTRUCTION ENGINEER, WHO WILL KEEP ALL RECORDS ON THE PILES DRIVEN. PILES SHALL BE DRIVEN BY A STEAM HAMMER AND THE DRIVING SHALL BE CONTINUOUS FROM THE TIME OF STARTING UNTIL THE REQUIRED RESISTANCE HAS BEEN ATTAINED. IF, IN THE OPINION OF THE CONSTRUCTION ENGINEER, PILES BRING UP AT THE SPECIFIED RESISTANCE ON A THIN LAYER OF HARD MATERIAL OVERLYING SOFTER MATERIAL, THE PILES SHALL BE DRIVEN THROUGH SUCH THIN LAYER OF HARD MATERIAL TO THE REQUIRED RESISTANCE BELOW. ANY PILES SO DRIVEN AS TO PRODUCE AN INCREASE IN LOAD ON ANY PILE BY ECCENTRICITY OF MORE THAN 10% SHALL BE CORRECTED BY DRIVING REQUIRED ADDED PILE OR PILES WITHOUT COST TO THE GOVERNMENT. A NEW PILE CAP AS REQUIRED FOR "DEFECTIVE PILES" SHALL BE PROVIDED BY THE CONTRACTOR WITHOUT ADDITIONAL COST TO THE GOVERNMENT. FOR PILE CLUSTERS THE DRIVING SHALL BE STARTED FROM THE CENTER OF THE CLUSTER AND PROCEED TOWARD THE OUTSIDE OF SAME.

107. WEIGHT OF THE RAM.--THE WEIGHT OF THE PILE DRIVER RAM SHALL BE NOT LESS THAN 2500 POUNDS NOR MORE THAN 6000 POUNDS. THE VALUE USED FOR W IN THE FORMULA GIVEN HEREIN SHALL NOT BE GREATER THAN THE TOTAL WEIGHT OF THE HAMMER. THE ENERGY PER BLOW SHALL NOT BE LESS THAN 12,000 FOOT POUNDS OR MORE THAN 15,000 FOOT POUNDS.

108. BEARING VALUES.--BEARING VALUE OF DRIVEN PILES SHALL BE DETERMINED BY THE FOLLOWING FORMULA:

Omit

$$P = \frac{2WH}{S \text{ PLUS } 0.1} \text{ IN WHICH}$$

P EQUALS THE BEARING VALUE OF PILE IN TONS.
W EQUALS THE WEIGHT OF THE RAM IN TONS.
H EQUALS THE STROKE OF THE RAM IN FEET.
S EQUALS THE AVERAGE PENETRATION OF THE PILE IN INCHES UNDER THE LAST TEN BLOWS. THE CONTRACTOR SHALL OBTAIN FROM THE MANUFACTURER OF THE HAMMER A WRITTEN STATEMENT GIVING THE PROPER VALUE OF W TO BE USED IN THE ABOVE FORMULA FOR THE WEIGHT AND SIZE OF THE HAMMER USED. THIS STATEMENT TOGETHER WITH DESCRIPTIVE CATALOG, SHALL BE FORWARDED TO THE CONSTRUCTION ENGINEER.

109. LOAD TESTS.--THE CONTRACTOR SHALL MAKE LOAD TESTS ON TEN (10) PILES AS SELECTED BY THE CONSTRUCTION ENGINEER. PILES SHALL BE TESTED SEVEN DAYS AFTER THE CONCRETE HAS BEEN PLACED. THE PILES SHALL BE LOADED BY MEANS OF A SUITABLY BALANCED PLATFORM AND HEAVY MATERIAL WITH AN INITIAL WEIGHT OF 30 TONS EACH. AFTER 24 HOURS THE LOAD SHALL BE INCREASED TO 45 TONS. AFTER ANOTHER 24 HOURS THE LOAD SHALL BE INCREASED TO 60 TONS AND ALLOWED TO REMAIN 24 HOURS. DURING THE TEST THE PILES SHALL BE FREE FROM ANY ARTIFICIAL LATERAL BRACING, AND ACCURATE READINGS SHALL BE TAKEN WITH AN INSTRUMENT TO DETERMINE ANY SETTLEMENT WHICH MAY OCCUR. TEST READINGS SHALL BE TAKEN BEFORE PLACING ANY LOAD, AT THE TIME OF COMPLETING THE PLACING OF THE FIRST LOAD AND EACH INCREASED LOAD, AND 24 HOURS AFTER EACH LOAD HAS BEEN PLACED. SETTLEMENT UNDER THE 30 TON LOAD SHALL NOT EXCEED ONE QUARTER (1/4) INCH, AND THE TOTAL SETTLEMENT UNDER THE 60 TON LOAD SHALL NOT EXCEED ONE HALF (1/2) INCH. A FULL REPORT IN DUPLICATE OF THE RESULTS OF THESE TESTS SHALL BE MADE AND SUBMITTED TO THE CONSTRUCTION ENGINEER.

110. UNIT PRICES, ETC.--THE ACTUAL LENGTH OF PILES SHALL BE DETERMINED BY THAT NECESSARY TO SECURE THE SPECIFIED BEARING CAPACITY. THE MEASUREMENT OF EACH PILE SHALL BE FROM THE TIP TO THE LEVEL AT WHICH THE PILE IS CUT OFF AT THE ELEVATION INDICATED ON THE DRAWINGS.

IT IS ESTIMATED THAT 4180 PILES OF THE AVERAGE LENGTHS AS HEREIN-ABOVE SPECIFIED, MEASURED IN PLACE FROM THE TIP TO CUT-OFF LINES INDICATED ON THE DRAWINGS, WILL BE REQUIRED. SHOULD THE TOTAL NUMBER OF LINEAR FEET OF PILES DRIVEN, WHEN SO MEASURED, BE GREATER OR LESS THAN THE TOTAL NUMBER OF LINEAR FEET ESTIMATED, ADJUSTMENT WILL BE MADE IN THE CONTRACT PRICE ON THE FOLLOWING BASIS: \$2.00 PER LINEAR FOOT IN EXCESS OF THE TOTAL LINEAR FEET ESTIMATED, OR \$1.00 PER LINEAR FOOT DEDUCTION FROM THE CONTRACT PRICE FOR THE NUMBER OF FEET LESS THAN THE TOTAL LINEAR FEET ESTIMATED. IN NO CASE WILL THE CONTRACTOR BE ALLOWED PAYMENT FOR WITHDRAWN, BROKEN, OR INJURED PILES, NOR FOR ANY PORTION OF ANY PILE REMAINING ABOVE THE CUT-OFF INDICATED.

PILE DRIVER P.W.
N 6000 POUNDS.
N SHALL NOT BE
HE ENERGY PER BLOW
RE THAN 15,000

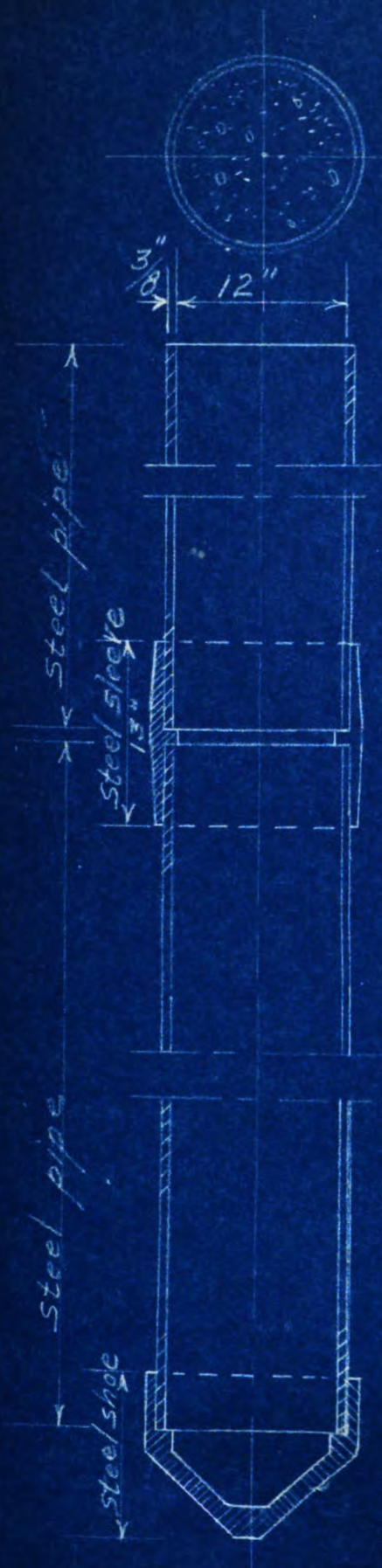
VEN PILES SHALL BE

TONS.
S.
T.
HE PILE IN
HE CONTRACTOR
OF THE HAMMER
PER VALUE OF
R THE WEIGHT
STATEMENT
SHALL BE
NEER.

KE LOAD TESTS ON TO
GINEER. PILES SHALL
EEN PLACED. THE
BALANCED PLATFORM
30 TONS EACH. AFTER
ONS. AFTER ANOTHER
ONS AND ALLOWED TO
SHALL BE FREE FROM
DINGS SHALL BE TAKEN
NT WHICH MAY OCCUR,
ANY LOAD, AT THE TIME
AND EACH INCREASED
PLACED. SETTLEMENT
QUARTER (1/4) INCH,
D SHALL NOT EXCEED
ATE OF THE RESULTS
O THE CONSTRUCTION

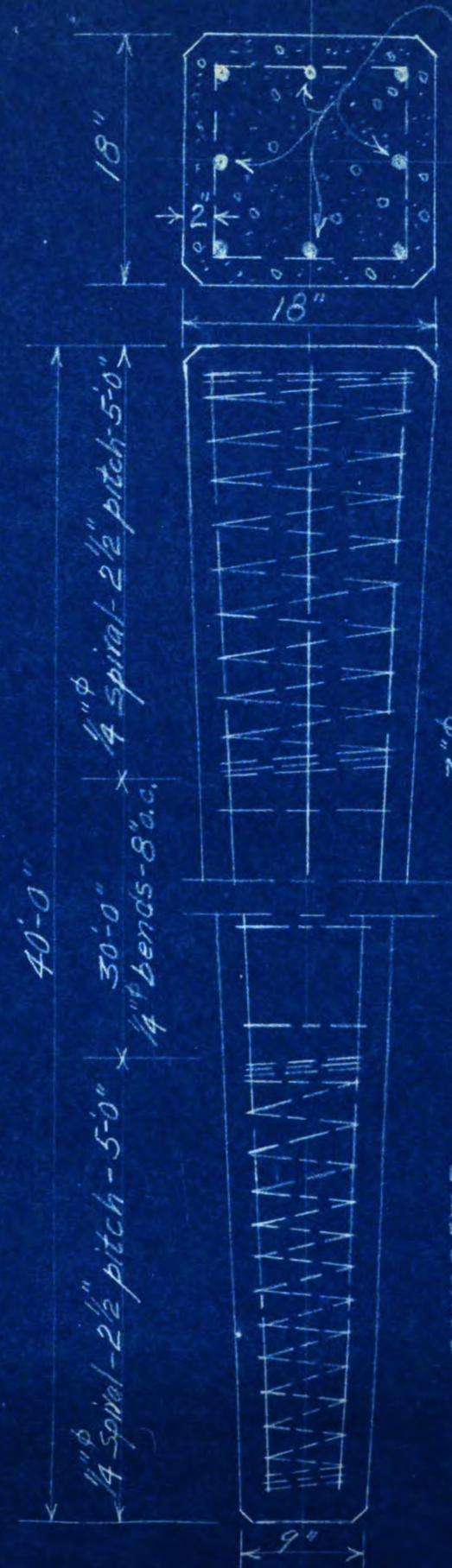
TH OF PILES SHALL BE
PECIFIED BEARING CAP
FROM THE TIP TO THE
EVATION INDICATED ON

ERAGE LENGTHS AS PER
TIP TO CUT-OFF LINE
SHOULD THE TOTAL
SO MEASURED, BE GREATER
ESTIMATED, ADJUSTMENT
OLLOWING BASIS: 20%
AR FEET ESTIMATED, IF
NTRACT PRICE FOR THE
ESTIMATED. IN NO CASE
WITHDRAWN, BROKEN, OR
ILE REMAINING ABOVE THE



SECTION THRU
PIPE PILE

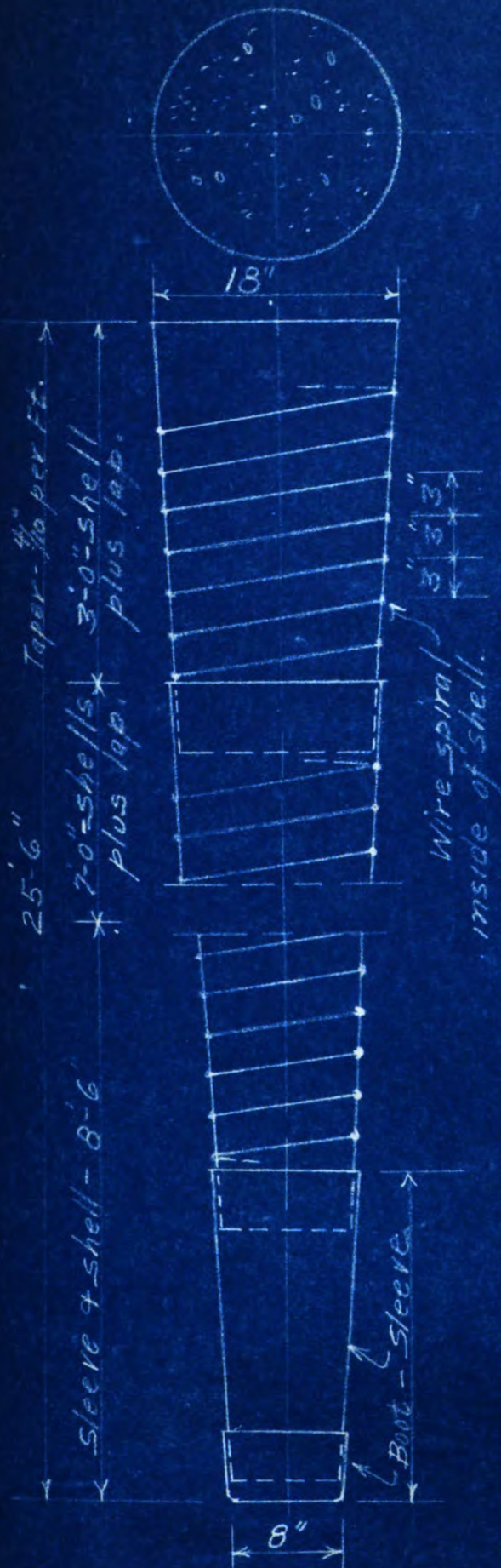
Pipe lengths ranged from 20'-0" to 30'-0".
Some piles had 3 and 4 sleeves.



PRECAST
CONCRETE PILE

CONCRETE
1 part cement,
1 1/2 parts coarse sand,
3 parts gravel 3/4" maximum.

8-3/4" bars - stop these bars at mid length.



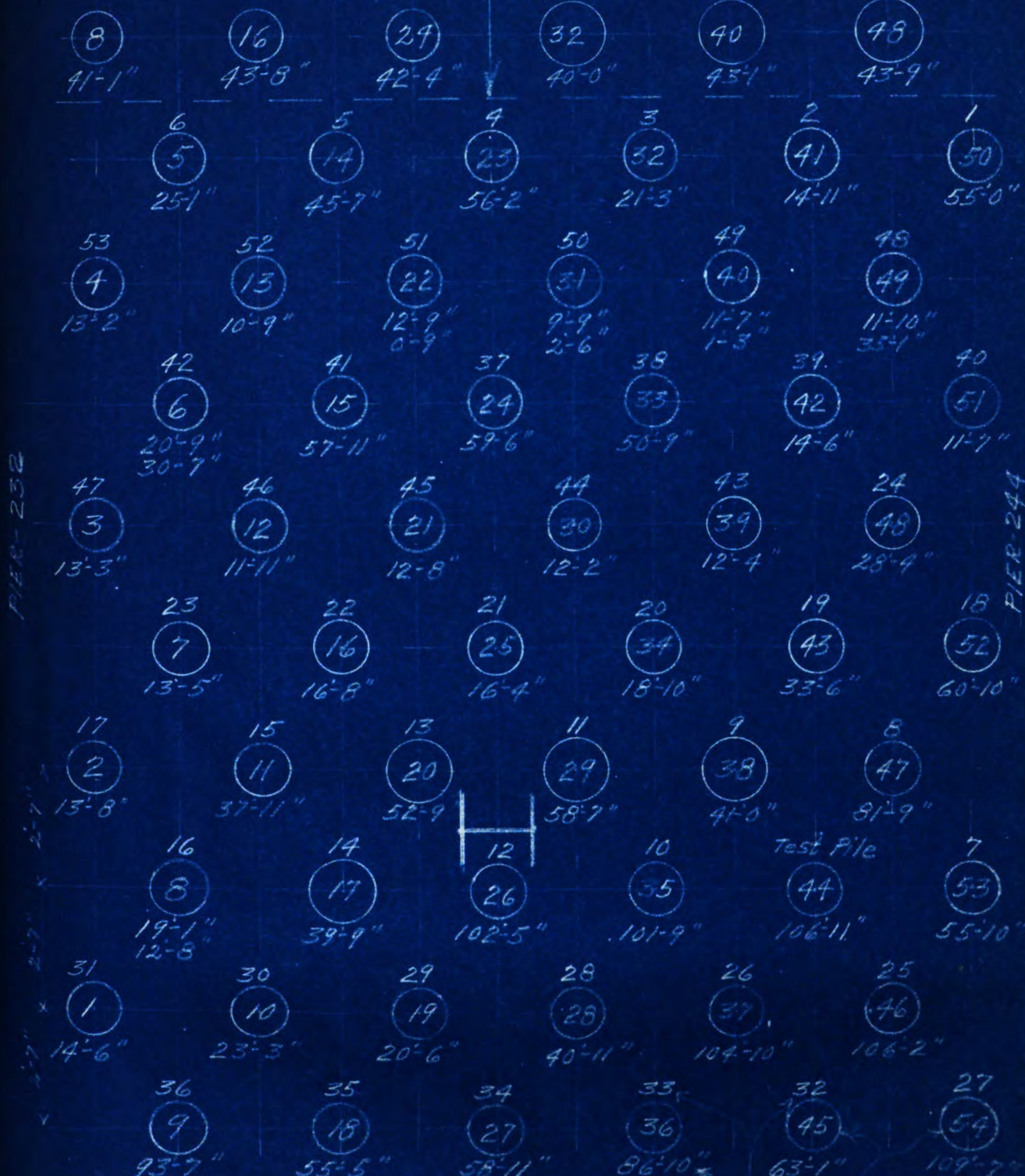
STANDARD RAYMOND
CONCRETE PILE



STEP-TAPERED RAYMOND
CONCRETE PILE

PIER - 239

1-6" x 1-6" x 1-5 1/2" x 1-5 1/2"



PLAN OF PIER-238

PILE NO.
ORDER DRIVEN
LENGTH

SK-3

PIERS 212 AND 213

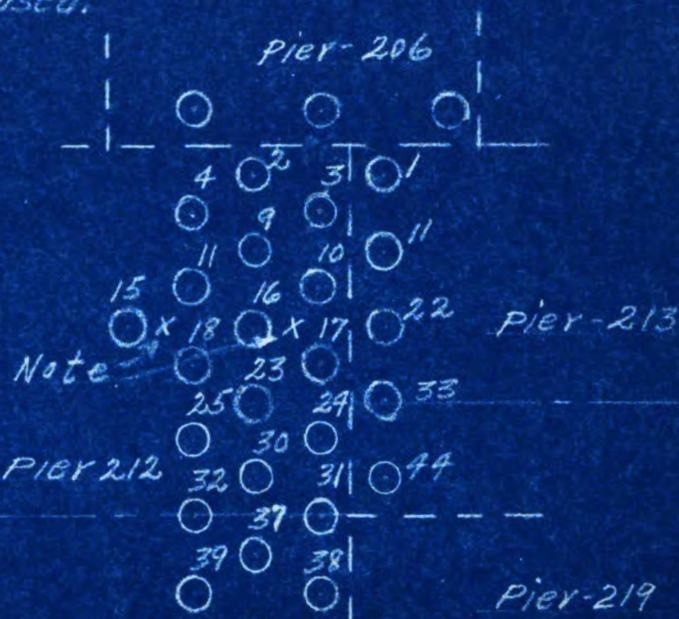
Final results of pile driving in piers
212 - 213 also location and result of soil borings.

Weight used 280 #,
Hammer drop 2'-0".
About a 2" dia. pipe used.

Soil BORING Between Piles. x

Depth Blows per foot
Feet Piles 15-18 x Piles 16-17 x

6		
7	55	
8	61	67
9	63	89
10	52	121
11	53	632
12	54	786
13	105	927
14	232	532
15	260	460
16	426	871
17	607	873
18	777	684
19	764	373
20	955	278
21	860	287
22	489	439
23	389	393
24	527	379
25	530	297
26	523	314
27	828	367
28	949	309
29	919	427
30	923	416



SOIL BORING

0' to 13' Medium sand
13' to 16' Coarse sand
16' to 23' Coarse sand-gravel
23' to 30' Coarse sand-gravel

Pier No. 212	Pier No. 212	Pier No. 213
Pile No. Length	Pile No. Length	Pile No. Length
4 53'-2"	9 14'-3"	1 53'-5"
11 56'-6"	10 12'-4"	11 42'-7"
18 41'-11"	16 13'-2"	22 43'-1"
25 41'-9"	17 13'-0"	33 66'-8"
32 43'-3"	23 13'-1"	44 36'-2"
39 58'-0"	24 13'-7"	
	30 14'-2"	
	31 15'-6"	
	38 15'-6"	

SK-5, Graph showing penetration of piles in different locations.



TEST PILES.
FOUNDATION WORK
NEW COURT HOUSE, NEW YORK.
NOV. 28-32
N. H.

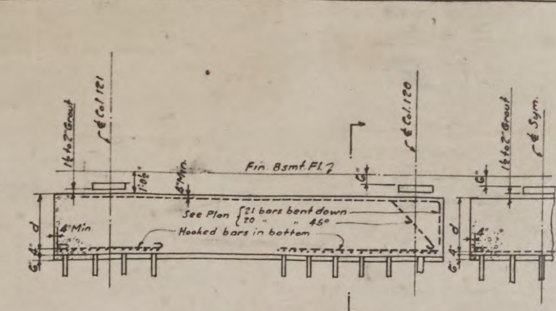
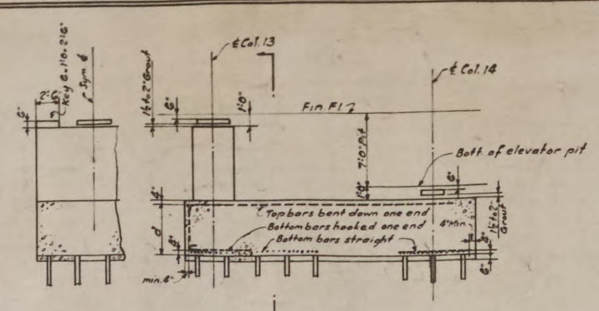
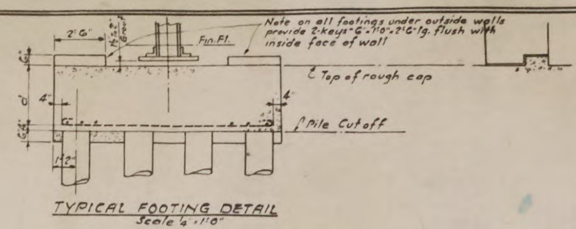
#7-83 driven 30' and tested settled $1\frac{3}{8}$ " at 46 Ton.
~~#2-249 not tested etc.~~



#21-96 driven 30' and tested settled 10" at 60 Ton.
#26-238 " " " " 5" at 60 Ton.





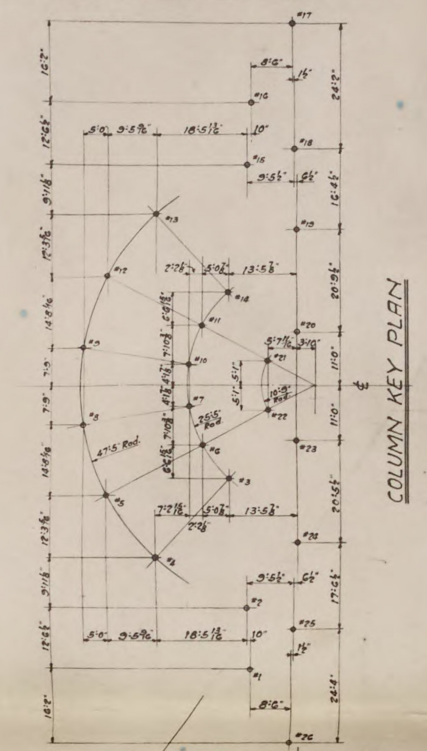


DETAIL AT COLS. 13 & 14

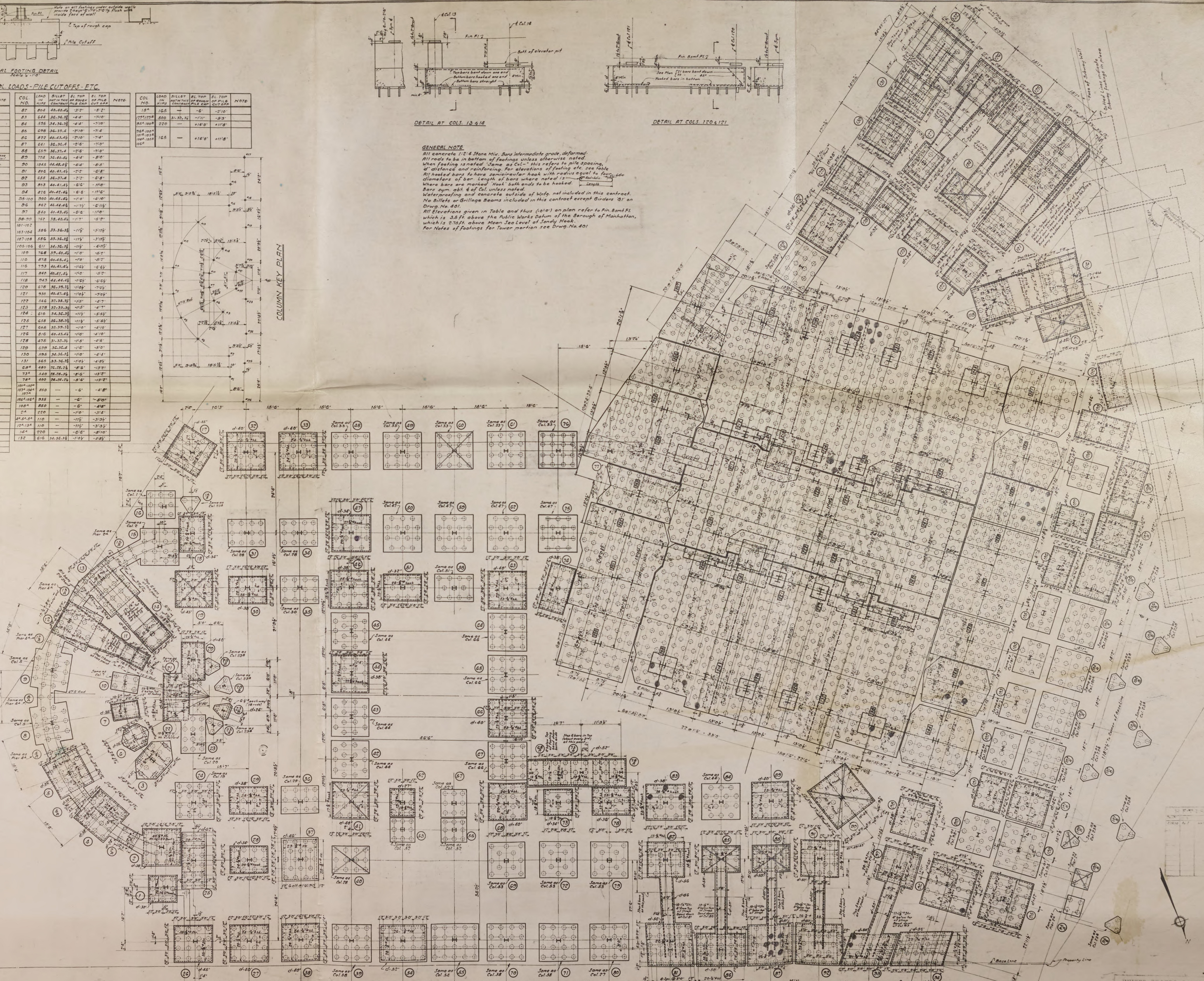
DETAIL AT COLS. 120 & 121

GENERAL NOTE
 All concrete 1:2 1/2:4 Stone Mix. Bars intermediate grade, deformed.
 All rods to be in bottom of footings unless otherwise noted.
 When footing is noted "Same as Col." this refers to pile spacing, elevation and reinforcing. For elevations of footing etc. see table.
 All hooked bars to have semi-circular hook with radius equal to four times diameter of bar. Length of bars where noted is - (hook) -
 Where bars are marked "hook" both ends to be hooked.
 Bars sym. abt. 6" of Col. unless noted.
 Waterproofing and concrete outside of Wpfs. not included in this contract.
 No Billets or Grillage Beams included in this contract except Girders 31' on Drwg. No. 401.
 All Elevations given in Table and thus (Col.) on plan refer to Fin. Bm. Fl. which is 3.5 ft. above the Public Works Datum of the Borough of Manhattan, which is 2.75 ft. above Mean Sea Level of Sandy Hook.
 For Notes of Footings for Tower portion see Drwg. No. 401.

COL. NO.	LOAD IN TONS	PILE CUTOFF	NOTE
1	368	25.75	-11.5'
2	793	40.60	-11.0'
3	578	36.30	-11.0'
4	677	40.60	-11.0'
5	581	36.30	-11.0'
6	487	28.30	-11.0'
7	568	36.30	-11.0'
8	787	40.60	-11.0'
9	686	36.30	-11.0'
10	677	40.60	-11.0'
11	578	36.30	-11.0'
12	487	28.30	-11.0'
13	568	36.30	-11.0'
14	787	40.60	-11.0'
15	686	36.30	-11.0'
16	677	40.60	-11.0'
17	578	36.30	-11.0'
18	487	28.30	-11.0'
19	568	36.30	-11.0'
20	787	40.60	-11.0'
21	686	36.30	-11.0'
22	677	40.60	-11.0'
23	578	36.30	-11.0'
24	487	28.30	-11.0'
25	568	36.30	-11.0'
26	787	40.60	-11.0'
27	686	36.30	-11.0'
28	677	40.60	-11.0'
29	578	36.30	-11.0'
30	487	28.30	-11.0'
31	568	36.30	-11.0'
32	787	40.60	-11.0'
33	686	36.30	-11.0'
34	677	40.60	-11.0'
35	578	36.30	-11.0'
36	487	28.30	-11.0'
37	568	36.30	-11.0'
38	787	40.60	-11.0'
39	686	36.30	-11.0'
40	677	40.60	-11.0'
41	578	36.30	-11.0'
42	487	28.30	-11.0'
43	568	36.30	-11.0'
44	787	40.60	-11.0'
45	686	36.30	-11.0'
46	677	40.60	-11.0'
47	578	36.30	-11.0'
48	487	28.30	-11.0'
49	568	36.30	-11.0'
50	787	40.60	-11.0'
51	686	36.30	-11.0'
52	677	40.60	-11.0'
53	578	36.30	-11.0'
54	487	28.30	-11.0'
55	568	36.30	-11.0'
56	787	40.60	-11.0'
57	686	36.30	-11.0'
58	677	40.60	-11.0'
59	578	36.30	-11.0'
60	487	28.30	-11.0'
61	568	36.30	-11.0'
62	787	40.60	-11.0'
63	686	36.30	-11.0'
64	677	40.60	-11.0'
65	578	36.30	-11.0'
66	487	28.30	-11.0'
67	568	36.30	-11.0'
68	787	40.60	-11.0'
69	686	36.30	-11.0'
70	677	40.60	-11.0'
71	578	36.30	-11.0'
72	487	28.30	-11.0'
73	568	36.30	-11.0'
74	787	40.60	-11.0'
75	686	36.30	-11.0'
76	677	40.60	-11.0'
77	578	36.30	-11.0'
78	487	28.30	-11.0'
79	568	36.30	-11.0'
80	787	40.60	-11.0'
81	686	36.30	-11.0'
82	677	40.60	-11.0'
83	578	36.30	-11.0'
84	487	28.30	-11.0'
85	568	36.30	-11.0'
86	787	40.60	-11.0'
87	686	36.30	-11.0'
88	677	40.60	-11.0'
89	578	36.30	-11.0'
90	487	28.30	-11.0'
91	568	36.30	-11.0'
92	787	40.60	-11.0'
93	686	36.30	-11.0'
94	677	40.60	-11.0'
95	578	36.30	-11.0'
96	487	28.30	-11.0'
97	568	36.30	-11.0'
98	787	40.60	-11.0'
99	686	36.30	-11.0'
100	677	40.60	-11.0'



COLUMN KEY PLAN







" 2.
American Studios N.Y.

July 11th, 1932. Feb. 25th 1930
Federal Court House 505 Pearl St
George J. Atwell Foundation Co. Inc.
View Looking South West

EXCAVATION & FOUNDATION WORK,

NEW FEDERAL COURT HOUSE, NEW YORK, N. Y.

CASS GILBERT, Architect

GEORGE J. ATWELL FOUNDATION CORPORATION, Contractor

JULY 11th 1932

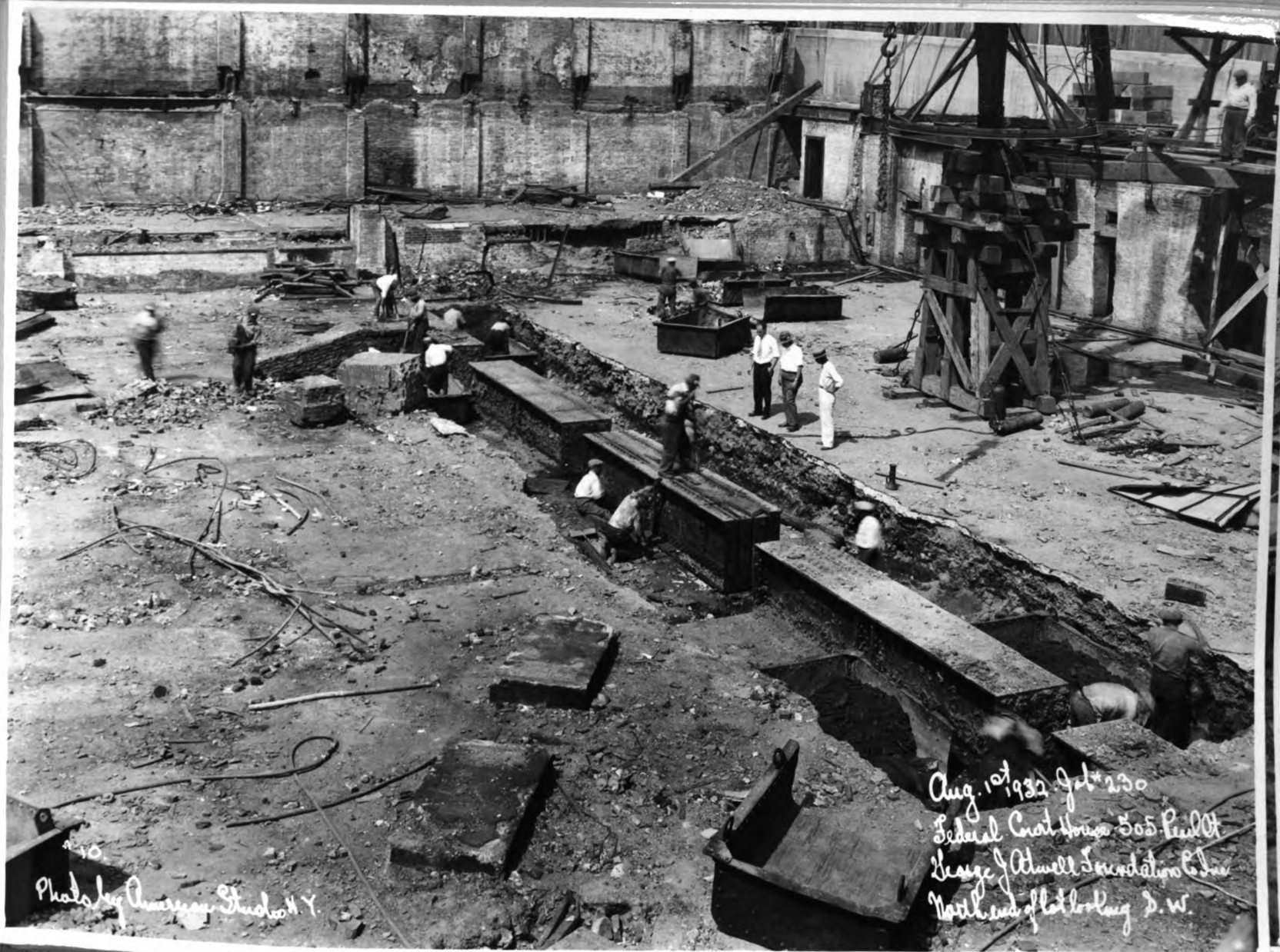


Photo by American Studio N.Y.

Aug. 17, 1932. Job # 250
Federal Court House 505 Keith
George J. Atwell Foundation Co. Inc.
North end of lot looking S.W.



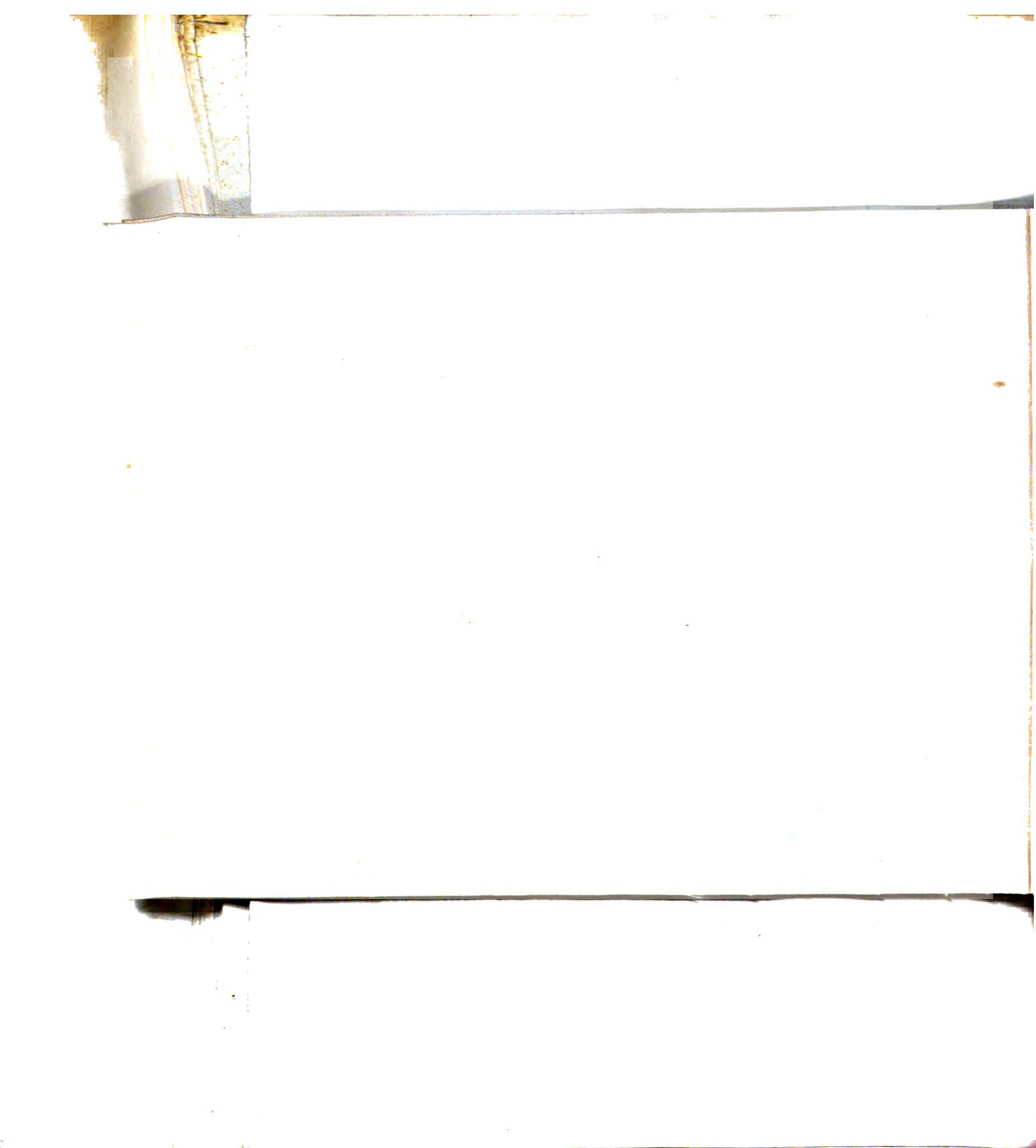
38
Photo by American Studios N.Y.

Sept 1st 1932. Job #230
Federal Court House - 505 Pearl St
George J. Atwell Foundation Corp
West end of lot North side



26
Photo by American Studios N.Y.

Aug 16 1932. Job 230
Federal Court House - 505 West
George J. Atwell Foundation Corp.
Architect of the Building - Smith & Woot

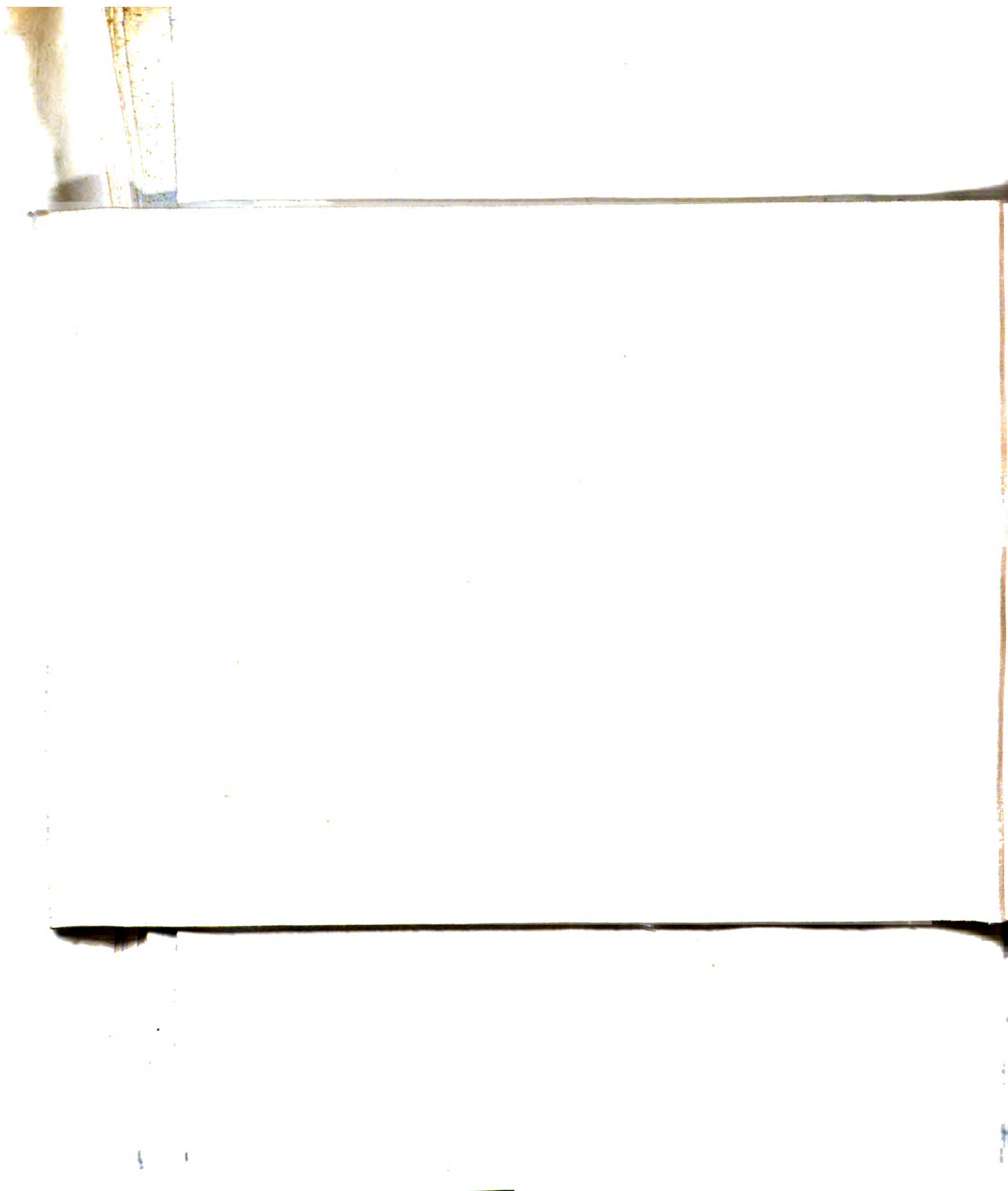




#35

Photo by American Photo N.Y.

Aug 27th 1932 Feb 230
Federal Fuel House 305 Broad St
George J. Albrecht Foundation Corp
New York Looking South West

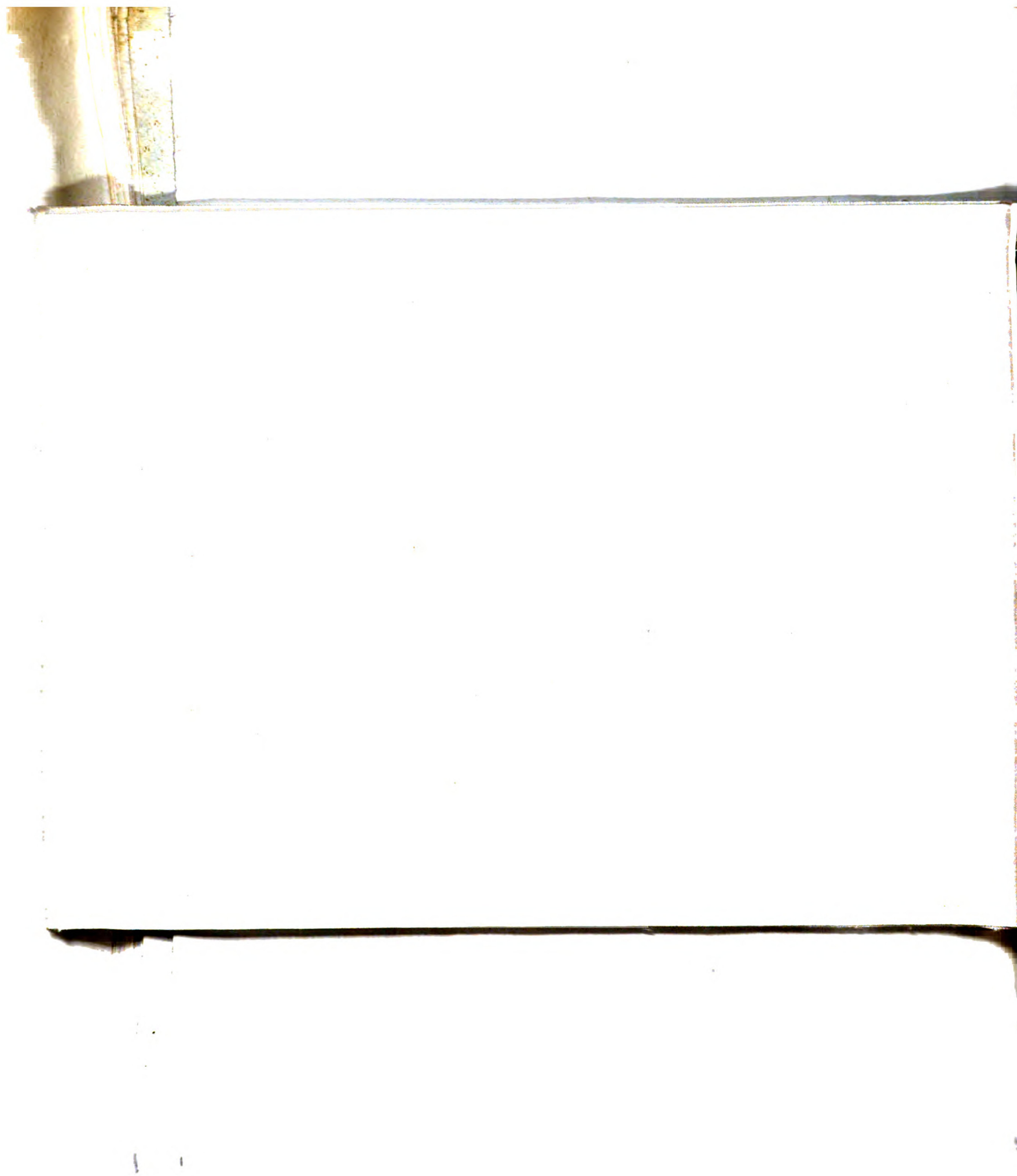




437

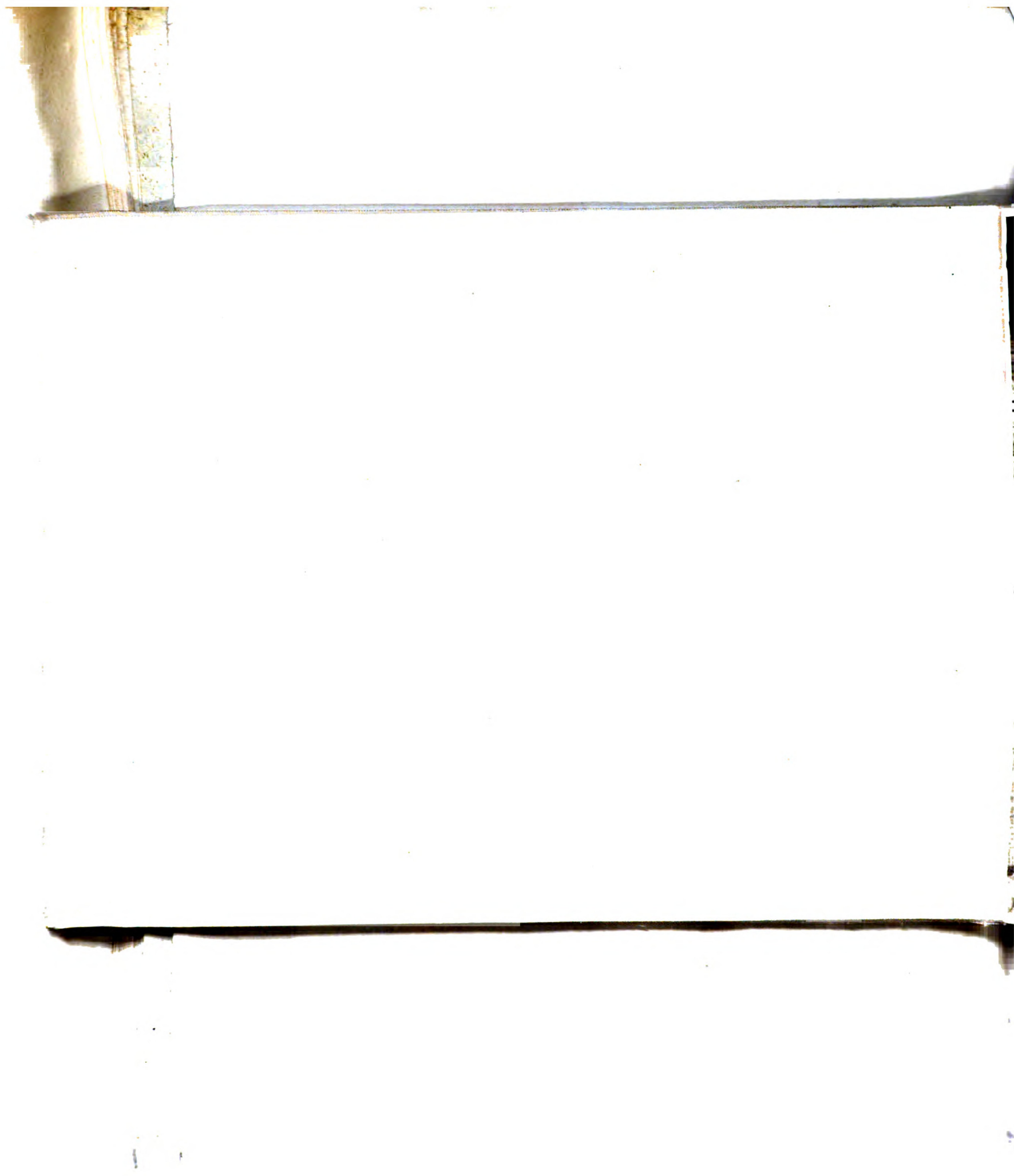
Photo by American Studio N.Y.

Sept 11, 1932 - Job #250
Federal Court House - 505 Pearl St.
George J. Atwell Foundation Corp.
New View looking South West





Sept 1, 1932. Job #230
Federal Court House - 505 Canal St
George J. Howell Foundation Corp.
Center of lot - East end

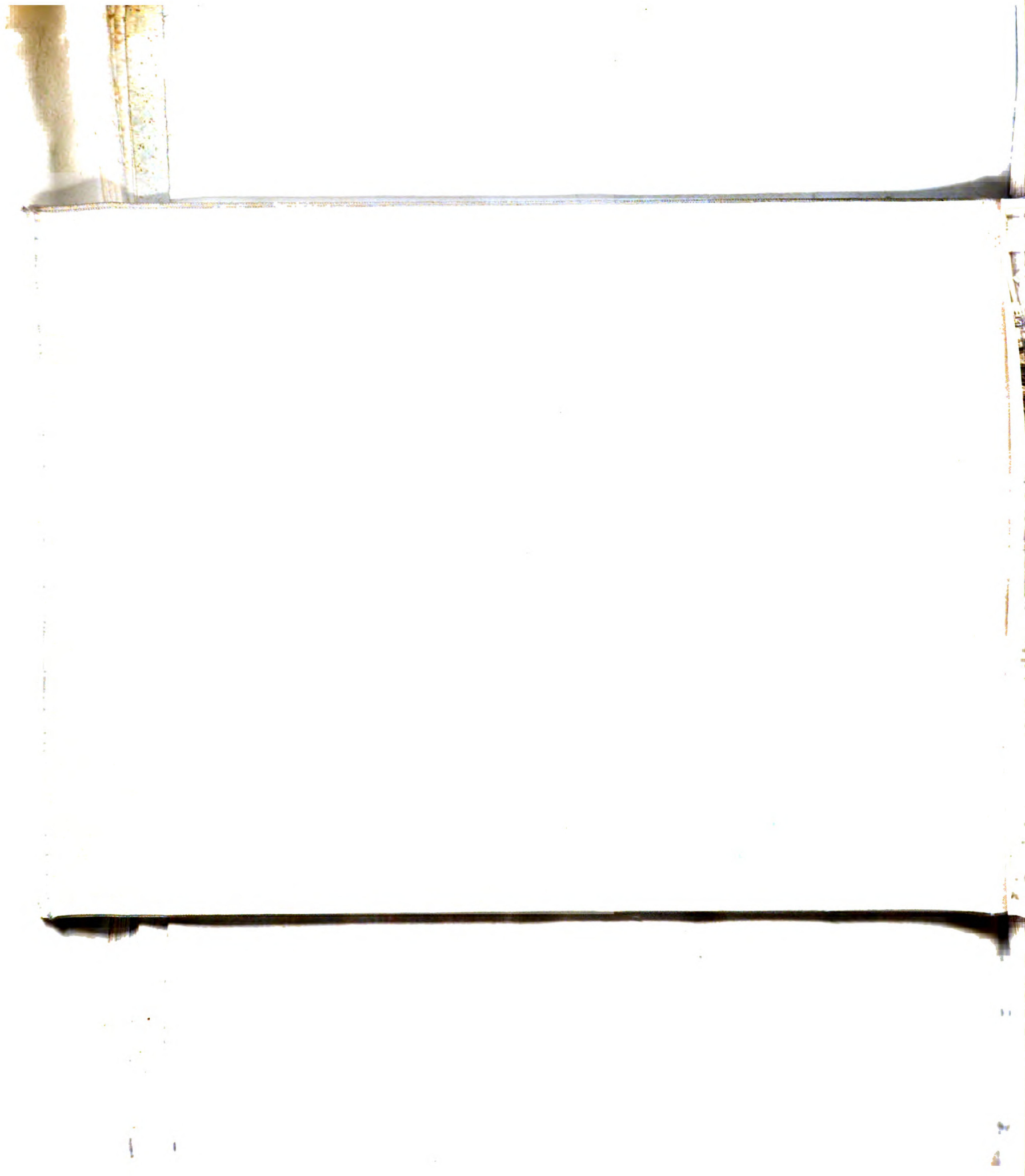




↑
This piece broken
in pulling

Dec. 8th, 1932. Job #230
Searg J. Atwell Foundation Co.
Precast Concrete piles driven
and withdrawn
Federal Court House, 505 Pearl St.

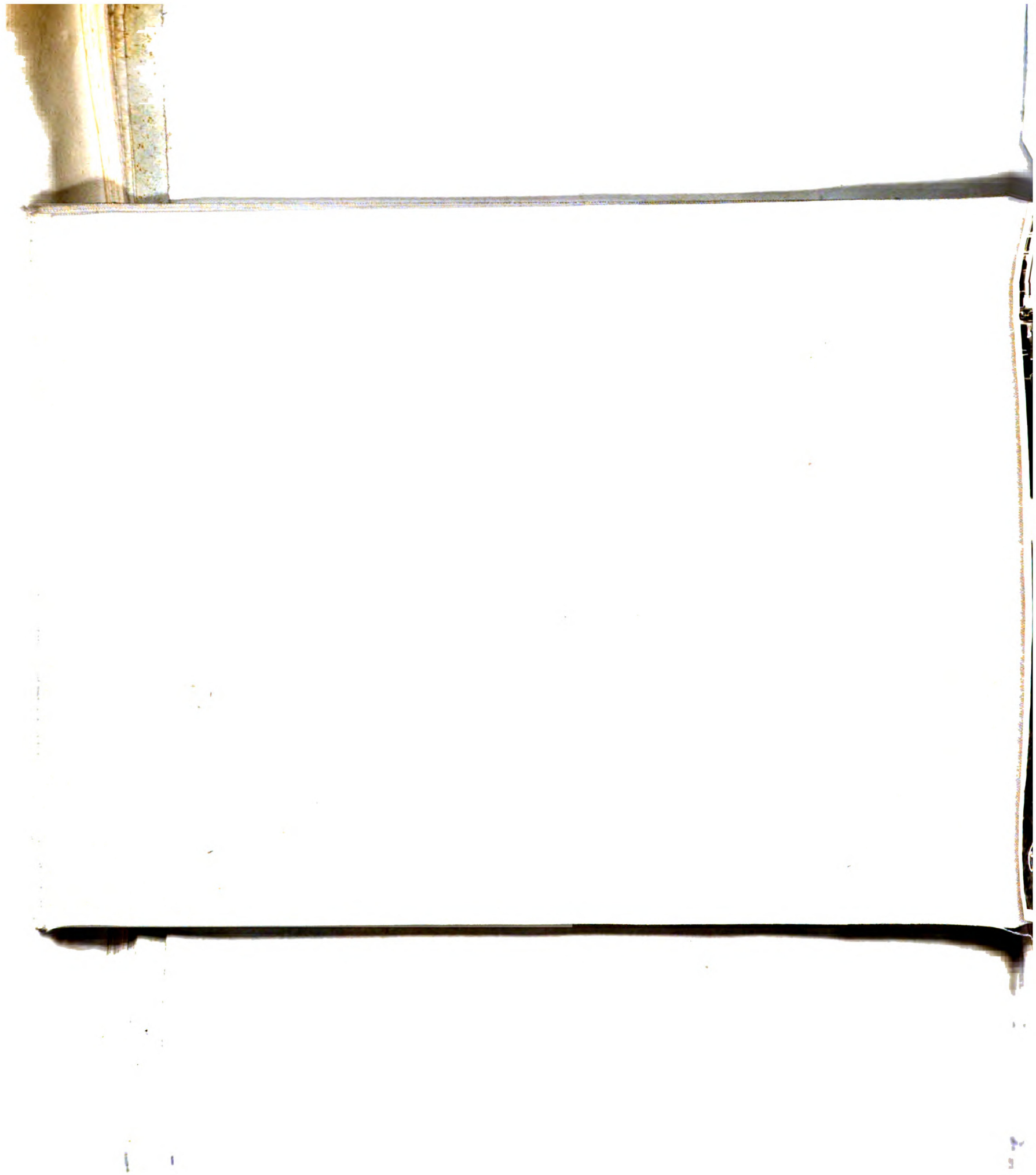
#68
Photo by American Studio N.Y.





#70
Photo by American Photo N.Y.

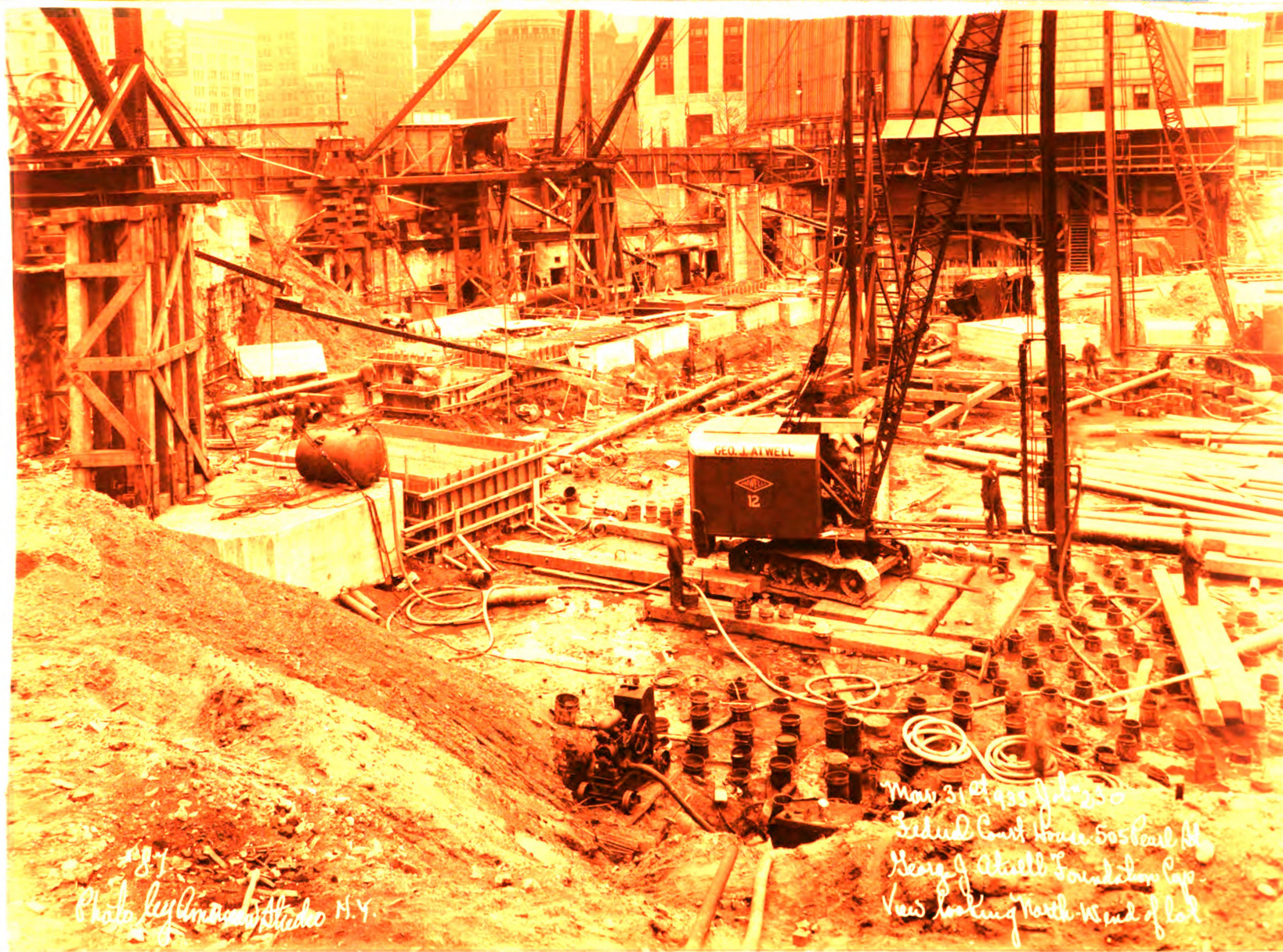
Jan. 3rd 1933. Lot #250
Federal Court House 505 Canal St.
George J. Atwell Foundation Corp.
New View of lot looking S. West





74
Photo by American Photo N.Y.

Mar. 1st, 1933 Job #230
Federal Court House - 505 Pearl St.
George J. Alvord Foundation Corp.
View looking South West.



1894
Photo by Lincoln Studio N.Y.

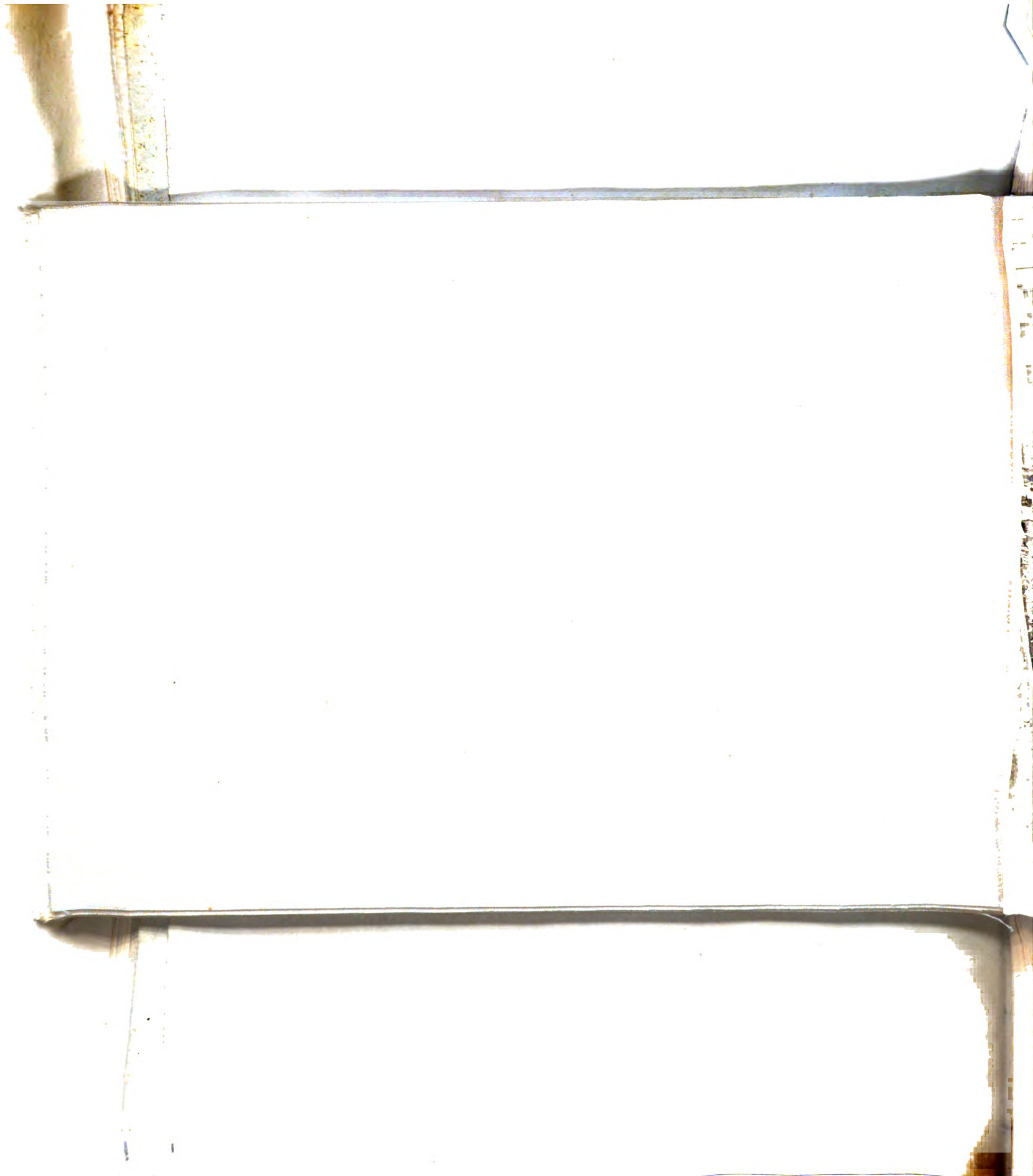
Nov 31st 1905 Feb 25th
Federal Court House 505 Pearl St
George J. Alwell Foundation Co.
View looking North-West of lot



+ 91

Photo by American Photo N.Y.

May 1st, 1933. Job # 230
Federal Court House 505 Pearl St.
Care of Otiswell Foundation Co.
Looking North West.

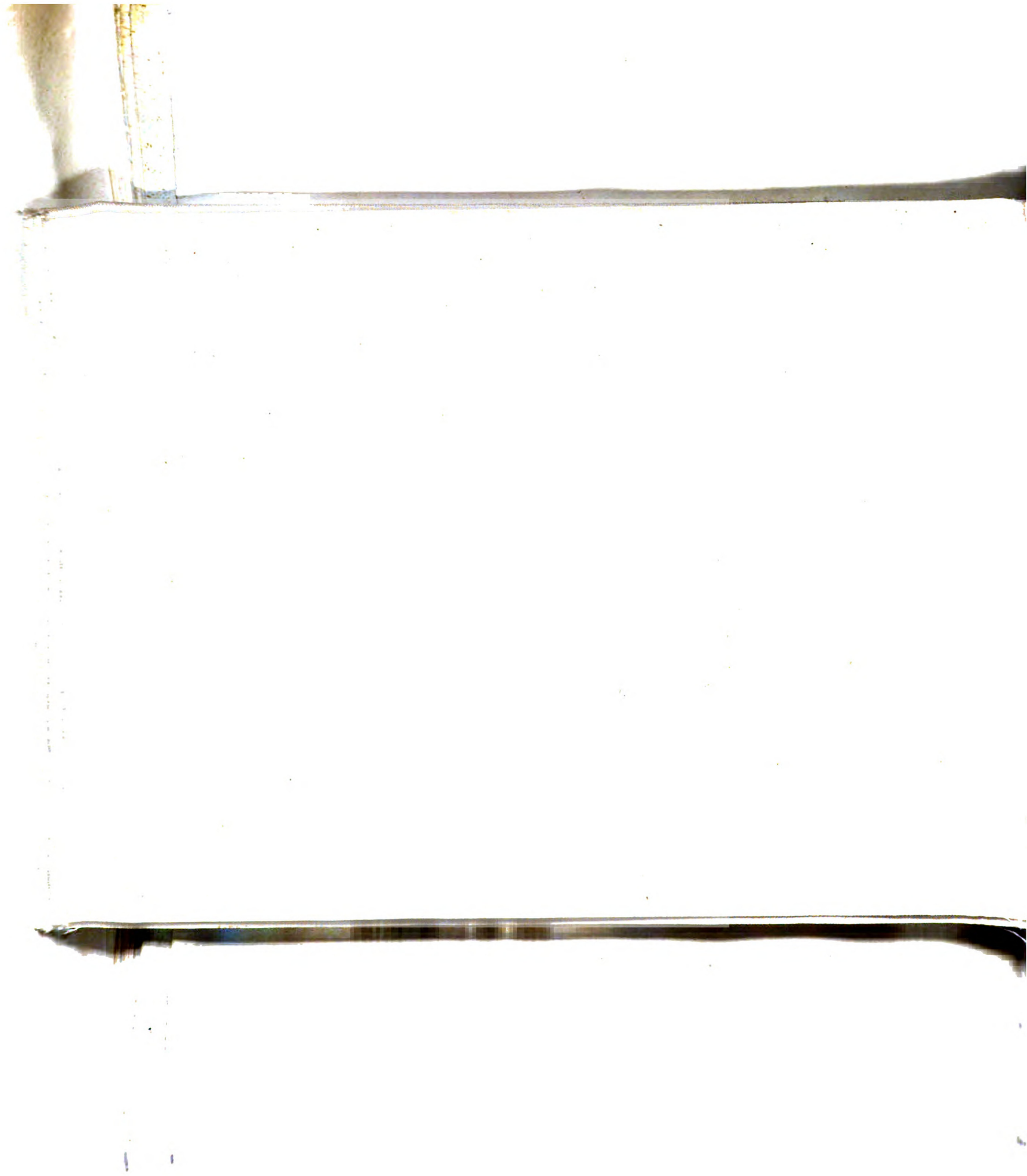




*93

American Studio N.Y.

June 1, 1933. Job #230
George J. Atwell Foundation Co.
Federal Court House 505 Pearl St
New View of job looking S. West

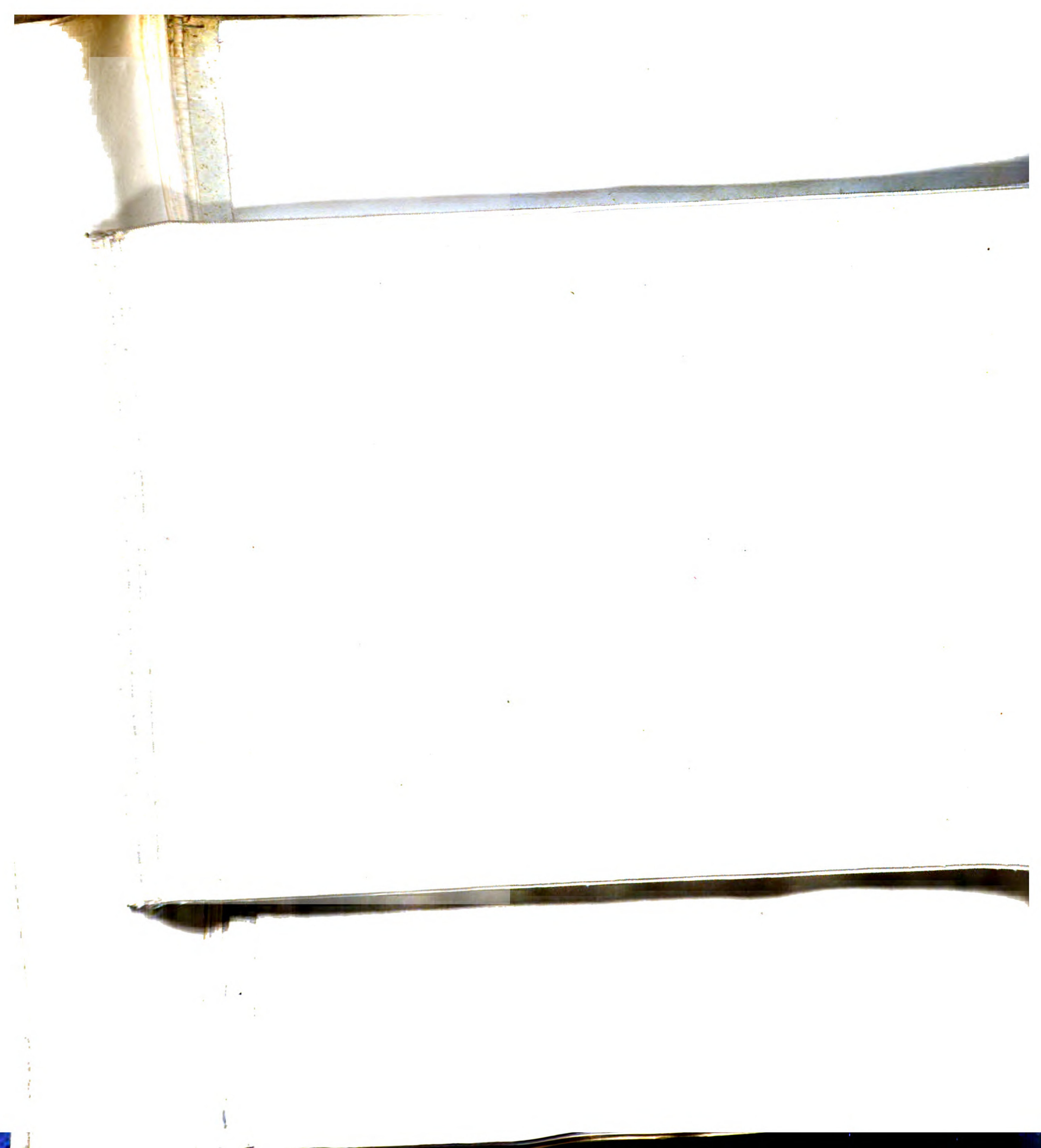




Jan 20 1911
George J. Alvert Foundation Co.
Center of last looking west.



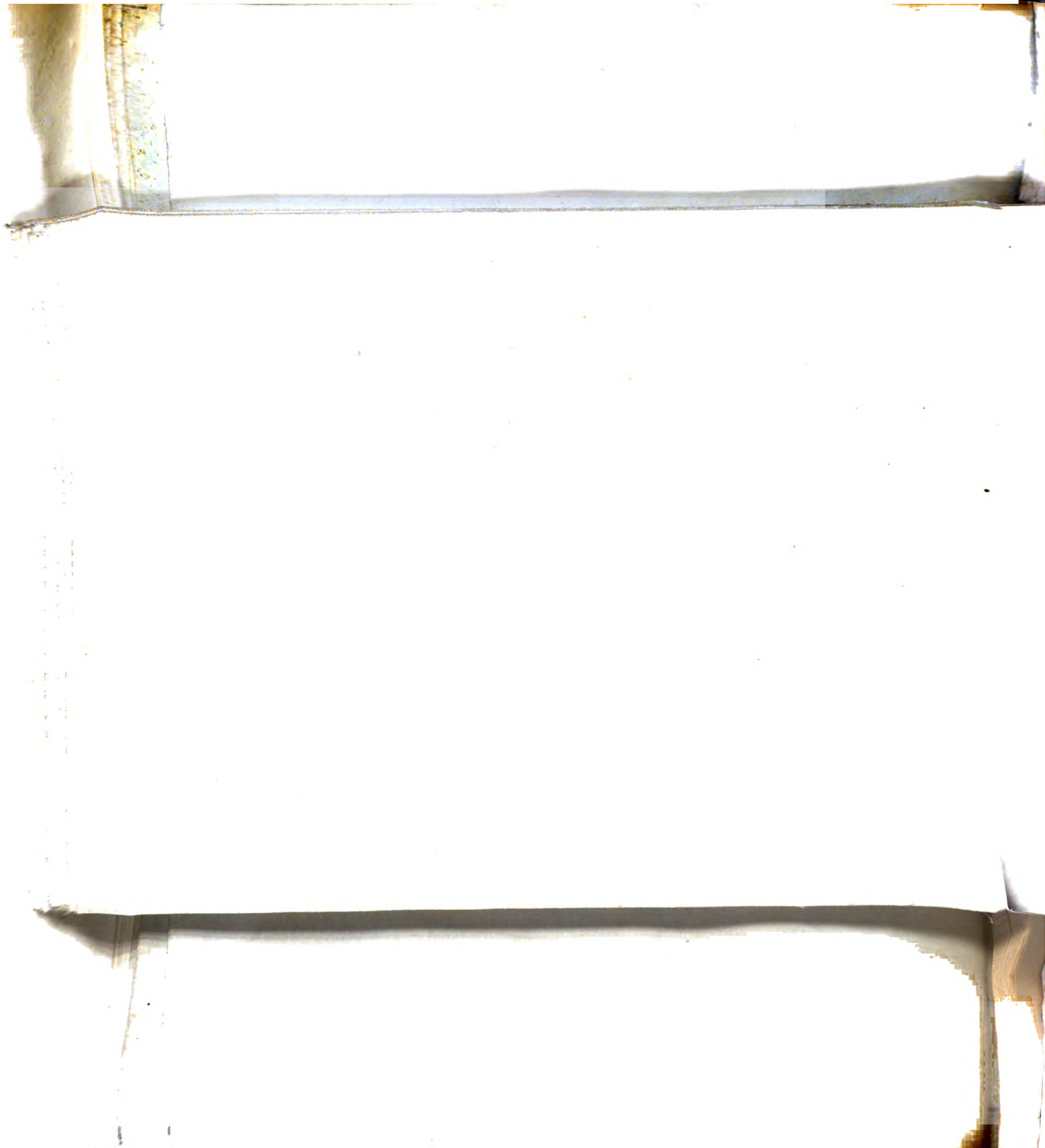




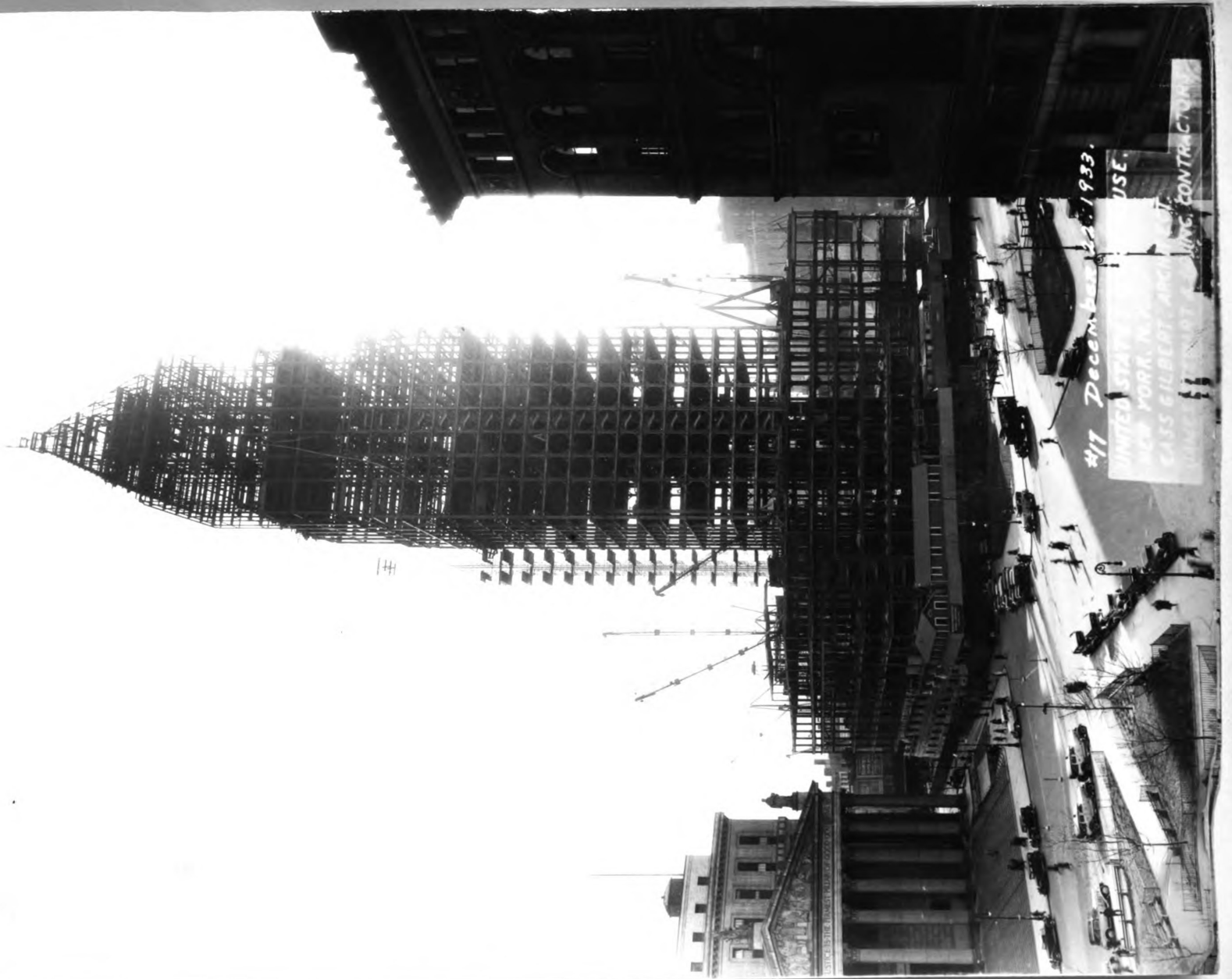


103
Philadelphia, Pa. N.Y.

Aug 1, 1933 Job # 230
Federal Court House, 505 Pearl St.
George Jaywell Foundation Co.
Looking South West.

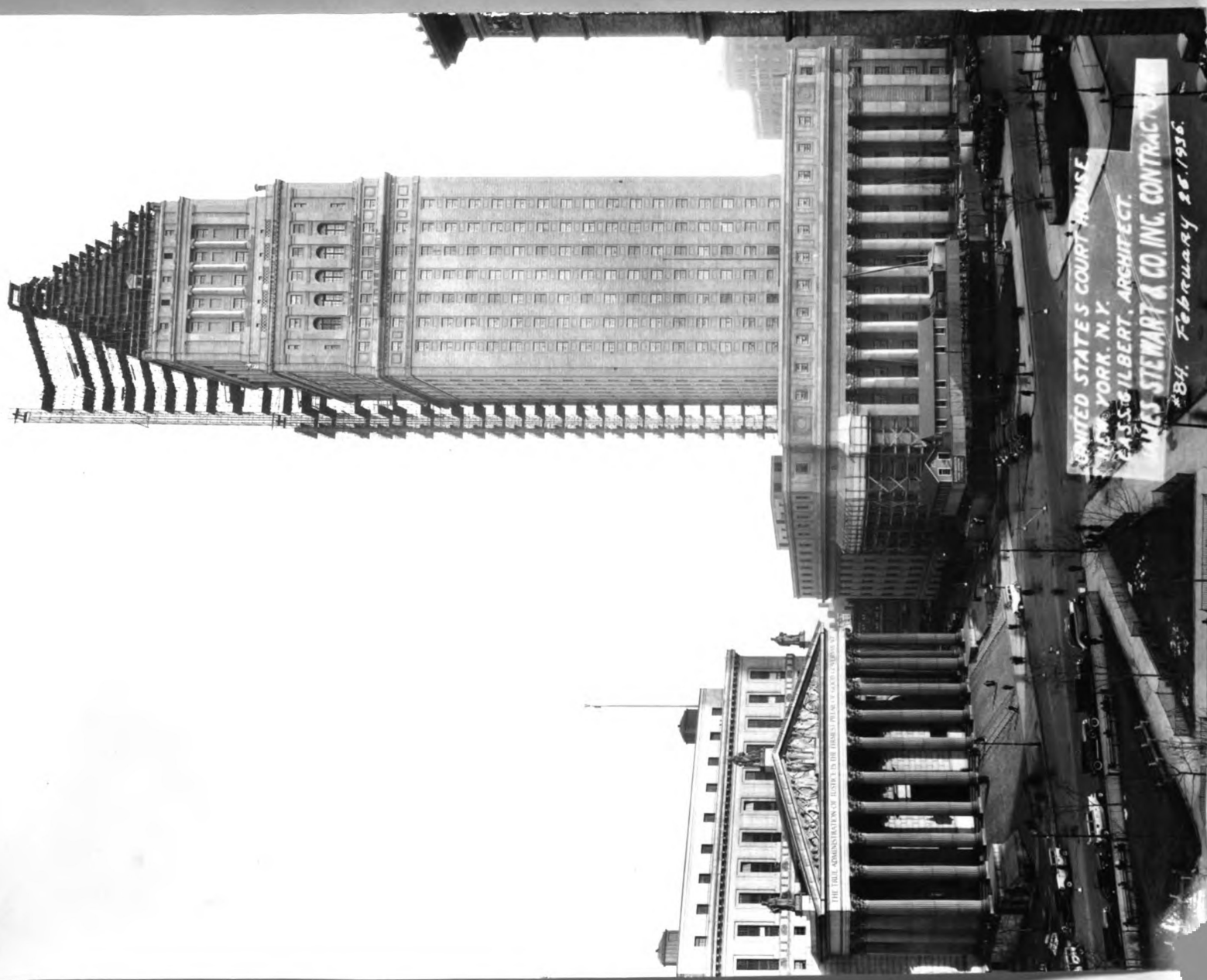


120000



417 December 1933.

UNITED STATES
NEW YORK, N.Y.
CASS GILBERT, ARCHT.
JAMES H. RYAN, JR.,
INC. CONTRACTORS



UNITED STATES COURT HOUSE
NEW YORK, N. Y.

WES STEWART & CO. INC. CONTRACTORS

284. February 26, 1936.



ROOM USE ONLY

ROOM USE ONLY



MICHIGAN STATE UNIVERSITY LIBRARIES



3 1293 03084 8620