Richmond, Virginia,

December 6, 1923.

To the Faculty of Washington and Lee University,

Lexington, Virginia.

Gentlemen:-

I respectfully announce myself a candidate for the degree of Civil Engineer at the close of the present session on the requirements according to the Catalogue, Session 1922-23.

I received the degree of Bachelor of Science in Civil Engineering, from Washington and Lee University June 1909.

The following is my professional record.

August 1, 1909 to March 1, 1910, Instrument-man and Engineer, under Stevenson Archer, Greenville, Miss.

March 1, 1910 to April 1, 1911, Instrument-man and Inspector, Mississippi Levee Board, Greenville, Miss.

April 1, 1911 to September 1, 1911, Private Civil Engineering Practice, Cleveland, Miss.

September 1, 1911 to August 1, 1912, Draftsman, Inspector and Engineer, City of Memphis, Tenn.

August 1, 1912 to June 1, 1913, Engineer of Construction, Unit Construction Company, Memphis, Tenn.

June 1, 1913 to February 1, 1915, Engineer of Construction, and Assistant Superintendent, Ferro Concrete Construction Company, Memphis, Tenn and Cincinnati, Ohio.

February 1, 1915 to March 13, 1917, Private practice and other business, Harrisonburg, Virginia.

March 13, 1917 to present, County Engineer, Resident Engineer, District Engineer, Assistant Engineer of State Highways, Maintenance Engineer, Virginia State Highway Commission, Richmond, Virginia.

My thesis will be submitted in the department of Civil Engineering subject to the approval of the Engineering Department.

Respectfully submitted,

J. S. Forrer

EDUCATION AND TRAINING

February 15, 1886 - June 30, 1909

I was born February 15, 1886 near Harrisonburg, Virginia and being raised on a farm attended the one room country schools, five months a year, until 1901 when I entered a graded school. I spent two years each in the graded and high schools at Harrisonburg obtaining such instructions that enabled me to enter Washington and Lee University in the fall of 1905. At the University I pursued the course of Civil Engineering and received a degree of Bachelor of Science in 1909.

During vacation periods, while at college, I was employed by Joseph G. and William J. Myers, Land Surveyers and Engineers, Harrisonburg, Virginia, as axman, rodman, chainman, and instrumentman and obtained very valuable practical experience on mountain and farm surveys. The equipment

used on these surveys was confined to the needle compass and 4 rod (66foot) chains. Notes were plotted and the area calculations made by the "Latitude and Departure" method.

EXPERIENCE AND FIELD PRACTICE

June 30, 1909 - March 1, 1910

In the fall of 1909 I went to Greenville, Mississippi as Engineer for Stevenson Archer, an engineer in private practice, making surveys of old Government township and section lines, city subdivision layouts, drainage, rice plantation projects, etc. I remained with Mr. Archer until March 1910.

Land Surveying.

The State of Mississippi was laid off in township and sections about 1830 by Government surveyors. These men must have worked under very adverse conditions because in order

to retrace their lines it was often necessary to wade waist deep, for days. In spite of these conditions their work proved remarkably accurate. Following these surveys by the government, "squatters" moved in and claimed certain poorly defined areas and this together with the work of the "Jack Leg" surveyors had caused most of the lines to be disputed. It required most exacting work to prove old corners. In every case possible, the original scribe marks on the witness trees were found but, ofcourse, in eighty years many had become obliterated. To prove an obliterated corner often necessitated running three or four lines from established corners of other sections. The original corners had been marked by wooden posts because of the lack of stones in this section of country and these referenced with three or four witness trees. All of the posts had disappeared and but few of the witness trees remained with their scribe marks intact. On

birch and other smooth barked trees the scribe marks had been made on the bark and were still legible to the trained eye. On rough barked trees the bark had been blazed off and the scribe marks made on the wood. These in time grew over but the scar or "catface" remained to tell the story. If there was any doubt the "catface" was chopped out and the marking examined. In fast growing trees, such as ash, the markings were often eight to ten inches in the tree. The part blocked out was saved as evidence. In the time spent at such work a large number of the original markings were found and many cases that had been fought both in and outside of the courts were settled. The marking found usually gave the township and section numbers, thus T 16, S 13, 14, 23, 24. The witness trees were usually described in the records, thus 10 in. Elm S 80 W 39 links, 6 in. Block Oak N 52 W 30 links, 4 in. Hackberry S 68 E 30 links, etc. Using bearings and distances, the corner point could be relocated.

It was also very improtant to know how much trees grew over a certain period so they could be recognized at the present time. The "cat-faces" had often become practically invisible especially on the north side of the trees and required a very experienced eye to detect them.

The instrument used in retracing the old lines was the modern transit with six inch needle. The transit was often checked over a true north and south line to determine the variation of the needle. The solar attachment was also extensively used.

The 66 foot (100 links) tape was used for measurments. The notes were easily plotted and areas calculated on account of the lines being so nearly parallel. The usual obstacles such as lakes, streams, etc. were encountered in making the surveys. The land was low and swampy.

City Subdivision.

Subdivision of land for town sites was part of the work done in this period. The

land was laid off in lots with the usual avenues, streets and alleys. Surface drainage was taken care of as near as possible by the natural slopes of the land but where this was impossible sufficient excavations were made to relieve the situation. Water and sewer lines were staked out and their locations well noted on the plots. This was very important and should save many puzzling problems in the future.

No unusal engineering methods were necessary on this class of work. The transit, level and 100 foot tape was used. Great care was exercised in checking over the work to insure the accuracy.

Drainage Work.

Individual farm drainage in the Mississippi Delta presented quite a problem within itself and while there was nothing intricate about the engineering work, on account of the flatness of the country, the question was where to spill the water or the point of outlet. Sections near the Mississippi River

had to be drained into other streams instead of into the river as the levee could not be cut. The banks of all streams in the Delta were high because the overflow waters for hundreds of years, before the days of the levee, had been checked by underbrush, thereby causing the deposit of the heavier sediments near the streams. This naturally caused swamps in the areas between streams and as the water in these swamps varied with weather conditions they could not be relied upon as outlets for drainage of farm tracts. In laying out and executing the work it was necessary to combat the laws of nature as well as the sentiment of the public by apparently running water up hill. If a very apparent outlet could not be seen a survey was run around the property and sufficient stakes set for reference, after which levels were run and elevations figured. Other lines were run in the same manner across the area. The troughs in this way were determined, after which the lines

for the main ditches were run, grades determined and grade stakes set and marked ready for excavation. The minimum fall required for good drainage, of a tenth foot to the hundred, was the maximum obtainable in this country. Very often farm tile was installed following excavations with a great many branches leading into the mains. The plot of a drainage survey resembled the skeleton of a fish. The level, transit and 100 foot tape were the instruments used.

Rice Plantation Layouts.

Surveys for rice fields ~~was~~ WERE not unlike drainage work only the object was the reverse. Instead of locating the lines for drainage they were so located as to permit ponding or draining the water as required. The preliminary work as in drainage done the contours for dikes were traced in by a plow which followed the rodman who was given the proper point by the man at the instrument. The dikes were then gone over and built to

the proper elevation by hand. Instruments used were the same as in drainage work.

March 1, 1910 -April 1, 1911

Being offered a position, as levelman, by Wm. G. Shackleford, Chief Engineer of the Mississippi Levee Board, I accepted and was sent to Rosedale to aid in the survey for the location of a new section of levee. The preliminary work finished, I was made inspector of the construction work which was completed November 1st, 1910. The remaining time with this organization was spent in shore line, levee enlargement and channel surveys, and patrol work during high water.

Levee Location.

Levees were usually built on straight lines, back from two to five miles, on each side while the stream meandered in the area between. In front of towns they were usually near the banks. Local levee projects were undertaken many years ago by individuals to protect their crops and properties. When the work was undertaken by the

States many of the local sections were included in the big system. The general drainage in the Mississippi Delta, as previously explained, is away from the river and finds its outlet through the Yazoo River along the foot hills.

The current of the Mississippi shifts continually and especially during high water caves off large areas eating its way towards the levees at places which makes it necessary to relocate and build new sections. This terrific erosion is prevented near cities by large willow mats that are woven and sunk by being loaded with rocks.

The engineering features to levee locations were not difficult. The line was located carefully checked and referenced. Levels were run and temporary bench marks set. Check levels were then run and permanent benches installed. When the grade was determined the ground was carefully cross sectioned, readings taken where necessary, and the slope stakes set, guarded and referenced. Yardage was calculated

VIEW OF DAMAGED LEVEE

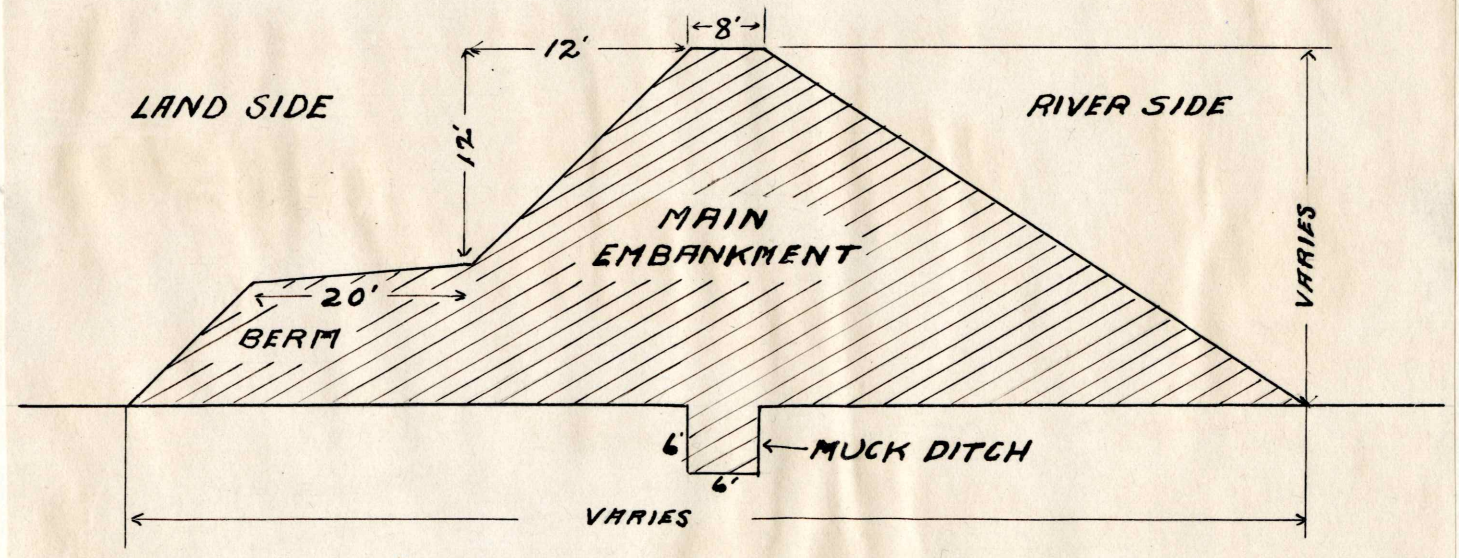
The river current shifted during high water and caused the banks and a part of the levee to cave off leaving only a small ragged embankment to protect the land from an overflow.

A new levee was built several miles inland.

from field books without plotting by the field party after which they were sent to headquarters for checking.

Construction and Inspection.

As the yardage was paid for in the fill instead of cut, as is usual, 15% to 20% was added for shrinkage. It was impossible to cross-section all borrow pits but it was done when possible to check the quantities. The better equipped contractors used tractor drawn elevators for loading dump wagons. Wheeled scrapers were used extensively and at times the wheel borrow. The borrow pits were usually made two hundred feet from the toe on the river side of the levee.



- SECTION OF LEVEE -

Attention is called to the berm on the land side which greatly reinforced the main levee. Also note the "muck ditch" which was dug well ahead of construction for the purpose of locating buried trees and crawfish holes that would allow water to seep under the levee. This ditch was filled with clay or what was known as "buck shot". The levee was sodded after completion, by planting Barmuda grass at points three feet apart each way.

It was the inspector's duty to see that the grade stakes were properly set, the ground well cleared and grubbed, the muck ditch dug, examined and filled, make all necessary measurements, reports and calculations. An inspector was kept busy on three miles of work.

Shore Line Surveys.

A shore line record of the river was kept. After each high water season where considerable erosion had occurred, stadia lines were run and tied in to previous surveys. Telescopes with powerful lenses and special stadia hairs were used for taking reading at long distances. Under

favorable weather conditions this work was very rapid.

Levee Enlargement.

It was often necessary to enlarge the old levees. The cross-section work was much more tedious on this but similar to other work of this nature. The enlargement was usually made on the slope next to the river.

Channel Surveys.

Channel surveys were at times necessary and required quick work back of transit to accurately take readings. A base line, usually two thousand feet long, was laid off on the shore. A transit was set up at one end and a target at the other. A motor boat with sounding equipment, was started from the target and kept on a line with a point on the opposite bank. Soundings were taken about every hundred feet. At the same time the sounding was taken, and recorded in the boat, a signal was given the man at the instrument who read the angle. As a check a second instrument was often placed in the

middle of the base to take readings at the same time.

Patrol Work.

It was very necessary during high water that the levees be closely watched. Engineering work under such conditions was suspended and sections from five to twenty miles in length assigned to each man. The duties were to walk or ride over each section twice a day noting conditions and reporting to headquarters. Hogs were shot and other aminals kept off. If a weak place was found a sand bagging gang was organized and the place repaired as quickly as possible. At times when the water was high the wind would whip it over the top in places not protected by nearby trees. In such cases sand bags were piled along the top. No levees gave way during the time I was with the Mississippi Levee Board.

April 1, 1911 - September 1, 1911

On April 1st, Mr. E. W. Offutt, B. S. Washington and Lee, 08, and I formed a partnership

to practice Engineering. Mr. Offutt was located at Greenville, Mississippi and I was at Cleveland. Our work was similar to the work I did in 1909 and 1910 under Mr. Archer. The cotton boll weevil entered the Delta in the summer of 1911 and as all other business became dull we gave up the work.

September 1, 1911 - August 1, 1912

September 1, 1911 I accepted a position with the Engineering Department of the City of Memphis. I had the good fortune to work, as draftsman, under A. H. Payne, B. S. Washington and Lee, 08. Mr. Payne, now deceased, was an artist, and required the most exacting work. During the spring of 1912 the Mississippi River went on a rampage and having had levee experience I was put in the field to help protect the city from an overflow. I remained in the field in charge of a survey party for several months and was then transferred to grading and paving work.

City Water Protection.

A large part of Memphis is built on ground about fifty feet above normal water and

naturally is not subject to overflow. There was a section along Gayoso Bayou, that ran through the city, that was used for industrial sites, and lower class dwellings that was on low ground. The crest of the water was estimated before it reached the city and preparations begun for protection. The low levees along the Bayou were reinforced and raised by sand bags and pumps installed to take care of seepage. Individual industrial plants built sand bag levees around their property and installed their own pumping machinery. The sand bags held the water in check for about a week until the ground in the old levee became soaked and broke down under the pressure at several places. The people had been well warned and although no lives were lost about 5 square miles were inundated. There was nothing that could be done until the water subsided. The Street Railway Company foresaw the breaks and had elevated their tracks. Boats were used in many places to ferry passengers where elevated sidewalks had not been constructed.

HIGHWATER - MEMPHIS, TENNESSEE.

Note levee in background topped with sand bags. Levee later became water soaked and gave away flooding five square miles within the city limits.

HIGHWATER - MEMPHIS, TENNESSEE

Industrial plant with sand bag levee.
Note Seepage pumps.

Overflow. Note elevated car tracks and walkway.

When the water begun to subside the fire department flushed the deposits back into the stream. The damage had been considerable and immediate steps were begun to prevent a repetition. Highwater marks had been located on each street and the area between cross-sectioned with a view of filling it in by hydraulic workings from the river. I had charge of this survey but the project was abandoned on account of the improvements that would have been destroyed. Another method was later used, my survey serving for the preliminary, but I was not detailed on this work.

Paving Work.

I was given charge of the engineering and inspection of the paving of Rayburn Boulevard. A mile and a quarter of concrete base with asphalt top was constructed. The work consisted of staking out for excavation, giving curb locations and elevations and setting grade stakes for the concrete base. The only difficult part was the street intersections which were usually warped to fit local conditions. All of the work required

careful supervision especially the curb setting. After the base was poured I acted as asphalt inspector on the street and secured a very excellent piece of work by rigid enforcement of the specifications.

August 1, 1912 - June 1, 1913

The Unit Construction Company of St. Louis was the successful bidder on a large cotton warehouse project for the Memphis Terminal Corporation. The cotton sheds covered about thirty acres of land and cost two million dollars. I was employed as engineer to lay off the buildings, supervise the footing work, check and distribute the units. I also gave part of my time to the supervision of the erection, especially that of the columns.

Unit construction of concrete buildings was a method that had at that time been little used. The procedure was to cast all units at a central mixing plant and after sufficient curing they were hauled to the building site and erected

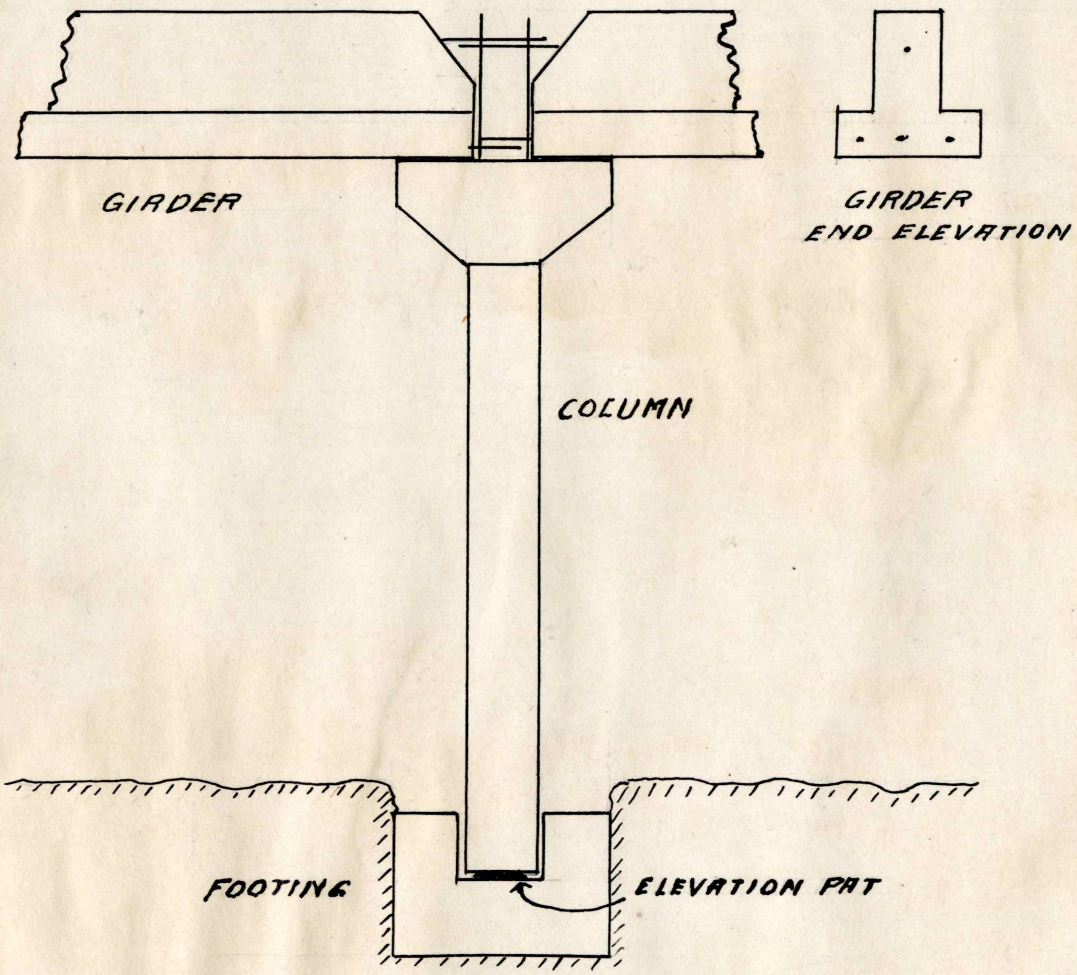
very much like steel members in bridge building.

Laying off the Buildings and Footings.

The building site had been laid off very much like a village with streets at right angles. The majority of the warehouses were 800 feet long and 125 feet wide with a 100 foot street on four sides. The streets were for fire protection and transportation of cotton. Base lines were run in the streets from which measurements to the building locations were taken. Hubs, with tack centers, were set in the base lines at panel length intervals.

To lay off the footings a wire was stretched from a hub in one base line to an opposite hub in another line. Measurements along the wire gave the location of the footing and sufficient stakes were set for the excavation. Levels were run over the locations and a grade hub set for each footing. After the excavations had been made levels were again run to determine the elevation of the bottom. Concrete was then poured to within an inch of the proper grade for

the bottom of the column. (see sketch) A square form one foot high and an inch larger all around than the column was then set on the footing and concrete poured around it to the top. This form was later removed and an "elevation pat" put in which completed the footing. (see sketch) To properly lay off a building it was necessary to make seven separate surveys over the site.



- UNIT CONSTRUCTION -

Method of Making Units.

The mixing plant and casting yard was located by a railroad siding. A large mixer was installed and elevator erected to hoist the concrete to the top of a distributor that had three chutes to the forms. The distributor was structural steel and swung in an arc of 250 degrees being held in position by two stiff legs. The chutes had swivel nozzles that swung 360 degrees so that all forms under the distributor could be filled.

The bases of all forms were made stationary but the sides were built so that they could be clamped in place and used again. After the forms were assembled, fabricated reinforcing steel was placed and secured inside. Concrete was poured and the forms were stripped from the sides after about forty eight hours and assembled on other bases. The units were allowed to cure ten to fourteen days. They were then loaded on flat cars by traveling cranes, and hauled to the building site being allowed to cure a week longer before erection.

Erection.

Equipment used for erection were stiff leg derricks and traveling cranes. Columns were placed in the footings and shored with timbers. Girders with hips on each side to support the roof slabs were then placed on the columns. After the roof slabs were erected there remained an open space over each column which was poured full of concrete. The ends of the reinforcing steel from the columns, girders and roof slabs met in this pocket. About an inch space was left between the roof slabs and was filled with grout. The roof slab resembled an inverted boat the sides acting as beams. Fire and end walls were also built from units. Columns with grooves were erected and the wall slabs filled in between. Sections were left out of the roof for ventilators and sky lights. The frame and rib work of these were also built up of small units so that when the building was completed it was all concrete except the fire doors and the glass in the sky lights.

UNIT CONSTRUCTION COMPANY

Casting yard and distributor.

Pouring roof slabs. Note empty form.

UNIT CONSTRUCTION COMPANY

"Pulling" and loading units.

Storing units at building site.

UNIT CONSTRUCTION COMPANY

Erection

Erection

UNIT CONSTRUCTION COMPANY

Wall erection.

Side view of warehouse.

UNIT CONSTRUCTION COMPANY

View of a roof. Note concrete ribs in sky light.

Some completed warehouses.

This project was finished in May 1913. The equipment was shipped back to St. Louis.

June 1, 1913 - February 1, 1915

In June 1913 I was employed by the Ferro-Concrete Construction Company of Cincinnati. They were erecting a large factory for the American Snuff Company in Memphis. Besides being engineer for this firm I ordered materials, kept cost and time data, was paymaster, made all reports to the head office and was assistant superintendent of construction. When bidding on new work in Memphis I made up the estimates. On one of these bids they were successful and erected a display room and warehouse for the Electric Supply Company at a very nice profit. In August 1914 I was transferred to Covington, Kentucky where a large lithographing plant was erected. While in Covington the same firm erected the concrete approaches and encased a stone pier to the bridge between Covington and Newport.

The Snuff Factory.

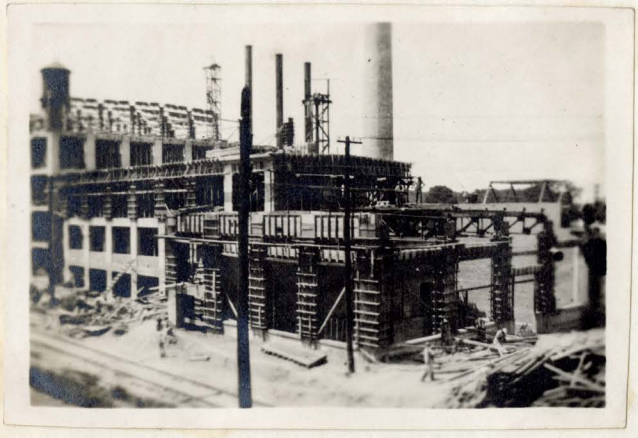
The Ferro-Concrete Company, as the name implies, specialized in reinforced concrete construction of the monolithic type. The Snuff Factory was a very special design in that it had a wood floor instead of the usual concrete. Over the open work of girders and beams a heavy oak floor was built on which a maple floor was laid. The basement floor and roof were of concrete. The spaces between the outside columns and beams, which were left exposed, were filled with windows supported by low brick walls. A power house and brick smoke stack was erected seperate from the factory.

Only two sets of forms were used on the work. As soon as the concrete for one story was poured the erection of the forms for the next story was begun. The forms were clamped together and were small enough to be easily handled which made erection rapid and economical.

The main building was six stories high three hundred and sixty feet long by one hundred and

FERRO - CONCRETE CONSTRUCTION

SNUFF FACTORY

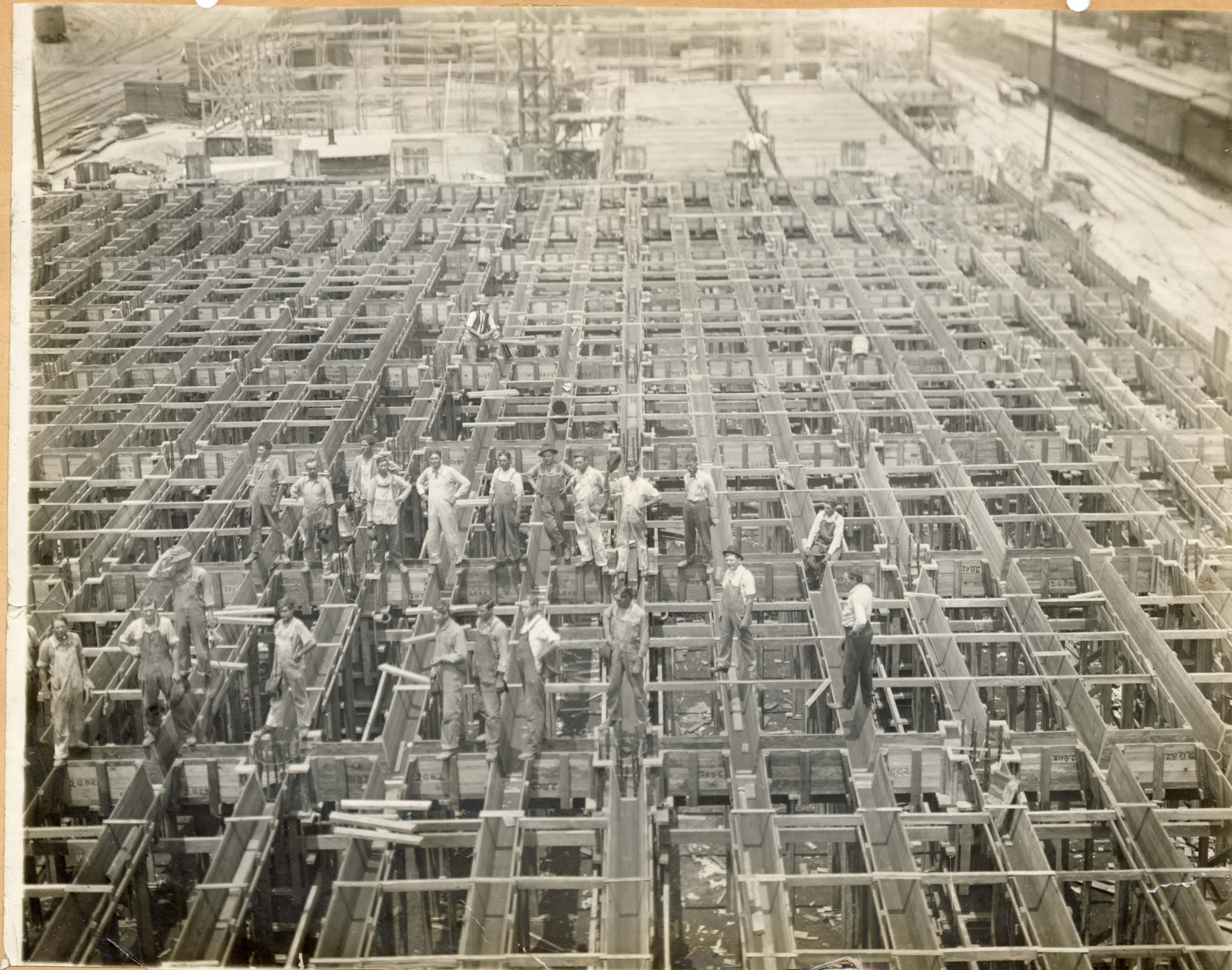


Forms in place

Interior

Interior
Completed

Completed
Factory



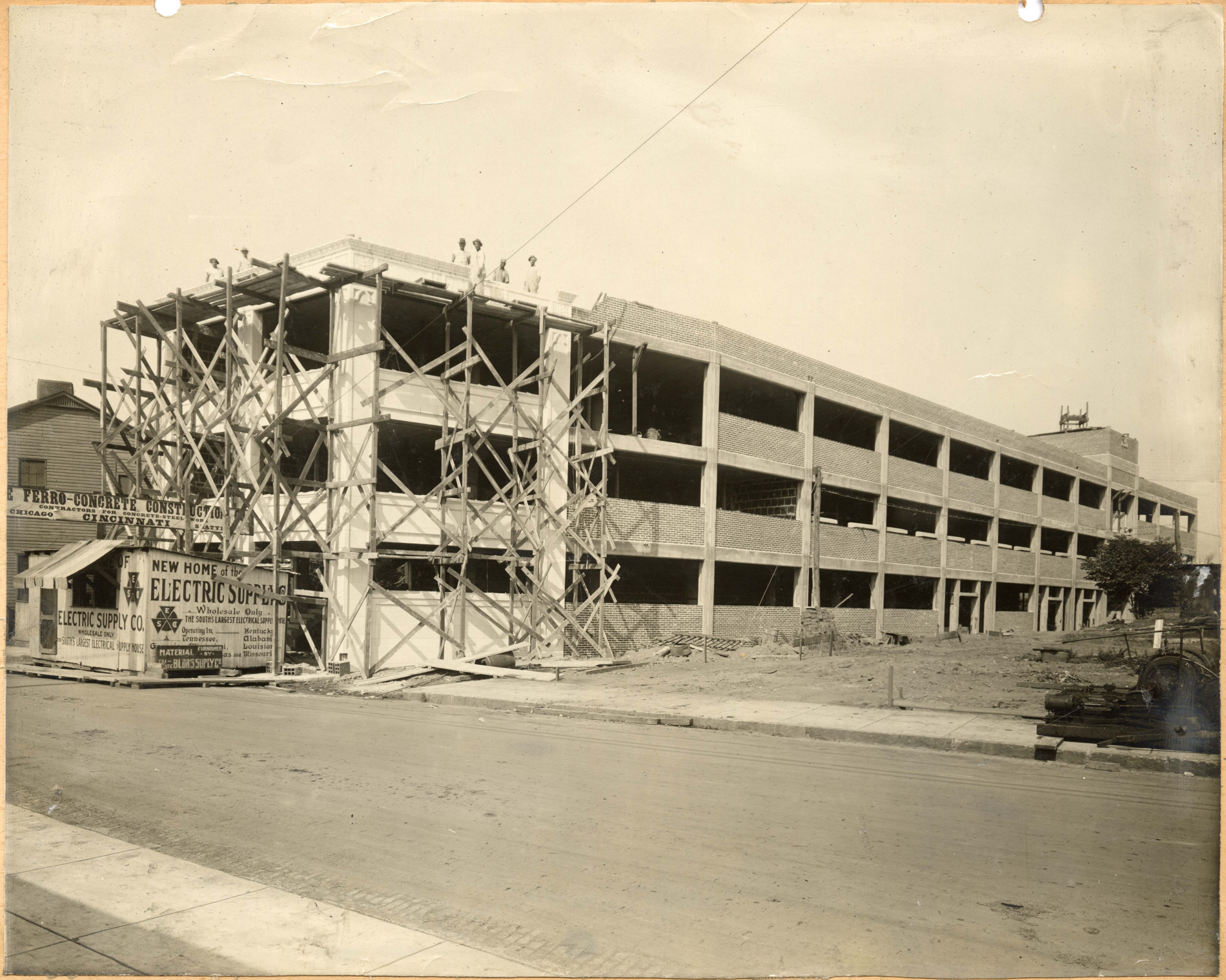
GIRDER FORMS - SHORE FACTORY

sixty feet wide. The other buildings were smaller. The factory was completed before the contract time and besides receiving a bonus the company made a fair profit.

The Electric Supply Building.

The costs in the construction of the Snuff Factory had been closely watched and with the organization intact it was possible to handle the Electric Supply building to an excellent advantage. The building was constructed five stories high in the back and three stories in front. The site was on the side of a ravine and allowed the odd story construction with a straight roof grade. The floors and roof of this building were built of concrete and were free of girders and beams, the mushroom method of construction being used. In this type of work the reinforcing steel extended out in every direction from the columns. The space between the columns on one side were completely filled with a brick wall while the other three sides were filled with windows supported by a low

ELECTRIC SUPPLY BUILDING


FERRO-CONCRETE
CONTRACTORS FOR CONCRETE-STEEL WOR
CHICAGO
CINCINNATI
NEW HOME of the
ELECTRIC SUPPLY
Wholesale Only
THE SOUTH'S LARGEST ELECTRICAL SUPPLY HOUSE
Operating In
Tennessee.
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WHOLESALE ONLY
SOUTH'S LARGEST ELECTRICAL SUPPLY HOUSE
MATERIAL FURNISHED BY
BLOSS SUPPLY CO

parapet of brick. The front of the building was finished with white tile.

Before the building was roofed Mr. F. F. Fisher, the superintendent, was called to Cincinnati. I was given complete charge and completed the work on time.

The Lithographing Plant and Newport Bridge Approach.

These two contracts were handled by one organization but were on opposite sides of the city. Each job had seperate equipment and the work was so timed that different operations were in progress at the same time. This method served to cut expenses as well as making the work rapid.

There were no unusual features to the Lithographing Plant except that the roof was of the saw tooth type. This allowed excellent lighting and ventilation facilities. The outside walls were of concrete.

The concrete encasement of the old stone pier for the Newport Bridge presented

many difficulties. The pier was about 50 feet high and was encased with 3 feet of concrete. Thousands of holes were drilled in the stone and dowel pins secured. Vertical reinforcing steel as well as girdles were used. Upon excavation it was found that the old pier was set upon piles. Piles were also driven for the foundation of the concrete jacket. The concreting was carried on in the winter which necessitated heating all materials. After the concrete was in place it was kept warm by the use of large tarpaulins under which heaters were placed.

The concrete approach was 400 feet long and ran from 40 feet high to street elevation. The substructure was open work and presented no difficulties except that of being constructed in cold weather.

also did the engineering work and had charge of the construction of 30 miles of gravel roads in the same county. I reported to Mr. F. D. Henley, Division Engineer, Norfolk, Virginia. Resident Engineer.

In the fall of 1917 I was transferred to Saluda and given the title of Resident Engineer. All of the road work in Middlesex, Mathews, Gloucester, King and Queen, King William, Essex and Caroline Counties was directly under my supervision. My duties were to locate the roads, organize construction crews and give the work general supervision. Monthly reports were made to the Richmond office through Mr. S. J. Sadler, Division Engineer, Fredericksburg. The funds for this work were furnished equally by the Counties and the State. The surface types used were sand-clay and gravel. I assisted in the location of Federal Aid Project #17 between Saluda and West Point and supervised the engineering work ahead of the construction forces.

In 1918 about 175 miles of roads in this Residency were taken into the State System and maintained by the State Highway Commission. I organized maintenance crews and supervised the work. The payments for thiswork was made direct from a revolving fund advanced me from the Richmond Office.

District Engineer.

In the summer of 1919 I was promoted to office of District Engineer and given charge of Loudoun, Fairfax, Arlington, Fauquier, Culpeper, Rappahannock, Orange, Green and Madison Counties with headquarters at Manassas. The district was reorganized with an Assistant District Engineer, two County Engineers, five inspectors, a maintenance superintendent and an office man reporting to me. All other employees reported to these officials.

Fifteen Federal Aid, State and State Aid projects were completed having a total length of about 100 miles. The types of surface used were concrete, penetration and waterbound macadam, gravel and soil. The work was done by contract and by

convict labor. A fund of twenty five thousand dollars was placed to my credit and was checked out once a month on the maintenance work. About 550 miles of road was maintained. As a great deal of the work was done for the counties it was necessary to meet with the boards of Supervisors once a month.

Assistant Engineer of State Highways and Maintenance Engineer.

In 1921 I was moved to Richmond, the main office of the Highway Department, and given the position as Assistant Engineer of State Highways under Mr. C. S. Mullen, Engineer of State Highways. The following year the Department was reorganized and I was made Assistant Engineer in charge of Maintenance (Maintenance Engineer) reporting directly to the Commissioner. My duties as Maintenance Engineer are purely executive having charge of the maintenance of the State Highway System of four thousand four hundred miles, fifteen hundred of which were taken over in an unimproved condition January 1923. The eight District Engineers report directly to me on maintenance and it is

necessary that I travel over the entire mileage two or three times a year. The maintenance budget is made up once a year, supplies and equipment authorized and monthly reports approved.