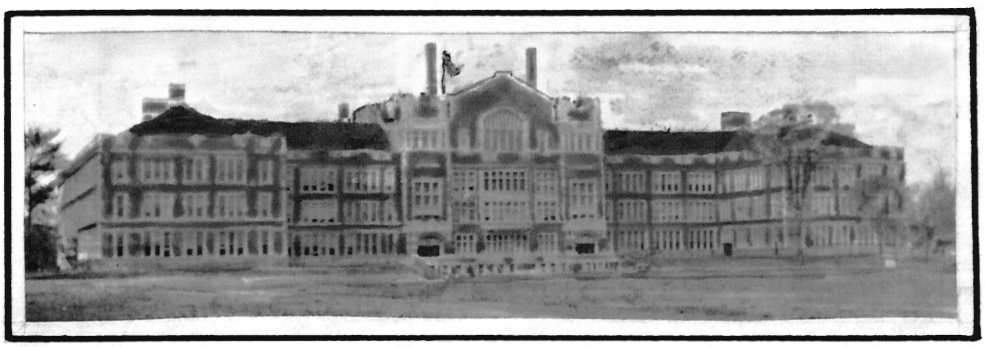
The "JESUP W. SCOTT" HIGH SCHOOL. TOLEDO, OHIO.



THESIS

for the degree of "CIVIL ENGINEER".

Submitted by

Harry Clifford McClure.

1914

By Resolution passed Oct. 19th, 1908, the Board of Education of the school district of the city of Toledo decided to submit at the following election the question of issuing bonds to the amount of $500,000.00 to start the construction of two new high schools. These schools were to be located one on each side of the Maumee River, which divides the city into two separate communities. The bond issue met with the approval of the people as it carried Nov. 3rd, 1908 by a vote of 2½ to 1. The following spring sites were purchased for the proposed new schools.

To facilitate the drawing of plans, as well as on the grounds of economy, the Board established its own Department of Architecture, and this department has up to the present time justified its existence several times over.

The above preliminary work was the first undertaken to relieve the conjested condition of Toledo's one high school, at that time housing over twice the number it was designed to accommodate.

It was decided that the new schools should be of a cosmopolitan character, having the academic, commercial, manual and scientific departments all incorporated under the one roof, placing equal emphasis on each department. It was thought that this plan would tend toward democracy in education and minimize false ideas a student might have of any department in which he was not especially interested.

After considerable study of suggested layouts, inspections of plans and completed buildings in most every large city in the eastern half of the United States, the following general plans were decided upon;-

GENERAL PLANS

"The buildings will be duplicates in every way except what differences might arise in the treatment of the ground plans. The design selected is a modified English Gothic executed in dark, reddish tapestry brick with cream terra cotta trimmings and a roof of matt green tile. The buildings will be entirely fireproof".

WRITERS CONNECTION

The writer entered the employ of the Board as assistant to Mr. L. M. Gram, Assoc. Mem. A. S. C. E., Structural Engineer for the Department of Architecture, after the plans along the above general lines were well under way and continued in the office on the concrete plans and schedules and steel work until construction work was started. At that time he was detailed as Supervising Engineer in charge of the construction of the Jessup W. Scott High School under the direction of Mr. Gram. On the completion of the "first" contract, which consisted of the concrete and steel frame complete and the building enclosed, Mr. Gram resigned and the writer was given general charge of all construction work, including finishing, heating plumbing and equipment. It is on account of the writers more intimate knowledge of the building known as the "Jessup W. Scott School" that the discussion and figures from this point will deal more particularly with that building.

DETAIL PLANS

The plan is like an "H" section, having a frontage of 381'-4" and wings 214'-8" deep. The central portion of the building is devoted to academic work, library, and study rooms. The laboratories and most of the manual training rooms are located in the wings.

The building is three stories high, all above grade, over the entire erea with an additional story over a portion of the center section giving room for a refectory, with a seating capacity of over 300, and a large kitchen and store rooms in connection. Lunches are served to the students at cost by a caterer employed by the Board.

The basement contains the heating and ventilating plant and ducts, store rooms, employee lockers, and a large room with all necessary outlets connections, etc., for use as an advanced heavy testing laboratory.

A portion of the manual training wing is given over to an auditorium with a seating capacity of 1100. The corresponding part of the scientific wing is used as a gymnasium with lockers, showers, visiting teams rooms and plunge.

Both the auditorium and gymnasium are provided with separate outside entrances thus allowing their use without access to the balance of the building.

ACADAMIC

The building accommodates a maximum of 1500 students. Standard class rooms 20x24 feet accommodate classes of 30 each and the three study rooms have a capacity of 200 each. The library will contain the book stacks and study tables accommodating about 50.

SCIENTIFIC

The scientific department consists of six laboratories in suites of three and four rooms. Each suite has a lecture room and working laboratory; three have private working laboratories and stock rooms combined and the balance are provided with separate private laboratories and stock rooms.

MANUAL

The manual training and domestic science departments are complete and include six shops, five free hand and mechanical drawing rooms and three rooms for domestic science and dressmaking. The domestic science has in connection a model flat for home keeping instruction. All of the above rooms have special locker and wash rooms, stock rooms, etc.,

COMMERCIAL

The commercial department includes rooms for bookkeeping, stenography, typewriting and commercial geography.

FINISH

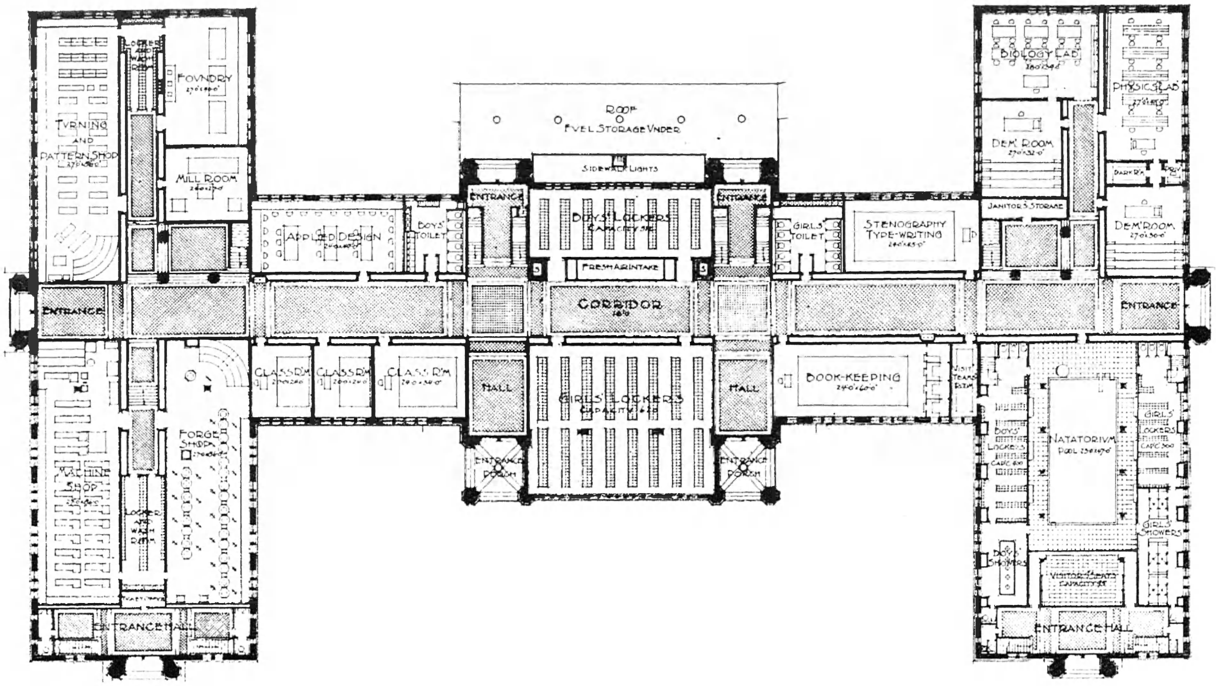
The building is finished in the best possible manner throughout. Plain white oak trim and flush panel doors all finished with three coats of varnish and hand rubbed, with pumice stone and water, to a dull gloss. All class and study rooms have clear maple floors; toilets and showers, terrazzo floors and base; laboratories, asphalt floors and corridors, tile floors and terrazzo base. All rooms have cement plaster wainscot except the auditorium and refectory, which have wood; the toilet, shower and wash rooms which have marble and the kitchens which have white tile. Marble thresholds and window stools are used throughout. All windows are equipped with weather strips. The Refectory and Auditorium stair hall are finished in Caen stone plaster, lined and jointed with white plaster and hand rubbed. The walls throughout the balance of the building are given three coats of flat wall finished in various color combinations.

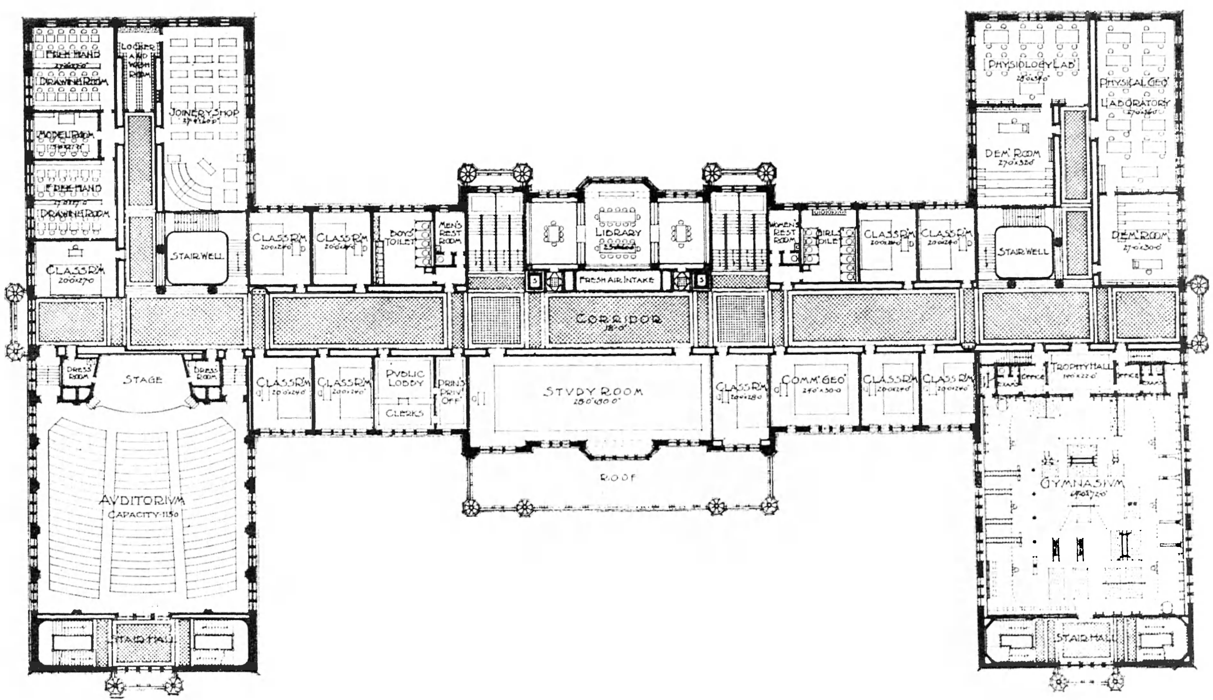
SPECIAL FEATURES

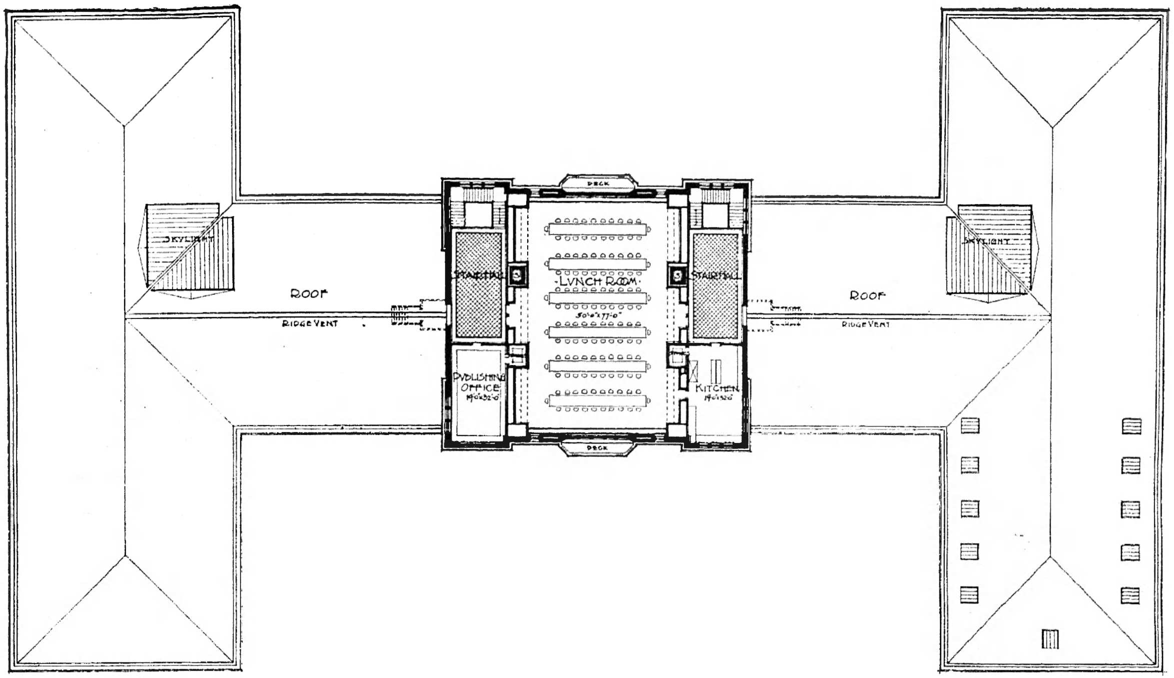
Among the speeial features included in the building are the following:-

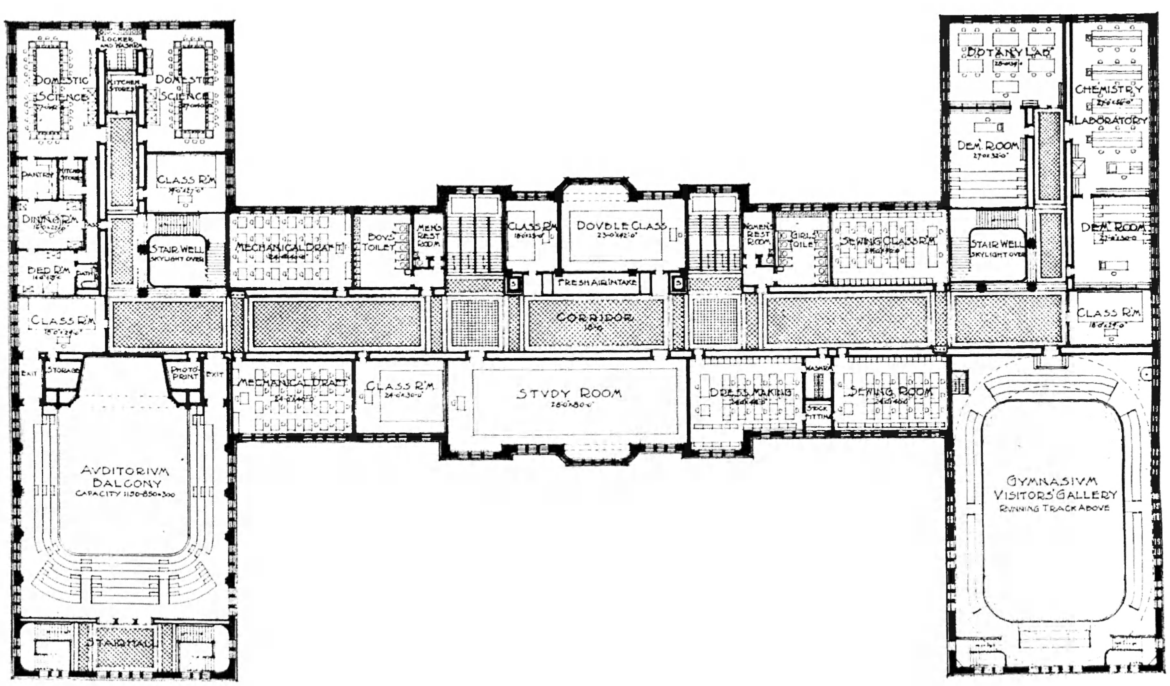
Absence of interior courts or court lighted rooms; large amount of outside light for all rooms; double stairways for up and down traffic; no long flights of outside approach steps; no basement class rooms; individual lockers for each student; number of conveniently located toilet and wash rooms; teachers emergency rest rooms; automatic programe bell system and intercommunicating telephone system counciling all rooms with the principals office.

The following plates of the several floor plans are shown to give a general idea of the building. They are not entirely correct, however, in that they do not show private and stock rooms separate from the laboratories and stock rooms, and demonstration rooms, separate from the several shops. The locker rooms shown on the ground floor plans have been utilized as class and study rooms and wainscot lockers have been installed in the corridors The plates were taken from the original show drawings and have never been brot up to date.


FOUNDRY
TURNING AND PATTERN SHOP
MILL ROOM
APPLIED DESIGN
BOYS' TOILET
ENTRANCE
ROOF
FUEL STORAGE UNDER
SIDEWALK LIGHTS
BOYS' LOCKERS
FRESH AIR INTAKE
GIRLS' TOILET
STENOGRAPHY TYPE-WRITING
BIOLOGY LAB
PHYSICS LAB
DEM' ROOM
JANITOR'S STORAGE
CORRIDOR
CLASS R'M
HALL
GIRLS' LOCKERS
BOOK-KEEPING
FORGE SHOP
MACHINE SHOP
ENTRANCE PORCH
NATATORIUM
BOYS' LOCKERS
GIRLS' LOCKERS
GIRLS' SHOWERS
BOYS' SHOWERS
VISITORS' SEATS
ENTRANCE HALL


FREE HAND
DRAWING ROOM
MODEL ROOM
JOINERY SHOP
STAIR WELL
CLASS R'M
BOYS' TOILET
MEN'S REST ROOM
LIBRARY
FRESH AIR INTAKE
WOMEN'S REST ROOM
GIRLS' TOILET
PHYSIOLOGY LAB
PHYSICAL GEO' LABORATORY
DEM' ROOM
CORRIDOR
STAGE
DRESS ROOM
AUDITORIUM
CAPACITY 1150
PUBLIC LOBBY
CLERKS
PRIN'S PRIV' OFF
STUDY ROOM
COMM' GEO'
OFFICE
TROPHY HALL
GYMNASIUM
ROOF
STAIR HALL

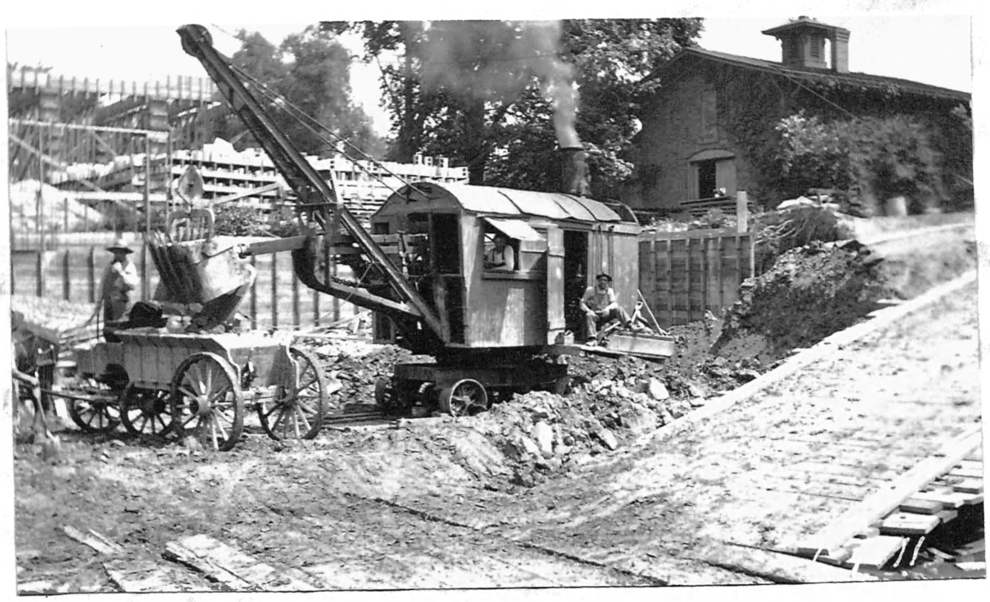

DECK
STAIRHALL
LUNCH ROOM
STAIRHALL
ROOF
RIDGE VENT
ROOF
RIDGE VENT
SKYLIGHT
SKYLIGHT
PUBLISHING OFFICE
KITCHEN
DECK


DOMESTIC SCIENCE
DOMESTIC SCIENCE
LOCKER AND WASH R'M
KITCHEN STORES
PANTRY
KITCHEN STORES
CLASS R'M
DINING R'M
STAIR WELL SKYLIGHT OVER
MECHANICAL DRAFT
BOYS TOILET
MENS REST ROOM
CLASS R'M
DOUBLE CLASS
FRESH AIR INTAKE
WOMENS REST ROOM
GIRLS TOILET
SEWING CLASS R'M
STAIR WELL SKYLIGHT OVER
BOTANY LAB
CHEMISTRY LABORATORY
DEM. ROOM
DEM. ROOM
CLASS R'M
CORRIDOR
CLASS R'M
STORAGE
PHOTO PRINT
EXIT
EXIT
MECHANICAL DRAFT
CLASS R'M
STUDY ROOM
DRESS MAKING
WASH R'M
STOCK FITTING
SEWING ROOM
CLASS R'M
AUDITORIUM BALCONY
CAPACITY 1150-850-300
STAIRHALL
GYMNASIUM VISITORS' GALLERY
RUNNING TRACK ABOVE

CONSTRUCTION

The construction work required quite an extensive contractors plant and this will be described somewhat in detail.

A three quarter yard Thew steam shovel was employed in removing the 15, 000 cubic yards of excavation in the basement area and hand shovel work in trimming banks and excavating piers and footings. A motor at the top of the drive into the hole took the place of a snap team. This work was started the first part of January, 1911, and continued to completion with but few interruptions on account of inclement weather. All of the excavated material was deposited on the site and later used in grading.

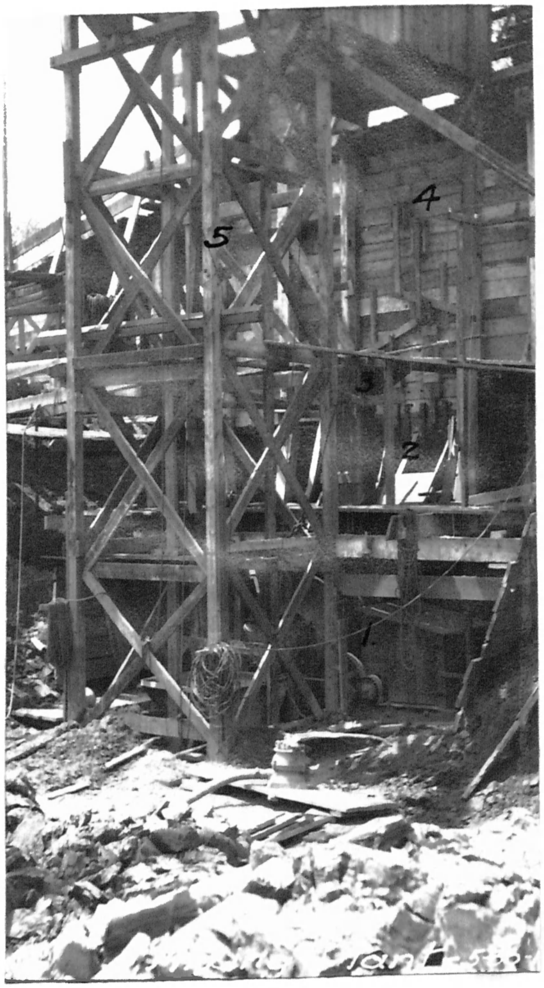


FORMS AND STEEL

The concrete work made up a large part of the rough construction work and the plant employed was a complete and effieient one. The carpenter shop contained a motor driven rip saw and the steel shed a power bender. The bender was so geared that the largest rods (1¾ inch) could be bent cold. On account of the school site being in an exclusive, built-up, residence section, storage capacity beyond that required by the carpenter and steel work was out of the question. The problem of depositing the 8000 yards of concrete without serious delays on account of lack of material was, however, very satisfactorily handled in the following manner.

CONCRETE PLANT

The basement excavation was carried out in front of the building line far enough to allow the installation of a ¾ yard, motor driven, Ransome mixer and erection of an 8'-0"x8'0" hoisting tower. With the mixer on the basement level it was possible to erect gravity sand and stone bins, of two and four cars capacity, respectively, extending but ten feet above the natural grade level. These bins were replenished as required by two yard bottom-dump wagons drawn up and easy incline by an electric hoist located near by. A seven car cement shed was built on the natural grade level around two sides of these bins. Motor trucks were employed to keep this shed full in order to allow at least a seven day test on all cement used.



1 Motor Driven Mixer

2 Sand and Stone Chutes

3 Cement Hopper

4 Sand and Stone Bins

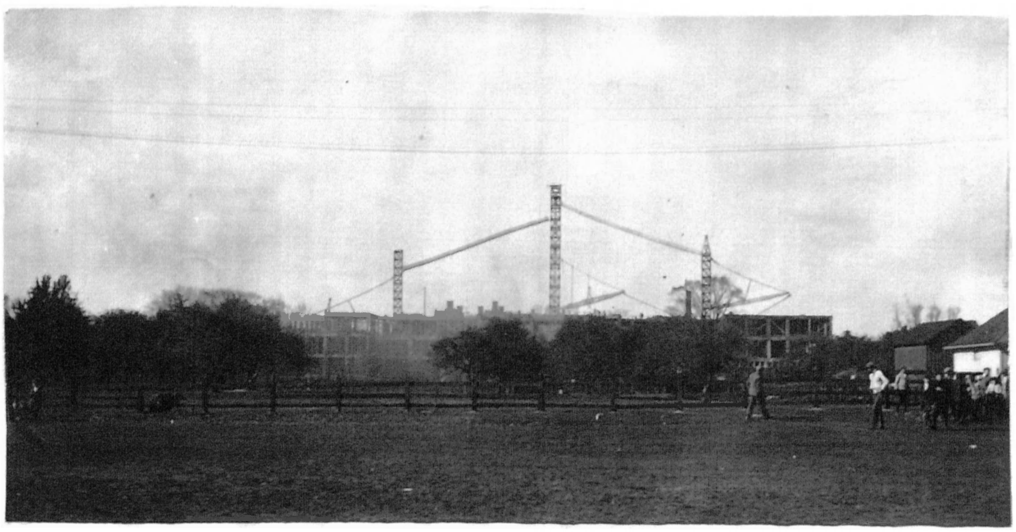
5 Hoisting Tower

DISTRIBUTION SYSTEM

The distribution system was one of the numerous "spouting" system. It consisted, briefly, of the mixing plant, noted before, and towers, with booms, supporting closed galvanized iron spouts in such manner as to discharge concrete at any point desired, by gravity.

There were three "distribution" towers, including the hoisting tower. The hoisting tower, 150 feet in height, w s made up of 6"x6" posts and 2"x8" sway and cross bracings. The other two towers, one located in each wing, each 100 feet in height, had 4"x4" posts and 2"x6" bracings. The hoisting tower carried two large hoppers, and each of the smaller towers, one smaller hopper. The tower hopper on the hoisting tower was connected to a round 8 inch, galvanized iron spout, of #16 gage metal leading to the free end of a 60 foot, wooden, lattaced boom, Here it emptied into a small hopper on the upper end of a 50 foot, trussed spout, suspended from the free end of the boom. Swivel connections were made in the spout at the free boom-end and at the hopper on the tower to permit turning through 360 degrees, thereby reaching any point within the circular area covered, with the discharge end of the trussed spout. The upper hopper on the hoisting tower was connected to similar spouts, lashed to light wooden girders which were suspended from $\frac{3}{4}$ inch flexible cables running over the tops of the towers. These spouts ran to the wing towers and then emptied into the small hoppers. These small hoppers were connected to spouts and booms in the same manner as at the hoisting tower.

The girders supporting the spouts between towers were suspended by blocks and tacklex, using 5/8 inch manilla line, and, as the building progressed, the entire system of spouts, booms, and hoppers was raised to maintain a uniform grade of 40 to 45 percent between the main hoppers and discharge ends.



CHARGING ARRANGEMENT

An efficient charging arrangement was made in the following manner. Inclined chutes were installed leading from the low points in the sand and stone bins. These were boarded over for the proper distances from the bottom ends making with bottom flap gates, gravity measuring chutes

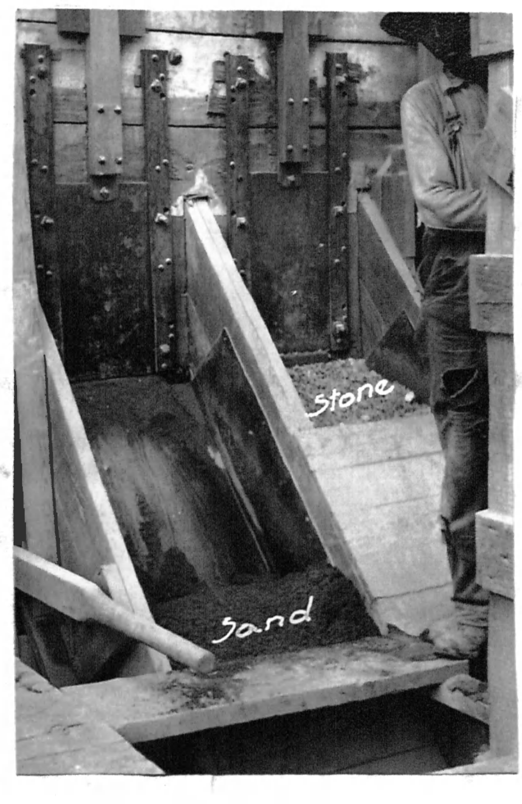
Separately controlled cutoffs were installed at each bin outlet. Directly over the discharge ends of the measuring chutes was placed the cement hopper. A vertical discharge chute from this hopper was provided with a horizontal cutoff. This cutoff and the bottom flaps on the measuring chutes were controlled by a single release lever, enabling the operator to charge the mixer the instant the signal was given.

1- Cement Hopper

2- Sand Chute

3- Stone Chute

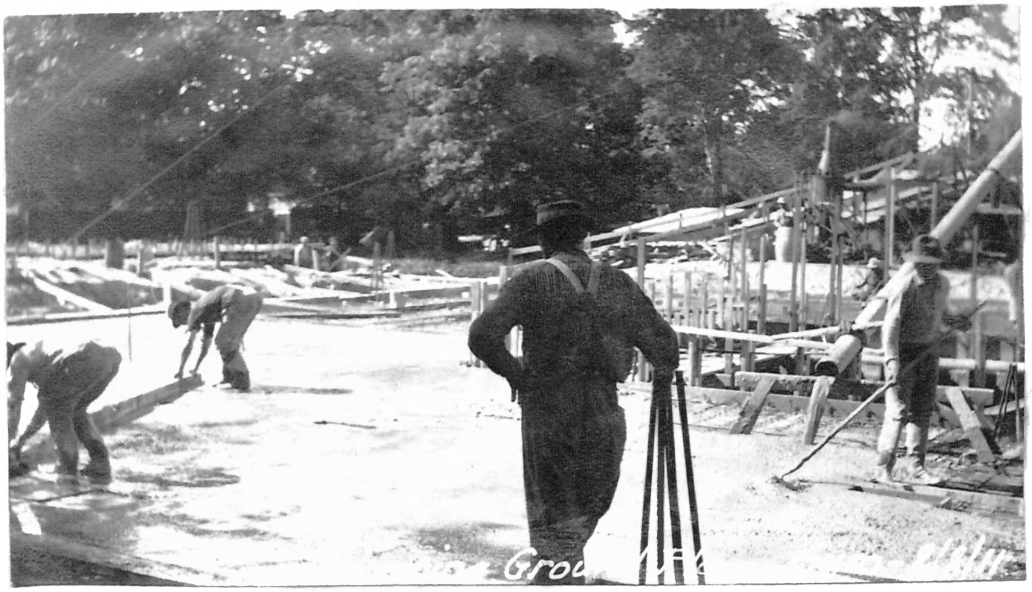
4- Release Lever



LABOR AND OPERATION

WIth three men wheeling cement, one each operating the sand and stone cutoffs and one looking after the emptying of the mixer and gaging the water, this charging arrangement was not hard pushed at the rate of a batch per minute.

Comparitively few men were required on the distribution end also. One man was stationed on the main tower, at the hopper in use, who fed the concrete steadily through a cutoff gate and thereby prevented clogging in the spouts. The concrete was wet enough to then flow by gravity to the discharge end where from five to seven men would handle the free end of the trussed spout, two distribute the concrete with hoes and two or three level off. Where pouring columns, on account of the necessarily more frequent moving of the spout, four men were generally used on the free end while one men grouted columns ahead of the pouring. Grouting columns, which was found necessary to prevent stone pockets at the bases, consisted merely of pouring a number of pails of grout into the column before concreting. Whether working on floors or columns, however, at least one batch of thin grout was sent thru the spouts to "grease" them; otherwise they tended to clog up on account of a portion of the mortar in the first batch staying in the pipes.



RESULTS

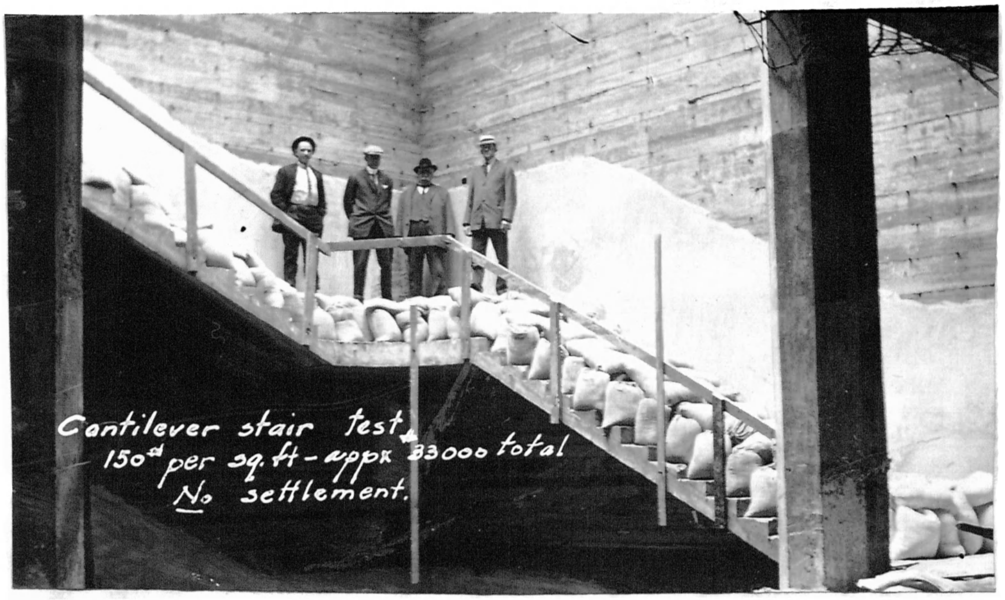
As compared with ordinary wheelbarrow or car concrete, the work done by the above system was enimently more satisfactory. There was absolutely no separation of the ingredients and the concrete was delivered at very nearly the exact spot required in the same mixed condition as it left the mouth of the mixer. The following photo looking down onto a footing shows this very clearly. It was unnecessary to "work" the stone into the mixture on the floors, or to "puddle" columns; also unnecessary to use extra precautions to see that the steel was entirely embedded. And yet, on recovering the centers, scarcely a foot of steel, aside from spacers, was visible and less than a half dozen stone pockets as large as six inches square appeared.

STEEL WORK

Practically all rivets in the field connections were 7/8" rivets so an air compressor delivering 225 pounds was employed to make all connections.

TESTS

It was decided when the concrete work was about finished that only one test would be made in addition to the loads, the floors, etc. had been subjected to during construction.



This test was on one flight of the cantilever stairs at the ends of the corridor. A test load of 33,000 pounds was applied and no deflection, large enough to be read on level rods with a transit, was observed. During the Construction work five ton trucks loaded, making actually 9,500 pounds total load, were driven over practically the entire ground floor without any noticeable damage to any part.

DETAILS OF STRUCTURAL PLANS

The plans were very complete in all details and more than usual care was exercised to make the concrete plans, expecially, as clear as possible. Schedules of footings, beams, stirrups, columns, slabs, etc., were made up which included everything under the several headings, except special parts which had to be detailed. Details showed all rods, stirrups, bending, etc.

Test borings were made over the site to determine the character of the soil. These borings showed blue clay soil at a depth of about eight feet with nothing but blue clay below. One loading test was made. This test showed a settlement of about one quarter of an inch up to 4,000 pounds per square foot with three quarters at about 10,000 pounds. 3,000 pounds was then taken as the allowable load per square foot on the footings. The excavation work however, did not confirm the evidence in the borings that the blue clay was rather soft at the depth of the basement footings. It proved to be very hard dry clay throughout capable of sustaining a much greater load than the one used. But as the error was on the side of safety no revision was made in the foundations and the building is today free from settlement cracks.

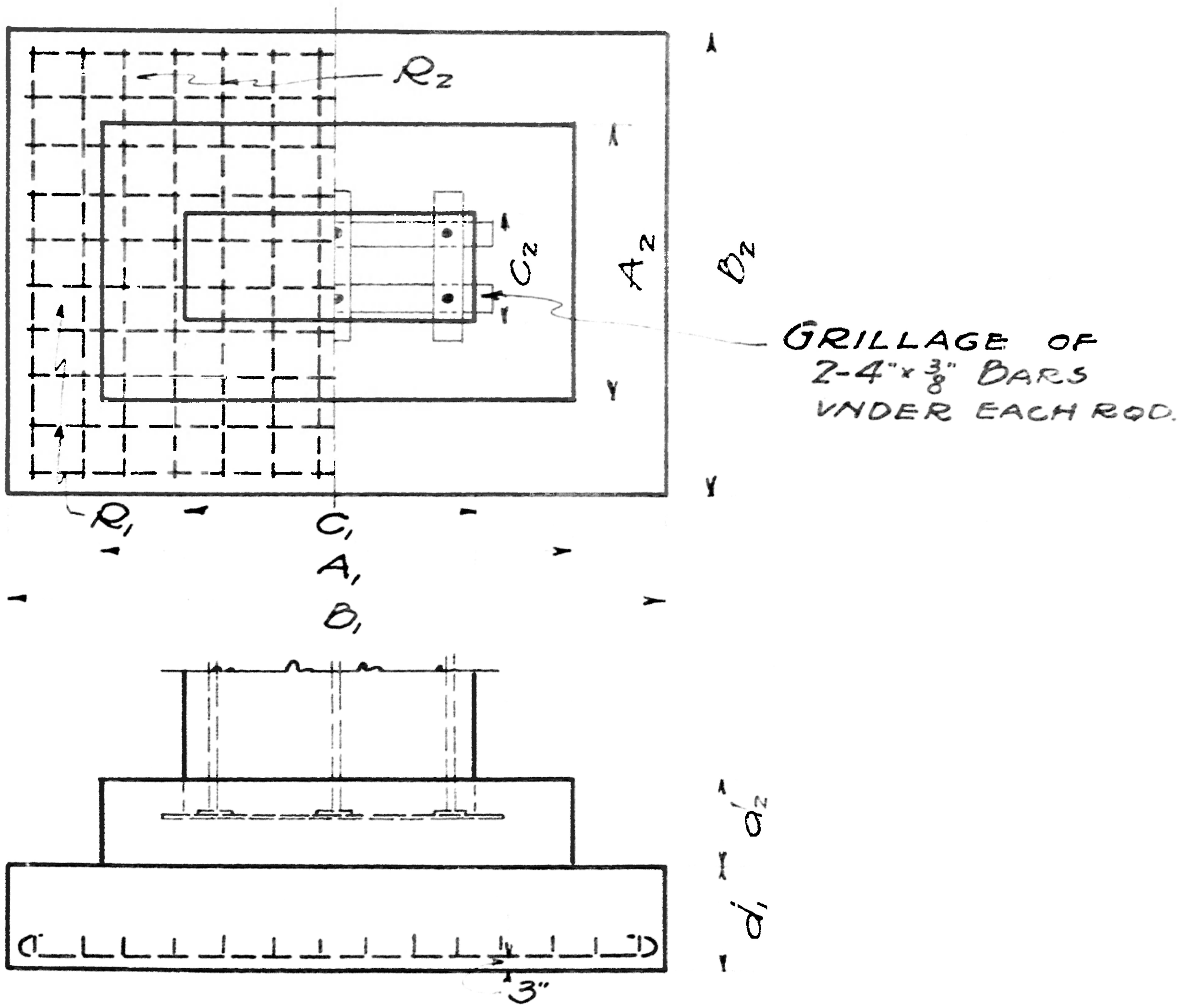
FOOTINGS

The foundation for the entire building consisted of individual square or rectangular footings for each column, of such areas as not to exceed a load of 3,000 pounds per square foot under almost any condition of loading. The footing plan was dimensioned to centers of columns and each footing tied up to these center lines. With but few exceptions the footings were of two courses with the base course reinforced with a double grillage of rods. The numbers of the footings, offsets, thicknesses of courses and rods were all scheduled as shown in plate #1, which shows a small part of the schedule. In the schedule the heading, "footings", contained the number of all footings and those of the same size, steel etc. were placed in the sub-division, "B_1" was the dimension of the bottom course along the north and south, or long, axis of the building; "B_2" the dimension along the short axis; "A_1", and "A_2" were the corresponding dimensions of the top course and "C_1", and "C_2" the corresponding dimension of the column supported. "D_1" and "D_2" were the thicknesses of the bottom and top courses respectively.

In all plans, details, etc. the above system of giving the dimension parallel to the long axis of the building first was followed as far as possible.

Under the headings "R_1"and "R_2" were placed the number and size of rods forming the grillage. Their length was taken from the "B_1" and "B_2" dimensions.

FOOTINGS	B_1	B_2	A_1	A_2	C_1	C_2	d_1	d_2	R_2	R_1
115-117 ETC.	11-0	11-0	7-10	7-10	22	33	20	20	24-7/8	24-7/8
133 ETC.	6-6	6-6	-	-	24	24	19	-	17-5/8	17-5/8
126 "	11-0	12-4	8-0	9-4	24	40	22	19	20-1	22-1
115 "	8-3	8-3	6-0	6-0	28	24	16	13	16-3/4	16-3/4
142 "	7-9	7-0	5-9	5-0	25½	16	15	12	14-3/4	13-3/4
141 "	6-3	5-6	-	-	25½	16	18	-	16-5/8	14-5/8



A bearing plate for all columns was made up of $4'' \times \frac{1}{2}''$ bars arranged as shown in plate #1.

COLUMNS

The column schedule was made up as shown in part on plate #2. It merely gives, under "C.S", the concrete section, and, under "S.S.", the steel section for each story. While this schedule could not be used for ordering steel, it nevertheless contained sufficient information for the bidders to a fairly accurate estimate on. It also proved valuable in checking up the job.

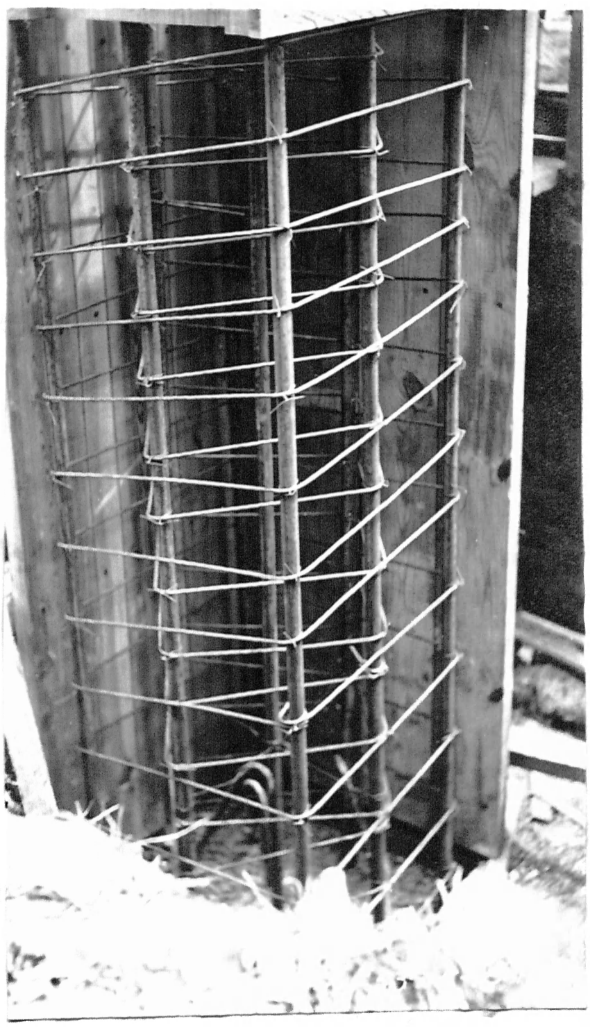
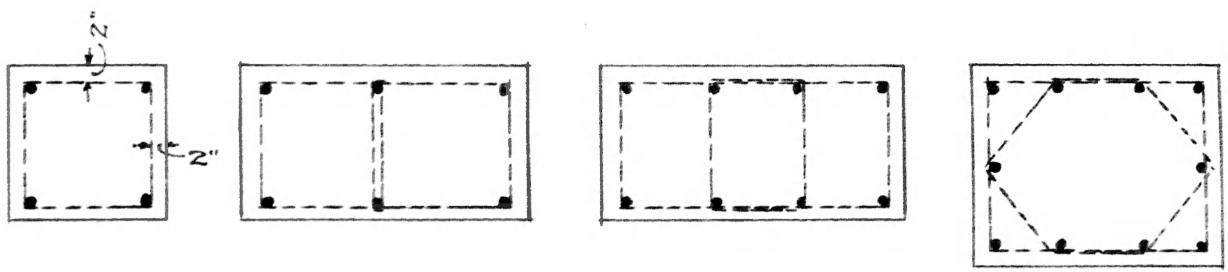
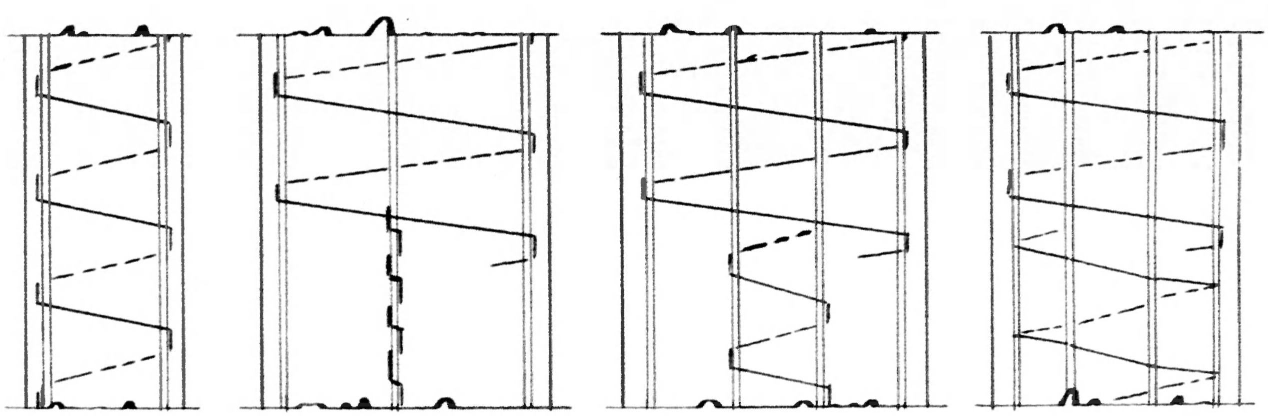


Photo shows the hooping on an eight rod column.

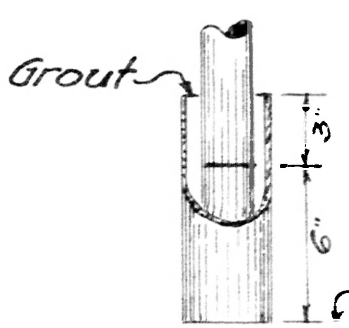
COLUMNS.

Col. No.	141		126		143		125		124		127		116-117			
	C.	S.	C.	S.	C.	S.	C.	S.	C.	S.	C.	S.	C.	S.	C.	S.
Attic			12×28	6-7/8	16×12	4-3/4	16×16	4-7/8	16×16	4-7/8	12×28	8-3/4	12×28	6-7/8		
2nd			16×30	8-1 1/8	16×20	8-3/4	16×16	4-7/8	16×16	4-7/8	16×28	8-3/4	22×28	8-7/8		
1st			16×30	4-1 1/8 4-1 5/8	16×20	8-1 1/8	16×16	4-1 1/8	16×16	6-1 1/8	16×28	8-3/4	22×28	8 7/8		
Gd.	16×16	4-7/8	24×30	10-1 5/8	26×20	4-1 1/2 6-1 1/8	18×20	6-1 1/8	18×24	8-1 1/8	16×28	8-1 5/8	22×28	6-1 5/8 4-7/8		
Bsmt	16×25 1/2	6-7/8	24×30	10-1 5/8 3-1 1/8	26×30	10-1 1/2	20×28	10-1 1/8	28×24	12-1 1/8	20×30	8-1 5/8	22×32	10-1 5/8		





Typical Column Hooping



Pipe splice for large rods.
Diameter pipe = rod + 1/2"

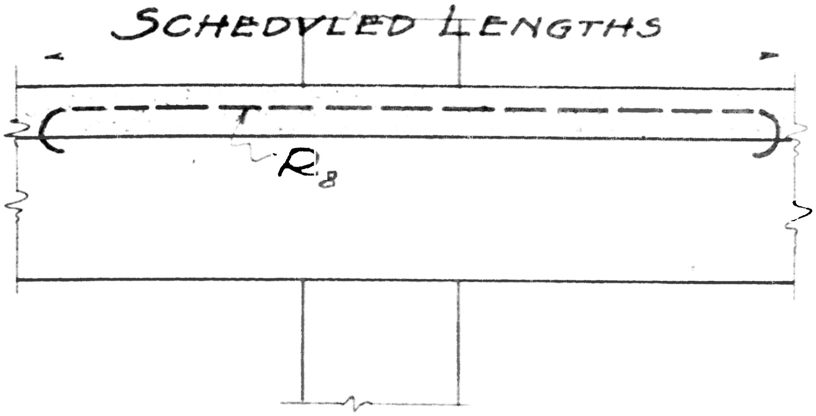
As shown on the accompanying section, Plate #2, the system of hooping was such that each cluster of four rods in a column had a separate set of hoops as far as practicable. These hoops of $\frac{1}{4}$" rods had a maximum spacing of 8" and this was narrowed to 4" for a distance of two feet above supports and below loading points.

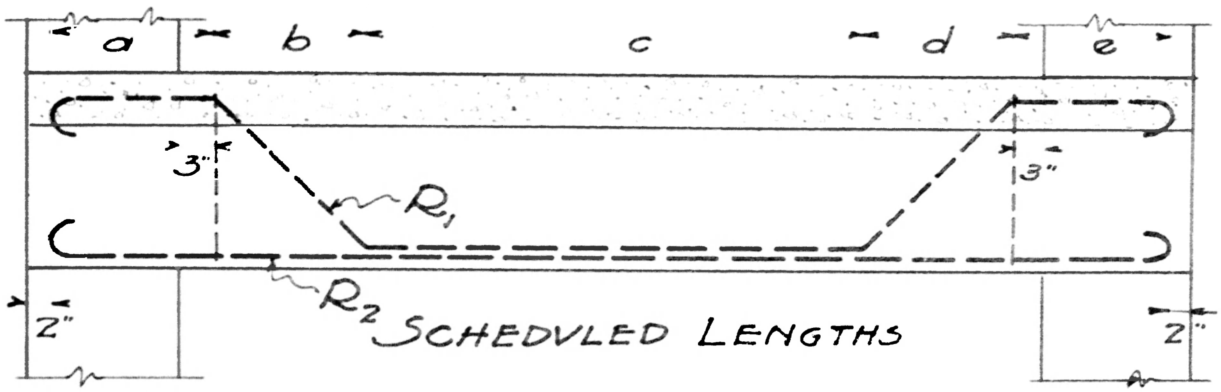
BEAMS

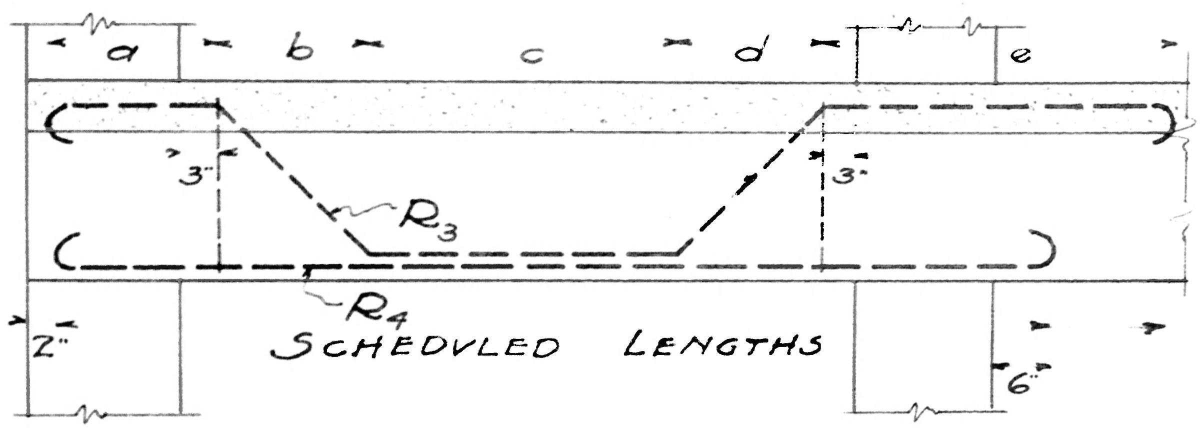
The most elaborate set of schedules was furnished for the beams and girders. These schedules, in connection with special beams detailed, contained information enough for the contractor to order, bend and place the steel for every beam on the job. No bending diagrams were required beyond these schedules.

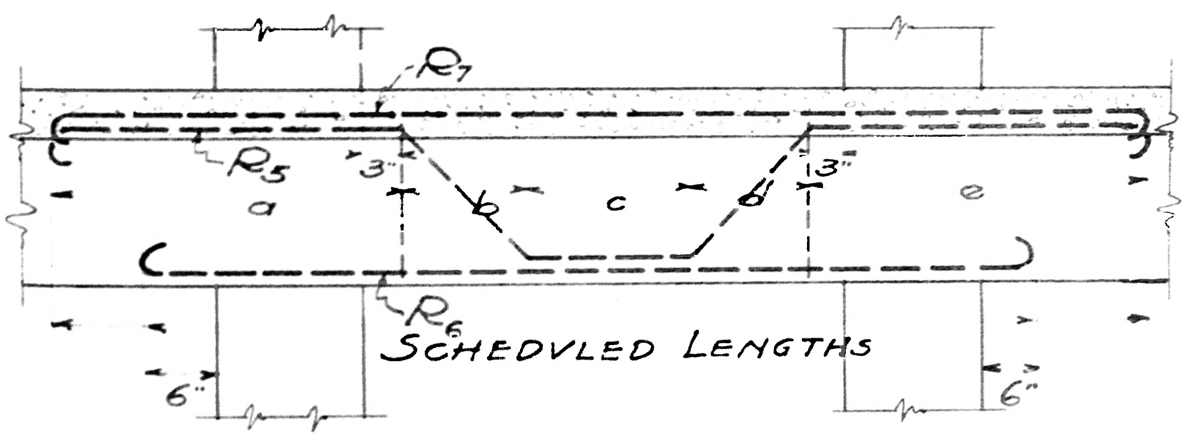
Eight types of rods were used, plate #3, numbering from "R_3" to "R_8". "R1-3-5" were trussed rods of practically the same type; the only difference being as follows; "R_1", a rod used in single beams not extending beyond supports; "R_3", used in beams continuous over one and only and "R_5", used in beams continuous over both ends. "R2-4-6" were straight rods with the same differences as noted for "R_1", etc. "R_7", a straight rod used in beams where negative moments occur and "R_8", shorter rod used over supports where additional steel was required. The trussed lengths and over-hand of "R1-3-5" were determined from the shear and moment diagrams for the various groups of rods. The schedules for beams and girders are shown on plate #4. They contained the number and numbers of beams; under "Rods", the number, size, type and length of all rods; under "a to e", the projected lengths of all parts of

BEAMS AND GIRDERS.





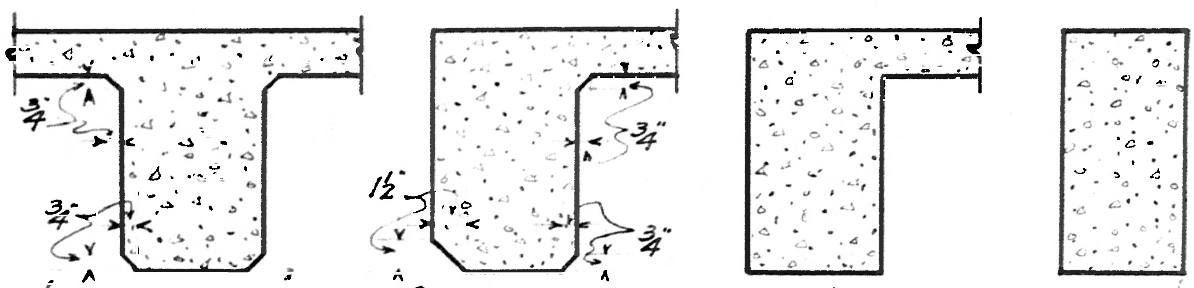




BEAMS AND GIRDERS.

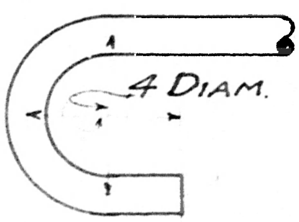
"B" BEAMS	400 ETC.	409 413 ETC.	345 ETC.	426 ETC.	330 331 ETC.
SIZE	12"×18"	12×16	12×42	12×18	12×18
	2-1 1/8-22-6-R_1	2-1 1/8-24-1-R_3	2-1 1/8-27-5-R_5	2-1 1/4-31-9-R_5	2-1 1/8-26-10-R_3
RODS	2-1 1/8-22-6-R_2	2-1 1/8-23-0-R_4	3-1 1/8-22-0-R_4	3-1 1/4-30-0-R_6	2-1 1/8-24-0-R_4
		2-1 1/8-14-0-R_8			2-3/4-35-0-R_7
a	1-1	1-7	3-3	3-3	3-3
b	2-0	2-0	3-6	4-6	4-0
c	15-2	13-3	11-2	16-3	12-4
d	2-0	4-0	3-6	4-6	4-0
e	2-3	3-3	6-0	3-3	3-3
STIRRUPS	26-S_1	28-S_1	28-S_1	34-S_1	28-S_1

NOTE - ON THE REGULAR PLANS "B BEAMS" SPACE CONTAINS ALL BEAMS ON "B", OR FIRST, FLOOR HAVING THE SAME SECTION, STEEL AND BENDING. IN SOME CASES AS HIGH AS TWENTY-SEVEN BEAMS WOULD BE DUPLICATES.



INTERMEDIATE. OUTSIDE WALL. INTERIOR.

TYPICAL BEAM AND GIRDER DETAILS.



HOOK REQUIRED ON ENDS OF ALL BEAM AND GIRDER RODS.

the trussed rods and the number and size of stirrups required. Beams with brackets, of varying size, of a cantilever type, etc. were all detailed showing all rods and stirrups required.

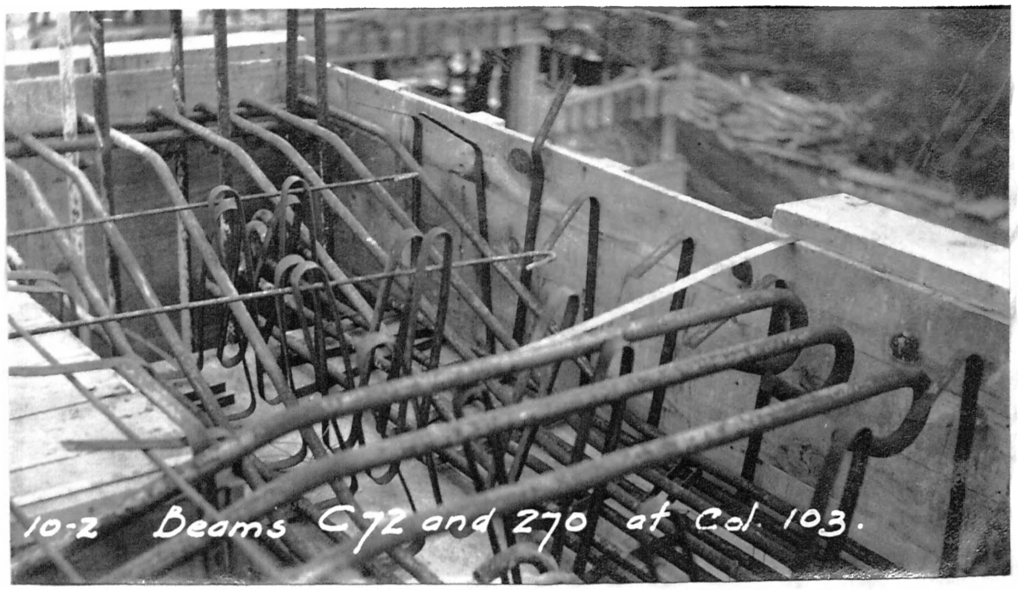


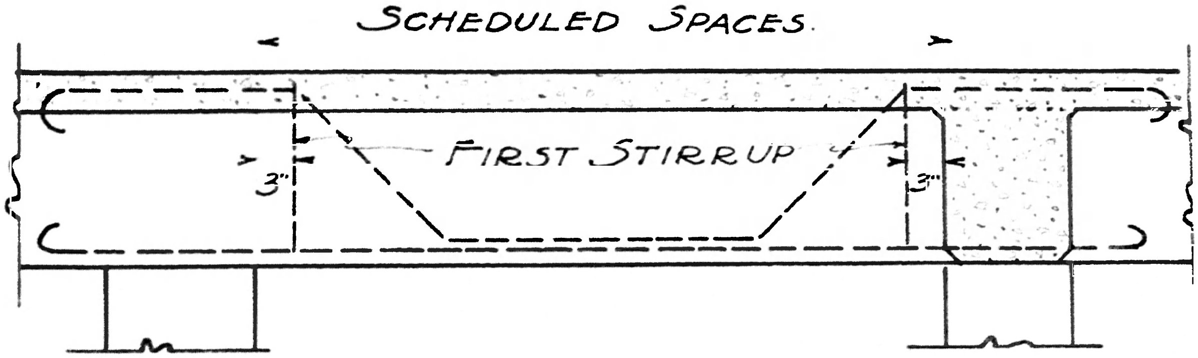
Photo shows stirrups and typical hooks on rods.

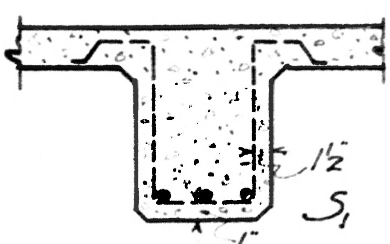
STIRRUPS

Stirrups of 1"x8" steel were required in all beams and girders. Schedules were made up, Plate #5, corresponding to the beam schedules giving the numbers of beams, size, number of beams of one size and type, number of stirrups required for each beam and the detailed spacings for them. There were four types of stirrups used. Numbers 1-2-3, depending principally on the width of beam and the number of rods, were used in practically all cases. Type No. 4 was a special stirrup used in a few cases in beams having points of excessive shear.

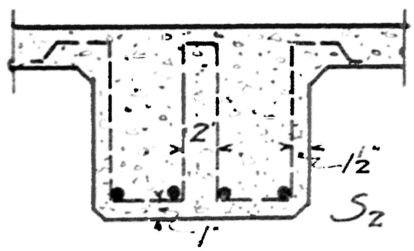
"B" BEAMS	SIZE	NO. OF BEAMS	NO. OF STIRRUPS	STIRRUP SPACINGS.
426 ETC.	12×18	11	32	3 - 9×8 - 13×12 - 9×8 - 3
400 "	12×18	6	22	3 - 3×8 - 15×12 - 3×8 - 3
345 "	12×42	4	27	3 - 5×8 - 4×6 - 8×12 - 4×6 - 5×8 - 3
330 "	12×18	12	25	3 - 6×8 - 12×12 - 6×8 - 3
409 "	12×16	22	28	3 - 3×8 - 4×5 - 3×8 - 8×12 - 9×8 - 3

NOTE - "B" BEAMS SPACE ON PLANS CONTAINED ALL BEAMS OF SAME SIZE, TYPES AND NUMBERS OF STIRRUPS ON FIRST FLOOR.

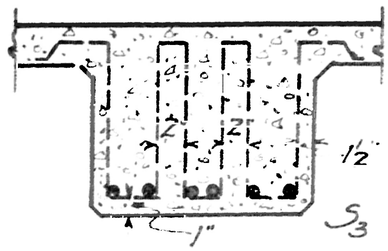




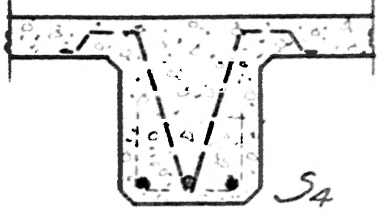
S_1



S_2



S_3



S_4

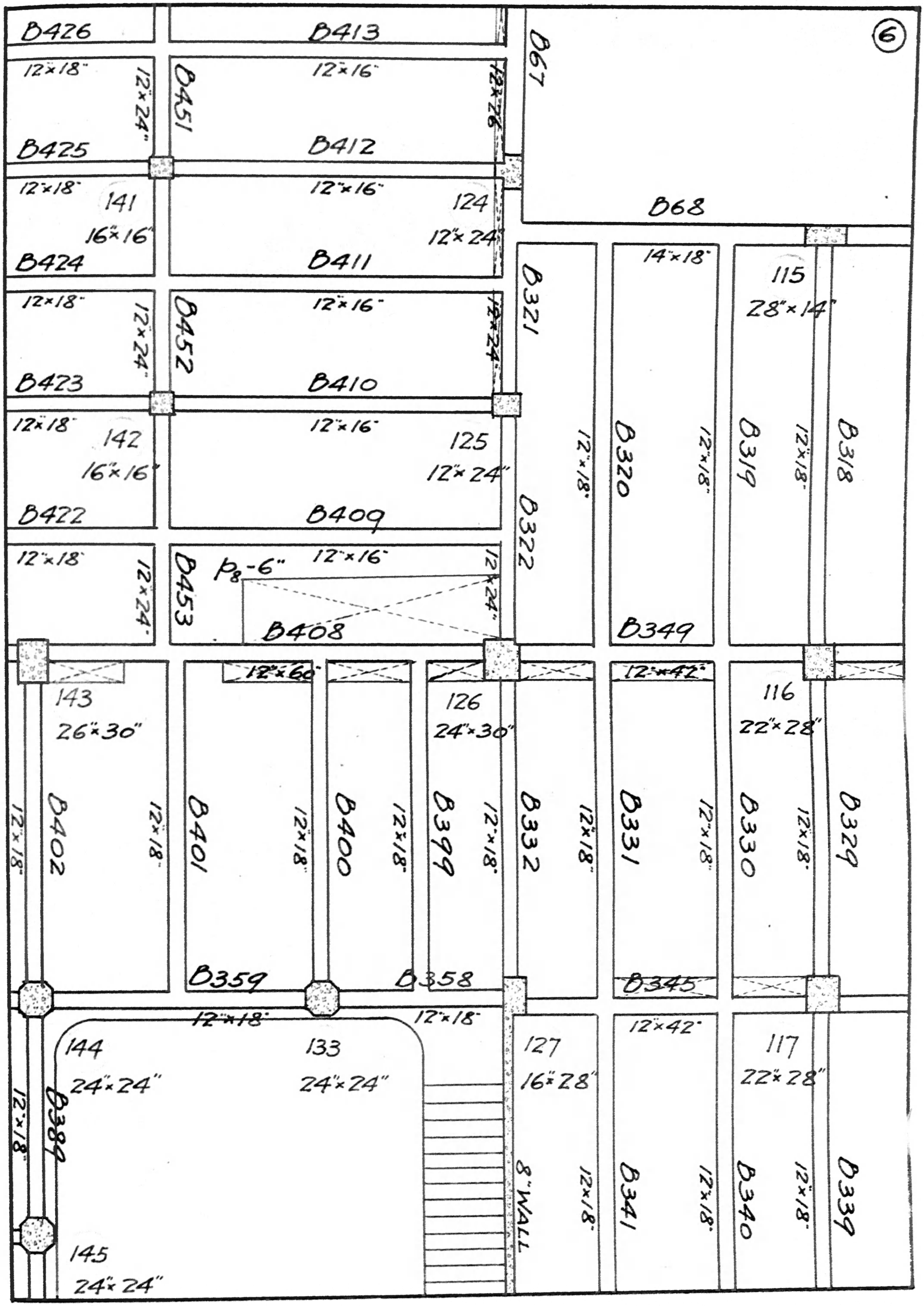
SLABS

Slabs were for the most part 4" thick with 3/8" rods at 4½" centers for the main reinforcement and 3/8" at 12" centers for shrinkage. Unless otherwise marked (plate#6) all panels, except 2nd floor ceilings slab, were of this kind. Panels of different thickness or of different steel section were so marked on the panel in question. No laps were allowed except over supports, At these places 3/8" rods extended 12" and 1/2" extended 18" beyond for side of support. At walls or elsewhere where such laps could not be made a semi-circular hook was required.

In the design of the structural work values of 600 # in compression and 40# for shear were used for concrete and 16000# for steel. Usual straight line formular were used throughout.

HEATING AND VENTILATING

The heating and ventilating systems are practically one installation and they will be described together. The building is heated by a "split" steam system;plenums and forced air circulation being used throughout the building supplemented by direct radiation in rooms having plumbing installed. The plenum coils are fed by exhaust steam from the engines driving the main fans and the direct radiation is connected directly to the low pressure lines. In this way the plumbing may be protected during cold spells when school is not in session without the expense of running the fans. The steam in the entire



6
B426
B413
B67
12"×18"
12"×24"
B451
12"×16"
12"×26"
B425
B412
12"×18"
141
16"×16"
12"×16"
124
12"×24"
B68
B424
B411
12"×18"
12"×24"
B452
12"×16"
12"×24"
B321
14"×18"
115
28"×14"
B423
B410
12"×18"
142
16"×16"
12"×16"
125
12"×24"
12"×18"
B320
12"×18"
B319
12"×18"
B318
B422
B409
B322
12"×18"
12"×24"
B453
P_8-6"
12"×16"
12"×24"
B408
B349
12"×60"
12"×42"
143
26"×30"
126
24"×30"
116
22"×28"
12"×18"
B402
12"×18"
B401
12"×18"
B400
12"×18"
B399
12"×18"
B332
12"×18"
B331
12"×18"
B330
12"×18"
B329
B359
B358
B345
12"×18"
12"×18"
144
24"×24"
133
24"×24"
127
16"×28"
12"×42"
117
22"×28"
12"×18"
B389
8" WALL
12"×18"
B341
12"×18"
B340
12"×18"
B339
145
24"×24"

system is circulated at atmospheric pressure or less, vacuum return pumps being employed to secure a positive circulation. Two eighty horse power engines using steam at thirty to forty pounds drive the two main fans. These fans pull fresh air in at the third floor level, through heating coils, which temper the air to seventy degrees, and then force it through underground ducts to the plenums and flues throughout the building. The combined capacity of these two fans is in excess of 225,000 cubic feet of air per minute. Four 200 horse power water tube boilers, tested to 250 pounds, supply steam for all purposes. At present they are far in excess of demands but provision is made to take care of future power units if the same are installed. Seven additional fans, motor driven, take care of foul air in the toilets, lockers, chemistry laboratory, shop, forge and kitchen through separate exhaust flues. In these rooms the air is drawn through the fixtures in each case, thereby eliminating the possibility of odors.

All heating coils, direct radiation and rooms with air blast are thermostatically controlled; a steam driven air compressor furnishing air for this purpose.

PLUMBING

The plumbing throughout the building is of the very best character. All inaccessable water, steam and return line are of iron-pipe-size brass and all waste pipe in connection with the chemistry, etc. is double-extra-heavy lead. All iron pipe is Byers wrot iron and all cast iron pipe is extra heavy. Drinking fountains and toilets are located on each floor and special toilets are provided for the public and employees. Toilet fixtures, drinking fountains, lavoratories and slop sinks are of solid white vitreous ware and lavoratory sinks are in most cases of Alberdene stone.

Showers are equipped with non-scalding mixing valves. All exposed piping in connection with the plumbing work is nickle plated.

ELECTRICAL WORK

The entire wireing system for lights, bell, clocks, and phones is a conduit system and all wiring for lighting and power throughout the building is heavy enough for use with a 220 volt system.

In addition to the motors used in connection with the foul air system, before mentioned, there are two motor generator sets for experimental purposes. All shop equipment is individual motor driven.

The general lighting is direct, supplemented by individual table outlets in all lecture rooms and drawing rooms. Special attention was given the fixtures in the Refectory, a special composition lantern being used. Stock fixtures, brushed brass, with Alba glass were used for the balance of the building.

All lecture rooms, laboratories, etc. are provided with stereoptican outlets and all special rooms are provided with necessary plugs for special equipment.

The clock, programe bell and phone systems are all controlled by apparatus in the principals office. A four sweeper electric vacuum cleaner system is installed in the basement.

EQUIPMENT

The equipment throughout the building is special for the building and designed to meet the requirements of each special case. Fifty four rooms have built in cases or cabinets for exhibition, stock or note book purposes. Each department is masterkeyed in itself, but not with anyother, and all are masterkeyed with the keycase in the principals office.

Work benches, laboratory tables, demonstration tables etc. are all special for the use intended. The entire equipment is of the same oak and finish as the trim throughout the building.

COST

The cost given below are contract prices with subdivisions of the contracts, as per schedules required, following:

First General Contract (Building Enclosed) / Electric Wiring Contract (Complete except)	$290,200.00
fixtures)	16 379.65
Second General Contract (Interior Finish)	209,945.00
Heating and Ventilating	39,989.00
Plumbing	34,874.00
Automatic Temperature Regulation	4,365.00
Vacuum Cleaning	2,827.00
Equipment	64,588.68
Sidewalks	5,250.00
	$668413.33

On a cubic foot basis the above cost, exclusive of equipment, equals but slightly more than 20¢ per cubic foot or, including equipment, about 22½¢ per cubic foot. The site, including the athletic field, cost approximately $75,000.00.

The following subdivisions of the various contracts are given merely to show of what they consisted.

Excavation and bond	9760.00
Drainage	2500.00
Cast Iron Down Pipes	2700.00
Concrete Structural Work	123445.00
Brick Work	53470.00
Granite Work	3410.00
Cut Stone Work	4070.00
Terra Cotta	33000.00
Structural Steel	17050.00
Carpenter Work	20465.00
Sheet Metal Work	5100.00
Tile Roofing	9776.00
Composition Roofing	190.00
Glass & Glazing	4400.00
Painting	525.00
Extra Adjustable Pivot Windows	339.00
	290200.00

Subdivisions of the "Second" Contract.

Excavation and bond		1367.81
Brick Work		40500.47
Cut Stone		770.00
Concrete Work		17698.36
Asphalt Floors and Waterproofing		5500.00
Sheet Metal		118.80
Marble Work		4400.00
Tile and Terrazzo		14149.00
Metal Plugs	925.00	
Caulking	981.36	
Weatherstrips	1485.00	
Metal Corner Beads	1215.00	
Rubber Carpet	266.20	
Track and Scale	1366.20	
All Lumber and Labor	32709.60	
Total Carpenter Work		38748.36
Glass and Glazing		1705.00
Hardware		2277.00
Painting		11568.70
Dahlstrom Doors		740.30
Plastering		40378.20
Ornamental Work		29823.00
		209945.00

Subdivision of the "Plumbing" Contract.

Cast Iron Pipe	4300.00
Wrot Iron Pipe	3500.00
Lead Pipe	425.00
Brass Pipe	5000.00
Hot Water Heater and Storage	420.00
Toilet Fixtures	10084.00
Marble Work	9020.00
Compressed Air Piping	350.00
Gas Piping	565.00
Galvanized Iron Work	140.00
	34874.00

Subdivision of the "Heating and Ventilating" Contract.

Boilers	6700.00
Smokeless Furnaces	2200.00
Cast Iron Floor Plates	472.65
Valves and Specialities	3425.00
Pipe and Fittings	2300.00
Vacuum Pumps and Traps	675.00
Boiler Feed Pumps	400.00
Gauges and Thermometers	190.00
Fans and Motors	4500.00
Blast Radiations	2300.00
Direct Radiation	880.00
Engines	2800.00
Belting	300.00
Sheetmetal Ducts and Casings	4005.57
Diffusers, Ventells, etc.	2657.78
Foundations	385.00
Painting	175.00
Pipe Covering	1400.00
Manhole Doors	275.00
Labor	3954.00
	39989.00

Subdivision of the "Equipment" Contract.

Lockers ------------------------------------	8869.70
Screen Partitions and Cupboards -------------	16209.04
Special Furniture ---------------------------	11547.52
Refectory Chairs ----------------------------	893.00
Opera Chairs --------------------------------	3150.00
School Desks --------------------------------	957.74
Pedestal Chairs ---------- - ----------------	576.00
Tablet Arm Chairs ---------------------------	3744.00
Chairs without Arms -------------------------	864.00
Teachers Chairs -----------------------------	396.00
Pulpit Chairs -------------------------------	102.50
Stools --------------------------------------	352.16
Teachers Desks ------------------------------	987.50
Clerks and Principals Desks -----------------	88.85
Bookkeeping Desks ---------------------------	1030.00
Typewriting Desks ---------------------------	330.25
Clerks Tables -------------------------------	60.50
Drafting Tables ------------ ----------------	450.00
Filing Cabinet and Bookcase -----------------	124.00
Dining Room Furniture -----------------------	130.00
Mirrors ------------------- -----------------	250.00
Rugs ------- --------------------------------	326.08
Window Shades ----- -------------------------	984.05
Elevators -----------------------------------	545.00

"Equipment" Continued.

Refrigerators			296.00
Manual Equipment (Not including Machine Shop)			6150.00
Fixtures-	(Auditorium	1254.66	
	(Refectory	1040.00	
	(Balance of Building	2880.13	
			5174.79
			$64588.68

Submitted in connection with the foregoing paper are the following exhibits.

Exhibit "A"- Specifications for the "first" general contract.

Exhibit "B" -Specifications for the electric wiring contract.

Exhibit "C"- Specifications for the "second" general,heating, plumbing, vacuum cleaning and temperature regulating contracts.

Exhibit "D" Specifications for the equipment contract.

Exhibits "E" to "J"--Blue print plans for first general, wiring, second general, heating,plumbing, and equipment contracts.