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The Canadian Engineer

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Comparisons of Various By-Laws Covering Flat Slab Concrete Buildings, with Actual Tests

Codes Compared Give Fairly Similar Results Under Actual Conditions and When Reduced to a Common Basis—Tests Made on the Wm. Davies Building, Toronto

By W. W. PEARSE

City Architect and Superintendent of Building Toronto

Toronto, October 10th, 1917.

EDITOR CANADIAN ENGINEER:

You no doubt are aware that Toronto has no building code to govern the flat slab type of construction, and as a number of large buildings have been erected by this method, it was necessary for this department to give a ruling as to what American codes would be allowed. Up to the present time I have passed those of Chicago and Philadelphia, and structures have been designed by these two methods. Upon an examination of Table No. 1, it will be noted that there is really very little difference between the two by-laws when they are compared on a common basis.

I am handing you herewith copies of tests made on the reinforced concrete building of the William Davies Company, Limited, of Toronto, and as noted elsewhere, the structure is designed in what is commonly known as the two-way flat slab type of construction. I have endeavored to compare the codes of Chicago, Philadelphia and Pittsburgh, also the regulations proposed by the Joint Committee on Concrete and Reinforced Concrete, with the actual stresses which were measured by extensometers. From a first observation it would appear as if none of the codes gave results that would in any way compare with the actual tests, but if the actual conditions were taken into consideration, such as the tension in the concrete, I found that they all gave a very fair comparison with the actual test as far as we had sufficient readings to go by. The steel at the column cap agreed approximately and the concrete was within fair bounds. The centre part of the slab could not be compared very well, due to the fact that the concrete readings were not taken immediately above the steel readings and, therefore, the neutral axes of the sections could not be arrived at.

It is evident from the very nature of things that the comparisons must always vary considerably, due to the utter impossibility of being able to get two batches of concrete the same mix, etc.; therefore the modulus of elasticity will constantly vary at different sections. As pointed out in the discussion, no test was made to arrive at the modulus of elasticity of concrete in tension. It has been the common assumption that the concrete has the same modulus for either tension or compression, but Johnson's "Materials of Construction" gives a number of tests and he states that the ratio is 7:10. I have taken it as 8:10, taking as a basis for compression as 3,000,000 pounds, whereas the tests warrant anywhere from that figure to 3,500,000 pounds.

One test is not sufficient evidence on which to base any theory, but as I have a number of other tests on which I am working, the results of these may throw additional light on the subject.

Mr. T. D. Mylrea conducted the tests and Mr. W. A. McM. Cook, of the city architect's department, carefully checked over all my work.

Trusting the above may be of some interest to your readers, I am

Yours very truly,

W. W. PEARSE,

City Architect and Superintendent of Building.

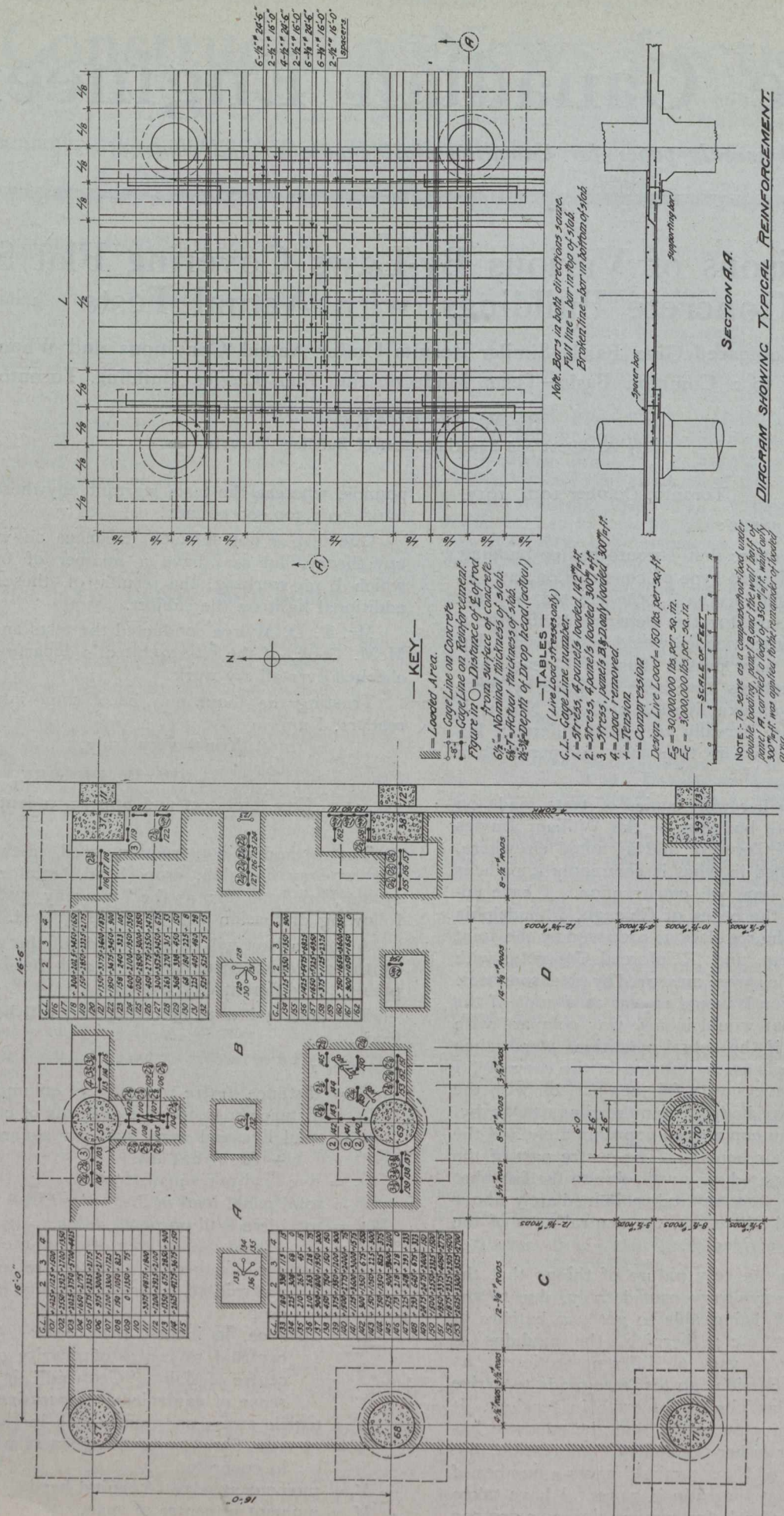
The method of construction used in this building is the two-way flat slab, drop head, reinforced concrete system, briefly known as the "two-way system," and the following discussion will be so designated.

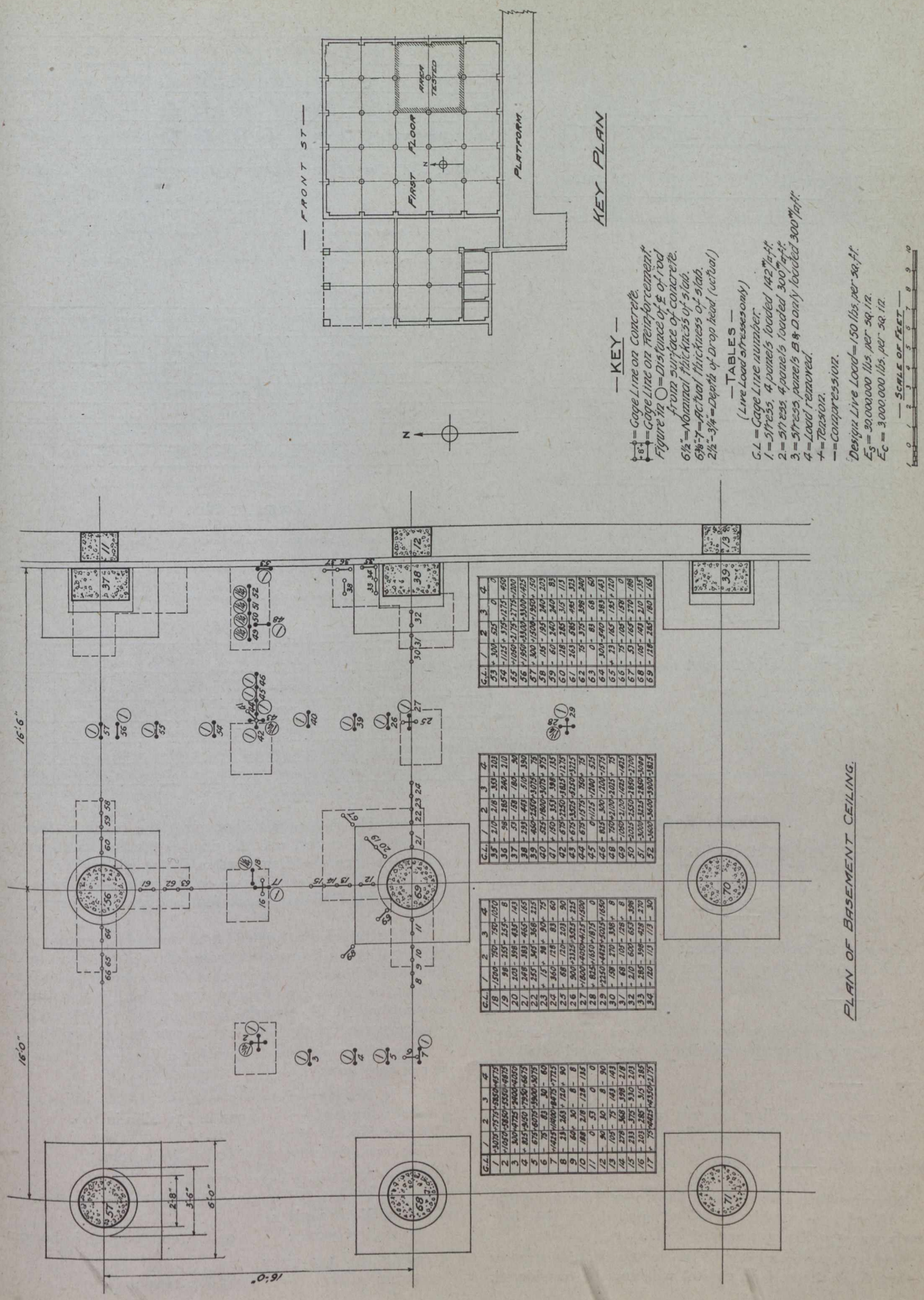
A comparison will now be made of the stresses found by the actual extensometer tests and those found by applying the different city by-laws.

The first by-law to be considered will be the Chicago Code.

Notation:

L = distance centre to centre of columns, in feet.
L_1 = distance edge to edge of heads of capitals, in ins.
w = total live and dead load per square foot = 142 + 82 = 224 lbs.
w_L = live load per square foot.
W = total panel load in lbs. = $w L^2$.
W_L = total live load on panel in lbs. = $w_L L^2$.
W^1 = W — load within area of column capital.
d = distance, in inches, from centre of gravity of centroid to centre of gravity of steel at the drop.
d_1 = distance, in inches, from centre of gravity of centroid to centre of gravity of steel at the centre of slab. "Centroid" is used in the sense of equivalent compressive area.
s = tensile stress per square inch in steel.
c = extreme fibre compression stress per square inch in concrete.
$-M$ = moment at edge of capital head.
$+M$ = moment at centre of span.


6-½" = 24'-6"
2-½" = 16'-0"
4-½" = 24'-6"
2-½" = 16'-0"
6-¾" = 24'-6"
6-¾" = 16'-0"
2-¾" = 16'-0"
spacers
Note. Bars in both directions square.
Full line = bar in top of slab.
Broken line = bar in bottom of slab
Spacer bar
Square hanger bar
SECTION A.A.
— KEY —
= Loaded Area.
= Gage Line on Concrete
= Gage Line on Reinforcement.
Figure in ○ = Distance of ℄ of rod from surface of concrete.
6½" = Nominal thickness of slab.
6¾" = Actual thickness of slab.
2'-3½" Depth of Drop head (actual)
— TABLES —
(Live Load stresses only)
G.L. = Gage Line number.
1 = Stress, 4 panels loaded 142 lbs. ft.
2 = Stress, 4 panels loaded 300 lbs. ft.
3 = Stress, panels 3 & 2 only loaded 300 lbs. ft.
4 = Load removed.
+ = Tension
− = Compression
Design Live Load = 150 lbs. per sq. ft.
Es = 30,000,000 lbs. per sq. in.
Ec = 3,000,000 lbs. per sq. in.
— SCALE OF FEET —
NOTE:- To serve as a compression chord under double loading, panel B and the west half of panel A, carried a load of 350 lbs. ft. while only 300 lbs. ft. was applied to the remainder of the floor area.
DIAGRAM SHOWING TYPICAL REINFORCEMENT.
PLAN OF FIRST FLOOR.


KEY PLAN
— FRONT ST —
FIRST FLOOR
PLATFORM
FIRST TESTED
— KEY —
= Gage Line on Concrete.
= Gage Line on reinforcement. Figure in ○ = Distance of ℄ of rod from surface of concrete.
6½" = Nominal thickness of slab.
6⅜"-7" = Actual thickness of slab.
2½"-3¼" = Depth of Drop head (vertical)
— TABLES —
(Live Load Stresses only)
G.L. = Gage Line number.
1 = Stress, 4 panels loaded 142 lbs./sq.ft.
2 = Stress, 4 panels loaded 300 lbs./sq.ft.
3 = Stress, panels B & D only loaded 300 lbs./sq.ft.
4 = Load removed.
+ = Tension.
− = Compression.
Design Live Load = 150 lbs. per sq.ft.
E_s = 30 000 000 lbs. per sq. in.
E_c = 3 000 000 lbs. per sq. in.
— SCALE OF FEET —
PLAN OF BASEMENT CEILING.

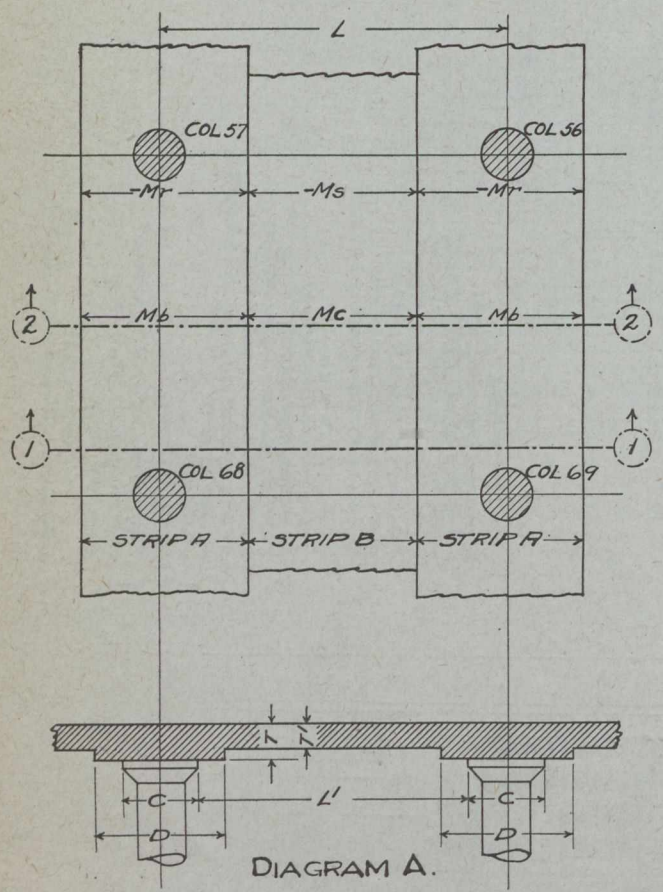


DIAGRAM A.

TABLE No. 1

BY-LAW	STRIP A	STRIP B	Mr	Mb	Ms	Mc	C	D	T	T'
CHICAGO	$\frac{L}{2}$	$\frac{L}{2}$	$\frac{WL}{30}$	$\frac{WL}{60}$	$-\frac{WL}{120}$	$\frac{WL}{120}$	.225L			6" or $\frac{L}{32}$
PHILADELPHIA	$\frac{45L}{100}$	$\frac{45L}{100}$	$-\frac{WL}{31}$	$\frac{WL}{77.5}$	$-\frac{WL}{124}$	$\frac{WL}{124}$	.2L	$\frac{38}{100}L$	$1\frac{2}{3}T'$	
JOINT COMMITTEE	$\frac{L}{2}$	$\frac{L}{2}$	$-\frac{WL}{25}$	$\frac{WL}{55}$	$-\frac{WL}{100}$	$\frac{WL}{133}$	.2L			6" or $\frac{L}{32}$

NOTE. T. T'. C and D are minimum dimensions allowed by Codes.

TABLE No. 2.

Comparison of stresses for Live and Dead loads combined according to various by-laws with those found by test

Stresses given in lbs. per sq. inch

BY-LAW	Reading No. 12. Stress in Concrete	Readings Nos. 140 & 141 Stress in Steel	Reading No. 16. Stress in Concrete	Reading No. 132. Stress in Steel.	Reading No. 134. Stress in Concrete	Reading No. 136. Stress in Concrete	Reading No. 1. Stress in Steel	Reading No. 2. Stress in Steel.
CHICAGO	-556	13860	-237	15900	-215·8	-215·8	15050	15050
PHILADELPHIA	-537	13410	-258	16650	-235	-235	15880	15880
PITTSBURG	-723	9750						
Joint Committee	-667	16600	-288·5	18930	-194·5	-194·5	13590	13590
TEST	-142	+2080	-316	+824	-355	-331	+4850	1656.

TABLE No. 3.

Comparison of stresses for Live and Dead loads combined according to various by-laws with those found by test using the section modulus determined by deformation readings.

BY-LAW.	Reading No. 12. Stress in Concrete.	Readings Nos. 140 & 141 Stress in Steel.	Reading No. 16 Stress in Concrete	Reading No. 132. Stress in Steel	Reading No. 134. Stress in Concrete	Reading No. 136. Stress in Concrete	Reading No. 1. Stress in Steel	Reading No. 2. Stress in Steel
CHICAGO	-105	2100	144	448	-141	-141		940
PHILADELPHIA	$-101\frac{1}{2}$	1625	155	516	$-151\frac{1}{2}$	$-151\frac{1}{2}$		1010
JOINT COMMITTEE	-126	2520	173	576	-127	-127		848
TEST	-142	+2080	-316	825	-355	-331	4850	1656

Chicago Code

Extracts from Chicago Code, using the above notation:

The negative bending moment taken at a cross-section of each strip A at the edge of a column capital or over it shall be taken as $-\frac{WL}{30}$.

The positive bending moment taken at a cross-section of each strip A midway between column centres shall be taken as $\frac{WL}{60}$.

The positive bending moment taken at a cross-section of each strip B in the middle of the panel shall be taken as $\frac{WL}{120}$.

The negative bending moment taken at a cross-section of each strip B on the centre line of the columns shall be taken as $-\frac{WL}{120}$.

Referring to the plan of first floor, it will be noted that $L = 16'\ 0''$ and that the first load applied to the four panels was 142 lbs. per square foot.

The readings around column No. 69 for the stresses in strip A at the column capital will now be considered.

The plan of the first floor gives the readings for the stresses in the steel and the plan of the basement ceiling gives the corresponding stresses in the concrete.

NOTE: The stresses given on the plans are for the live loads of 142 lbs. per square foot and 300 lbs. per square foot.

The stresses for the dead load would be approximately correct if taken in the direct proportion of the dead to the live load; therefore, the stresses due to the dead load are 82/142, or about 4/7 of those due to the live load (if the elastic limit of the material is not passed. Most authorities give the elastic limit of concrete as very indefinite.)

The following stresses are for a live load of 142 lbs. per square foot:

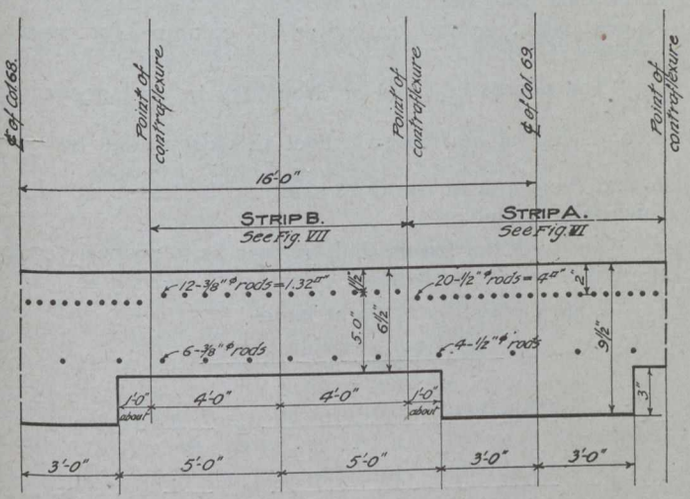
Reading No. 137 gives
stress in steel = 900 lbs. tension in top.
Reading No. 11 gives
stress in concrete = 0 lbs. in bottom.
Reading No. 140 gives
stress in steel = 1,500 lbs. tension in top.
Reading No. 12 gives
stress in concrete = 90 lbs. compression in bottom.
Reading No. 153 gives
stress in steel = 2,625 lbs. tension in top.

Reading No. 21 gives

stress in concrete = 248 lbs. compression in bottom.

On referring to readings Nos. 137 and 11 it will be noticed that the stress in No. 11 is zero, so we cannot consider a section through 137, and the readings for Nos. 153 and 21 are on the wall side, which we are not now considering. This, therefore, leaves the readings Nos. 140 and 12 as the ones to be considered.

Assume a section to be taken along 1-1 cutting through the centre of 140 and 12 and running parallel to column 68 and 69.



SECTION 1.1.

Referring to Diagram A it will be noticed that the negative bending moment in strip A, $M_r = -\frac{WL}{30}$

$W_L = 142 \times 16 \times 16 = 36{,}352$ lbs; therefore

$M_r = -\frac{36{,}352 \times 16 \times 12}{30}$ in.-lbs. = 232,652 in.-lbs.

Referring to section 1-1 it will be noticed that there are twenty ½-in. ϕ rods and that they are 2 ins. below the concrete. From this section Fig. 1 has been made.

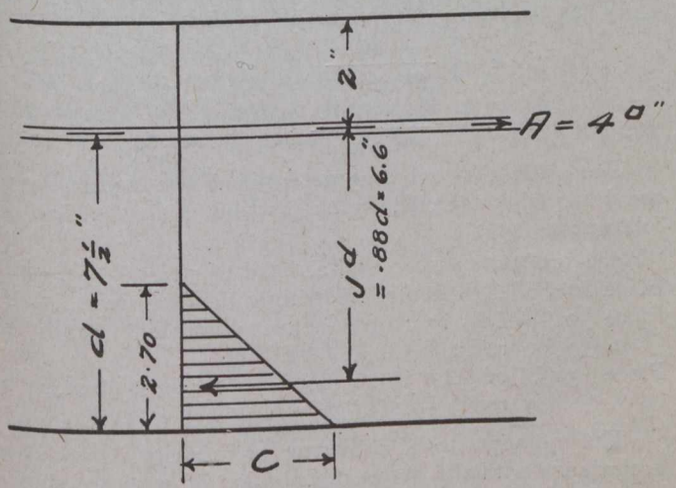


Fig. 1.

A = 4 sq. ins. = ½% of steel. The unit stress in the steel at No. 140, due to the live load, according to the Chicago Code, is

$s = \frac{232{,}652}{4 \times 6.6} = 8{,}812$ lbs. per square inch,

which is about 5.9 times as great as that given by the extensometer reading No. 140, which was 1,500 lbs.

If the compressive stress in the concrete is now considered, then

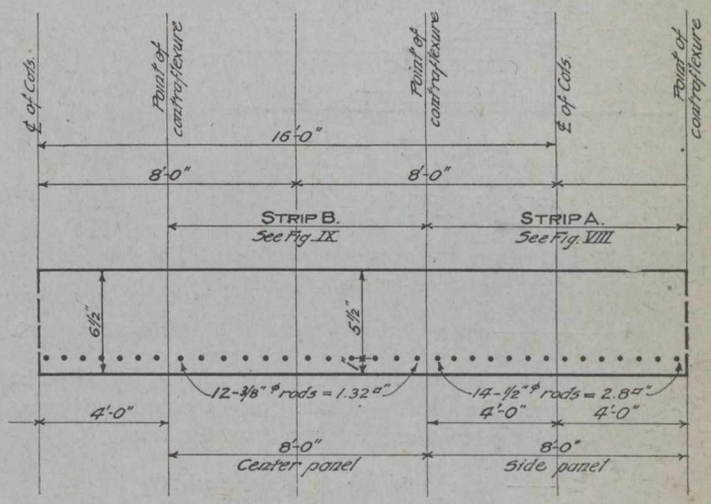
$$\frac{c}{2} \times 2.7 \times 6.6 \times 96 = 232{,}652$$

therefore $c = \frac{232{,}652 \times 2}{2.7 \times 6.6 \times 96} = 272$ lbs. per sq. in.

which is about three times as great as that given by reading No. 12, which was 90 lbs.

Referring to Diagram A, the bending moment at the centre of strip A is

$M_b = \frac{W_L L}{60} = \frac{36{,}352 \times 16 \times 12}{60} = 116{,}326$ in.-lbs.



SECTION 2.2.

Referring to section 2-2, it will be seen that there are fourteen ½-in. ϕ rods and that they are 1 in. from the bottom of the concrete. From this section Fig. 2 has been made.

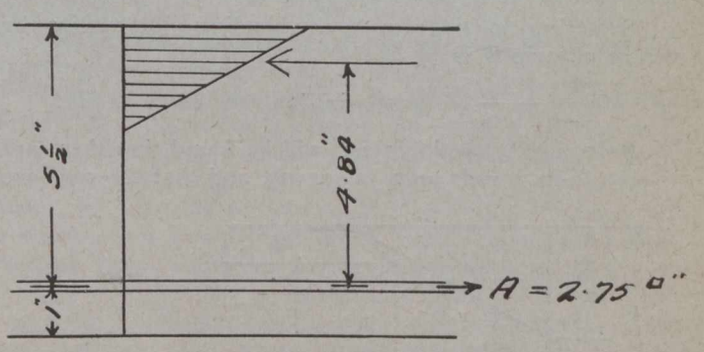


Fig. 2.

Reading No. 17 gives steel stress = 75 lbs. per square inch tension.

Reading No. 7 gives steel stress = 1,425 lbs. per square inch tension.

Since Mb = 116,326 in.-lbs. as found above,

$\therefore s = \frac{116{,}326}{2.75 \times 4.84} = 8{,}739$ lbs. per square inch, which is more than six times as great as reading No. 7, the greater of the two readings.

As there were no corresponding readings taken on the concrete it is impossible to compare them to the Chicago Code.

Referring to Diagram A, the negative bending moment will now be found for strip B.

$$Ms = -\frac{WLL}{120} = \frac{36,352 \times 16 \times 12}{120} = 58,163 \text{ in.-lbs.}$$

Referring to section 1-1, it will be noticed that there are twelve ⅜-in. ϕ rods = 1.32 sq. ins. and that the rods

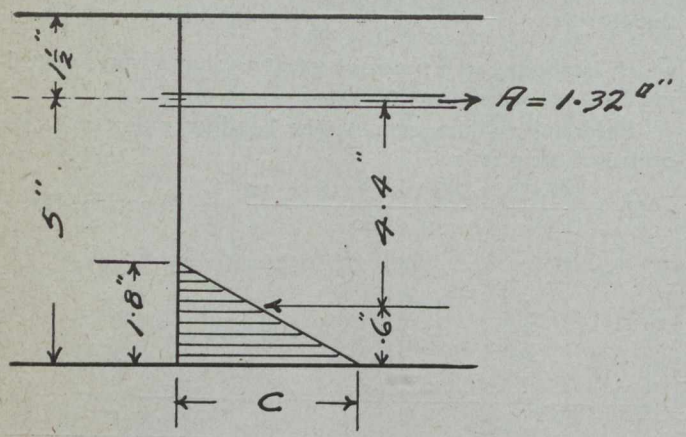


Fig. 3.

are 1½ ins. below the top of the concrete, and from this section Fig. 3 has been made.

$$s = \frac{58,163}{1.32 \times 4.4} = 10,030 \text{ lbs. per sq. in. tension in steel.}$$

By referring to reading No. 132 it will be found to be 525 lbs., hence the Chicago Code gives a computed stress twenty times as great as that given by the reading.

$$\frac{c}{2} \times 1.8 \times 96 \times 4.4 = 58,163$$

$$\therefore c = \frac{58,163 \times 2}{1.8 \times 96 \times 4.4} = 153 \text{ lbs. per square inch compression in the concrete.}$$

Referring to reading No. 16 it will be noticed that the stress given is 203 lbs. per square inch, which is greater than that found by the Chicago Code.

Referring to Diagram A, the bending moment for the centre of strip B is

$$Mc = \frac{WLL}{120} = 58,163 \text{ in.-lbs., the same as } Ms.$$

Referring to section 2-2 it will be found that there are twelve ⅜-in. ϕ rods = 1.32 sq. ins. and that the rods are

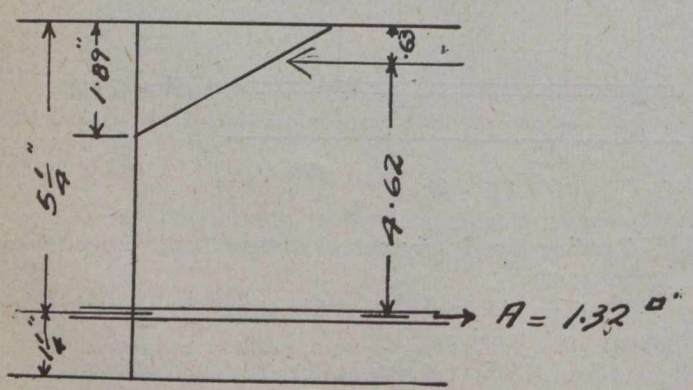


Fig. 4

1¼ ins. from the bottom of the concrete and from this section Fig. 4 has been made.

$$s = \frac{58,163}{1.32 \times 4.62} = 9,535 \text{ lbs. per sq. in. tension in steel.}$$

Referring to readings Nos. 1 and 2 it will be found that No. 1 gives a stress of 3,075 lbs. per square inch and No. 2 a stress of 1,050 lbs. per square inch, hence the Chicago Code gives a stress three times as great in the former and nine times as great in the latter, as found by test.

Philadelphia Code

The second by-law considered will be the Philadelphia Code. Extracts from the Philadelphia Code, using the same notation as before:

"The column capital shall have a diameter at the top in no case less than 0.2 L where L is the length of the longest side, centre to centre of columns for square capitals.

"The depressed head or drop may be cast above the column capital and the width of this drop shall be $\frac{38}{100}$ L and the depth of the drop shall not be less than ⅔ the thickness of slab.

"The width of bands shall be such as to properly cover the panel area but shall not be wider than 0.45 L.

"Load carried by straight band

$$= \frac{\text{total bay} - \text{capital head}}{2} \times w$$

$$-M = \frac{\text{total bay} - \text{capital head}}{2} \times \frac{wL_1}{12} \quad - - - \quad (1)$$

$$+M = \frac{\text{total bay} - \text{capital head}}{2} \times \frac{wL_1}{24} \quad - - - \quad (2)$$

"Width of concrete to resist compression at edge of capital head = width of drop.

"Width of concrete to resist compression in centre of the span = width of band = $\frac{45}{100} L$."

Taking 0.2 L as the diameter of capital head and substituting this value in equations (1) and (2) we obtain:

$$-M = \frac{WL}{31} \text{ ft.-lbs.} \quad - - - \quad (3)$$

$$+M = \frac{WL}{62} \text{ ft.-lbs.} \quad - - - - \quad (4)$$

Areas of steel required to resist these moments are:

$$A = \frac{-M}{16,000\,d}$$

$$\text{and } A_1 = \frac{+M}{16,000\,d_1}$$

The areas of steel thus determined are, according to the Philadelphia Code, to be distributed in the slab as follows:

"Place 100% of A over capital head to resist $-M$.
Place 80% of A_1 in centre of straight bands to resist $+M$.
Place 50 % of A_1 in centre between straight bands to resist $+M_1$.
Place 50% of A_1 in centre of straight bands to resist $-M_1$."

The moments to be provided for in strips A and B in accordance with the above distribution of steel are shown in Diagram A, Table I.

Thus, over capital head, moment = 100% of $-M$ $= -\frac{WL}{31}$ ft.-lbs.

At middle of strip A moment = 80% of $+M = \frac{80}{100} \cdot \frac{WL}{62}$ ft.-lbs. $= \frac{WL}{77.5}$ ft.-lbs.

At middle of strip B moment = 50% of $+M = \frac{50}{100} \frac{WL}{62}$ ft.-lbs. $= \frac{WL}{124}$ ft.-lbs.

In strip B at centre line of column moment is the same as at middle but opposite in sign $= -\frac{WL}{124}$ ft.-lbs.

These moments are nearly the same as those called for by the Chicago by-law, so that the computed stresses would be about the same as found before.

(To be concluded in the next issue)

PURPOSES SHOULD GOVERN WATERWORKS VALUATIONS*

By J. W. Ledoux
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AFTER years of discussion of valuation of public utilities, such as a waterworks property, there is still no unanimity of view, so that each case has to be treated on its merits by the valuator, with a fair chance that the court or commission will discredit the whole argument. The writer believes one reason for this chaos is the frequent attempt to find one valuation only, whatever the purpose. In the writer's estimation there should be several materially different valuations, depending on the purpose. In particular, there are three different bases—original investment, reproduction cost less depreciation, and market value—all of which have their applications in three common cases.

Original Cost for Ratemaking

If rates are to be established, the valuation should be based on the fair and legitimate investment. If the financial transactions have been honest and the works have been built and operated according to average practice, and the book records are in good shape, the historical cost should be taken, and the rates should be such as will enable the utility to receive a fair return on its investment from the beginning. Hence, if the utility has not yet received a fair return past losses must be added to the historical cost.

The logical method of procedure is to tabulate for each year a, plant cost; b, operating expenses; c, estimated depreciation; d, gross revenue; e, fair return; and v, valuation. Then

$$e = (a + b + c - d)\ p/100$$

and

$$v = a + b + c + e - d$$

where p is the fair return decided upon as a percentage on the investment.

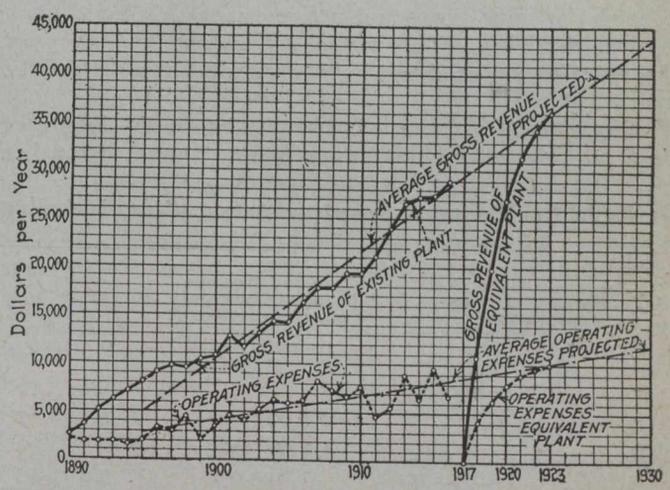
By this process it is seen that if the utility has earned a fair return and no more, $b + c + e = d$ and $v = a$. If it has earned more than a fair return, v will be less than a, and if it has earned less than a fair return v will be more than a.

Under this plan no allowance would be made for accrued depreciation, obsolescence or fluctuation of value of real estate, water rights or other property. Neither would allowance be made for service pipes or street pavements unless their cost were borne by the water company.

*Engineering News-Record, New York.

Following are some of the reasons why the writer believes this method of determining value should be used for establishing rates, or where the property is being condemned by the municipality: Most waterworks systems were established before the advent of state control and regulation of rates. The owners knew there would have to be a development period, but believed the works would eventually pay a sufficient return to make up for early losses. Hence if the city should condemn, the owners should receive the past cost plus a reasonable rate of return on such cost. With proper regulation of rates the public is protected against undue profits to the water company, and the company is protected against loss. Hence, the valuation must be based on investment and not on estimated cost of reproduction at present prices, nor on market value, which cannot be established until the rates have been fixed for a long period in the future.

Where there are difficulties in the way of determining original cost, because of loss of accounts, or mismanagement or extravagance in the construction or operation of



Forecast of Revenues and Expenses of Existing and Equivalent Plants for Determining Going Value

the works, the valuator must use his best judgment to supply proper data for a fair valuation.

What shall be taken for p, the percentage of fair return? A waterworks is one of the most important and vital elements upon which the health and welfare of a community depends. To be operated well and continuously, its financial success must be certain. Because of a tendency on the part of public service commissions to squeeze down valuations to figures that are a grave menace to this class of property, capital is reluctant to invest in it unless earnings are assured far in excess of the legal rate of interest. Men experienced in waterworks management and finances refuse to purchase these properties except on a 9 or 10 per cent. basis, and it would therefore seem that for the present at least 8 per cent. should be taken as a fair return.

Table I. applies the foregoing reasoning and develops the value for rate-making purposes of a typical plant, established in 1889. By this method the valuation as of January 1st, 1917, was $241,170.11.

Reproduction Cost for Forced Sales

Next comes the case wherein a municipality desires to acquire the utility. It may have the option of negotiating with the owners, of exercising its right of eminent domain or of building its own plant. Assuming that the municipality prefers not to condemn, it asks the valuator

what it can afford to pay for the utility rather than build its own works. The valuator estimates at present prices the cost of construction of an exactly equivalent plant, from which he deducts a proper allowance for accrued depreciation. To the remainder he adds the value of the acquired revenue and obtains a valuation based on the cost of reproduction—usually designated as "the cost of reproduction less depreciation plus going value."

The municipality may or may not be able to prevent the water company from continuing its business when the new municipal plant is completed. If it cannot the going value will be a maximum, as the city can afford to pay the water company a high price rather than be subjected to disastrous competition. If the city can prevent the water company from continuing its business, it is sure to secure all the revenue within a few years after the new works are completed.

To determine what the going value should be for either of these cases, it is necessary to make a comparison of the financial operation of each plant from the present time up to the time when the new plant is receiving the same gross and net revenues as the old plant is then receiving. The annual differences in favor of the old plant reduced to a present-worth basis will be the going value.

Some broad assumptions have to be made—length of time required to build the new plant, annual operating expenses, depreciation, interest and gross revenue for each plant up to the time at which they are equivalent, and the value of money to be used in calculating the present worth. While the calculation is subject to uncertainty, it is likely to reach much nearer the truth than a mere guess.

Graphs to Forecast Future

Prognostication of the future is much aided by the graphical method. As shown in the illustration, curves can be drawn to indicate the variation of gross revenue and operating expenses for the old plant, and these can be extended into the future years, preferably by straight lines. From these straight lines an equation of operating expenses is derived in the form $O = a + bR$, in which O is annual operating expenses, R is gross revenue and a and b are constants. Substituting known values of O and R for two points on each of the straight lines, the constant values of a and b are obtained.

The estimated annual gross revenue for the new plant is tabulated and from this an equation may be used to calculate the operating expenses. This gives sufficient data to complete the table. To reduce the net-revenue differences to present worth, it would seem that the rate of interest which the municipality has to pay for money should be used rather than that which the water company should receive as a fair return.

Table I.—Valuation Based on Actual Cost, Including a Fair Return of 8% on Investment, and 1% Depreciation

Year	1 Plant Cost and Improvements from Year to Year	2 Operating Expenses Including Taxes and Insurance but Not Interest or Depreciation	3 Gross Receipts from Operation	4 Total Expenses (1 + 2 + 7*)	5 Total Expenses Minus Receipts (4 — 3)	6 Fair Return 8%, Plus 1% Depreciation = 9% on Col. 5	7 Valuation of Plant at end of Each Year (5 + 6)
1889	$42,000.00	.....	.....	$ 42,000.00	$42,000.00	.....	$42,000.00
1890	6,535.40	$2,025.39	$ 2,249.67	50,560.79	48,311.12	$ 4,347.99	52,659.11
1891	2,879.92	1,885.36	3,606.66	57,424.39	53,817.73	4,843.59	58,661.32
1892	6,936.30	1,819.99	5,101.43	67,417.61	62,316.16	5,608.43	67,924.63
1893	1,903.61	1,955.96	6,186.59	71,784.20	65,597.61	5,903.78	71,501.39
1894	1,425.85	1,559.92	7,128.58	74,487.16	67,358.58	6,062.26	73,420.84
1895	7,780.83	2,020.84	8,152.77	83,222.51	75,069.74	6,756.27	81,826.01
1896	1,607.65	3,437.83	9,056.45	86,871.49	77,815.04	7,003.35	84,818.39
1897	10,747.41	3,025.36	9,716.35	98,591.16	88,874.81	7,998.73	96,873.54
1898	1,290.32	4,470.75	9,562.28	102,634.61	93,072.33	8,326.50	101,398.83
1899	1,862.82	2,089.35	10,413.49	105,351.00	94,937.51	8,544.37	103,481.88
1900	532.78	3,479.73	10,803.68	107,494.39	96,690.71	8,702.16	105,392.87
1901	2,870.80	4,596.83	12,774.14	112,860.50	100,086.36	9,007.77	109,094.13
1902	3,279.23	4,151.63	11,627.44	116,524.99	104,897.55	9,440.78	114,338.33
1903	2,779.56	5,252.57	13,207.14	122,370.46	109,163.32	9,824.70	118.988.02
1904	4,322.97	6,284.04	14,363.17	129,605.03	115,241.86	10,371.77	125,613.63
1905	1,636.30	5,885.11	14,272.20	133,135.04	118,862.84	10,697.65	129,560.49
1906	7,262.56	6,196.80	16,257.90	143,019.85	126,761.95	11,408.57	138,170.52
1907	26,412.27	8,209.25	17,772.66	172,792.04	155,019.38	13,951.74	168,971.12
1908	217.71	7,330.24	17,903.87	176,519.07	158,615.20	14,275.37	172,890.57
1909	522.41	6,631.18	19,253.54	180,044.16	160,790.62	14,471.15	175,261.77
1910	6,543.13	7,585.01	19,277.86	189,389.91	170,112.05	15,310.08	185,422.13
1911	11,816.56	4,615.73	21,141.01	201,854.42	180,713.41	16,264.21	196,977.62
1912	3,560.60	5,464.42	23,856.75	206,002.64	182,145.89	16,393.13	198,539.02
1913	7,250.51	8,785.21	26,599.76	214,574.74	187,974.98	16,917.75	204,892.73
1914	13,929.53	6,389.78	27,204.29	225,212.04	198,007.75	17,820.70	215,828.45
1915	14,602.90	9,646.46	27,403.57	240,077.81	212,674.24	19,140.68	231,814.92
1916	11,518.71	6,698.41	28,775.06	250,032.04	221,256.98	19,913.13	241,170.11
1917	369.93	2,036.63	1,080.62	243,576.67	242,496.05	5,456.16	247,952.21

*Figures for 7 in Col. 4 are for end of previous year.

(Valuation as of January 1st, 1917, by this method, $241,170.11.)

This valuation will represent what the city can afford to pay rather than build its own plant; and it will also show what the water company can afford to ask.

Table II. shows the foregoing method of determining going value, based on an assumed price for the existing plant, to be verified afterward, of $276,740 and an assumed reproduction cost of $235,265 for the equivalent plant, and gross revenues and operating expenses of both plants as indicated by the diagram, which assumes that six years after the equivalent plant is completed it will have the same earnings and operating expenses as the present plant. It is also assumed that it will take one year to build the equivalent plant.

The left-hand side of the table shows the principal items, including net return, over and above interest on capital, for each of the next six years. With the equivalent plant we assume that $235,265 for construction is borrowed uniformly during the first year, and therefore the interest during the year will be 5 per cent. on the total amount for six months. That year there will be no revenues and no operating expenses, and to make up the interest on capital and the net return of the present plant, $12,945 capital must be added. In the next year there will be operating revenues, but the interest will cover the entire year, so that a slightly larger addition to capital will have to be made to make up deficits. Thereafter each year the necessary capital addition will be less, and in the sixth year it will be zero. The going value will be the sum of these additions, or $41,479, and the valuation of the plant will be $235,265 + $41,479 = $276,744.

Several trial calculations for the going value will, of course, have to be made, and the table worked out from the existing data in each case until we find the sum that will be just sufficient so that at the end of the six years the two plants will be earning the same without any extraction for capital added to make up deficits.

Market Value for Voluntary Sales

The third important case is where the city has neither the right to condemn, grant a new franchise nor build its own works, so long as the water company furnishes good water and service, and where the rates are established for a long and indefinite term of years. If the city or some outsider desires to acquire the plant, what should be the process of valuation?

This is a case where the market value applies. The appraiser is not interested in what it will cost to reproduce the plant, but he is interested in what it will cost to operate and maintain it and make the necessary renewals and improvements. He wants to know how the revenue is varying from year to year and what it is likely to be in the future. His inquiry does not extend beyond thirty or forty years, because he recognizes such remoteness to be in the realms of posterity.

He proceeds to draw graphs of the operating expenses during the past years, and extends them forty years into the future. To find out how the plant is likely to grow he makes a similar graph of the plant cost, which aids him in determining depreciation. With a graph for past and future gross revenue he completes the data from which to tabulate the annual net revenues for the next thirty or forty years. This is preferably divided into two parts, one of which applies to the plant as existing at present. The latter figures are determined by taking the earnings in proportion as the present plant cost is to the future total plant costs. If money in the waterworks business is worth 8 per cent., he takes that to reduce the future annual net revenues to present worth, and the sum will be a valuation from which should be deducted the accumulated depreciation up to the present time.

Accumulated depreciation up to the present time must be deducted, for we are starting with a plant that has suffered a certain amount of depreciation. If this be figured from the beginning on a sinking-fund basis, at a fixed per cent. on the cost, we cannot be justified in figuring it in the future at the same rate unless we place the accumulated depreciation up to the present time in a depreciation fund to the credit of the water company—or, what is exactly equivalent, deduct that amount from the price of the plant. Future depreciation, however, must be figured on the plant cost the same as if no deduction had been made.

Table III. shows a calculation for the market value of the property according to this method. At the present time the historical cost of the existing physical plant is assumed to be $204,000 in round numbers—as derived

Table II.—Calculation of Going Value of Plant to be Acquired

	Given Data, Present Plant				Calculated Data, Equivalent Plant				
Date	Capital Invested to Buy Old Plant	Gross Revenue	Operating Expenses	Interest on Capital	Net Return	Capital Invested in Plant	Capital Added to Make Up Deficits	Gross Revenue	Operating Expenses	Interest on Capital	Net Return
1917											
Jan. 1 ..	$276,740	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
July 1 ..	276,740	.....	.....	.....	.....	$235,265	.....	.....	.....	.....	.....
Dec. 31 ..	276,740	$29,400	$8,500	$13,837	$7,063	.....	$12,945	.....	.....	$5,882	$7,063
1918											
Dec. 31 ..	276,740	30,500	8,700	13,837	7,963	.....	13,733	$10,800	$4,160	12,410	7,963
1919											
Dec. 31 ..	276,740	31,700	9,000	13,837	8,873	.....	8,400	19,800	6,240	13,097	8,863
1920											
Dec. 31 ..	276,740	32,700	9,300	13,837	9,563	.....	3,990	27,000	7,910	13,517	9,563
1921											
Dec. 31 ..	276,740	33,900	9,500	13,837	10,565	.....	1,820	31,400	8,940	13,717	10,563
1922											
Dec. 31 ..	286,740	35,100	9,800	13,837	11,463	.....	591	34,300	9,620	13,808	11,463
1923											
Dec. 31 ..	276,740	36,100	10,100	13,837	12,163	.....	.....	36,100	10,100	13,837	12,163

Going value = $41,479

Valuation of plant = $235,265 + $41,479 = $276,744.

from the first column of Table I. The table shows the gross earnings in the future, both for the present plant and the necessary additions to it for capital account. The last column shows the present worth of these net returns, year by year, and the sum of these, less accrued depreciation, gives the required valuation—in this case $244,830.

Table III.—Valuation Based on "Market Value"

Year	Estimated Cost of Plant at end of Year	Net Returns = Gross Revenue Less Operating Expenses and 1% Depreciation	Net Return on $204,000 — Original Plant Cost	Present Worth of These Net Returns on Original Plant Cost at 8%
1917 ...	$204,000	$20,730	$20,730	$19,180
1918 ...	204,000	21,560	21,560	18,470
1919 ...	207,300	22,390	22,030	17,490
1920 ...	213,400	23,220	22,190	16,300
1921 ...	219,500	24,050	22,350	15,220
1922 ...	225,600	24,880	22,500	14,180
1923 ...	231,700	25,710	22,640	13,220
1924 ...	237,800	26,540	22,770	12,300
1925 ...	243,900	27,370	22,890	11,450
1926 ...	250,000	28,200	23,010	10,660
1927 ...	256,100	29,030	23,130	9,920
1928 ...	262,200	29,860	23,230	9,220
1929 ...	268,300	30,690	23,330	8,580
1930 ...	274,400	31,520	23,430	7,980
1931 ...	280,500	32,350	23,530	7,420
1932 ...	286,500	33,180	23,620	6,890
1933 ...	292,700	34,010	23,700	6,410
1934 ...	298,800	34,840	23,790	5,960
1935 ...	304,900	35,670	23,860	5,530
1936 ...	311,000	36,500	23,930	5,130
1937 ...	317,100	37,330	24,010	4,770
1938 ...	323,200	38,160	24,080	4,430
1939 ...	329,300	38,990	24,150	4,110
1940 ...	335,400	39,820	24,220	3,820
1941 ...	341,500	40,650	24,280	3,545
1942 ...	347,600	41,480	24,360	3,290
1943 ...	353,700	42,310	24,420	3,060
1944 ...	359,800	43,140	24,470	2,840
1945 ...	365,900	43,970	24,520	2,630
1946 ...	372,000	44,800	24,570	2,440
1947 ...	378,100	45,630	24,620	2,265
1948 ...	384,200	46,460	24,670	2,105
1949 ...	390,300	47,290	24,720	1,950
1950 ...	396,400	48,120	24,760	1,810
1951 ...	402,500	48,950	24,810	1,680
1952 ...	408,600	49,780	24,860	1,555
1953 ...	414,700	50,610	24,900	1,440
1954 ...	420,800	51,440	24,940	1,340
1955 ...	426,900	52,270	24,990	1,240
1956 ...	433,000	53,100	25,030	1,150
				$272,980
Less accrued depreciation				28,150
Required valuation				$244,830

In this particular case the valuations by the first and last methods are substantially the same, and that by the second is higher. This is not always true. There is, in fact, as will readily be seen, no necessary relation or agreement of the results.

There are still other purposes of valuation, for which the methods to be pursued are not so obvious. Among these may be mentioned valuation for purposes of taxation and valuation for security issues. The three cases cited, however, are the most important ones for which valuations are required.

Summary

Summarizing, there are three fundamentally different methods of valuation, only one of which is applicable to any particular case:—

1 Legitimate Actual Cost, including deficiencies of net income below a fair return on the legitimate investment. This is applicable to the fixing of rates, and to condemnation of the plant by the municipality.

2. Estimated Cost of Reproduction Less Depreciation Plus Going Value. This is applicable to negotiations between the city and the water company, whereby the city desires to know what it can afford to pay for the water company rather than build its own works.

3. Market Value—determined from a sufficient number of public sales of the company's stocks and bonds, or, if such records are inadequate, from the present worth of the annual net revenues for the next 30 or 40 years. This is applicable where the rates are fixed for a long and indefinite period in the future and the city has neither right to condemn, build its own works nor grant a franchise to another water company, and where the city or another company desires to purchase. It is also applicable when it is desired to create a mortgage or capital-stock issue, or to determine the valuation for taxation purposes.

QUEBEC BRIDGE LECTURE

R. L. Dobbin, B.A.Sc., waterworks superintendent of Peterborough, Ont., addressed the Engineers' Club of Peterborough last Thursday evening giving a complete description of the central span of the Quebec Bridge. Mr. Dobbin's lecture was illustrated with lantern slides. The club had dinner at the Empress Hotel, and after a short business session Mr. Dobbin read his paper, which was followed by considerable discussion.

The Engineers' Club at Peterborough has a membership of 35, meeting once each month, every second Thursday evening. C. E. Canfield, of the Canadian General Electric Company, is president, P. P. Westly, of the Wm. Hamilton Company, is vice-president, and Mr. Dobbin is secretary-treasurer. The directors are G. R. Munro, H. O. Fisk, Wm. Sangster and R. B. Rogers.

Near Bridgeton, N.J., 110 acres of farm land is irrigated by a system of overhead conduits. The pipes are elevated several feet above the ground, and in no way interfere with the things growing beneath them.

Russia may carry out a complete reorganization on a huge scale of its inland waterways, if plans made previous to the recent political upheaval are realized. The project includes improvement of existing waterways, construction of new waterways and ports, utilization of waterfalls for producing electric power, improvement of navigation, etc. The work, it is estimated, will be finished in 1930, and cost $487,000,000.

In connection with the proposals for the encouragement of new industries in Portugal, it is reported that a scheme has been submitted to the government dealing with the establishment in the country of large iron and steel works to comprise blast-furnaces, a steel-making plant and rolling mills. It is stated that if the government is prepared to grant the necessary facilities, the applicants will undertake to have running within a period of five years works capable of turning out 100,000 tons of steel ingots per annum.

COMPARATIVE TESTS OF AIR DIFFUSERS AND DEVICES FOR DEWATERING ACTIVATED SLUDGE*

By Prof. Edward Bartow

FOUR reinforced concrete tanks were remodelled and each fitted with a different air diffuser. The tanks operate on the fill-and-draw system and are 3 ft. 2 ins. square and 8 ft. deep. At each filling 350 gals. of sewage were added.

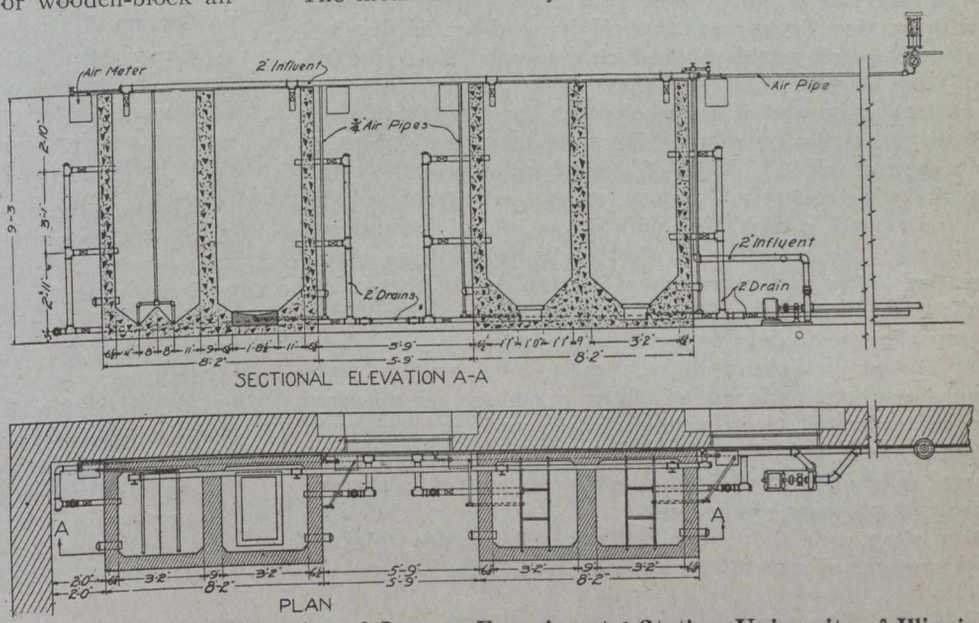
One tank was fitted with a system of perforated pipes having perforations 1/25 in. in diameter placed 2 ins. apart and staggered at an angle of 45° from the top of the pipes. There were about 40 holes in the pipes or 4 to each square foot of surface area. The bottom of the tank is sloped from the centre and sides at an angle of 45°, thus forming two V-shaped channels of equal size, 1 ft. in depth, running entirely across the tank.

The bottom of the second tank was hoppered from all four sides and a concrete container for wooden-block air diffusers was placed in the bottom of the hopper. The container was patterned after one designed by Nordell and used at Milwaukee in the Nordell aerating tank. The container is a 1-piece casting 2 ft. 8 ins. long, 1 ft. 8 9/16 ins. broad, and 5 ins. thick with a receptacle for the blocks 1 ft. 3 9/16 ins. by 2 ft. 3 ins. in plan, ¾ in. deep at the edge, and 1¼ ins. deep at the centre. The wooden blocks rest upon a series of 13 ridges, ½ in. wide and ¼ in. high that run across the receptacle leaving a ¼-in. space underneath for the air to circulate. The surface of the container was cast on a curve so that the tendency of the wooden blocks on swelling would be to wedge themselves more firmly into position. The basswood blocks used in the experiments were ½ in. thick, 6 ins. long, and 2⅛ ins. wide. At first, difficulty was experienced in keeping the blocks in position because of the excessive swelling that took place when they were placed under water and also because they became soft and spongy. Many of the blocks became so curved and twisted that they were discarded. It was found necessary to place strips of heavy galvanized iron on edge between each row of blocks for reinforcement and to close up certain joints with oakum.

Filtros plates of different porosity furnished by the General Filtration Co. were placed in two of the tanks. Three plates were used in each tank, covering one-third of the area and forming the bottom of a trough with sides sloping at an angle of 45°. The plates of the third tank were marked "fine" because on the basis of dry rating these plates passed 5.8 cu. ft. of air per minute per square foot under a water pressure of 2 ins. When saturated with water and passing 2 cu. ft. of air per minute they showed a resistance on a water gauge of 11.4 to 11.8 ins. The fourth tank was equipped with plates marked "coarse" which on the same basis passed 12 cu. ft. of air per minute per square foot. When passing 2 cu. ft. of air per minute these plates registered a resistance of 8.8 to 9.6 ins. of water pressure.

The tanks were operated during three periods of 15, 20 and 35 days, respectively. Each of the tanks was operated in three aeration periods daily of 510, 300 and 270 minutes with a 2-hour allowance between the periods for settling, emptying and filling. The same amount of air as measured by ordinary gas meters was added to each tank. All conditions were maintained as nearly identical as possible. The sewage was pumped from the main sewer just outside the city limits of Champaign and accordingly was fresh. It was a fairly strong domestic sewage with no trade wastes. No activated sludge was added to the tanks at the beginning of any of the series of tests.

Samples of sewage were taken as the sewage was being pumped into the tanks and samples of effluents were collected at the close of each aeration period after the sludge had been allowed to settle for 30 minutes. The methods of analysis were those given in the 1917 edition of Standard Methods for the Examination of Water and Sewage of the American Public Health Association.



Sectional Plan and Elevation of Sewage Experimental Station, University of Illinois

In the first series of tests only the perforated pipes and filtros plates were used. The series continued only 15 days. The average purification, measured in terms of removal of turbidity, removal of oxygen-consuming capacity, and the production of nitrate nitrogen was greatest in the tanks with the coarser filtros plates, next in the tank with finer plates, and least in the tank with perforated pipes. Measured in terms of reduction of ammonia nitrogen and sludge accumulation the order was reversed. About 19,000 gallons were treated with 2.5 cu. ft. of free air per gallon.

All four tanks were in operation in the second series of tests, which continued 20 days. Measured in terms of removal of turbidity, removal of oxygen-consuming capacity, production of nitrate nitrogen, and sludge accumulation, the tanks containing filtros plates gave the best results. The tank with the wooden blocks was next and the tank with perforated pipes the poorest. Measured in terms of reduction of ammonia nitrogen, the tank with

*Abstracted from paper read before the Buffalo meeting of the American Institute of Chemical Engineers.

the perforated pipes was the best. About 17,000 gallons of sewage were treated with 1.8 cu. ft. of free air per gallon.

The third series of tests, which lasted 35 days, was the most satisfactory. (See Tables I. and II.) There was no sludge present at the beginning and owing to the length of the test at times some of the excess of the accumulated sludge was wasted. No accurate comparison of the sludge accumulation at the end of the series can be made. The maximum amount of sludge was reached last in the tank with perforated pipes. Removal of turbidity and oxygen-consuming capacity was practically the same in all tanks. Measured in terms of removal of ammonia nitrogen and in production of nitrate nitrogen the tanks with filtros plates were decidedly superior. Ammonia nitrogen was entirely removed in the tanks with filtros plates after 17 days. Owing to rains nitrate nitrogen was present in the raw sewage during the early part of the series and continued to increase in the tanks containing filtros plates reaching about 25 parts per million. Practically all of the nitrate nitrogen disappeared from the other tanks. The poor results from the tank with wooden blocks were probably caused by the development of a hole in the tank which prevented the formation of finely divided bubbles. The stability to methylene blue was tested on and after the eleventh day and all effluents from the tanks containing filtros plates were stable for 10 days at 20° C. Most of the effluents from the other tanks were unstable. Nearly 30,000 gallons of sewage were treated in each tank with 3.2 cu. ft. of free air per gallon. The sludges in the tanks with filtros plates settled better and after removal at the end of the series, had specific gravities of 1.013 and 1.022 compared with 1.006 for the sludges from the other tanks.

The results obtained from these comparative tests indicate the superiority of filtros plates as air diffusers over perforated pipes, such as were used in our tests under the conditions maintained. The wooden blocks were difficult to handle though this was caused in part by the faulty design of our containers. Even in the time they were used there was evidence of considerable deterioration. From the results obtained little, if any, difference could be distinguished between the coarse and fine grades of filtros plates. With air free from dust and oil there should be little trouble experienced from clogging of plates.

Dewatering of Activated Sludge

Experiments in drying on sand beds were not successful. Owing to the large amount of moisture in the sludge 98 to 99 per cent., the solid matter obtainable from a foot depth of sludge would be only from ¼ to ½ in. according to the residual moisture content. It was also difficult to separate the sludge and sand. The fertilizer obtained was more or less impure and of decreased value. The sand beds used were 0.01 acre in area and divided into five compartments. Underdrains were overlain with 10 ins. of coarse gravel and 8 ins. of sand. The beds were provided with a canvas cover supported on a frame work so that they could be protected during storms. One compartment was allowed to dry after a single filling, another after two fillings and another after three fillings. In no case were the results sufficiently satisfactory to warrant the use of sand beds for the drying of the sludge and the production of a commercial fertilizer.

Experiments with a filter press with leaves 8½ ins. square operating on a fairly concentrated sludge were also unsatisfactory, it being impossible to obtain a cake of good consistency. Further experiments are to be tried with the hope that better results can be obtained.

Through the courtesy of the Koering Cyaniding Co., of Detroit, a rotary filter was obtained. This style of filter is used satisfactorily in filtering slimes in extracting gold and silver by the cyaniding process. The apparatus consists of a cylinder of filtros plates supported on a perforated steel cylinder, outside of which at a distance of about 1 in. is a solid steel outer shell. The material to be filtered is forced into the interior of the cylinder of filtros plates, the cylinder is revolved and a cake of sludge is built up on the inside of the plates. The liquid filters through the plates into the space between the cylinders. Air pressure can be exerted from the interior to dry the cake, and from the exterior to loosen it. The plates can be cleaned by back-flushing with water. The first trial

Table I.—Summary of Results Obtained in the Comparison of Efficiency of Methods of Aeration Measured in Terms of Ammonia Nitrogen, Nitrate and Nitrite Nitrogen, and Oxygen Consumed

(Parts per million)

Period. 1917.	Ammonia Nitrogen					Nitrate and Nitrite Nitrogen					Oxygen Consumed				
	Sewage.	Effluents A	B	C	D	Sewage.	Effluents A	B	C	D	Sewage.	Effluents A	B	C	D
March 27-April 1.	21	17	17	18	17	.9	1.2	4.0	3.9	3.9	58	26	19	20	22
April 1-6	17	17	16	16	16	4.7	3.9	4.7	6.1	6.3	46	21	18	15	14
April 6-12	16	11	9	8	9	5.1	4.9	4.5	5.9	7.2	50	26	24	19	26
April 12-17	26	30	29	0	0	.3	.4	.3	6.8	10.2	55	32	26	25	16
April 17-22	21	21	21	0	0	1.2	.3	.0	15.0	16.9	..	..	..	..	..
April 22-27	25	24	23	0	0	1.0	.2	.1	25.8	26.0	..	..	..	..	..
April 27-30	22	30	20	0	0	4.5	.3	.0	23.8	24.7	..	..	..	..	..
Average	21	20	19	6	6	2.5	1.7	1.9	12.6	13.6	52	21	22	20	19
Reduction		5%	10%	71%	71%							60%	58%	62%	63%
Results April 12-30 after Activated Sludge was formed.															
Average	24	24	23	0	0	1.7	.3	.1	17.8	19.4	55	32	26	25	16
Reduction		0%	4%	100%	100%							41%	53%	54%	70%

A—Tank with perforated pipes.
B—Tank with wooden blocks.
C—Tank with fine filtros plates.
D—Tank with coarse filtros plates.

Table II.—Summary of Results Obtained in the Comparison of Efficiency of Methods of Aeration Measured in Terms of Turbidity and the Accumulation of Sludge

(Parts per Million)

Period. 1917.	Turbidity					Per Cent Sludge			
	Sewage.	Effluents A	B	C	D	Effluents A	B	C	D.
Mar. 27-Apr. 1	283	48	39	46	46	9	8	8	7
April 1-6	317	9	6	6	6	14	14	12	12
April 6-12	190	9	5	5	5	18	21	18	18
April 12-17 ...	248	7	5	5	5	26	29	25	28
April 17-22 ...	306	5	5	5	5	29	35	34	31
April 22-27 ...	309	5	5	5	5	38	37	44	39
April 27-30 ...	268	5	5	5	5	35	33	36	33
Average	274	13	10	11	11				
Reduction ...		95%	96%	96%	96%				
Results April 12 to 30 after Activated Sludge was formed.									
Average	283	5	5	5	5	38	37	44	39
Reduction ...		98%	98%	98%	98%				

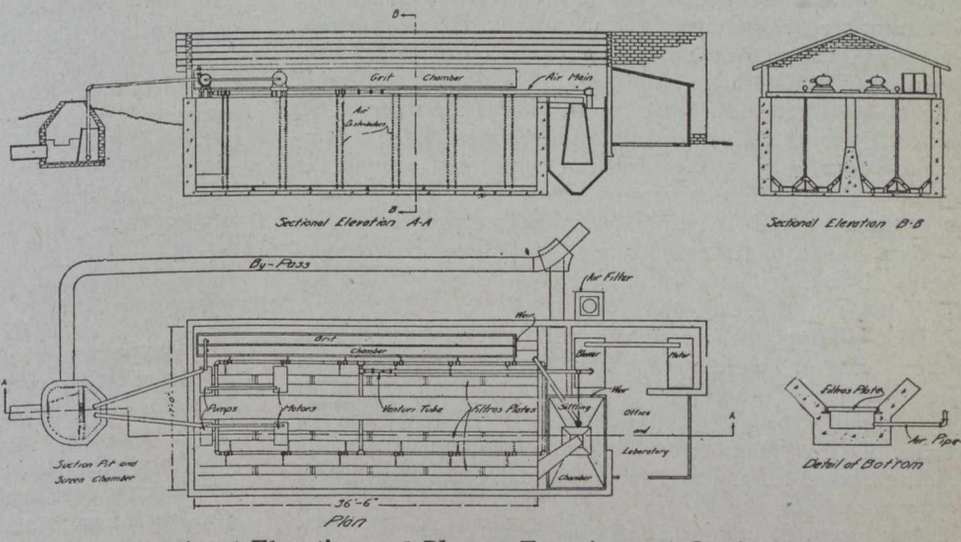
with a comparatively heavy and not very fresh sludge did not give satisfactory results. The quick-opening door could not stand the pressure. Another trial will be given as soon as the door can be replaced.

Mohlman reported experiments with two small centrifuges, one of the low-speed basket type and the other of the high-speed bottle type. The basket of the low-speed machine was 8 ins. in diameter and 6 ins. deep. The periphery was perforated with numerous holes 1/16 in. in diameter. When the holes were covered with a strip of muslin cloth, approximately 1 gallon 98 per cent. moisture sludge was put into the centrifuge and after 15 minutes, 700 grams of 91 per cent. moisture sludge were obtained. The high-speed bottle-type machine reduced the moisture from 98 per cent. to 92 per cent. in three minutes. Mohlman stated that in order to be economical there should be an automatic arrangement for removing the cake.

At Cleveland, Pratt and Gascoigne used a laundry centrifuge with a 26-in. basket, lined with a ¼-in. wire mesh inside of which was a canvas bag. In the best run, when the basket revolved about 1,200 revolutions per minute, 60 gallons of 97½ per cent. moisture sludge was added in about 25 minutes and in 2 hours the moisture content was reduced to 84 per cent. The time required would seem to make this process impracticable.

Working on the assumption that the principle used in drying of china clays or that used in the cream separator might be applicable, a modified basket-type centrifuge and a modified cream separator were tried. The holes of an 8-in. basket-type centrifuge were covered with a strip of rubber packing. The best results were obtained with 1,500 revolutions per minute, which was the limiting speed of the machine. This would seem to indicate that the process would give efficient results if carried on at an increased speed, but would yield an effluent that must be returned with the sewage to the aeration chamber. A series of tests was made with a cream separator, the bowl of which was modified, by removing the inner disks and discharging the clarified liquid about an inch from the centre of the bowl at the top. The sludge added at the top dropped to the bottom of the bowl, and the liquid was thrown out over the rim. Sludge cakes containing from 85 to 86 per cent. of moisture were obtained by the cream separator in 6 to 8 minutes, which encouraged us to obtain a special machine for further experiments.

A specially designed centrifuge was purchased from the Tolhurst Machine Works, of Troy, N.Y. This machine is 12 ins. in diameter, 9½ ins. high and at a speed of 1,800 exerts a centrifugal force of 550 lbs. According to its concentration from 10 to 25 gallons of the sludge are added and 10 lbs. of cake obtained. The sludge cake contains about 88 per cent. moisture. The space underneath the rim contains 0.158 cu. ft. Owing to the small size of the machine and to the fact that the material must be scraped out, the time of cleaning is longer than would be required for a larger machine with an opening in the bottom, so that a large machine could undoubtedly have been filled and emptied more rapidly than the small laboratory machine. It was found entirely possible to fill and empty the small machine four times in one hour. Calculating that the same rate could be used with a 40-in. machine having 46 times the capacity, it was possible to obtain in each filling 460 lbs. of sludge of 88 per cent. moisture, equivalent to 55 lbs. of dry material. One 40-in. machine would, therefore, deliver the equivalent of 2,200 lbs. of dry material in a working day of 10 hours. On the supposition that ½ ton of dry material will be obtained from 1,000,000 gallons of sewage, one machine would dewater the sludge from 2,000,000 gallons of sewage per day. The cost of the 40-in. machine at present is only $750 and the power to run it is small enough to make the process appear practical for preparing sludge cake for a dryer.



Sectional Elevation and Plan of Experimental Station of Illinois State Water Survey

The actual cost of dewatering will depend upon the amount of water that can be removed by the centrifuge, the size of dryer and the amount of coal required for removing the residual water. A drying test using 220 lbs. of 88 per cent. sludge cake made by the John P. Devine Co. indicates that the dewatering process can be made practical.

A VISIT TO THE HOME OF CIVIL ENGINEERING

By Sergt. Gordon L. Shanks, A.M.Can.Soc.C.E.
Formerly Municipal Engineer, Rockwood, Man.

TO any practising member of the profession, especially if he be British, or to any student interested in its history and development, there is but one place thought of as the home of the profession,—the headquarters of the Institution of Civil Engineers, in Great George Street, Westminster, London, England. All civilized countries have their own national civil engineering societies, with headquarters or homes in the political or commercial capitals of the respective countries, as the case may be, but the British Institution (or Society) of Civil Engineers is the oldest one existing to-day and easily the leading engineering organization in the world in rank, in power, in influence and in dignity. Its home, then, may quite properly be taken as THE home of the profession.

Such, at least, were the thoughts of the writer as he approached the building one afternoon in late October, 1916. The situation and surroundings for this home are ideal. Great George Street is a short street, connecting Westminster Bridge with St. James' Park. Directly across the street is the minor facade of one of the huge government departmental buildings fronting on Whitehall. Almost across the street and a little to one side is a corner of St. James' Park, that beautiful breathing space in the aristocratic, official city of Westminster, while just around the corner and only a few hundred yards away are the Houses of Parliament and Westminster Abbey, representing, as it were, the thought-essence and blood-essence, respectively, of the British race. Surely a fitting setting for the home of the greatest profession!

The building itself, which is only a few years old, is three stories in height with a frontage of about 150 feet. The exterior is quite plain, but massive and dignified. The interior is large, but evidently none too large for the wants of the members. All the rooms, especially the reading room, library and lecture theatre are excellently proportioned for the use to which they are put. The reading room, of course, is stocked with copies of every engineering and scientific periodical published in the world and the writer easily picked out such well-known and familiar magazines as *The Canadian Engineer*, Engineering & Contracting, Engineering Record and Engineering News.

But the library is probably the greatest attraction in the building. The room itself, on the second floor, stretches completely across the whole frontage of the building and is a magnificent apartment. One may find here, under courteous and expert guidance, any information and literature on the subject of civil engineering that has ever been published. The transactions of all the great engineering societies are here in complete bound sets. Indeed, it may safely be said that all that is known to-day of the science and art of civil engineering is reduced to writing, printing or diagrams and kept available in this great room. The writer noticed, among other things, that all the American text-books he had ever read or heard of, in connection with different subjects he was interested in, were here and evidently used quite as much as European books on the same subjects.

A feature of the interior of the building of particular interest to a visitor is the collection of portraits and paintings hanging on the walls. This includes all the past-presidents and distinguished members of the institution and views of some of their works. To look at the portraits of a few of the greatest of these men, such as Telford, Rennie, Smeaton, Macadam, Stephenson, Aird, Willcocks, Baker, Wolfe-Barry, etc., and then think how much their life and works has added to the advancement of civilization during the period in which they lived, is to realize what a very important constructive element this institution and its component members has been in the history of the world since it was founded, hardly 100 years ago. Probably the finest picture in the whole collection (and certainly the most attractive) is a large oil painting of the Forth Bridge, placed in a conspicuous situation at the head of the great staircase. A new hanging, and one probably not thought of when the building was planned, is displayed proudly and prominently, and yet quite modestly, on the main floor near the entrance. It is the Roll of Honor. Evidently this institution is doing its full share, in common with all its professional brethren, to support the cause of the Empire in the Great War.

The bulletin-board in the hall stated that a general meeting of the institution, with a lecture, was booked for the evening of the writer's visit, so he decided to stay. Sir John Griffiths, the chief engineer for the Port of Dublin, was the speaker of the evening, and his subject was "Modern Appliances for Handling Raw Materials at Ports and Other Centres of Traffic." He was clearly master of his topic and delivered a very fine address. Although, naturally enough, most of the descriptions and illustrations (the lecture was accompanied by excellent lantern slides) were applied to and taken from ports in the British Isles, the whole world was included in the scope of the paper, and views were shown of the latest labor-saving machinery at such ports as Antwerp, Hamburg, Duluth, Cleveland, Montreal and New York.

To the writer, however, the most interesting feature of the meeting was not the subject matter of the lecture but the character and personnel of the audience. The presiding officer was Mr. Alexander Ross, the president of the institution. Seated around him was the council, and taking part in the animated discussion which followed the lecture were a number of men, all famous in their respective lines of work, and men very well known, indeed, to anyone familiar with the personnel of the civil engineering profession.

The audience numbered probably 150, and almost filled the large and well-appointed lecture theatre. Only a few young men were present; the great majority were men well up in years. The writer could not help but think of a similar meeting he attended, while visiting Montreal, at the headquarters of the Canadian Society of Civil Engineers. The same professional spirit and enthusiasm was certainly present at both meetings, but the greater age and experience of the men taking part in this meeting, and the fact of its being held in London, the capital of the world, gave it a dignity quite impressive to a visitor from overseas. It induced a feeling of awe, almost of reverence, and the writer left the building afterwards quite humbled but thankful, indeed, that he had had the opportunity of visiting this home of civil engineering, this temple of applied science.

Chinese newspapers have discussed very generally the suggestion that the Allies may build wooden ships in China, using timber from the Philippines. The idea has met with great favor. China has an unlimited supply of labor.

MECHANICAL FILTER BOTTOMS AND STRAINER SYSTEMS*

By Robert Spurr Weston

IT is unnecessary to recall to your minds that the strainer system of the mechanical filter, unlike that of a sand filter, serves two purposes; namely, it must collect filtered water from the sand and must serve as a distributing medium for the wash water used for washing. Unfortunately, the velocity during washing may be more than five times the velocity during filtration, and this, of course, introduces great difficulties in design; for it is essential that the rate of filtration be uniform throughout the whole sand layer, and that the wash water be distributed as uniformly as practicable over the whole filter area so that it may rise as a plane or sheet for the purpose of separating the accumulated coagulant and fine suspended matter without at the same time causing any considerable loss of sand.

Four Strainer Systems Reviewed

The most generally satisfactory strainer systems are: (1) Manifolds, strainers and a 14-in. layer of gravel. (2) The Harrisburg system of perforated pipes with a 14-in. layer of gravel. (3) Troughs having strainers at their bottoms, with a 14-in. layer of gravel. (4) The Wheeler filter bottom with 8 ins. of gravel.

All of these systems should be designed to wash the sand layer without the use of air. Each system has its advantages and disadvantages, but the excessive cost of system No. 3 makes its use inadvisable. There are, therefore, three systems left. Of these, system No. 2, the Harrisburg system, is the simplest. It, however, consists largely of metal, all of which is exposed, and at the present prices is probably more expensive than the Wheeler filter bottom. System No. 1, like that installed by most of the filter companies, possesses the advantage over system No. 2, the Harrisburg system, of having the outsides of the pipes protected by concrete. The strainers, however, are exposed and must be constructed of bronze, which at present prices makes the installation costly, probably the highest of the three. The insides of the pipes are likewise exposed.

In either of the above systems there exist "dead" spaces on the floor of the filter between the openings where the wash water does not readily reach. This difficulty is overcome in systems Nos. 3 and 4, of which No. 4, the Wheeler filter bottom, is the cheaper. The advantages of the Wheeler filter bottom consist in the absence of metal (with the exception of the short brass tube at the apex of the pyramid); the nearly perfect distribution of the wash water secured by the "ball nozzle" effect of the balls; the lower cost, and the thinner gravel layer. The writer of these notes believes that the Wheeler filter bottom is best when placed above channels rather than built as a false bottom of the filter, although to construct the latter is perfectly feasible.

Why Sand Broke Through Gravel at Akron

Considerable difficulty has been experienced with the Wheeler filter bottom at Akron because of sand passing through the gravel around the walls of the filter, particularly at the corners. The writer has investigated this filter and found that there was a ledge 1 in. wide left around the walls of the filter and furthermore the gravel layer was only 6 ins. in depth. It was very difficult for the workmen to spread 1.5-in. layers of gravel evenly in the large units (2,000,000 gals. daily); consequently the sand had passed through the gravel in certain places until it rested on the ledge around the walls of the filter. This sand remained inactive. The difficulty was overcome by increasing the thickness of the gravel layer around the walls of the filter, particularly at the corners. Less than 0.5% of the area of the filter was involved. This is a very low percentage of sand surface out of action because of lumps, hard spots, etc., and the difficulty can be readily overcome. It would probably be best in a new filter with this bottom to make the gravel layer 8 ins. in thickness; namely, 4 ins. coarse gravel, 2 ins. medium gravel and 2 ins. fine gravel, rather than 3, 1½ and 1½ ins., respectively, first used. Where the filter area is small, the thickness of the gravel layer may be reduced to those last given.

In large filters there seems to be a tendency toward wave motion in the underdrains, which may accumulate pressure at certain points in the filter bed, particularly at the ends of the channels, and may possibly cause the rupture of the gravel layer if it be too thin. This statement, of course, applies equally well to the three systems under consideration. The Wheeler filter bottom is better designed to resist jet action from the strainers than are either of the others. The effect of a large ball immediately above the orifice is absolute and unchangeable.

False Bottom of Strainer Manifold Type?

The discussion regarding choice of filter bottoms at present centers around the relative merits of the false bottom and the strainer or manifold type. The false bottom was used in the Miraflores (C. Z.), Erie and other plants, but only a few plants have been so built. The fear in the minds of operators of filter plants is that they may not prove so efficient bacteriologically as a plant designed on the other plan. On the other hand, the false bottom approaches nearer the condition for successful washing—namely, that of a series of orifices discharging from a tank—but with underdrain channels of sufficient size, relative to the areas of the orifices discharging from them, good enough distribution may be secured for all practical purposes, and the dangers, both structural and in operation, which the false bottom presents, avoided. There should be no objection to the use of the false bottom in small filters.

Should Wash at High Velocity with Water Only

Thirty years' experience and the results of experiments by Ellms and others, indicate that the successful filter will be washed at a high velocity with water alone. This effect is best secured by a strainer system consisting of orifices, above each of which is placed a layer of graded material to prevent sand from passing out of the filter, either when filtering or washing.

The underdrain system should be designed to throttle the discharge of wash water from the orifices. The latter should be reasonably large to avoid unusual loss of head in the filter, and the underdrains should be proportioned to the orifices. The false bottom system, while cheaper, is not so reliable as the other systems, and there are more or less troublesome results from cast or wrought-iron headers and manifold-strainer systems, even when they are cheaper, which is rarely the case. The Wheeler bottom, with sufficient gravel, best fulfils the conditions of practice. It is, however, on account of its being a patented device, more expensive than the Harrisburg system. On the other hand, it is more durable.

*Abstract of paper read before the New England Water Works Association.

REPORT OF JOINT COMMITTEE ON WATER CONSUMPTION

THIS committee of the New England Water Works Association was appointed for the purpose of securing, by co-operation with the American Water Works Association, a standard form for water consumption statistics that would be adopted by both associations. The American Water Works Association appointed Messrs. W. W. Brush, J. N. Chester, J. H. Dunlap and J. H. Purdy, with Edw. S. Cole as chairman, as a conference committee.

Joint meetings have been held, and various members of the committee have presented their views in writing. A joint report was prepared with the unanimous assent of both committees, which was presented to the American Water Works Association at its annual convention in Richmond, in May, 1917, and formally adopted.

Your committee submits, for consideration, two forms to be used in the collection and publication of water consumption statistics. These forms are described as follow:

Form "A," to be used when only water consumption statistics and those closely allied thereto are to be presented.

Form "B," to be used when incorporated in a report, based on the form adopted by the New England Water Works Association and by the American Water Works Association in 1908.

These forms are attached hereto. They have been made as simple as possible, and consistent with the presentation of information which it is believed will be useful to the water supply profession.

Your committee has been impressed by the dearth of water consumption statistics which are comparable and typical of the various sections of this country. It believes that this association would be rendering a service that the membership generally would appreciate, if the association should publish yearly the consumption statistics of typical communities in the various sections of our country. These should be selected so that the statistics of a fully metered community would be placed in comparison with those of a city in which only a small fraction of the supply is metered. By selecting, say, from fifty to one hundred of such communities and enlisting their aid in furnishing accurate statistics, information of great and increasing importance would be made available. Each five years, beginning with the year 1920, statistics should be published, setting forth the more important water consumption figures for a much larger number of cities, selecting these so that a reasonable percentage of each size would be recorded. It is suggested that this list include all cities having a population of over 500,000, 50 per cent. of those having a population of from 250,000 to 500,000, 25 per cent. of those having a population of from 100,000 to 250,000, and 10 per cent. between each of the following limits: 50,000 to 100,000; 25,000 to 50,000, 10,000 to 25,000, under 10,000.

By co-operation with the American Water Works Association, the labor and expense of collecting and publishing this information can be divided between the two associations, and the information furnished to the combined membership.

Your committee makes the following recommendations:—

First: That Form "A" be adopted for use where water consumption statistics only are to be recorded.

Second: That a committee on uniform annual reports be appointed, the membership to represent those interested in pumping, filtration, water consumption, distribution, services, meters, and financial questions; that the American Water Works Association be requested to appoint a similar committee; that these committees, if possible, agree on a statistical form which will cover the entire waterworks field; that the committee of this association report at the next annual meeting the form recommended; and that this committee also report to what extent the association should collect and report statistics, giving the names of the communities from which such statistics should be regularly obtained and published.

Third: That your present committee should be finally discharged.

Respectfully submitted,

EDW. S. COLE, Chairman.
C. M. SAVILLE.
D. A. HEFFERNAN.
P. R. SAUNDERS.
E. W. KENT.

New York City, N.Y., August 1, 1917.

Form "A"

(To be used when only water consumption statistics and those closely allied thereto are to be presented)

1. City or town .....
2. Year for which report is made .....
3. Municipal or private .....
4. Miles of mains .....
5. Range of domestic pressure .....
   Is fire pressure raised? .....
   What is fire pressure? .....
6. Population:
   (a) Total ... Last United States census .....
   Estimated total population this date .....
   (b) Supplied. Estimated total population supplied, using 5 per family .....
7. Total number of services in use .....
8. Total number of metered services .....
9. Per cent. of metered services (8 divided by 7).....
10. How is the total water consumption determined:
    (a) By meter upon supply main. (Yes or No)...
    (b) By plunger displacement. (Yes or No).....
    Slip allowed .....
    (c) Other methods. Describe .....
11. Total annual water supplied for:
    (a) Domestic uses by metered services .....
    (b) Commercial use by metered services .....
    (c) Industrial use by metered services .....
    (d) Public uses by metered services .....
    (e) Total metered use .....
    Estimated public use unmetered .....
    (f) Total accounted for .....
    (g) Total annual amount of water supplied, gallons daily .....
    (h) Total unaccounted for .....
    Per cent. total supply .....
12. Minimum night rate (1 a.m.—4 a.m.) .....
    State how this rate is obtained .....
13. Maximum rate
    (a) Without fire .....
    (b) With fire per hour...per day...per month...
14. Total metered use per capita daily .....
    What population .....
15. Average supply per service per day, gallons .....

16. Average supply per day per capita based on:
    Total population .....
    Population supplied .....
17. Estimated total daily supply obtained by manufacturing or other plants from sources other than the city supply .....
18. Total per capita daily use, including all supplies....
19. Cost of supplying water per million gallons, figured on total operating and maintenance .....
20. Total cost of supplying water per million gallons, figured upon total operating and maintenance, depreciation, and interest upon the fair value of the plant .....
21. Revenue per million gallons .....

NOTE—Commercial: Stores, office buildings, hotels, boarding houses, and similar establishments. Industrial: Railroads, factories, public gas and electric plants. Public: All water for public use.

Form "B"

(To be used when incorporated in a report, based on the form adopted by the New England Water Works Association in 1902)

1. How is the total water consumption determined:
   (*a*) By meter upon supply main. (Yes or No)...
   (*b*) By plunger displacement. (Yes or No).....
   Slip allowed .....
   (*c*) By other methods. Describe .....
2. Total annual water supplied for:
   (*a*) Domestic uses by metered services .....
   (*b*) Commercial use by metered services .....
   (*c*) Industrial uses by metered services .....
   (*d*) Public uses by metered services .....
   (*e*) Total metered use .....
   Estimated public use unmetered .....
   (*f*) Total accounted for .....
   (*g*) Total annual amount of water supplied, gallons daily .....
   (*h*) Total unaccounted for .....
   Per cent. total supply .....
3. Minimum night rate (1 a.m.—4 a.m.) .....
   State how this rate is obtained .....
4. Maximum rate:
   (*a*) Without fire .....
   (*b*) With fire per hour...per day...per month...
5. Total metered use per capita daily .....
   On what population .....
6. Average supply per service per day, gallons.....
7. Average supply per day per capita based on:
   Total population .....
   Population supplied .....
8. Estimated total daily supply obtained by manufacturing or other plants from sources other than city supply .....
9. Total per capita daily use, including all supplies....

NOTE—Commercial: Stores, office buildings, hotels, boarding houses, and similar establishments. Industrial: Railroads, factories, public gas and electric plants. Public: All water for public use.

Germany expects to complete in 1925 a canal 440 miles long between the Main and the Danube. One hundred and thirty-two million dollars was the latest demand to carry on the work.

CAMP BUILDERS' ORGANIZATION

ACCOMPANYING is a chart which was published in last week's "Engineering News-Record," of New York, showing the organization of Bate, McMahon & Co., of Ottawa, who have built all of the concentration and training camps in Canada in recent years. All of the work done has been rush work and notable records for speed have been made. It should be remembered, says "Engineering News-Record," that the organization is self-contained, has a permanent skeleton and is mobile. Construction equipment, men and supplies are loaded on trains for transporting where needed. The construction camp is under canvas, but trains serve as the base of supplies for three weeks when required.

The managing director of Bate, McMahon & Co. is R. S. Low, commissioned colonel for the military co-ordination of the camp work. His place in the organization is peculiarly shown on the chart as "Colonel Low's

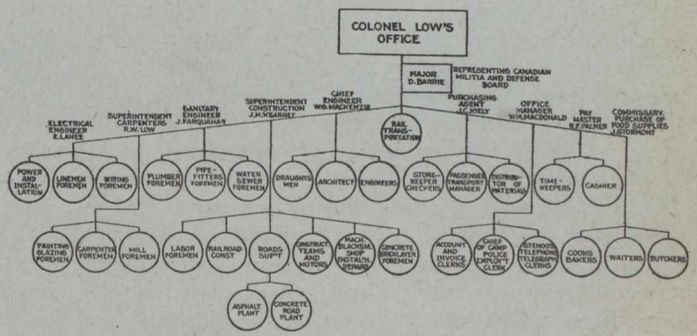


Chart showing Responsibility and Sequence of Work in Building Military Camps

Office," for the reason that in his absence all routine matters are disposed of as usual by his office force.

A second feature is the presence on the staff of a representative of the Militia and Defence Board of Canada or of the Imperial Munitions Board of Great Britain. This officer is virtually a co-ordinator placed here for the supervision and quick approval of the designing, which is done by Bate, McMahon & Co.

The sloping line to chief engineer, superintendent of construction, etc., indicates the rank of the several members of the staff. There is complete and harmonious informal confidence and co-operation among the members of the staff, although the records of requests and dispositions flow up, across and down through the regular channels.

The chart is so drawn that it shows the forces brought successively into action in the case of a new job. Rail transport arrangements are first taken up; then the purchasing agent's department moves to secure materials and to transport men, and the chief engineer's department opens up the preliminary work which paves the way for the superintendent of "construction"—meaning ground work. By this same time the office forces are transferred and the paymaster and commissary are duly on hand. The sanitary work of course starts before wood construction, and the lighting and power-supply treads on its heels.

The Chicago and Alton Railroad plans to expend $9,000,000 on improvements, including double tracking.

Orders for aeroplane motors, taken recently by one American firm, include 4,500 motors for the United States, 4,500 for Canada and 1,000 for England.

TOWN PLANNING

By W. H. Breithaupt
Chairman, Kitchener City Planning Commission.

THAT there should be consistent and harmonious planning ahead of large centres of population is obvious. That most of our larger cities in Canada have grown by haphazard, without any prearranged scheme or plan, is nevertheless a fact. In the early stages of development it may well be doubtful of any town whether it will ever attain to large population. Later along, however, definite indications of future growth demand forethought, and this has been generally neglected. Growth is left to private, individual initiative, the primary cause being real estate exploitation, until the available contiguous area becomes filled in with unrelated plots, each laid out on the governing idea of getting as many saleable land parcels as possible. Then comes the necessity for thoroughfares, which have to be provided at much cost and local inconvenience, and are even at that likely to be narrow and indirect. Provision of park areas or other open spaces, or of adequate room for public buildings, presents almost insuperable difficulties.

An awakening of interest in this question is now becoming increasingly evident. The need and great benefit of intelligent city planning is recognized the world over. The war-devastated cities of Belgium and France will arise from their ashes, sanitary, convenient and beautiful, in many respects as never before, and in this there will be recompense to an extent for features of art and historic veneration which are lost forever. National and local bureaus are already strongly active in planning for reconstruction. This spring, at the moment when the Germans were only sixty miles away and making their supreme effort at Verdun, there was held in Paris a City Planning Exhibition. It included plans for the reconstruction of Rheims and the towns and villages in the war zone. The French Senate has passed a bill requiring every town, whether in the devastated area or not, to carry out its future development on modern principles of city planning. The spirit of rational modern reconstruction is evident in all fields of the war. To distant Saloniki, destroyed by fire, a noted Canadian engineer has been called on this work.

In Canada the national Commission of Conservation has recognized the importance of the Town Planning movement in making it one of its principal fields of activity. The Province of Ontario has been behind other provinces of the Dominion in legislation on this question. In Nova Scotia and New Brunswick there have been Town Planning Acts since 1913, in Alberta since 1915. In Ontario there have been special Acts referring to Toronto and other large cities. The Municipal Act and other Acts have served in various respects; but the first definite recognition in a general Act of the principle of public initiative in Town Planning is in the Act entitled "An Act respecting Surveys and Plans of Land in or near Urban Municipalities," passed by the Ontario Legislature at its last session.

This Act provides for a general town or city plan, also for changes in existing streets, etc.; for zones adjacent to the municipality over which its authority for street planning shall extend, and for a central, provincial authority, the existing Railway and Municipal Board. The local authority is either the Municipal Council or the Town Planning Commission. Appointment of a Commission is optional with the Council, but, once appointed, the Commission is the local authority. The Commission consists of the head of the municipality and six ratepayers, members of the first Commission being appointed, two each, for one, two and three years. Each successive Municipal Council has appointment of two Commissioners for a three-year term. The Commission is thus a continuous one.

While this Act is a distinct advance in the right direction, in that it gives authority for a separate Commission charged with the important question of planning for the future, it does not cover various features of first importance, such as land expropriation, disposal of land remnants, the checking of undue holding up of land values, authority as to fixing residence or business districts, and others. One Commission appointed under the Act, that of Kitchener, Ontario, has found considerable scope for beneficial work. The mere fact that an independent Commission exists whose sole work it is to correct existing defects and to study and plan for the best future growth is an incentive to the general public.

Utility, convenience, is the first consideration in Town Planning. After that comes embellishment. The Kitchener Commission has regular monthly sessions, and at every session plans for connecting streets or for opening up of areas closed off by the existing street system are presented. The local Civic Association had a general plan for prospective growth for Berlin and Waterloo and the immediate surrounding territory prepared four years ago. The city is over one hundred years old. Its street system is mainly of two parts; the older part, the growth of the first fifty years about, more or less parallel and normal to King Street, the main street, and the later part parallel and normal to the Grand Trunk Railway, which was opened through in 1856. King Street changes direction several times and crosses the Grand Trunk Railway at a sharp angle. This gives confused, inconvenient turns where the two street systems meet. Adjoining the city on the north-west is the town of Waterloo, with a street system of its own, more or less matching that of the city. The surrounding township roads are also very irregular.

CONTRACT FOR STEEL COMPANY'S WHARVES

The Great Lakes Dredging Company, Limited, of Canada, Port Arthur, Ont., have been awarded the contract for the construction of wharves, slips and dredging in connection with the steel plant to be erected for the Canadian Steel Corporation, Ojibway, Ont. The company, who have handled some large contracts in Canada, including the terminal works at Port Arthur and Fort William, bid against 15 contractors. Tenders were placed by equal number of United States and Canadian companies.

The Canadian Steel Corporation have acquired 2,500 acres of land at Ojibway with a frontage of two miles on the Detroit River. The proposed docks to be built by the Great Lakes Dredging Company, Limited, of Canada will be on this frontage. The slips to be built are 2,100 feet long by 250 feet. The Canadian Steel Corporation are asking for tenders for 150 houses to be built to accommodate the workmen. The Canadian Steel Corporation's total expenditure for this industry will be about $25,000,000.

Mr. Ambrose Monell, president of the International Nickel Company, has tendered his resignation to accept a commission as Colonel on the staff of the Commander of the American aviation forces abroad. Mr. Monell is well known in Canada.

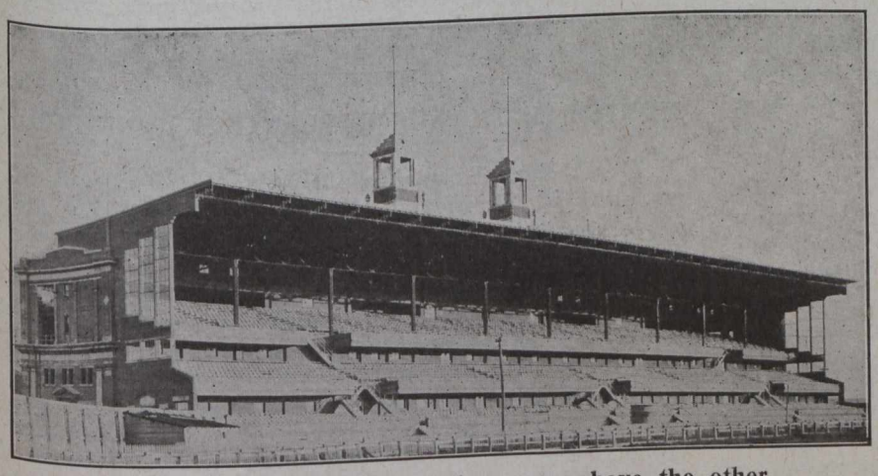
Letter to the Editor

Design of Exhibition Grounds

IN the issue of *The Canadian Engineer* for January 18th, 1917, an article was published dealing with the new grand stand under construction for the Provincial Exhibition Commission of Quebec. At that time the work was still in an uncompleted state and it was therefore impossible to illustrate the full architectural design of the structure. The building has now been completed, with the exception of the interior plastering work, and photographs are reproduced herewith showing the facade, and also the stand proper, in readiness to receive the crowds which taxed its seating capacity at the recent annual exhibition.

This stand constitutes a decided departure, at least in so far as Quebec is concerned and in all probability much farther afield, from the preconceived ideas of such structures, and there does not appear to be any good reason why the ideas conceived and carried out should not be expanded to include other buildings which may in the future be required for exhibition purposes.

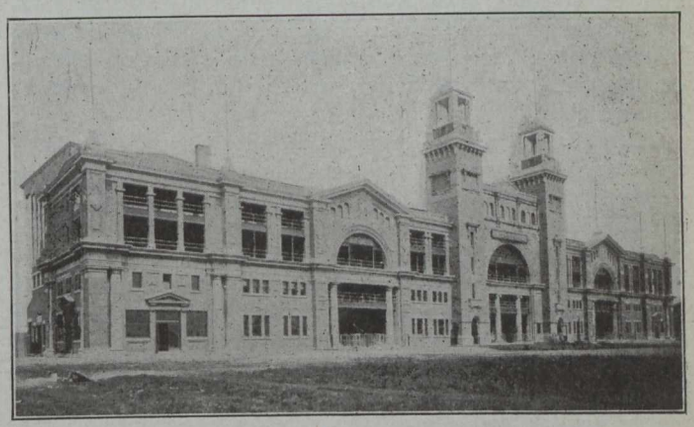
The question of the utility and the beauty of exhibition grounds in general, and the buildings thereon in particular, is a broad one, and it is unfortunately only too true that it has been generally approached in a haphazard manner without much idea of continuity or symmetry of design. This is due no doubt to the precarious and hand-to-mouth state of the finances of such institutions, which has led to the system of putting down a building when the funds were available, without much reference to what had been done before or what might be done in the future. Such a system is lamentably erroneous, and this fact should be impressed on the minds of those responsible for it; and it would appear that the engineer, in conjunction with the architect, is the one to undertake the campaign of reform. It is not by any means opening up a new vista for engineering as the matter is simply one of town planning and landscape gardening on a small scale, and as such belongs in the province of the engineer and the architect.



Showing arrangement of Tiers, one above the other

What matters it if an exhibition commission is not sufficiently in funds to immediately carry out a complete scheme? At least the scheme can be carried out on paper at small expense when the magnitude of the work is considered, and as the funds become available the actual work can be proceeded with as may be deemed expedient.

The present method appears to be for the commissioners, who as a rule know little or nothing about engineering or architecture, to visit the site and pick out a likely spot which may or may not be suitable, and then call in an architect to design a building to conform to the amount of money on hand. If the architect is of an original turn of mind and has an eye for beauty the chances are ten to one that he will find himself entirely unable to carry out his ideas, owing to the lack of means, or the opposition of laymen in authority who consider their own ideas superior to his.



This View Shows the Beauty of the Facade

To obviate the disastrous results which generally accrue from such a method, the better way would be for the commissioners to have their limitations laid squarely before them in the first place, in order that they might be induced to consult those who are qualified by training and experience to handle such problems. In this way a plan might be evolved, at no very great expense, which would serve as a basis for future designs and construction, and which plan should be consulted on all occasions when funds might be available for developments.

The concrete idea then would be for the exhibition commission to appoint a consulting board, consisting of an architect and an engineer, needless to say both of reputation and experience, to prepare a general plan of the whole site, with such buildings and other structures shown thereon as might reasonably be expected to be required in the future. This plan would then be strictly adhered to in preparing detailed designs whenever such might be required for the erection of structures.

The writer is aware that such methods have already been employed to a greater or less extent in certain communities, but they are not general; and in particular the city of Quebec is a flagrant example of the antiquated methods touched upon above. As a matter of fact, the exhibition grounds at Quebec have the general appearance of the buildings having been shaken up in a box and scattered at random, to be left wherever they chanced to fall; and as for the architecture of the buildings, there is none, with the exception of the grand stand shown herewith, and possibly one other building. The engineering profession, however, is not particularly concerned with

this individual case, but it will serve as an example of what might be done in these matters were the profession as a whole to take more interest in civic, provincial, or Dominion affairs as the case might be, even if the members were compelled to "butt in" through the medium of the public press.

The illustrating herewith of this particular grand stand is intended not so much to show what has been done, as what might be done. As a matter of fact, although as a single building it is one of which any city might be proud, it is practically ruined by its surroundings at the present time, and likely to be permanently so if the present scheme of year-to-year extension is proceeded with, without first preparing a really comprehensive plan.

Many articles and letters written by engineers have appeared from time to time complaining that the claims of the profession have not been duly recognized in appointments to positions of responsibility on works which come directly within the meaning of the word "engineering," but it is the opinion of the writer that the members of the profession have the remedy in their own hands by placing themselves and their qualifications directly before the public. Indeed, it is their duty to do so in matters of public interest such as the one under discussion, where the general public is in all probability ignorant of the mistakes which are being made, and will continue to remain in ignorance until its attention is drawn to the facts, or until the result has reached such a stage as to become apparent even to the casual eye, when it will be too late for remedy. An open discussion by trained men of just such questions as exhibition grounds will do much to place before the public the need of reform in such a manner as to eventually bring it about.

C. V. JOHNSON,
A.M.Can.Soc.C.E.,
Consulting Engineer.

Quebec, P.Q., October 10th, 1917.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, TORONTO SECTION

The next meeting of the Toronto section of the American Institute of Electrical Engineers will be held in the lecture room of the Engineers' Club, 96 King Street West, on Friday, October 19th, at 8 p.m., when a paper will be presented by Mr. Frank T. Wyman, electrical engineer, Packard Electric Co., St. Catharines, Ont., on the subject of "Transformer Design as Influenced by the Quality of the Steel employed for the Magnetic Circuit."

On Friday afternoon, October 26th, through the cooperation and kindness of Mr. E. L. Cousins, general manager of the Toronto Harbor Commission, the officers of the institute have arranged for a visit to the Toronto harbor developments. The starting point will be the foot of York Street and the tour will be made in motor launches, leaving at 1.30 p.m. and returning about 5.30 p.m.

According to the railway returns for 1913—the last published in a complete form—there were in England and Wales 77 railway companies working railways, seven in Scotland, and 23 in Ireland. There were also 68 in England and Wales, 19 in Scotland and 13 in Ireland, whose railways were worked by other companies, and in England and Wales 76 railways or joint committees which owned rolling-stock, eight in Scotland and 23 in Ireland.

OTTAWA BRANCH OF CANADIAN SOCIETY OF CIVIL ENGINEERS TO VISIT AYLMER FILTRATION PLANT

The Ottawa Branch of the Canadian Society of Civil Engineers has accepted the invitation of the mayor and council of the town of Aylmer to inspect its new filtration plant on Saturday, October 20th, when it is expected that the whole apparatus will be in actual operation.

It is expected that Mr. James O. Meadows, the town's consulting sanitary engineer, who designed the filters, will personally conduct his fellow-engineers through the plant and explain its operation as well as its construction to them. In any event, Mr. H. L. Seymour, C.E., of the Topographical Branch of the Department of the Interior, will read a paper to his confreres after luncheon at the British Hotel at Aylmer, in advance of their visit to the filtration plant. Mr. Seymour is a resident of Aylmer. He has for years taken an unusually keen interest in sanitary engineering and as he and his family will be served with the water from this new filter plant, he has followed with persistent energy every step connected with the construction of it. His paper is expected to arouse much interest and perhaps discussion. because the question of filtering Ottawa River water by various processes has long been a topic for popular debate. The engineers are strong believers in the old adage: "One look is worth a thousand words," and on Saturday next they will do some investigating on their own accounts.

If the British Hotel can accommodate others in addition to the members who signify their intention of making the excursion to Aylmer at noon on Saturday next, it is expected that members may invite friends to accompany them. In any event, Aylmer's mayor and council will, later on, undoubtedly welcome everyone to inspect its water filtration plant.

Mr. Fraser S. Keith, the new general secretary of the society, will make his first official visit to the Ottawa branch on the 20th instant, and will probably address the members at the luncheon at the British Hotel, Aylmer, on the occasion of the visit to the filtration plant.

MONTREAL THANKS RATEPAYING ENGINEERS

W. F. Tye, chairman of the committee of ratepaying engineers of Montreal, who have been criticizing the city's aqueduct plans, has received the following letter from the Montreal city clerk's department:—

"I beg to transmit to you herewith a resolution of the City Council concerning the report of the engineers, ratepayers, of Montreal, submitted to the city some time ago.

"Copy of extract from minutes of the City Council meeting, held September 10th: 'On motion of Ald. Blumenthal, seconded by Ald. Macdonald, it was resolved: That this Council desires to express its most sincere thanks to the ratepaying engineers of Montreal for the disinterested work done by them in connection with the proposed improvements to the aqueduct, and to enable the administration to exactly know the value and usefulness of the works undertaken within the past few years for the purpose of enlarging the aqueduct and of developing electrical energy.' "

Argentina has built near Bahia Blanca the largest drydock in South America, capable of handling the Dreadnoughts of its navy.

The Canadian Engineer

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Notice to Advertisers

Changes of advertisement copy should reach the Head Office two weeks before the date of publication, except in cases where proofs are to be submitted, for which the necessary extra time should be allowed.

Notice to Subscribers

When changing your mailing instructions be sure to give your old address in full as well as your new address.

PRINCIPAL CONTENTS OF THIS ISSUE

PRESENT REPRESENTATION AND THE ENGINEER

Sir Thomas More, who was Lord Chancellor of England, wrote Utopia, which represents one view of the perfect state. In this dream, or ideal, laws were so clear and commonsense that all men could interpret them. The author, as the head of the legal profession, realized clearly that there was room for great improvement in that direction.

The legislature makes laws; the profits of the lawyer are in interpretation thereof. The attraction that the rôle of law-maker has to the lawyer must be obvious.

The training of the legal profession is possibly the least suited to interpret popular wishes. A lawyer, by virtue of his profession, needs to confuse issues, hang argument upon pin points, and trap the unwary into damaging admissions. He always acts *ex parte* on behalf of one client, irrespective of the justice of the cause at issue. Hence the lawyer makes an ideal party politician, for he can concoct a plausible case from the most slender materials.

The other type prominent in politics is the professional party politician, about whom the less said the better. Politics concern themselves with the hoisting of a particular party to power. When in office the professional secures the plums for his services. He has a party viewpoint all the time and the national interest must therefore be a side issue.

It is not denied that there are men honest in intention in both connections, but in too many instances broad motives are lacking, while the opportunity for abuse is always open. Casuistry is the sheet anchor of the lawyer while fooling the electorate, and not serving the national interest is too often the supreme desire of the professional party politician.

"The war has shattered many illusions," is a phrase continually appearing in the contemporary press. But how many realize the complementary truth that the war has transvalued nearly all pre-war values, including political representation?

The administration and management of a thousand men contain problems as complex as the administration of half a continent. The problems differ in degree, not in kind. Personal touch with masses of men, and the tact and discrimination necessary, are a first-class training for work of a similar kind in bigger fields.

Every industry depends directly upon the engineer. There are few points of life where his work has not effected big alterations. Tolerant he must be to human weakness; efficient he must be, for in few other fields of effort is the elimination of the unfit more rigorously practiced. His training is applied science and his practice demands large commonsense.

The engineer is one of the pivots of modern civilization; therefore he should be more in evidence as a public man. He is well fitted to carry forward the lessons of practical experience in the realm of national affairs.

UNION GOVERNMENT

The new Union Government is one step forward to what the people of Canada desire,—a government composed of men of both political parties and of men independent of political considerations,—but it is only one step forward. It is a government which will do much to help carry conscription at the next election, because the majority of people, we hope, want conscription, and largely because many Liberals and Conservatives will find it difficult to vote against a Union Government in which both parties are strongly represented. The outstanding feature of this coalition is its political character. With perhaps two exceptions, the cabinet as at present constituted consists of men who have made a mark in professional politics, not in business. Sir Robert Borden, as premier, probably recognizes the necessity for much more modern business methods in the administration of Canada's affairs while at war. He probably recognizes the need for the abolition of government red tape and the throttling of persistent old precedents. He probably endeavored to recognize these facts in the formation of the Union Government, but partisan politics were too strong.

Sir Robert had an extremely difficult task to get any kind of a Union Government, in view of the strength of party politics in war time. While we have a coalition government, it is still striped with politics rather than with business. The desire of the people for the inclusion in the cabinet of some of Canada's big business and

technical men, is not met. We have allowed the services of several such of our men to be commandeered by the British government. The engineering profession has no place in the Union Cabinet. A party politician, for whom we have respect as a politician and as a lawyer, is the new Minister of Public Works. He is, so far as we know, without any of the technical or engineering knowledge which *The Canadian Engineer* deems very desirable for such an important cabinet position. The same is true of other portfolios, such as the Railways and Canals and the Marine and Fisheries.

PERSONALS

MATTHEW W. KIRKWOOD, formerly general superintendent of the G., P. and H. and L. E. and N. Railway, Galt, Ont., has been appointed general manager of the two roads.

R. S. GOURLAY has had his term as Toronto harbor commissioner extended, by an order-in-council by the Dominion Government, for a further period of three years, from October 22, 1917.

M. WILFRID BOURASSA, civil engineer, Montreal, has been appointed by the Shawinigan Water and Power Co. to supervise the construction of the steel towers now being erected at Three Rivers, Que.

M. J. MCCORMICK, for some time manager of the machine tool department of the Canadian Fairbanks-Morse Co., Montreal, has resigned to accept a position with the McCormick Machinery Co., Montreal.

AMBROSE MONELL, president of the International Nickel Company, New York City, has tendered his resignation to accept a commission as colonel on the staff of the commander of the American aviation forces abroad.

GILBERT B. MCCOLL, B.A., D.T.S., M.L.S., addressed the Manitoba Branch of the Canadian Society of Civil Engineers last Thursday evening on "Drainage in the Red River Valley in Manitoba." The meeting was held in the engineering building of the University of Manitoba.

MICHAEL P. FENNELL has been appointed secretary-treasurer of the Montreal Harbor Commission, to succeed Major David Seath, who has retired after holding that position for eighteen and a half years. Mr. Fennell has been assistant secretary-treasurer of the Commission since 1909.

HAROLD GORDON YOUNG, of Ellesmere, Ontario, a former third year student in the electrical engineering department of the School of Practical Science, Toronto, has been promoted to the rank of warrant officer in the R.M.C.V.S. He enlisted from school last year with the Canadian naval service.

JAMES HAROLD RAMSAY, Jr.Mem.Can.Soc.C.E., son of Rev. Dr. D. M. Ramsay, of Toronto, formerly of Ottawa, has been awarded the Military Cross. He enlisted early in 1916 as a lieutenant in the Canadian Engineers. He graduated in science from Queen's University, Kingston, and was a post-graduate of Cornell.

Gunner PETER ANDERSON DURBROW, a student at the School of Applied Science, Toronto, has won the Military Medal. Gunner Durbrow left in March, 1915, and served with the 26th Battery, C.F.A. Later he acted as signaller in the 17th Battery in France, and returned to England in July to take out a commission with a machine gun battery.

Lieut. ALEXANDER G. SCOTT, of Smith's Falls, Ont., who graduated as an electrical engineer at the School of Applied Science, Toronto, in 1915, has been awarded the Military Cross for conspicuous gallantry in the recent fighting at Lens. He went overseas with the second contingent, and crossed to France with the 11th Machine Gun Division.

Lieut. W. J. T. WRIGHT, B.A.Sc., 1911, Toronto, the first officer commanding the 67th Battery, has transferred to the Royal Flying Corps and is now acting as intelligence officer of the 6th Squadron R.F.C., B.E.F. Lieut. Wright went overseas with a draft from the 67th Battery and had been serving in France with No. 1 Canadian Railway Battalion.

Major LOUIS ELGIN JONES, a graduate of the School of Applied Science, Toronto, 1911, has been gazetted lieutenant-colonel. He was a captain in the militia when war broke out and went overseas as major with the 2nd contingent. He crossed to France with the 18th Battalion in which he received his promotion. He has previously been awarded the D.S.O.

Lance-Corporal ROBERT THOMPSON, of Toronto, reported missing on September 20th, is now a prisoner of war in Germany. He attended the School of Applied Science before enlisting with the Divisional Cyclists in February, 1916, afterwards transferring to an infantry unit, and later to a machine gun battery. He was wounded in November of last year.

NOEL J. OGILVIE, has been appointed to succeed the late Dr. W. F. King, C.M.G., as superintendent of the Geodetic Survey of Canada. Mr. Ogilvie received his commission as surveyor in February, 1905, and in 1914 he was appointed assistant superintendent of the Geodetic Survey. Recently he was in charge of the Geodetic Survey of the British Columbia coast.

F. BORYSEWICZ has been appointed assistant general manager for Canada, of the Liquid Air Society, with headquarters in Montreal. Before coming to Canada, Mr. Borysewicz was connected with the work of the society of Japan, having taken a similar position there some years ago, previous to which he had been associated with the head office in Paris, France.

Lieut. R. DOUGLAS HUESTIS, son of Mr. A. E. Huestis, 54 Huntley Street, Toronto, was wounded in action on October 3rd. Lieut. Huestis was in his second year at the School of Practical Science when he enlisted, and trained in the C.O.T.C., obtaining his commission in Kingston a year ago last May. He left in July, and has been in France with the 2nd Howitzer Battery, C.F.A., since January of this year.

F. B. CARVELL, M.P., of New Brunswick, has joined Premier Borden's Union Government, and has been appointed Minister of Public Works. The Hon. C. C. Ballantyne, who was only last week sworn in as Minister of Public Works, has been transferred to the portfolio of Minister of Marine and Fisheries. The Hon. Mr. Carvell was born August 14th, 1862; he was educated in the public schools of New Brunswick, and was elected to the legislature of that province in 1899. The following year he was elected to the Dominion government as member for Carleton County, N.B., and was re-elected in 1904, 1908 and 1911. He is a lawyer and one of the Liberal leaders of the Maritime Provinces.

H. E. HILTS, formerly district engineer of the Portland Cement Association at San Francisco, Cal., has succeeded the late J. P. Beck as general manager of the association. Mr. Hilts has had extensive engineering experience with various railroads and has designed a great many concrete structures. In 1913 he became road

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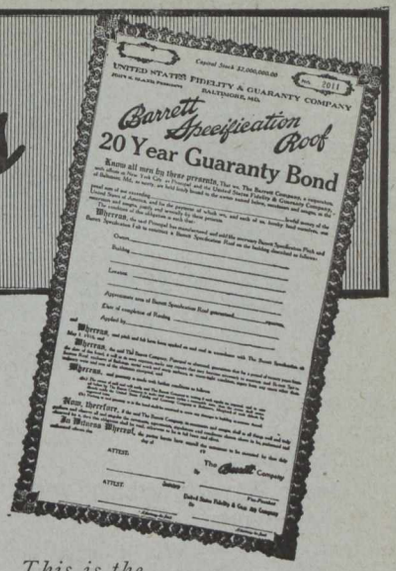

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We are now prepared to give a 20-Year Surety Bond on every Barrett Specification Roof of fifty squares and over in all towns of 25,000 population and more, and in smaller places where our Inspection Service is available.

This Surety Bond will be issued by one of the foremost surety companies in America and will be furnished by us without charge.

Our only requirements are that the roofing contractor shall be approved by us and that The Barrett Specification, dated May 1, 1916, shall be strictly followed.

Further information and copies of The Barrett 20-Year Specification, with diagrams, free on request.

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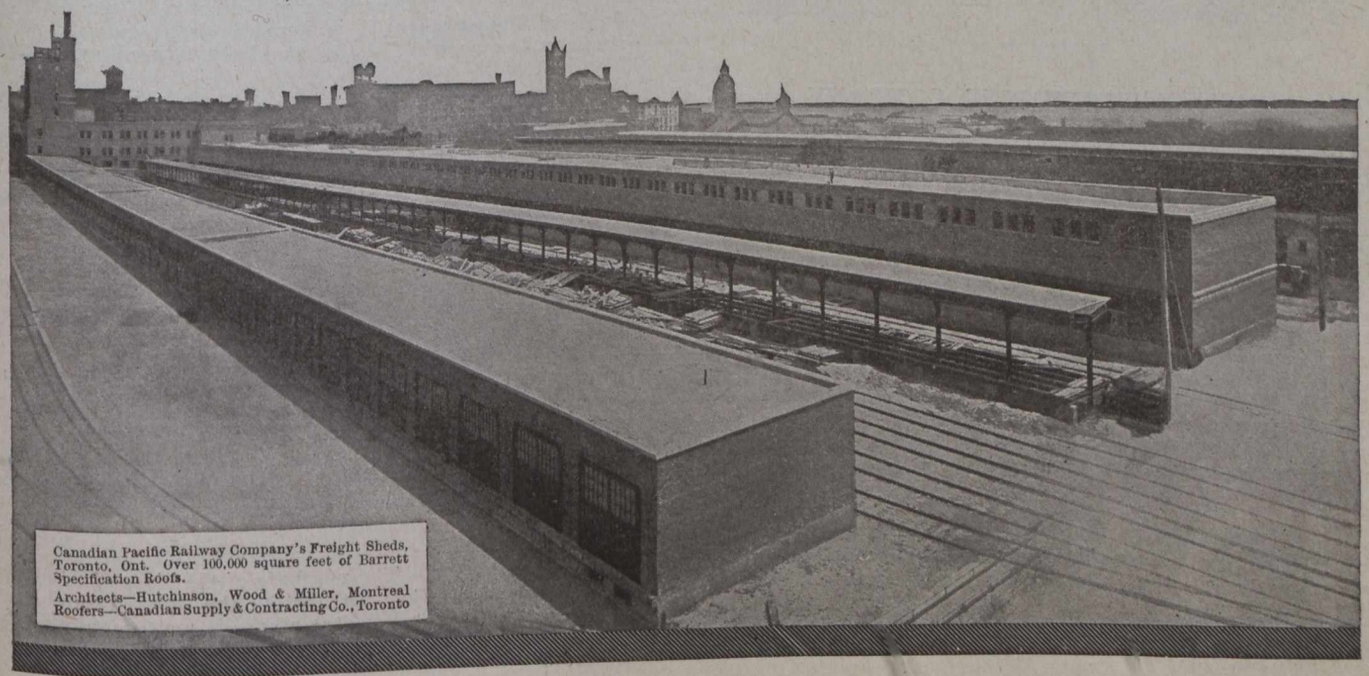

Canadian Pacific Railway Company's Freight Sheds, Toronto, Ont. Over 100,000 square feet of Barrett Specification Roofs.
Architects—Hutchinson, Wood & Miller, Montreal
Roofers—Canadian Supply & Contracting Co., Toronto

engineer of the Portland Cement Association in New England and the Northwestern States, becoming district engineer in San Francisco in 1915. Mr. Hilts is an associate member of the American Society of Civil Engineers, a member of the American Society for Testing Materials, an associate member of the American Railway Engineering Association, and a member of the American Concrete Institute.

OBITUARIES

THOMAS RUSSELL, one of the best-known mining men in British Columbia, died at Michel, B.C., on September 20th. He was mine manager for the Crow's Nest Pass Coal Company.

ROBERT WEIR, president and director of the J. A. and R. Weir Company, Limited, marine engineers and shipbuilders, of Montreal, died on October 8th in his 72nd year. He was born in Glasgow, Scotland, in 1846, and removed to Montreal in 1871, having resided there since.

Lieut. FRANK QUINLAN, son of Mr. Hugh Quinlan of the firm of Quinlan & Robertson, Limited, contractors, Montreal, was killed in action on September 29th. Lieut. Quinlan went overseas with a Pioneer unit under Lieut.-Col. Lordly. He had only been in France three months, and was doing railway construction work. He was born in Montreal twenty-five years ago and was an engineer by profession, being employed by Quinlan & Robertson, Limited, who built the Grand Trunk Pacific shops at Transcona, Manitoba, where the deceased was employed prior to enlisting.

ALLEN F. KENNEDY, formerly construction superintendent of the Nova Scotia Construction Co., passed away at Sydney, N.S., on September 22nd, following an illness of over a year. Deceased was born at Mulgrave, Guysboro County, N.S., and when nineteen years of age left to connect himself with construction work in the Upper Provinces. In 1897 he returned to Nova Scotia, accepting a position with the Dominion Iron & Steel Co. Continuing for nine years with this concern, he then transferred to the Nova Scotia Construction Co., and superintended many a difficult piece of construction work. He continued with this company until failing health compelled his retirement.

CANADA FOUNDRIES COMPANY

The purchase of the Delaney Iron and Forgings Company, of Buffalo, by the Canada Foundries and Forgings Company has been ratified at a special meeting of the shareholders of the latter company, held at Brockville, Ont. The transaction will materially strengthen the Canadian organization in its programme of extension into shipbuilding activities at its Welland properties, as the Delaney plant has been a successful producer of ship forgings for many years. The transfer of the ownership of the Buffalo plant will be effective as of date July 1st last, according to the terms of the option given to the Canada Forgings interests some months ago. Profits which have accrued from the Buffalo plant since that date, owing to the activity in shipbuilding, have been substantial, and will reduce the net cost of the Canadian company's purchase, viewing it from the conclusion of the transaction.

Siamese capital, employing Danish engineers and machinery, has built a large cement plant near Bangkok.

Quebec province sold to the United States last year more than sixteen million dollars worth of lumber, laths, shingles and pulp products.

Coast to Coast

Brantford, Ont.—The Brantford and Paris road, tolls on which have been suspended by the Ontario Department of Public Works because the road was not in proper condition, has been offered to Brantford County for $10,000. The County Council will consider this offer at its next meeting. The Cockshutt toll road over part of the highway to Scotland and the Indian Reserve, is also on the market for Brantford County to purchase, but the price is a great deal higher, owing to a big steel bridge over the Grand River.

Bridgeburg, Ont.—The large shipbuilding plant on the Niagara River three miles below Bridgeburg, which has been closed for several years, will be opened at once for the construction of all-steel ships of Welland Canal size. The Canadian Allis-Chalmers Co., the holding concern of the Canada Foundry Co., which has owned the plant for ten years, will go into the shipbuilding business. Some additional shipbuilding machinery will be needed.

Chatham, Ont.—A new 12-inch water main laid across the river at Lacroix Street was turned on on October 12th. The new main will supply the plant of the Dominion Sugar Company in addition to other industries and residential districts in that vicinity.

Chatham, Ont.—The Board of Works Department have completed all the paving which will be done in the city this year, with the exception of some small strips. The city workmen have now been instructed to lay sidewalks in various parts of the city.

Duncan, B.C.—Seventy mayors, aldermen, publicity and development men from all the chief centres of the Province on October 9th adopted a constitution of the Good Roads League. A resolution was passed unanimously that the Government be urged to proceed with the construction of a road across the Province with the utmost expedition and to endeavor to obtain financial assistance from the Federal Government. The convention unanimously decided to change the road rules in British Columbia to make them conform with the rules elsewhere.

Elgin County, Ont.—The Good Roads Committee have been making an inspection of the county's roads.

Fernie, B.C.—On October 4th a terrific dynamite explosion totally wrecked the Farcy Creek water main, the main water supply line of this city. A large force of men are now working swiftly to repair the damage.

Gravenhurst, Ont.—The National Potash Corporation, Limited, with E. L. Wettlaufer, of Wettlaufer Brothers, Toronto, as president, has been incorporated to manufacture and produce potash in Canada from feldspar in the vicinity of Muskoka Lakes where it is found in large quantities. The company has acquired the plant of the Gravenhurst Crushed Granite Co.

London, Ont.—A by-law providing for the abandonment of the Board of Control system will be submitted to the electors in January. At the same time, a Commission form of city government may be submitted.

London, Ont.—The most important question to come up for consideration by the members of the Middlesex County Council at the December sessions will be the recommendations to the Ontario Minister of Public Works as to the county roads that should be designated by the minister as county provincial roads. The roads that will be recommended to the minister, it is expected, will be the Proof Line, Longwood's, Talbot, Sarnia Gravel and Goderich roads.

Montreal, Que.—By a recent decision of the Board of Control, all building permits before being issued must be approved by the sanitary engineer of the Board of Health.

Montreal, Que.—Keels are ready to be laid for two 2,500-ton wooden ships in the Lachine Canal by Fraser, Brace and Company, and it is expected that about 600 men will be employed in the construction of the ships. Two more of similar size will follow.

Montreal, Que.—The purchase of the plant of the Delaney Iron & Forgings Co., Buffalo, by the Canada Foundries & Forgings Co., was ratified at a special meeting of the shareholders of the latter company, held at Brockville on October 10th.

Construction News Section

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand or projected, contracts awarded, changes in staffs, etc.

▲—Denotes an item regarding work advertised in *The Canadian Engineer.*
+—Denotes contract awarded. The names of successful contractors are printed in CAPITALS.

TENDERS PENDING

Including Those Reported in This Issue

Further information may be had from the issues of *The Canadian Engineer* to which reference is made.

PLACE OF WORK	TENDERS CLOSE	ISSUE OF
Malden Tp., Ont., drain work	Oct. 20.	Oct. 18.
West Oxford Tp., Ont., construction of drain	Oct. 29.	Oct. 18.
New Glasgow, N.S., erection of building	Oct. 30.	Oct. 18.
Regina, Sask., erection of building	Oct. 26.	Oct. 18.
St. John, N.B., erection of brick and concrete chimney; also reinforced concrete tunnel	Oct. 19.	Oct. 18.
Toronto, Ont., miscellaneous supplies	Oct. 30.	Oct. 18.

FACTORIES AND LARGE BUILDINGS

Brantford, Ont.—The Gibson Coal Company will erect a modern frame coal elevator on Clarence St. Approximate cost, $1,000.

Byron, Ont.—Tenders are being received for the erection of a $10,000 vocational school for the Government Hospital Commission. Architects, Watt & Blackwell, Bank of Toronto Bldg., London.

Campbellford, Ont.—Fire damaged the mill of the Northumberland Paper and Electric Co.

+—Fort William, Ont.—E. J. McQUEEN & CO., of this city, have secured the contract for the erection of a reinforced concrete elevator for Henry Ford & Son, of Detroit, Mich., to be erected on the Ford country estate at Dearborn, Mich., and to be completed before January 1, 1918. The cost of the elevator will run about $175,000.

+—Glace Bay, N.S.—D. J. McISAAC has the contract for $25,000 convent and chapel for the Roman Catholic Episcopal Corporation of Antigonish.

Hamilton, Ont.—Building permit issued to the Procter-Gamble Company for the erection of an office building on Burlington Street, to cost $5,000.

Langley, B.C.—Fire completely destroyed the saw mill and shingle mill of W. E. Laking.

Leamington, Ont.—An $800,000 sugar plant may be erected here. A by-law in this connection will be submitted to the ratepayers in November.

Listowel, Ont.—The Perfect Knit Mills have decided to add a dyeing plant to their new factory.

London, Ont.—A site has been purchased for the new medical college of the Western University, which is to be erected at the northeast corner of Ottaway Avenue and Waterloo Street. Building operations will probably be undertaken next summer.

London, Ont.—The Utilities Commission contemplate adding another story to Hydro offices at a cost of $20,000. General manager, E. V. Buchanan.

Maryfield, Sask.—The Saskatchewan Co-operative Elevator Company's elevator was destroyed by fire, with an estimated loss of $10,000, covered by insurance.

+—Moncton, N.B.—JAMES REID, 54 Church St., has the contract for $12,000 factory extension for the Atlantic Underwear Co., Church St.

+—Montreal, Que.—FRANCOIS DUFRESNE, 252 St. Laurent Rd., St. Laurent, has the general contract for $45,000 two-story brick veterinary college for the Laval Veterinary College, 391 Demontigny St. E.

+—Montreal, Que.—H. P. BOOTH, care of owners, has the general contract, and the STRUCTURAL STEEL CO., LTD., 10 Cathcart St., the steel contract for $23,000 addition to running shop of the Montreal Locomotive Works, Dominion Express Bldg.

+—Montreal, Que.—R. RIGBY, care of company, Montreal, has been awarded the general contract for office costing $50,000 for the Canadian Northern Express Co., 411 Dorchester St. W.

+—Montreal, Que.—The CHURCH ROSS CO., LTD., 40 Hospital St., have the contract for a $5,000 two-story brick technical laboratory for McGill University, University Ave.

New Glasgow, N.S.—Tenders will be received until October 30th for the erection of a $30,000 nurses' home for the trustees of Aberdeen Hospital. Plans and specifications with J. W. Carmichael & Co., George St.

+—North Vancouver, B.C.—Several sub-contracts in connection with the construction of the office building and foundry plant additions to the Wallace shipyards have been awarded by the general contractors, Hodson & King, Vancouver. The pile-driving contract for such portions of both buildings as are to be built over the water has been awarded to PALMER BROS. The roofing goes to CAMPBELL & GRILL, while BARR & ANDERSON get the plumbing contract.

+—Ottawa, Ont.—JOS. BOURQUE, 75 De Salaberry St., Hull, has the general contract for alterations and addition to post office for the Department of Public Works, Dominion Government.

+—Ottawa, Ont.—Public Works Department, Dominion Government, awarded the following contracts in connection with the erection of the Parliament Buildings:—Roofing and sheet metal work, W. E. DILLON CO., LTD., 183 George St., Toronto; expanded metal, TRUSSED CONCRETE STEEL CO., 285 Beaver Hall Hill, Montreal.

Peterboro, Ont.—The planing mill of the Peterboro' Lumber Co. was totally destroyed by fire recently.

Regina, Sask.—Sealed tenders, addressed to R. C. Desrochers, Secretary, Department of Public Works, Ottawa, will be received until 4 p.m., on Friday, October 26th, 1917, for alterations to old Royal Bank Building, Regina, for post office purposes. Plans and specifications mey be seen at the offices of the Chief Architect, Department of Public Works, Ottawa; Clerk of Works, Regina; the Postmaster, Brandon, Man., and Resident Architect, 802 Lindsay Building, Winnipeg, Man.

+—Simcoe, Ont.—WM. C. TILLEY, Dalhousie St., Brantford, has been appointed architect, and tenders will be called soon for the erection of a $4,000 school.

+—St. Boniface, Man.—CLAYDON BROS., Furby Place, Winnipeg, have been awarded the general contract in connection with the erection of a $10,000 reinforced concrete and brick factory for the Prest-O-Lite Co., 579 Portage Ave., Winnipeg.

+—St. Boniface, Man.—General contract in connection with the erection of a $10,000 one-story mill and brick factory for the Winnipeg Ceiling & Roofing Co., Ltd., Desautels St., has been let to the CARTER-HALLS-ALDINGER CO., Winnipeg; steel contract let to the DOMINION BRIDGE CO., Winnipeg.

St. John, N.B.—Tenders will be called for the heating, plumbing and ventilating of No. 5 shed.

+—St. Johns, Nfld.—WM. CUMMINGS has the general contract for $6,000 frame and brick citadel for the Salvation Army, Albert Street, Toronto.

Brantford, Ont.—Fire damaged the plant of the Kitchen Overall Co. on Queen Street to the extent of $15,000.

Calgary, Alta.—The Hospital Board decided to proceed with the erection of the new nurses' home, which will cost about $15,000.

Edmonton, Alta.—C.P.R. plans erection of a new station next spring. The undertaking will include the complete razing of the old building.

Lethbridge, Alta.—It is stated that the erection of a large flour mill here is under consideration by several citizens.

+—London, Ont.—The contract for the erection of the $35,000 Salvation Army Hospital has been let to R. G. WILSON & SON.

+—Montreal, Que.—School Commission let contract for brick and reinforced concrete school, to J. TRENETTE, 324 Broeboeuf St. Estimated cost, $115,000.

Port Stanley, Ont.—Plans have been prepared for a $10,000 frame addition to hotel for B. F. Honsinger, 312 Talbot Street, St. Thomas.

+—Salisbury, N.B.—The contract for remodelling and enlarging the unoccupied buildings at the Jordan Memorial Sanitarium has been awarded to A. E. TRITES, THOMAS R. CAMPBELL and N. C. JONAN, of this village.

+—Saskatoon, Sask.—Contract for steel in connection with the warehouse being erected by the T. Eaton Company, Ltd., has been let to the MANITOBA BRIDGE CO.

Southey, Sask.—The Maple Leaf Elevator was destroyed by fire.

St. Marys, Ont.—W. W. Porter. Detroit, was here recently seeking a site on which to erect a factory for the manufacture of farm tractors.

Sydney, N.S.—A permit has been granted to the Sydney Foundry and Machine Company to erect a two-story steel addition to their foundry.

Three Rivers, Que.—La Cie de Produits en Beton Special Ltee. contemplate the erection of a factory. Architect, Chs. Lafond, 15 Bonaventure St.

Toronto, Ont.—As the masonry work at the Jesse Ketchum School has been completed, the concrete work for the floors will be proceeded with by day labor.

Toronto, Ont.—Building permit issued to F. A. Bowden & Sons, Ltd., for addition to office on east side of Greenwood Avenue. Cost, $1,300.

Toronto, Ont.—Building permit issued to Trustees of Massey Hall to alter "Albert" Building to offices and dressing room, cost $4,000, and to the Imperial Munitions Board, for erection of six barracks buildings for war orders, on Weston Road, cost $15,000.

Toronto, Ont.—Definite announcement that the King Edward Hotel has passed into the hands of the United Hotels Co., of America, and that it will shortly be under new management, and that some $200,000 is to be spent on its renovation was made by Lieut.-Col. W. S. Dinnick, a director of the United Hotels Co.

Toronto, Ont.—Sealed tenders, whole or separate, addressed to W. C. Wilkinson, Secretary-Treasurer of the Board of Education, will be received until Thursday, October 25th, 1917, for electric wiring, plumbing, steamfitting, tinsmithing, ash hoists, for sundry schools. Specifications may be seen at the office of the Superintendent of Buildings, 155 College St.

+—Toronto, Ont.—The CANADIAN WRECKING & CONSTRUCTION CO., 108 Terauley St., will wreck old structure on the site of the proposed $50,000 warehouse for Thos. Essery, Elliott House.

Toronto, Ont.—The City Architect has granted a building permit to the Imperial Oil Co. for a gas-line service station at the south-west corner of Roxborough and Yonge Streets, to cost $14,300.

+—Toronto, Ont.—The CRESCENT CONCRETE CO., Temple Bldg., have been awarded the contract for an $8,000 addition to shop for the Willys Overland Co., Weston Road.

+—Toronto, Ont.—The JOHN V. GRAY CONSTRUCTION CO., LTD. Toronto, have been awarded the general contract for an addition to the hydraulic building for the Canadian Fairbanks-Morse Co., Ltd., Bloor St. W., Toronto.

Vancouver, B.C.—The Ayres Varnish and Paint Company will erect a new paint factory at the corner of Raymur Avenue and Parker Street. The new structure will be of mill construction, two stories high, and will cost in the neighborhood of $2,000.

Vancouver, B.C.—Work is about to start on an $8,000 frame machine shop for the Schaake Co. Architects, Gardiner & Mercer, Birks Bldg.

Walkerville, Ont.—Brigadier Miller, Albert St., Toronto, has drawn plans for a $10,000 one-story frame hall and residence for the Salvation Army.

West Lorne, Ont.—Work will be commenced here shortly on a new textile factory, of which Bernard C. Weisbrood, of Toronto, will be the manager.

+—Winnipeg, Man.—CARTER-HALLS-ALDINGER CO., 1010 Union Bank Bldg., have the general contract for $90,000 addition to nurses' home at the Winnipeg General Hospital, Bannatyne Ave.

+—Winnipeg, Man.—The Union Bank, it is announced, will build a bank building in Regina, besides six others in different parts of Saskatchewan, at a cost of $8,000 each, also two in Manitoba towns, and two in Alberta. The CARTER-HALLS-ALDINGER CO., Winnipeg, have the contract for the Regina building.

BRIDGES, ROADS AND STREETS

Ailsa Craig, Ont.—The bridge over the Aux Sable River near here, collapsed recently. A new cement bridge will be built. Clerk, J. S. Smith.

Amherstburg, Ont.—Town Council contemplates the construction of reinforced concrete pavements and cement curbs costing $12,000 on Apsley, Murray and Dalhousie Streets. Clerk, A. J. Burns.

Aylmer, Ont.—In all probability work on the Talbot Road between Aylmer and St. Thomas will be started shortly.

Brant County, Ont.—County Council decided to gravel a number of roads; also to obtain a stone crusher to be used in the work.

+—Dundas County, Ont.—The following contracts have been awarded in connection with the erection of bridges for the County Road System:—F. M. EGLESON, Winchester, 6 bridges, cost $12,000; H. J. WALKER, Cornwall, 6 bridges, $12,000; ONTARIO BRIDGE CO., LTD., Toronto, 2 bridges, $10,000; D. McRAE, Finch, 2 bridges, $2,000.

+—Fort William, Ont.—STEWART McKENZIE, of this city, has been awarded the contract for the building of a new street railway bridge across the McIntyre River, the cost to be $2,892.40.

Hamilton, Ont.—City Council intends to construct a cement curb on the north side of King Street between James Street and Hughson Street. S. H. Kent, City Clerk.

Hamilton, Ont.—City Council intends to construct a 12-inch pipe sewer on Cannon Street from Robins Avenue to Kenilworth Avenue, at an estimated cost of $4,024. S. H. Kent, City Clerk.

+—Maidstone Twp., Ont.—The following contracts have been awarded by the Township Council:—Drains, STEPHEN CONROY, HARRY PEMPRAISE, D. G. MONTGOMERY and WM. ROBINSON; cement bridges, HARRY PEMPRAISE and JOS. QUINLAN; bridge and breakwater, W. G. TAYLOR. Address contractors, care of clerk, A. Mousseau, R. R. No. 1, South Woodslee.

Moncton, N.B.—City Engineer J. Edington will prepare a plan for improving the road from the Coverdale Bridge to the Hill.

Montreal, Que.—A delegation waited on the Board of Control regarding the necessity of repairing the Lachapelle Bridge. Favorable consideration was promised.

Montreal, Que.—The Board of Control decided to present a report to the City Council asking for $20,000 to repair the Cartierville bridge. City Engineer, Paul E. Mercier.

+—Oakbank, Man.—A. POWELL, 203 Morley Ave., Winnipeg, has been awarded the contract for a 60-foot and a 52-foot pile bridge by the Municipal Council of Springfield.

Ottawa, Ont.—The Department of Public Works, Dominion Government, contemplates the construction of an asphalt macadam pavement on St. Patrick St. Secretary, R. C. Desrochers.

Port Colborne, Ont.—The steel ore bridge No. 1 at the Canadian Furnace Company's plant was damaged during a storm to the extent of $80,000.