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# The Canadian Engineer

*A Weekly Paper for Civil Engineers and Contractors*


# Hydro-Electric Development at Ranney's Falls

**Two 5,000-H.P. Units to Operate Under 47-Ft. Net Head Between Upper and Lower Reaches of Trent Canal near Campbellford — Conditions Almost Ideal — Another Generating Station for Hydro-Electric Power Commission's Central Ontario System**

PLANS and specifications have been prepared by the Hydro-Electric Power Commission of Ontario for the construction of another water power development on the Trent Canal. At present the commission operates eight plants on the Trent Canal system, six of which are on the Trent division of the canal and are supplied with water from the Trent River, and two of which are on the Severn division and are supplied from the Severn River. The proposed ninth plant is to be on the Trent division, at Ranney's Falls, between the present Campbellford and Frankford plants, or about one mile below the town of Campbellford and about two miles above lock No. 11.

When the Trent Canal was constructed by the Dominion government, a dam was built a short distance above Ranney's Falls to maintain the level in the upper reach, and an artificial waterway was constructed through a part of the town of Campbellford, terminating in locks numbers 11 and 12, by means of which the boats obtain access to the lower reach of the canal. (The lower end of this portion of the canal and these two locks are shown on p. 458.) It was then planned to take advantage at some future time of the difference in level between the two reaches which is available at this point, and as a part of the wall on the river side of the canal there was installed a reinforced concrete sluiceway with five overflow sections, each 20 ft. long. The concrete deck of the sluiceway serves as a bridge to carry a main highway across the proposed forebay.

SITE OF RANNEY'S FALLS DEVELOPMENT, LOOKING FROM LOWER END OF TAILRACE TOWARD INTAKE SLUICEWAY IN BACKGROUND

The total length of the sluiceway, including the four piers, is 116 ft. and the height is 15 ft., the deck being at elevation 480 and the foundation at elevation 465. The regulated water level in the upper reach of the canal is at elevation 477.2, and in the lower level of the canal, 429.2, so that the difference in elevation, or gross head, is 48 ft. Allowing 1 ft. for losses through the plant, the net head on the plant will be about 47 ft.

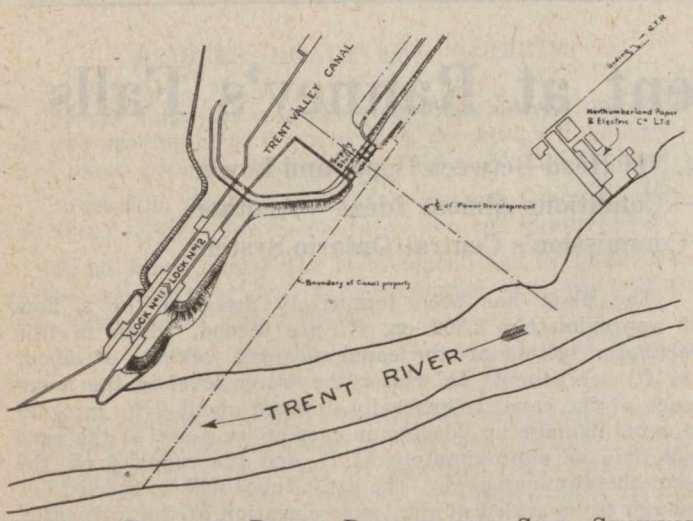
The plant has been tentatively designed for a flow of approximately 2,300 cu. ft. per second, which in this particular section of the canal means a velocity of about 1½ ft. per second. In winter the water level in the lower reach of the canal is generally dropped about 7 ft. in order to avoid damage by flooding in case of ice-jams, so the head will then be approximately 54 ft. and the capacity of the plant thereby increased. The draft tubes will be carried low enough to be sealed at the lower elevation of the tail water. Under normal conditions, with 47 ft. head, the capacity will be about 9,000 k.v.a. at 80% power factor, current lagging.

From the outside walls of the sluiceway, gravity retaining walls, approximately 120 ft. long and averaging 20 ft. in height, will extend to the gate-house, which will house the racks and head gates and which will adjoin the power-house proper. The gate-house and power-house will be of reinforced concrete construction. Provision will be made in the head works for an ice chute for handling any ice which may find its way into the forebay. The power-house floor will be at elevation 455 and the generator coupling about 4 ft. lower.

There will be two units, and for each unit there will be provided two head gates of the Stoney sluice type, from which the water will be carried to the turbine casings through reinforced concrete supply pipes approximately 53 ft. long. The turbine casings will be of the scroll type, molded in concrete. The hydraulic turbines will be of the single runner vertical type, direct connected to generators. The turbines will have a capacity of 5,000 b.h.p. under 47 ft. net head when operating at 120 r.p.m. The generators will be 3-phase, 60-cycle, 6,600 volts, each of 4,500 k.v.a. capacity at 80% power factor, capable of operating continuously at an overload of 5,300 k.v.a. The maximum efficiency of the turbines will be at approximately 90% full load, and they will normally operate between 70% and 90% of full load. The scroll cases will be about 30 ft. in inside diameter, as the physical dimen-

sions of the units will be large, the capacity being large in proportion to the relatively low head. The turbine runners will be about 8 ft. in diameter. An exciter will be mounted directly on top of each generator and will be direct connected to the main generator shaft. The governors will be of the oil pressure type.

The tailrace will be approximately 250 ft. long, extending from the power-house to the lower level of the Trent




General Plan of Power Development Site, Showing Upper and Lower Reaches of Trent Canal

River, and a certain amount of dredging will be required in the Trent River at the tailrace outlet. Other than this, all work will be in the dry, as the small amount of spill and leakage from the sluiceway can be readily piped away. A siding from the G.T.R. will be built directly to the site of the work.

The rock, which is exposed over practically the whole site, is a good grade of limestone, and no construction difficulties are expected. In fact, the whole layout is very simple, the site being almost ideal, no head dam being required, headrace and tailrace both being short, the forebay conditions ideal, no rapids immediately above the plant to cause frazil, all ice troubles being at a minimum, and there being no runoff or storage problems requiring solution.

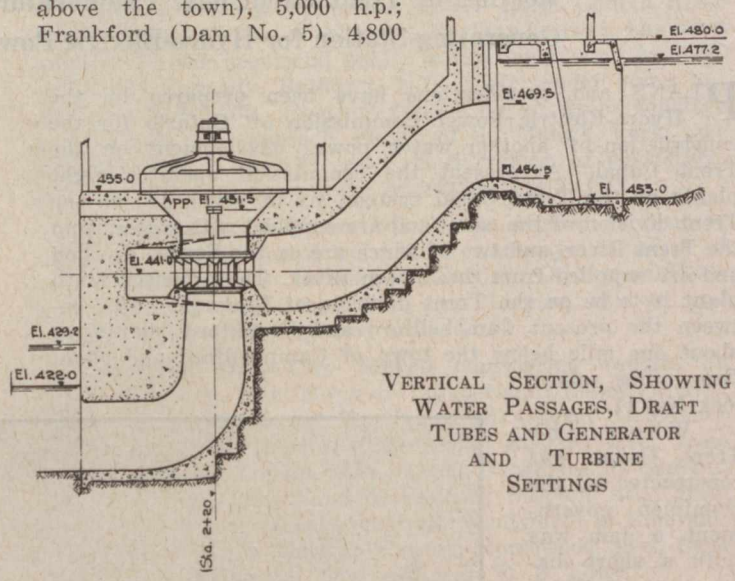
Two additional smaller generating plants in the immediate vicinity of Ranney's Falls are contemplated, and when built they will be connected to the low-tension bus in the Ranney's Falls generating station.

The operation of the Trent Canal is in the hands of the Dominion government, and the plant necessarily will have to operate with whatever water the government operation permits, but, as above stated, it has been designed for a flow of about 2,300 c.f.s.

Like many other power sites on the Trent Canal, this site was formerly leased by the Dominion government to the Seymour Power Co. When the Ontario government purchased the Seymour Power Co. a few years ago, the rights to this site and others were acquired.

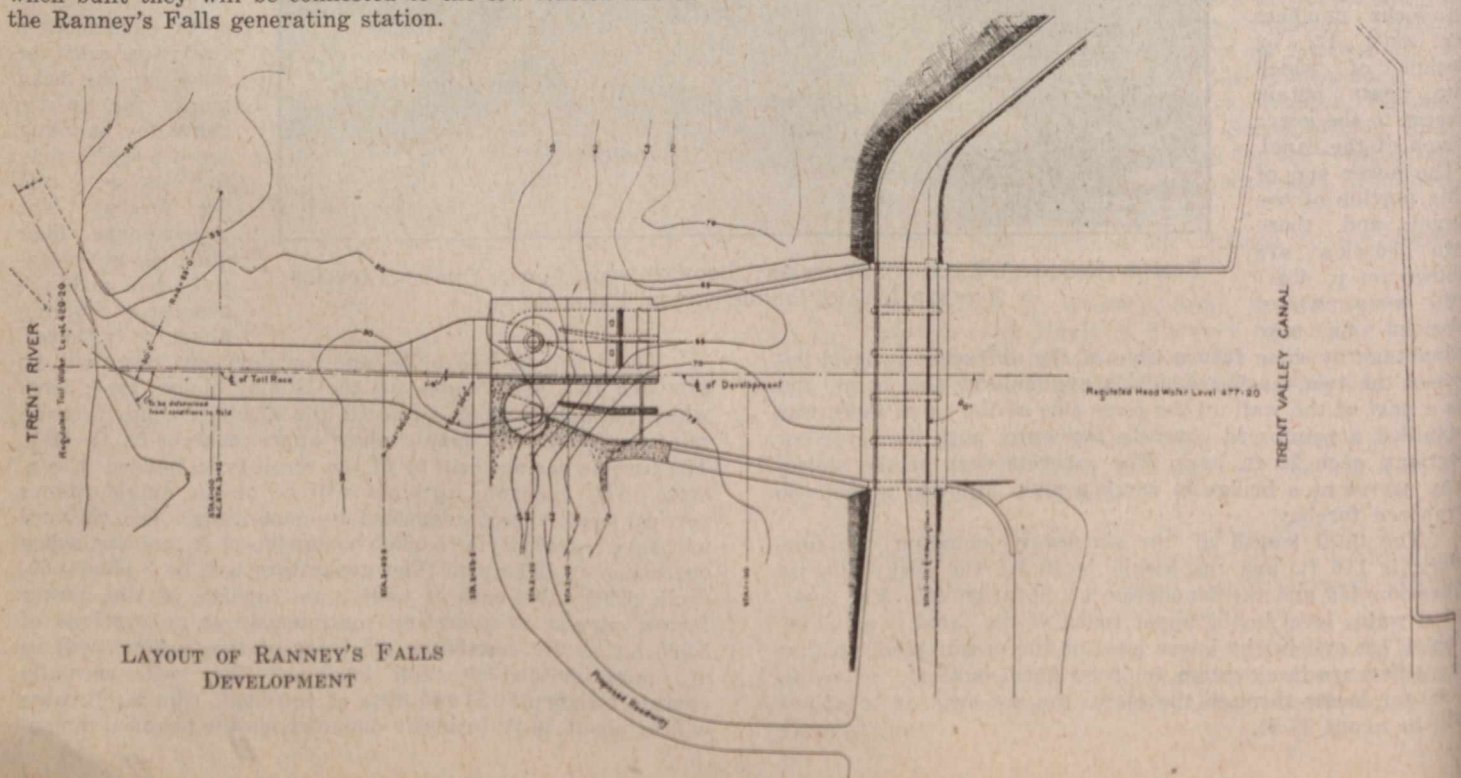
The other developments on the Trent division of the canal which are now operated by the Hydro-Electric Power Commission of Ontario are as follows:—

Healy Falls, six miles above Campbellford, 16,800 h.p. capacity; Trenton (Dam No. 2), 5,600 h.p.; Campbellford (development about one mile above the town), 5,000 h.p.; Frankford (Dam No. 5), 4,800




Vertical Section, Showing Water Passages, Draft Tubes and Generator and Turbine Settings

h.p.; Auburn, 2,850 h.p.; Fenelon Falls, 1,000 h.p. The total capacity of these six plants is 36,050 h.p., and with the 10,000 h.p. which will be developed by the Ranney's Falls plants, there will be a total of over 46,000 h.p. developed by the Hydro-Electric Power Commission on this division of the Trent Canal. There are several other sites yet to be developed on this division, including Burleigh Falls and Dams Nos. 8 and 9. Considerable extension of the de-




Layout of Ranney's Falls Development

velopments at Fenelon Falls and Campbellford is also possible.

There are a number of privately-owned plants on the Trent division of the canal, including those of the Quaker Oat Co. at Peterborough, the Lakefield Portland Cement Co. at Lakefield, and the Canadian General Electric Co. at Peterborough.

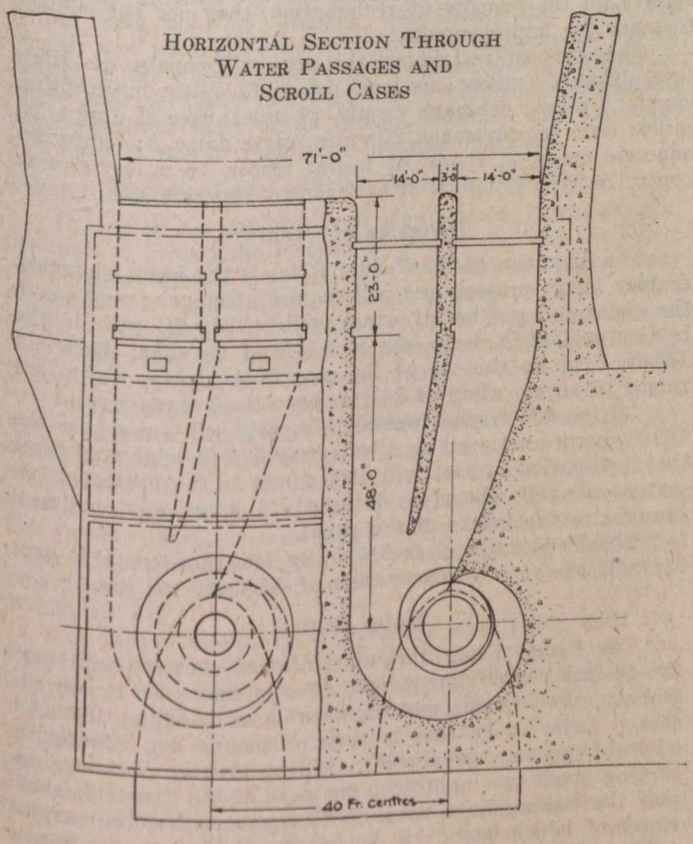
On the Severn division of the canal, the Hydro-Electric Power Commission of Ontario operates a plant at Wasdell's Falls, 1,200 h.p. capacity, and a plant of 5,600 h.p. capacity at Big Chute, or a total of 6,800 h.p. in these two plants.

The total power generated by the commission on both divisions of the canal, after the completion of the Ranney's Falls plant, will, therefore, be approximately 53,000 h.p.

On the Severn division there is a site of about 1,400-h.p. capacity, at Port Severn, which is not yet developed. The largest of the plants on the Severn division not under the control of the Hydro-Electric Power Commission is the 4,800-h.p. plant at Swift Rapids, which is owned by the town of Orillia.

None of the six plants which the commission is now operating on the Trent division of the canal were built by the commission, but were all taken over from the Seymour Power Co. A new unit of 5,600-h.p. capacity has been installed at Healy Falls, however. This new unit has been in operation for about ten months.

The proposed Ranney's Falls plant, like all of the other plants on the Trent division of the canal, will feed the commission's "Central Ontario System." This system supplies power to about twenty-five municipalities in central Ontario, including Peterborough, Kingston, Belleville, Oshawa, Lindsay, Trenton, Cobourg, Port Hope, Bowmanville, Picton,



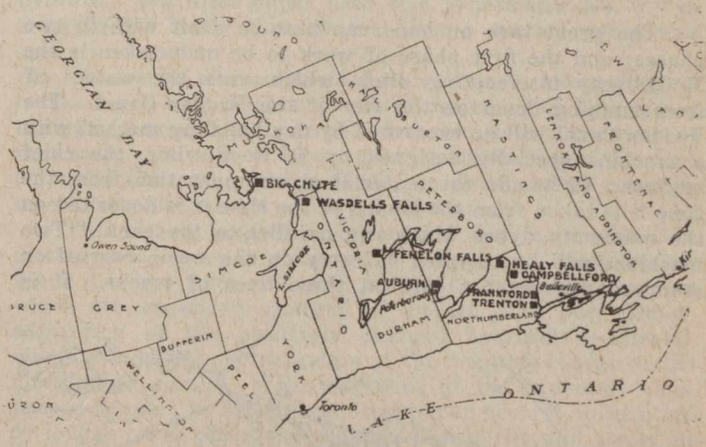

HORIZONTAL SECTION THROUGH WATER PASSAGES AND SCROLL CASES

Deseronto, Napanee and Whitby. The total population served by this system is approximately 120,000. The transmission voltage on this system is 44,000 volts. Although the current is 60 cycles, this system may in the future be connected to the Niagara 25-cycle system through frequency changers, and may also be connected to the commission's St. Lawrence system.

The two plants on the Severn division of the Trent canal feed the commission's "Severn System," which distributes power to nineteen municipalities in the Georgian Bay district, including Collingwood, Orillia, Midland, Barrie and Penetang. The total population served by this system is approximately 42,000. Of the two H.E.P.C. plants on the Severn division, one—Wasdell's Falls generating station—was constructed by the commission, and the other—Big Chute—was taken over from the Simcoe R'y & Power Co.

The estimate of the cost of the Ranney's Falls plant was made several months ago, and as prices of material and labor have since increased considerably, the commission has asked its engineering department to prepare a new estimate before authorizing the construction of this plant. Tenders have already been called, however, for the required hydraulic and electrical machinery.

Hon. Sir Adam Beck is chairman of the Hydro-Electric Power Commission of Ontario; W. W. Pope is secretary; and Frederick A. Gaby is chief engineer. The design and con-




MAP SHOWING HYDRO-ELECTRIC POWER COMMISSION'S PRESENT DEVELOPMENTS ON THE TRENT CANAL

struction of the Ranney's Falls plant, with the exception of the electrical work, will be under the direction of the commission's hydraulic department, of which Henry G. Acres is chief hydraulic engineer; Thomas H. Hogg, assistant hydraulic engineer; and Maxwell V. Sauer, designing engineer. E. T. Brandon is the electrical engineer of the commission; and Arthur H. Hull, assistant electrical engineer. The construction will be carried out by the commission's own construction department, of which Arthur Trimble is general superintendent and Jas. McGraw, assistant superintendent.

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The head office of the Beaver Board Co., Ltd., has been transferred to Thorold, Ont., where the company has been operating a large mill for the past ten years.

According to legislation recently introduced in the Ontario parliament, the operation of jitneys, buses and all passenger and freight vehicles other than steam and electric railways will be under the jurisdiction of the Ontario Department of Public Highways.

Hon. C. W. Robinson, of Moncton, N.B., is being frequently mentioned by the newspapers of that province as the probable representative of the provincial government on the New Brunswick Hydro-Electric Power Commission, which will be appointed at an early date. C. O. Foss, chief engineer of the St. John Valley Railroad, is said to be in line for appointment as chief engineer. Mr. Foss has been engaged for the past year in investigating the water powers of New Brunswick for a government committee. He is now engaged in an investigation of the Pokiok and Shogomoc Rivers, which may be developed for supplying power to Fredericton, Woodstock and the St. John River Valley district. Engineers are also completing surveys of Lepreaux Falls for the development for the St. John district. Mr. Foss has recommended that a report be secured from consulting engineers before proceeding with any other expense in connection with the project for harnessing the tides at the mouth of the Petitcodiac River, a project which would cost about $5,000,000.

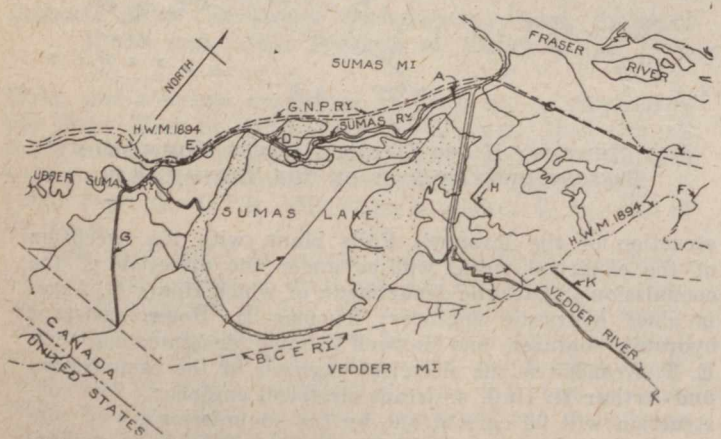
## SUMAS LAKE RECLAMATION PROJECT*

THE huge dyking plan commonly known as the Sumas reclamation scheme is now attracting the attention of engineers all over the continent. The scheme, when carried out, will bring under intense cultivation 33,000 acres of fertile land, while its affects will be felt throughout the length and breadth of the Fraser Valley down to the coast cities, which will also reap their full share of the development of these wonderful lands.

The letting of the first contract marks the beginning of a new era of prosperity for British Columbia, the first real sign that the country is once more at peace, and the first real step towards the much-talked-of new development and reconstruction.

### Two Phases of Work

The great task on hand can best be dealt with in two phases; and the first phase of work to be undertaken is the McGillivray intercepting ditch, which cuts the water off from running down on the site of the Vedder Canal. The Vedder Canal will be excavated by dry handling method with a machine specially designed by F. N. Sinclair, the chief engineer, to handle the material in one operation from the time it is taken from the trench to the time it is deposited on the mammoth dykes which run parallel to the canal. Two machines will be required to carry on the work, carried on standard railway flat cars on three lines of tracks. It is




MAP SHOWING SUMAS LAKE AND CANAL THAT WILL DIVERT VEDDER RIVER TO FRASER RIVER

A, Dam; B, Vedder Canal and dykes; C, Fraser dykes; D, Sumas Canal and dykes; E, Marshall Creek Canal; F, Atchelitz dyke; G, Arnold Creek—Sarr Creek ditch; H, McGillivray ditch; K, Barrage dyke; L, Lake Canal.

planned that these machines shall construct the two dykes parallel to the canal between two high water periods of approximately 260 working days in duration.

### Fraser River Dyke

This portion of the work will cost, approximately, $600,000, and is about half of the amount of the present contract. The other half is the Fraser River dyke, the Sumas Canal, the Arnold Creek interception ditch, the Marshall Creek improvement canal, the Vedder River seepage ditch and the barrage dyke.

### Work to Run Concurrently

The second phase of the work, for which the contract has not yet been let, will include the main Sumas River controlling dam with a battery of five 54-in. direct connected, electrically-driven centrifugal pumps with a maximum capacity of 1,000 cu. ft. per second, the McGillivray Creek dam carrying one pump similar to the main battery, the concrete slab protection work on the Vedder Canal, the improvement of the Vedder River above the intake of the canal, fencing the project, lateral drains and rough construction of roads.

The key to the situation is the excavation of the Vedder Canal and the approximate maximum cost of the entire scheme is now estimated at $1,800,000. The following is a synopsis of the conditions, and other matters in connection with the scheme:

*From the Vancouver Daily Sun.

### Fifty Miles From Vancouver

The lands under this project are situated in the Fraser River basin, just north of the international boundary line, approximately at the head of navigation on the Fraser River and 50 miles from the city of Vancouver.

The district is traversed by the British Columbia Electric Railway and the Victoria, Vancouver & Eastern Railway.

The valley is also touched by the Canadian National Railway, the Canadian Pacific Railway, the Bellingham Bay & B.C. Railway, and is served by water transportation, giving exceptional transportation facilities.

### Tract of 33,000 Acres

The tract comprises 33,000 acres, 10,000 acres of which are in the bed of Sumas Lake, which will be entirely drained.

The lands to be reclaimed are subject to overflow from the annual spring freshet in the Fraser River, caused by the rapid melting of the snow in the Rocky Mountains, and occasionally in the fall, by an abnormal run-off in the coast range.

The latter, when it occurs, is very severe, and coming at a time of low water in the Fraser River, often causes great damage.

### Ownership of Land

The title to the land in the bed of Sumas Lake is vested in the Crown and 20,000 acres adjacent is privately owned. Some 2,100 acres of the tract lie on the United States side of the international boundary line, and although these lands receive all the benefits of reclamation, they are not subject to taxes for improvements.

The work of reclaiming the area will consist of: High level dykes, 12 miles; low level dykes, 13 miles; intercepting canals, 7 miles; drainage canals, 20 miles; lateral drains, 60 miles; river improvement, 20 miles; earth dams, 3; reinforced concrete dams, 2; roads, 65 miles; fences, 75 miles; stream control jetty, 1½ miles; stream control concrete slab, 1 mile.

### Diversion of Vedder

The diversion of the Vedder River is the most important feature in the project, and will require a compensating canal, the excavated portion of which will be 270 ft. wide in the bottom, and 12 ft. deep. On each side of the canal there is a 100-ft. berm to the toe of the mammoth dykes, which are raised to an elevation of 25 ft. above the ground level.

During the freshet period this canal will raise over the 100-ft. berm and swell to a waterway 570 ft. wide, and after the flood-period is past will drop again to the protected low water channel which is designed to scour any material brought to the intake of the canal.

The Vedder Canal is 3¼ miles long and contains over one-half of the total excavation of 4,500,000 cu. yds.

### Water Control

The Sumas River dam of reinforced concrete will carry five 54-inch centrifugal pumps, directly connected to 500 h.p. 3-phase, synchronous motors, capable of handling 120 c.f.s. each. Adjacent to this battery of pumps lies 125 square miles of drainage area, which will be gravity discharge excepting about two months, at the peak of the Fraser freshet; also the Sumas Lake area of 35 square miles, the surplus water of which basin will be exhausted through the Sumas dam at all times.

A small area of 12 square miles will be controlled through McGillivray Creek dam, a small structure of reinforced concrete, carrying one pump of 54 inches.

The area is divided into three distinct basins, and safeguarded by exterior dykes (high level) and interior dykes (low level).

The range of the flood water is from 10 to 25 feet, the extreme having been reached once, in 1894. The works will be built three feet higher than 1894 water, or to an extreme

*(Concluded on page 470)*

# Alumina Hydrate in Mechanically Filtered Water

## Some Observations on the Passage of Colloidal Alumina Through Water Filtration Plants—Research Work at Toronto Plant Indicates Impossibility of Removing Residual Alumina from Filtered Water—Alumina Becomes an Aluminate?

By NORMAN J. HOWARD* and FRANK HANNAN†
Toronto Filtration Plant Laboratories

PRESENCE of aluminum hydrate in the effluents of mechanical filtration plants has recently caused considerable differences of opinion amongst those directly concerned in the purification of public water supplies. In Toronto, where the new drifting sand system is in commission, an alumina reaction has always been obtained in the filtered water, and in view of the fact that this is an entirely new system, it has been claimed by some to be caused by the direct application of aluminum sulphate to the filters without a preliminary period of coagulation and sedimentation. The exponents of the standard mechanical gravity filter, claim that the filtered water from mechanical plants, if properly operated, would yield an effluent entirely free from aluminum sulphate or aluminum hydrate.

Correspondence has passed between numerous engineers, sanitarians and the writers, as to the conditions existing principally in the states of New York, Maryland and Rhode Island, and the province of Ontario. The consensus of opinion was that the presence of aluminum hydrate in the effluents of many mechanical plants was not an unusual condition, and was frequently met with, and the reason why such cases had not appeared in the experiences of some water works authorities, might well be due to the fact that a number of consulting engineers have little or no routine relation with the daily operating details or results in filtration plants.

### Investigation Confirms Previous Opinions

In view of the importance of the question, it was thought desirable to investigate further the conditions with the object of throwing light, if possible, on a subject involving a study of some of the colloidal properties of aluminium about which so little is known. It is yet too early to form any definite conclusion, and the opinions expressed hereafter are only based upon conditions as actually found to exist in Toronto.

Investigation in the laboratories of the filtration plant have confirmed previously expressed opinions that the removal of aluminum hydrate in treated Lake Ontario water is an impossibility. It is not proposed even to consider the question of aluminum sulphate occurring in the effluents of the Toronto plant, as with a normal alkalinity in the raw water of nearly 100 parts per million estimated as $CaCO_3$, the presence of undecomposed alum would be a chemical impossibility.

The initial laboratory experiments were made with mechanically filtered water, and with water treated in the laboratory with aluminum sulphate. The quantity of chemical applied ranged between one-half and two and one-half grains per imperial gallon. A period of four hours' sedimentation was allowed the laboratory samples before filtering through small rapid sand filters. The samples were then tested for a positive or negative alumina reaction. The reagents used were fresh solutions of extract of logwood (1%), hæmatoxylin (0.3%), and N×6 acetic acid. The presence of alumina was determined by the formation of a blue to purple color which after acidification turned to pink or brown. In the absence of alumina a deep pink color resulted, which turned to yellow on addition of the acid. It was found that control tubes were always necessary on account of the extremely sensitive nature of some of the reactions.

Throughout the whole series of a large number of tests, not a single sample that had been mechanically filtered or artificially treated with alum in the laboratory, failed to give a positive reaction. Further experiments were made to determine if six thicknesses of very fine paper would retain the hydrate. The filter paper used was Whatman's No. 5. In order to get water through the filter a suction pump was used.

The results of these tests were extremely interesting, as it was found that the first 50 c.c. of water which had passed through, showed a considerable decrease in the intensity of the reaction. The next 50 c.c. gave an increase over the first 50, while after the passage of 200 c.c. little change could be seen in the filtered and unfiltered solutions.

This clearly pointed to adsorption and the explanation of this would seem to point to the action being electrostatic. When positive hydrosols are passed through filter papers which are negatively charged in contact with pure water, adsorption of the positively charged hydrosols (colloidal alumina) and the neutralization of the negative charge of the filter paper result. When sufficient of the hydrosols have passed through to render the filter paper neutral, adsorption no longer takes place and alumina passes through freely in colloidal form. This explanation is supported by the fact that a filter paper which has had its negative charge neutralized by the adsorption of Al ions has much less action than a fresh paper.

A similar experiment was made with the positive colloid methylene blue (0.5 p.p.m., or a 0.00005% solution). This was passed through six thicknesses of filter paper and the color was retained until 1,115 c.c. had passed, after which a gradual and progressive increase was noted. The experiment was continued until 10,065 c.c. (approximately ten litres) had been filtered, after which it was impossible to distinguish between the filtered and unfiltered solutions.

Experiments were next made to determine the effect of variation in the rate of filtration. Water treated with 1 grain per gallon, and mechanically filtered at the rate of 75,-100,125 and 150,000,000 gallons per acre per day, showed little change in the alumina reaction. It should be pointed out here that our observations showed the sand to retain alum for a considerable period after the application of alum had ceased, and that frequent backwashing was necessary to free the sand particles from the hydrate. This experiment was duplicated using the small laboratory filters, when similar results were obtained.

### Effect of Lime

Further tests were made to determine the effect of the addition of $Ca(OH)_2$ to water treated with aluminum sulphate. To each sample of raw water one grain of alum was added plus the molecular equivalent of lime water [1.5 c.c. of N×0.04524 $Ca(OH)_2$ solution] necessary for exact precipitation. The application was in the following order:—

Series 1.—Water+Lime+Alum.
" 2.—Water+Alum+Lime.
" 3.—(Alum+Lime)+Water.
" 4.—Water+Alum.
" 5.—Control: Water+Lime.

The physical effects were first observed and it was seen that numbers 1, 2, and 4 generally flocced in a similar manner, but that number 3 produced a heavier floc which precipitated rapidly. The principal reason for making these tests was to determine if the addition of lime would decrease the residual hydrate after filtration. After standing 30 minutes, all samples were filtered through fine filter

*Bacteriologist in charge. †Chemist.

papers (Whatman's No. 5) and then tested for the alumina reaction. The whole series, excluding the control, gave a positive reaction. A slightly weaker reaction was obtained from number 3, while the control, consisting of water and lime, alone gave a negative reaction.

Considerable other work has been carried out, and every endeavor made to find a water in Ontario that had been treated with alum in the laboratory, or mechanically filtered after the application of aluminum sulphate, which would not give a positive alumina reaction. Samples under observation included:—

1.—Drifting-sand filtered water.
2.—Mechanical gravity filtered water.
3.—Mechanical pressure filtered water.
4.—Well water treated with $Al_2(SO)_3$.

Very careful technique and negative controls, having a similar degree of alkalinity were found to be always necessary in order that strictly accurate reactions could be recorded. On account of the large number of examinations involved, and the absence of any known rapid method for estimating minute traces of alumina, it was not found practicable to make quantitative estimations.

### All Yield Positive Reaction

So far, we have been unable to find a water which after treatment has not yielded a positive alumina reaction. We believe that the principal points involved are the hydrogen ion concentration of the water under treatment, and the colloidal nature of the alumina when in solution.

It seems to us very doubtful that the complete removal of decomposed alum in water having a similar hydrogen ion concentration ($^{P}_{H}$ 8.0–8.6) can be achieved by filtration. Laboratory experiments have shown alumina to remain in solution after standing for a period of four months, but it was noticed that the hydrate underwent a change, and probably became an aluminate,—in what form, we are at present unable to say. Of recent date chemists would appear to be satisfied with distinguishing only two sets of colloidal solutions, which they have called solutions of alumina and metalumina.

So far as we are in a position to judge, the residual hydrate in the Toronto water is harmless, has no corrosive properties and is devoid of all sanitary significance. Rudolph Thompson, of the laboratory staff, has taken an active part, along with the writers, in the whole of the experimental work carried out.

### Summary of Observations

Following is a summary of observations and probable fate of hydrosols in mechanically filtered water:—

1. Effluents from all treated waters examined gave positive reactions.

2. Intensity of reaction slowly diminished on long standing, but after four months was still perceptible.

3. If 25 c.c. of concentrated salt solution (commercial NaCl) were added to one litre of treated water, no reaction could be observed after 60 days.

4. Freezing did not affect the reaction, neither did boiling.

5. Concentration by boiling to one-tenth of original bulk threw down a rather abundant crystalline precipitate which included considerable Al. The clear solution no longer gave the reaction.

6. Filtered through six thicknesses of Whatman's No. 5 filter paper, the reaction was still obtained. There was evidence of adsorption of sol by the paper.

7. The sols freely ascended bibulous paper,—over 13 cm. in 48 hours.

8. Water of $^{P}_{H}$ 8.0–8.6, yielding no reaction if brought into contact with alumina gels, or if passed through a filter paper which has adsorbed alumina sols, will yield a positive reaction.

9. Non-reacting Al in solution can be brought to react by slightly acidifying, boiling, cooling and restoring the original $^{P}_{H}$ value by cautious addition of ammonium carbonate. The presence of iron may interfere with this test, as hæmatoxylin combines with iron in preference to alumina when both are present together in reactive form.

These reactions can be accounted for if we assume:—

(a) Hæmatoxylin enters into reaction with alumina sols but not with aluminate ion.

(b) Alumina gel is readily peptised in presence of OH– ion, even at $^{P}_{H}$ 8.0.

(c) Alumina sols are not stable in presence of OH ion, but are converted into aluminate ions.

$$Al(OH)_3 + OH^- \rightleftarrows AlO_2^- + 2H_2O.$$

(d) Aluminate ions are stable in presence of OH ion, but are decomposed by acids with formation of aluminum ions.

$$AlO_2^- + 2H^+ \rightleftarrows Al(OH)_2^+.$$

(e) The degree of dispersion of the sols is probably greater

(A) In presence of NaCl.
(B) With increased $OH^-$ ion concentration.
(C) After severe filtration.

(f) Higher dispersion accelerates the course of reactions.

These assumptions should not be regarded as anything more than a first approximation. The reactions which actually take place are in all probability far more complex.

## AMERICAN WATER WORKS EXHIBITS

APPLICATIONS for exhibit space at the fortieth annual convention of the American Water Works Association, to be held June 21st to 25th in Montreal, should be mailed at once to Burt B. Hodgman, care of the National Water Main Cleaning Co., 50 Church St., New York City, who is chairman of the exhibit committee of the Water Works Manufacturers' Association.

All exhibits will be placed in Windsor Hall, which is a room 50 by 100 ft. Space can be reserved only for members of the Water Works Manufacturers' Association. The rate has not yet been determined, but will be a uniform price per square foot, and will be announced after it is known just what the expenses relating to the exhibits will be. All applications for space must be made upon the association's printed, formal application blank.

To avoid customs charges, United States firms who wish to send exhibits should consign their packages to themselves, Windsor Hotel, care of W. P. Lunny, Montreal, Que. These firms should also invoice the goods to themselves, Windsor Hotel, care of W. P. Lunny, Montreal, Que. Invoices should be made in triplicate on export forms which will be supplied by Mr. Hodgman upon request. Goods should be valued at market value in the United States, and invoices should be marked: "For exhibition purposes, annual convention, American Water Works Association, Windsor Hotel, Montreal." The declaration on the back of the invoice must be signed. One copy of the "Oath for return of American products exported" must be made and signed before a notary public or a U. S. customs collector. The three invoices and the oath for return of American products must be mailed to W. P. Lunny, 6 St. Sacrament St., Montreal, Que., when the goods are shipped. Freight or express should be prepaid. There will be a charge of $4 to each exhibitor for customs broker's fee for handling each firm's entire exhibit in and out of Canada. Exhibitors should note that no water connections will be allowed in Windsor Hall.

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Among the graduates this year at the University of New Brunswick are three civil engineers and one electrical engineer. In the arts course there are 17 graduates, and in forestry there are 10.

Contract for the manufacture of twenty Armstrong shovels has been awarded to the Port Arthur Shipbuilding Co., of Port Arthur, by the Lake Superior Loader Co., of Duluth, Minn. It is the intention of the latter company to organize a Canadian branch in Port Arthur.

# ROAD LOCATION*

By R. T. Brown
*Chief of Surveys, South Carolina State Highway Department*

IT is worth while in studying road location to take a brief review of the factors that entered into the location of highways in the past. The first of these factors was, no doubt, the easiest way through,—the "line of least resistance."

In the days when settlements were few and far apart, labor scarce and machinery lacking entirely, the quickest way to open a line through was the one chosen. At first the roads were mere footpaths or bridle paths, which later developed into important highways.

Another important consideration in those days was that of local conveniences. Since communication would be chiefly between neighbors or nearby settlements, of course the roads wound around by each cabin and often considerably out of the way to pass by a mill situated at a convenient waterfall or a large cleared area where much hay and corn were produced. In some cases the trail even went a half mile out of the way to pass a good spring, just as it might do to-day to pass a good "still."

## Roads as Property Lines

A little later, when the community was more thickly settled and fences became necessary, the roads became property lines, or were relocated so as to follow property lines. When new roads were to be opened they often had to zigzag around half a dozen fields to the mile, hemmed in by the timber on one side and a rail fence on the other. We are still suffering from the effects of property lines on road location in many sections, even after the said property lines have ceased to exist.

When communication became more frequent and the condition of the roads of more importance, drainage became a factor in the location of roads. Since bridges were troublesome to build, and culverts of hollow logs were used sparingly, the natural course was to follow the ridges. This method of location provided for the most part better drained roads than were secured by following the lines of least resistance, or property lines, but it frequently necessitated the use of steep grades getting to the top of the ridges. Roads located on routes of natural drainage often went long distances out of the way to avoid crossing a creek or river. Such location, however, was a long step in advance of the principles followed previously. And to-day, with all our modern methods, materials and machinery, we will do well to keep the idea of natural drainage in mind.

The next factor in the development of the science of road location was the increasing use of wheeled vehicles. Previously most of the travel had been on foot and on horseback with only an occasional cart or wagon. But as wagons became more numerous, easier grades were found desirable. Steep grades continued to exist, however, but there was great improvement, due to the influence of wheeled vehicles.

## Surface Becomes a Factor

As traffic became heavier, the need for better kept road surfaces became more obvious. In order to avoid the formation of great gullies along the wheel tracks on steep grades, it became necessary to relocate the road around the hill instead of over it. Thus the requirement of a better surface came to be a factor in the location.

As the use of steel bridges became more common, it became possible to avoid the long detours formerly necessary when a large stream was encountered. The road could then follow a more direct course and often serve communities previously cut off from it. But the road must get to the bridge site somehow—and if the bridge were constructed at some other place than an old ford, a new stretch of road was necessary. Often the connection with a new bridge was made on a temporary location and was an awful example of "how not to do it." But occasionally the advantage of the hill was taken and good location was secured. Such an improvement made a lasting impression on the users of the road, and soon they began to relocate around other hills and to bridge other streams.

## Crooked Roads, Bad Grades

In the early development of the principles of road location, nearly all the factors tended to give crooked roads, with bad to fair grades, and of only sufficient width to enable two vehicles to pass by using the ditches. In many places these conditions still prevail to a considerable extent.

The conditions just described, however, are rapidly disappearing on the important highways of our state as well as throughout the country. While we have possibly been one of the most backward states in the matter of road building, we are at last recognizing the trend of the times and acting accordingly.

The effect of motor truck traffic has been to open our eyes to several needs, yes, even absolute necessities, in respect to our roads.

First, the coming of the automobile brought out the need of wider roads. We must be able to pass other vehicles without getting into the ditch. We must even be able to pass two other vehicles abreast on the main highway. We must also have a margin of safety in passing swiftly moving vehicles. These requirements mean wide roads.

Then we have found the need of better alignment. The shortest distance at which we are first able to see an approaching vehicle should not be less than 300 ft. Even with a sight distance of this length, two automobiles meeting at speeds of 25 miles per hour have only about four seconds in which to turn out and pass. Since the tendency is strong for both drivers to take the inside of curves, the actual sight distance allowed should be 600 ft. or more on the centre line of the road. To secure such a view as this of the road ahead requires long easy curves. When possible the curves should be so located that no buildings, high banks or cliffs stand close to the inside to obstruct the view. Since such buildings may be erected after the road is built, it is best to make the curve so flat that no building off the right-of-way can obstruct the view.

## Elimination of Grade Crossings

It is, of course, understood by road builders everywhere to-day that almost any feasible change of location should be made to eliminate railroad grade crossings. Counties can well afford to go to considerable expense to render an important highway free from these death traps. South Carolina certainly has its share of these, but it is very encouraging to see the great number that have been eliminated within the past two years. On one of the main highways in Laurens County, 15 grade crossings have been eliminated by merely relocating the highway. The same thing is being done elsewhere, though possibly on a smaller scale. In cases where grade crossings are unavoidable even by the relocation of the road or by the construction of bridges or under-passes, great pains should be taken to secure a location for the crossing that will give an unobstructed view of the track in either direction. The crossing should be as nearly as possible at right angles to the railway, for the same reason. The State Highway Department has established a ruling that on grade crossings constructed under its supervision, the road must make an angle of not less than 45 degs. with the railroad, both on account of the view and to prevent skidding when striking the track.

The tendency of the present is certainly toward better surfaces for our roads. This inevitably means that they must be so located as to secure easy grades. We cannot afford to build a hard surface on a road so steep that it would wash away on either side and undermine the surfacing. Motor truck traffic also demands that hard-surfaced roads have light grades on account of the load. A difference of 2 or 3% in grade can hardly be noticed on a road covered with 6 ins. of mud. But cover it with 6 ins. of concrete and a difference of ½ of 1% is noticeable. Thus, the location to-day must be

*Paper presented at the First South Carolina Road Institute, University of South Carolina.

made with a view to securing light grades. This does not mean, however, that it should be made absolutely flat. Money spent on cutting a grade below 1% had better be spent on building additional length of road.

### Routes Now Being Shortened

Present-day travel and traffic are not confined to neighborhoods nor even to counties, as was formerly the case. Long trips for both automobile and truck are common. This means that the roads must be as direct as possible. Although the neighbors did not complain when compelled to go half a mile out of the way by Mr. A's door, the people from the next town or next state much prefer to go straight and leave out Mr. A's house. This becomes important to the community also when an additional half-mile means an additional cost of $15,000 to $20,000, in the case of a hard-surfaced road. So strong is the tendency nowadays to locate on the shortest routes possible that sometimes good sized villages and even towns are left to one side of a main highway. In cases of small towns with narrow, crooked streets, it is doubtless for the best interest of the great majority of the users of the highway to miss the town and allow it to have a branch road into it.

Another effect of motor truck traffic is to require much heavier bridges. As is the case with the roads, bridges need also to be wider than formerly. In view of the high cost of such bridges, good location will eliminate as many bridges as consistent with good alignment, and will utilize such crossings as will make the cost of bridges a minimum.

The use of motor vehicles and the extension of travel beyond the bounds of local communities has had another marked influence on the location of highways. A few years ago a road was often located with but little or no regard to the roads of the adjacent counties or states. Sometimes one would hear it said, "If they want to come over here let them fix a way to get to our road." Now the case is different, except in rare instances. The road authorities in one county or state want to consult those in the adjoining county or state so as to ensure a suitable connection. Two counties will now issue bonds for a joint bridge between them, whereas a few years ago one would have feared the other would steal its trade.

A consideration of these factors, which have merely been touched upon, shows that much is involved in the selection of a proper location for a highway. The location should be made only after thorough study of all conditions pertaining to the road under consideration and by a man experienced in weighing the relative importance of the different factors.

### Chief Factors Affecting Location

The chief factors affecting road location are, in the speaker's opinion, the following, listed in the order of their importance: (a) Drainage; (b) grades; (c) alignment; (d) present and probable future traffic; (e) cost.

In these days when so many different kinds of culverts and bridges are being constructed, streams and surface water are not such obstacles to road building as formerly. In general, the location of drainage structures is made to suit the location of the road, particularly on important highways. Often, however, relocation of existing roads can be made, and certainly new roads should be located, so as to utilize desirable stream crossings and well-drained ground. One feature of location that is often neglected is that of following southern slopes of hills and providing for plenty of sunlight on the road. While we in this state are not hindered much by snow drifts and ice, we do suffer from mud holes caused by the road's being shaded all day long. Probably no other one thing can accomplish so much for a muddy stretch of road at the same cost as to cut off the shade or to relocate it on a southern exposure. This is, in effect, a form of drainage, since it helps to keep the road dry.

As indicated before, the matter of grades is of greater importance to-day than ever before. There is, however, nearly always in hilly country a conflict between good grades and good alignment. In many cases suitable grades and alignment can both be secured by a judicious use of curves, without seriously increasing the cost. In cases where the two cannot be combined at low cost, however, neither should be sacrificed for the other if the road is one of much importance. The only alternative then is more expensive construction, using heavy cuts and fills when necessary. The death of a single person, caused by a bad curve, would more than offset the saving of a few thousand dollars in cost Then, too, with an expensive type of surface and the maintenance through a long period taken into consideration, the ultimate cost of the road with good grades and straight alignment may be less than that of one with poor alignment or bad grades. The addition of 1 mile to the length of a road which carries an average of 10 motor vehicles per day costs the travelling public $3,650 additional per year, besides the extra cost of upkeep. This is equivalent to the interest on an investment of $73,000 at 5%. Hence, from a business standpoint, the public would be justified in such a case in spending a considerable sum to cut off the extra mile.

### Restriction of Loads Necessary

The location of a highway should also be made with due consideration to both present and future traffic. The amazing increase in volume of motor truck traffic and in the size of loads hauled within the past few years has upset many of our old ideas of road building and has shown us the necessity of looking to the future. It is equally important that we look to the future in our legislation so as to prevent unreasonable loads on the roads we are now building.

Along with the consideration of traffic requirements, present and future, arises the question of cost. In the past we were inclined to consider only present cost. We are beginning now to look forward to the cost of maintenance. County boards are now willing to spend thousands where formerly they hesitated about spending a few hundred. Sometimes our eagerness is so great for a smooth, hard-surfaced road, which so many people seem to think will last forever, that we are willing to spend far more than the traffic for years to come will justify. But regardless of the type of construction used at present, the location should be such as to provide efficient transportation at the lowest possible cost for maintenance. It is obvious, therefore, that there is need for thorough study of both present and future cost before we make final and fixed locations of our roads.

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The spring meeting of the American Society of Mechanical Engineers will be held May 24th to 27th, in St. Louis, Mo. There will be special excursions to Keokuk and Tulsa. At Keokuk the hydro-electric plant will be inspected, and at Tulsa, Oklahoma, the oil fields and refineries will be visited. The train for Tulsa will leave St. Louis May 27th. The Keokuk trip will be in advance of the meeting. The members will leave New York May 21st at 5.30 p.m., arriving in Keokuk May 23rd at 7.30 a.m.

In recommending to the House of Commons that a National Bureau of Standards should be immediately established, Hume Cronyn, of London, Ont., chairman of the Select Committee of Scientific and Industrial Research, said that the function of the bureau will be not only to do work similar to the Bureau of Standards at Washington, but also to assist in the development of the natural resources of Canada. First, said Mr. Cronyn, the bureau should be charged with the standardization of measures, including the standards of length, volume, weight, heat, electricity and other kinds of energy, and with seeing that the materials required in the construction of public works comply with the specifications; second, it should be charged with the organization and supervision of researches into such processes and methods as would assist in the development of natural resources, in the expansion of existing industries or furthering of new industries, and the utilization of materials formerly discarded as waste. "The establishment of such an institute will be a paying venture," declared Mr. Cronyn. "The need is pressing, the rewards to the country will be great and the expenditure proposed will be amply justified."

# New Brunswick's "Engineering Profession Act"

## Complete Text of Bill Passed by the New Brunswick Legislature and Signed by the Lieutenant-Governor of That Province—No Restrictions or Penalties to be Enforced for One Year After Passing of Act

FOLLOWING is the complete text of the "Engineering Profession Act" which was recently passed by the legislature of New Brunswick, and which has been signed by the lieutenant-governor of that province and will be fully enforced after a period of one year has elapsed:—

An Act to Provide for an Association of Professional Engineers of the Province of New Brunswick.—Be it Enacted by the Lieutenant-Governor and Legislative Assembly, as Follows:—

### Short Title

1. This Act may be cited as the "Engineering Profession Act."

### Interpretation

2. In this Act, unless the context otherwise requires, the following expressions shall have the following meaning:

(a) "Professional Engineer" means any person registered as a professional engineer under the Provisions of this Act.

(b) "Practices as a Professional Engineer" shall mean and include designing, laying out, and supervising in a professional capacity the construction, enlargement, alteration, improvement, and repair of public utilities, factories, industrial works, railways, bridges, tunnels, highways, roads, canals, harbors, harbor works, wharves, river improvements, light-houses, wet docks, dry docks, dredges, cranes, floating docks, and other similar works, steam engines; turbines, pumps, internal combustion engines, and other similar mechanical structures, air ships and aeroplanes, electrical machinery and apparatus, chemical and metallurgical machinery and works for the development, transmission or application of power, mining operations and apparatus for carrying out such operations, municipal works, irrigation works, water works, water purification plants, sewerage works, sewage disposal works, drainage works, incinerators, hydraulic works, and all other engineering works.

(c) "The Association" means the Association of Professional Engineers of the Province of New Brunswick hereby incorporated;

(d) "Council" means the Executive Council of the Association;

(e) "President" means the President of the Association;

(f) "Registrar" means the Registrar of the Association;

(g) "The Secretary" means the Secretary-Treasurer of the Association;

(h) "Board" means the Board of Examiners of the Association;

(i) "Registration" means the admission of a person to membership in the Association and the enrolment of his name in a book of registry known as the "Register."

### The Association

3. (a) All persons registered as members under the Provisions of this Act shall constitute the Association of Professional Engineers of the Province of New Brunswick, and shall be a body politic and corporate with perpetual succession and a common seal;

(b) The Head Office of the Association shall be at the City of St. John.

4. The Association shall have power to acquire and hold real estate for the purposes of the Association, and to alienate, mortgage, lease, or otherwise change or dispose of such real estate or any part thereof as occasion may require; and all fees, fines and penalties receivable and recoverable under this Act shall belong to the Association.

5. The Association may make by-laws not inconsistent with the provisions of this Act for:

(a) The discipline and honor of the profession, and the discipline and practice of the members;

(b) The management of its property;

(c) The levying and collecting of annual and other fees;

(d) The examination and admission of candidates;

(e) The filling of vacancies in the Council of the Association and the acceptance of resignations therefrom;

(f) All other purposes pertaining to the management of the Association.

6. All by-laws and amendments thereto shall become effective only after ratification by two-thirds of the votes received from members of the Association in good standing.

### Who May Practice

7. (a) Only those persons who are members of the Association hereby incorporated and registered as such under the provisions of this Act, or who have received a license from the Council of the Association as hereinafter provided, shall be entitled to take and use the title of "Professional Engineer," or any abbreviation thereof, or to practice as a professional engineer within the Province of New Brunswick;

(b) Any person residing in the Province of New Brunswick at the time of the passing of this Act, who has practiced engineering for at least six, (6), years preceeding the date of his application, and who during that period has had charge of engineering work, or has been employed as an assistant on engineering work for at least two, (2), years shall be entitled to be registered as a member of the Association without examination, provided that such person shall produce to the Council within one year from the passing of this Act satisfactory proof of having so practiced. In case of a graduate in engineering from a University or College recognized by the Council, the period of engagement in engineering work required by this section shall include his prescribed term of instruction in such college;

(c) Any person who shall come hereafter to reside in the Province of New Brunswick, and who at the time of his so coming to reside in this Province is a duly registered member of an Association of engineers of some other Province in the Dominion of Canada, with a constitution similar to the Association hereby incorporated may upon application be registered as a member of this Association without payment of fee for the then current year; provided that he produce to or file with the Council a certificate of membership in good standing in said other Association and an application for transfer of registry endorsed by the registrar or other proper officer of said other Association;

(d) Any person residing in the Province of New Brunswick not qualified as hereinbefore mentioned, and who may desire to become registered as a member of the Association, may make application to the Council, and shall submit to such examination as the Council may require, or shall submit such other proof of qualification in lieu of an examination as the Council may decide, and such person shall be registered as a member of the Association on payment of the prescribed fees after the Council shall have certified in writing that such examination has been satisfactorily passed, or that such other proof has been found satisfactory. If the applicant be a graduate in engineering of the University of New Brunswick or other college or standing recognized by the Council, he will not be required to submit to a written examination, but the applicant will be required to give the necessary proof as to his other qualifications as required by this act.

(e) Any non-resident of the Province of New Brunswick who is a registered member of an Association of Engineers in any other Province of the Dominion of Canada, hav-

ing a constitution similar to the Association hereby incorporated, may obtain from the registrar a license to practice as a professional engineer in the Province of New Brunswick upon application to the registrar for that purpose, and upon production of satisfactory evidence of his being a registered member in any such other Association, and on payment of a fee of one dollar. Such license when so issued shall entitle said person to practice as a professional engineer in New Brunswick during the then current year.

Upon submitting the evidence required by this subsection, and upon payment of the said fee, said person shall be entitled to practice as a professional engineer in New Brunswick pending the disposal of said application;

(f) Any person who is not a resident of Canada, but who is a member of any engineering or technical organization or society of standing recognized by the Council, may obtain a license to practice subject to the like qualifications as are required for registration under section 17 of this Act, and any person who is not a resident of New Brunswick, but who is a member of any said engineering or technical organization or society of standing may act in an advisory or consultative capacity without a license;

(g) Any non-resident of New Brunswick who is employed as a professional engineer by a public service corporation, a public utility, Government department, or private corporation, the work of which is normally carried on in the Province of New Brunswick, and also in some other Province or Provinces of Canada, and who by reason of his said employment is required to practice as a professional engineer in New Brunswick, may so practice in New Brunswick without holding a license and without payment of any fee, providing said person on demand produce proof satisfactory to the Council that he is a registered member of an Association of engineers of some other Province of Canada having a constitution similar to the Association hereby incorporated. It shall be the duty of such person to produce such proof of membership whenever so required by the Council;

(h) Any engineer who is a resident of some other Province of Canada in which there is no Association of engineers having a constitution similar to this Association, may obtain a license to practice subject to the discretion of the Council;

(i) An assistant working under the direct supervision of a professional engineer and not taking the responsibility for his work other than to his direct superiors, shall not be deemed to be practicing as a professional engineer when so engaged;

(j) Any person who has served in His Majesty's Military, Naval or Aerial forces or in those of any of His Allies during the late war and who, previous to entering the said service, had been practicing as an engineer in Canada, shall be entitled to be registered as provided for by section 7 sub-section (b) of this Act notwithstanding want of residence, and such service in said Military, Naval or Aerial forces shall be counted as engineering practice;

(k) Any engineer not a resident of Canada who is employed by any Public Utility Corporation and who by reason of his employment in the operation of said Corporation is required to practice in New Brunswick, may obtain a license to so practice at the discretion of the Council.

**Partnership**

8. When two or more persons carry on practice as professional engineers in co-partnership, only such members as are registered or licensed under this Act shall perform the duties of a professional engineer. A firm as such cannot be deemed to be a member of the Association or be licensed to practice.

**Administration**

9. (a) The management of the Association shall be vested in an Executive Council which shall consist of a president, vice-president, and such number of elected Councillors as may be from time to time fixed by by-law of the Association, not in any case to exceed fifteen in number. Only members in good standing shall be eligible for election to the Council;

(b) The president shall be elected annually and shall hold office until his successor is elected. He shall act as presiding officer at the meetings of the Council and the Association, voting only when the votes are evenly divided. On retirement he shall hold office as councillor for the next year;

(c) The vice-president shall be elected annually and shall have all the powers of the president during the absence of the latter;

(d) The full number of councillors so fixed by by-law shall be elected at the first general meeting. The councillors to the number of one-third receiving the largest number of votes shall hold office for three years. The Councillors to the number of one-third receiving the next largest number of votes shall hold office for two years, and the remaining one-third shall hold office for one year. At each annual meeting after the first, councillors to the number of one-third the number so fixed by the by-law shall be elected;

(e) The registrar and the secretary shall be appointed by the Council. The same person may be appointed to the office of both registrar and secretary;

(f) The secretary of the Association shall also be the secretary of the Council.

10. (a) The Council may on a two-third vote of all the members of Council reprimand, suspend or expel from the Association any member guilty of unprofessional conduct, negligence or misconduct in the execution of the duties of his office, or convicted of a criminal offence by any Court of competent jurisdiction.

The Council shall not take any such action until a complaint under oath has been filed with the registrar and a copy thereof forwarded to the person accused. The Council shall not suspend or expel a member without having previously summoned him to appear to be heard in his defence, nor without having heard evidence under oath in support of the complaint and on behalf of the member charged if offered. The Council shall have the power to summon witnesses to attend and to answer under oath concerning the matter of the said enquiry. The president of the Council or any person acting in his behalf on the hearing of the said charge, or the secretary, is hereby authorized to administer oaths in such case. All evidence given shall be taken down in writing or by a stenographer duly qualified and sworn for the purpose;

(b) Any member so expelled or suspended may within thirty days after the making of the order of expulsion or suspension, appeal to a judge of the Supreme Court from such order, giving seven days' notice of appeal to the secretary of the Council, who shall thereupon file the evidence so taken to be filed with the registrar of the Supreme Court, whereupon such judge shall decide the matter of appeal upon the evidence so filed, or may in his discretion hear additional evidence, and shall confirm or set aside such order of expulsion or suspension, and the order of the said judge shall be final. The costs of such appeal shall be in the discretion of the said judge;

(c) Unless the order of expulsion or suspension is set aside on such appeal, or the said judge or the Council otherwise order, the member so expelled or suspended shall not practice thereafter except in case of suspension upon expiry of the period of suspension. Pending an appeal, the members so expelled or suspended may practice.

**Penalties**

11. Any person who not being a registered or licensed professional engineer in New Brunswick, or who is suspended or has been expelled under the proceedings of the next preceding section:

(a) Practices as a professional engineer, or

(b) Uses the title of professional engineer or makes use of any abbreviation of any such title, or of any name, title or designation which may lead to the belief that he is a professional engineer or a member of the Association, or

(c) Advertises himself as such in any way or by any means, or

(d) Acts in such manner as to lead to the belief that

he is authorized to fill the office of or to act as a professional engineer,

shall be liable upon summary conviction to a fine of not less than $100.00 nor more than $200.00 and costs, and on failure to pay the same, to imprisonment for not more than three months for the first offence, and for any subsequent offence to a fine of not less than $200.00 and not more than $500.00 and costs, and on failure to pay the same to imprisonment for not more than six months.

### Registration

12. It shall be the duty of the registrar to enter in the register the name of each person entitled to practice as a professional engineer. He shall keep his register correct in accordance with the provisions of this Act and of the rules, orders and regulations of the Council. The certificate of the registrar under the seal of the Association shall be prima facie evidence of registration or license as the case may be.

### Examinations

13. A board of examiners shall be appointed annually by the Council, and such other special examiners as may from time to time be found necessary.

14. The board shall examine all degrees, diplomas, certificates and other credentials presented or given in evidence for the purpose of obtaining registration or license to practice if referred to them by the Council, and may require the holder of such degree, diploma, certificate or other credential to attest on oath viva voce or by affidavit concerning the matter of his application.

15. (a) Examinations of candidates for registration or license shall be held as often and at such places as the Council may direct;

(b) The scope of the examinations and the methods of procedure shall be prescribed by the Council;

(c) The candidate shall submit to examination in one or more of the recognized branches of engineering, such branch or branches to be selected by the candidate;

(d) As soon as possible after the close of such examination, the board shall make and file with the secretary a certificate stating the result of such examination, whereupon the Council shall notify each candidate of the result of his examination and of their decision upon his application;

(e) A candidate failing on examination may after an interval of not less than six months be examined again;

(f) The Council shall from time to time prescribe the fees payable by candidates for examination.

16. The Council shall have power conjointly with the Council of any Association in one or more of the other Provinces of Canada, to establish a central examining board and to delegate to such central examining board all or any of the powers possessed by the said Council respecting the examination of candidates for admission to practice, provided that any regular examination conducted by such central examining board shall be held in one place at least within this Province.

17. Notwithstanding any other provision of this Act, no person shall be registered unless he is at least twenty-three years of age and unless he has been engaged for at least six years in some branch of engineering, or unless he has been engaged for at least two years as a Professor of Engineering in a college of engineering recognized by the Council, provided however that in the case of a graduate from an engineering college recognized by the Council the period of engagement in engineering work required by this section may include his prescribed term of instruction in such college.

18. The registrar shall issue a certificate of registration to all professional engineers registered under this Act, and to any person entitled to a certificate under this Act, upon instructions from the Council, and upon payment of the prescribed fees. Such certificate shall be signed by the president and by the registrar and bear the seal of the Association, and shall also specify the branch or branches of engineering in which the professional engineer has been examined or otherwise accepted.

19. The registrar shall issue a license to practice to any person entitled thereto upon payment of the prescribed fee. Such license shall specify the period for which the same is issued, but in no case shall said period extend beyond the end of the calendar year in which said license is issued.

20. (a) Each person who is registered to practice shall on or before the first day of January in each year, pay to the secretary-treasurer or to such other person as may be deputed by the Council to receive same, such annual fee for the ensuing year as may be determined by the by-laws of the Association. Such fee shall be a debt due by said person to the Association and may be recovered with costs of suit in the name of the Association in any court of competent jurisdiction;

(b) If any person registered under this Act omit to pay the prescribed annual fee for six months from the date upon which it became due, and after notice, the registrar shall cause the name of such person to be erased from the register, and such person shall thereupon cease to be deemed to be a professional engineer, but such person shall at any time thereafter upon payment of all fees in arrear be entitled to all his rights and privileges as a professional engineer from the time of such payment;

(c) Any person registered under this Act may resign from membership in the Association upon giving notice in writing to the secretary, whereupon the name of the said member shall be erased from the register, and such member shall be relieved of the liability for further annual fees.

21. In case the Council neglect or refuse to register the name of any person as a member of the Association, or to issue a license to practice, the person aggrieved shall have the right to apply to a judge of the Supreme Court, who, upon due cause shown, may make an order directing the Council to register the name of such person or to grant to such person a license to practice, or make such other order as may be warranted by the facts, and the Council shall forthwith comply with such order. Such order when so made shall be final.

22. If the registrar makes or causes to be made any willful falsification in any matters relating to the register, he shall forfeit the sum of $100.00.

23. If any person shall willfully procure or attempt to procure himself to be registered or licensed under this Act by making or producing or causing to be made or produced, any false or fraudulent representation or declaration, either verbally or in writing, every such person so doing, and such person knowingly aiding and assisting him therein, shall forfeit and pay the sum of $100.00.

24. Any and all penalties imposed under this Act and any and all sums of money forfeited shall be recoverable with costs under the provisions of the law respecting Summary Convictions.

25. Any information for the recovering of any such penalty or forfeiture may be laid by any member of the Association or by any person appointed by the Council.

26. Any sum recovered as a penalty or forfeit under this Act shall upon being recovered belong to the Association for the use thereof.

27. No proceeding shall be commenced for any violation of the provisions of this Act but within one year from the date of such violation.

28. No person practicing as a professional engineer shall be entitled to recover any charge in any court of law for any service included within the practice of a professional engineer as defined in section 2, sub-section (b) of this Act unless he shall be registered under this Act.

29. The following persons are hereby constituted a Provisional Council of the Association: President—Charles C. Kirby, of the city of St. John; vice-president—Geoffrey Stead, of the town of Chatham; councillors—R. Fraser Armstrong, of the town of Woodstock; Collingwood B. Brown, of the city of Moncton; Burton M. Hill, of the city of Fredericton; David F. Maxwell, of the town of St. Stephen; R. J. Sandover-Sly, of the town of Campbellton; Alexander R. Dufresne, of the city of St. John; Charles O. Foss, of the city of St. John; Joseph A. Grant, of the city of St. John; Gilbert G. Murdoch, of the city of St. John.

30. The duties of the Provisional Council shall be to provide the register called for by this Act, to enter therein the names of those who are entitled to registration, and who apply therefor under the provisions of section 7, sub-section (b), and to call within six months from the coming into force of this Act the first general meeting of the Association for the said purposes; and for the purposes of organization of the Association they shall have the powers conferred by this Act on the Council of the Association. The powers of the said Provisional Council shall cease on the election of the first regular Council of the Association.

31. No provision of this Act restricting the practice of the profession or imposing penalties therefor shall take effect until one year after the passing of this Act.

32. Every person registered under this Act may have a seal, the impression of which shall contain the name of the engineer and the words "Registered Engineer, Province of New Brunswick," with which he may stamp all official documents and plans.

33. The activities of the Association are hereby restricted to the functions necessary to the administration of this Act.

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## NEW DEVELOPMENT IN SURFACE-TREATED CONCRETE AND STUCCO*

By J. C. Pearson and J. J. Earley

THE joint authorship of this paper requires a word of explanation. The writers have been closely associated by their membership on the Advisory Committee of the Bureau of Standards' stucco investigation, and on the Committee on Treatment of Concrete Surfaces of the American Concrete Institute. Both residing in Washington, they have had an unusual opportunity to study and discuss the results obtained from the experimental work of the Bureau in concrete and stucco, as well as those from Mr. Earley's work in connection with his contracting business. These discussions often led to the consideration of possibilities somewhat beyond the range of established practice, and, in fact, beyond the limitations of established theories relating to the gradation and proportioning of the ingredients of mortar and concrete.

It was therefore natural that ideas were conceived which were too visionary to be of use to any committee, but nevertheless deemed worthy of further investigation on the writers' own account. If these ideas proved to have no value, no one would be the loser; if they did amount to anything, the results would be a contribution to our knowledge of stucco and concrete.

### Scientific Combination of Particles

Hence it is a matter of some gratification to the authors to be able to describe these new developments in the treatment of concrete surfaces, the success of which is due largely to scientific studies of the behavior of combinations of various sized particles, and the development of a technique adequate for the molding of these combinations of particles in any desired form and place.

Studies of the experimental stucco panels at the Bureau of Standards led to the general conclusion that by adherence to well established practice, structurally sound and durable stucco could be secured, but that a great deal could be, or ought to be, done to improve its appearance. Crazing and map cracking are common to most stuccos, and are especially objectionable on surfaces of fine texture; the monotony of the cold grey cement color is objectionable, and is only partially relieved by the use of white cement and mortar colors; and finally the muddy appearance (due to cement, or cement and pigment; being too much in evidence) is objectionable from an artistic standpoint.

Consideration of these matters suggested at once the use of less cement, and it became evident that by efforts in this direction improvement in appearance might be obtained. The apparently insurmountable obstacle to this departure from usual practice was, of course, the lack of plasticity in the leaner mixtures. Various methods of overcoming this difficulty were considered, and some experiments were made which indicated that a real improvement might be obtained by substituting fine inert material for a portion of the cement.

The easiest way to accomplish this result seemed to be by using blended cements, that is, normal cements ground with a certain percentage of sand, stone-screenings or other suitable materials. These experiments were never carried very far, however, for it did not seem possible that any method which might be devised for retaining plasticity could bring about the desired result, viz., the elimination of all objectionable features mentioned above.

### Lean Mixtures Successfully Applied

Serious as was this lack of plasticity in the lean stucco mixtures, it was after all, something that could be overcome by work. This was demonstrated by the fact that mixtures as lean as one part cement to six parts of stone screenings were applied on some of the Bureau of Standards panels, with excellent results. But the improvement in these panels as compared with some of the easier working combinations did not seem great enough to justify the increased cost of application. The question finally arose whether by careful attention to gradation of the aggregates this improvement in appearance might not be so enhanced that the cost would be a secondary consideration.

This idea came from the fact that Mr. Earley had succeeded in making complicated casts of concrete from specially graded aggregates in such manner that a very large percentage of the area of the treated surface (first wire brushed and then washed) was aggregate, and a very small percentage cement. Possibly due in part to the higher reflecting power of the surfaces of the exposed aggregates, the color of the concrete surfaces thus produced was determined almost wholly by the color of the aggregates, and only very slightly affected by the cement itself. A most convincing demonstration of this fact was obtained by constructing two concrete slabs containing exactly the same proportions of specially graded aggregate, the one being mixed with gray cement, the other with white cement. After the surface treatment of brushing and washing had been applied, only an expert could have determined which slab contained the grey cement and which the white.

To digress still further for a moment, this method of obtaining permanent and very pleasing colors in concrete surfaces is such an important item in the development of the processes here described, that it is worthy of fuller explanation. Before color in concrete surfaces can be under artistic control, a technique must be developed which has for its medium the elements of the concrete itself.

Although in problems involving appearance aggregate is by reason of its greater bulk the major element, and cement the minor, it is, nevertheless, the color of the cement which is the natural color of normal concrete. The reason for this is that the cement is finely ground and deposits itself, paint-like, over the surfaces of the aggregates and colors the whole mass.

### Aggregate Deposited in Surface

If, therefore, concrete is to receive its color from the cement paste, variation must be obtained by the addition of pigments to the cement following the well-established practice of mixing paints; but if the aggregate is to be the source of color, the concrete must be so designed and manipulated as to deposit in the surface the greatest possible amount of aggregate.

Any great degree of success can hardly be expected in coloring concrete through the cement. The choice of colors is restricted by chemical reaction with the cement, which causes them to fade or change; depth of color is restricted by strength requirements of the concrete, which limits very closely the amount of pigment which may be added to the cement. Therefore, with the choice of color limited by one requirement and the depth of color by another, the cement itself must remain dominant.

*Excerpts from paper presented to the American Concrete Institute.

On the other hand, in coloring concrete through the aggregate all such restrictions are removed, and colors may be obtained from white to black through all the range of possible aggregates. An examination of drawings done in hard pastelles and of paintings of the impressionist school suggests a technique in coloring which is peculiarly adaptable to the coloring of concrete by means of aggregate. In the pastelles, tones are produced by hatching and cross-hatching with lines of pure color without blending on the surface of the drawing; in the paintings, by spotting with pure colors one beside the other, and without blending. In both cases the tones are effected by the blending of the light rays reflected from the picture to the observer. Wonderful depth and clarity of tone are characteristics of this school of coloring, and in it are to be found a great deal of exact knowledge and valuable precedent.

When this knowledge is translated in terms of concrete aggregates, it is obvious that if the aggregates are carefully selected and carefully placed, all the elements are present for the successful coloring of concrete surfaces. The results obtained in practice bear out the theory given above, and there is every reason to believe that the aggregate is the proper source of color for concrete.

### Plasticity Practically Ignored

Hence it was a most important conception that a similar result might be obtained with stucco. The success of this depended, first, upon securing a suitable gradation of the stucco aggregate, and, second, upon being able to apply such a mixture, once it were satisfactorily compounded. It was known at the outset that these mixtures would be harsh, therefore, plasticity no longer played any part in the calculations.

The laboratory program was fairly simple. The plan consisted simply in working first with concrete mixes in miniature, in which the sizes of cement particles, sand particles and coarse aggregate particles were reduced from the normal sizes in the ratio of about 1: 10, this being taken as the approximate ratio of the size of particles passing a No. 8 sieve to pebbles one inch in diameter. It was assumed that the density of such mixes would depend mainly on relative sizes of the component particles, with due allowance for the water content. If these mixes appeared to be satisfactory for the purpose, it was assumed that any reduction within the 1: 10 ratio would also be satisfactory, and the actual reduction to be employed in compounding any given stucco mixture of this type would be as slight as the requirements of texture and the difficulties of application would permit.

To make a long story short, these experiments in the laboratory with the miniature concretes were very successful. Not the least important part of the laboratory work was the microscopic examination of the structures of these little concretes, which yielded many valuable suggestions for the gradation in size of particles, and for the proper proportions of the various sizes, to yield the desired effects in the treated surfaces.

### New Stucco Applied Commercially

The first attempt to apply the new product to a vertical wall was not wholly discouraging. Small areas were treated successfully, and eventually a terra cotta tile pent house on one of the new laboratories of the Bureau of Standards was coated with the exposed aggregate stucco. This example, while not as free from imperfections as the more recent work, has attracted most favorable notice.

Fortunately, the mechanics who were selected for this work developed a real interest in the new type of finish, and subsequently a pride in the results of their work, which made for very rapid progress in the development of the methods of application and treatment. New requirements in thoroughness of mixing, consistency, and control of the absorption of the undercoats were met, and other improvements in the general process were gradually introduced as essential parts of the routine. Not all of the problems have been solved, but there has been very gratifying progress in the comparatively short time that the new stucco has been applied commercially.

The new type of exposed aggregate finish can not fail to arouse new interest in stucco as a product, regardless of the nature and treatment of the finishing coat. The product should be more widely used, and the reason it is not more widely used is that it has too often been applied by contractors or mechanics who consider it only as an outside plaster. This paper has attempted to convey the impression that cement stucco is more like concrete than plaster, and that plasticity is not essential. The point the writers wish to emphasize is that the art of applying durable stucco is very different from the art of plastering, and in their opinion, stucco will take the place it deserves among building products only when this fact is generally recognized.

## JUDGE FINES CITY OF HULL

JUDGE CHAUVIN has delivered judgment in the case of the Quebec Board of Health vs. the city of Hull, Que. He fines the city $200 for neglecting to obey the board's orders to instal a filtration plant. "Regarding the merits of filtration and chlorination," said the judge, "I am not here to discriminate, and further, it is not in my jurisdiction to do so. The defence has raised the point of its inability to pay the cost of a filtration plant, the approximate cost as estimated being in the neighborhood of $400,000. I find, after a careful study of the figures produced, that the finances of the city were able to obtain the amount required, as the government would give the necessary authority to borrow the money." The instructions given to the city of Hull by the provincial board, said the judge, were "perfectly in its jurisdiction," and the city should have obeyed the order. He commented on the fact that the Hull water was unfit to drink in 1915 and that a chlorinator was not installed until 1916.

## STEAM RESERVE FOR ONTARIO HYDRO

ESTIMATES and plans are being prepared by the engineers of the Hydro-Electric Power Commission of Ontario for a steam reserve plant, which will be located in Toronto, Hamilton, Windsor or Niagara Falls. The plant will require 15 or 20 acres, and negotiation will be conducted with the above cities before decision is made regarding location. Sir Adam Beck states that the first unit of the plant will generate 50,000 h.p. and will turn over by the fall of 1921.

## MAY DELAY QUEENSTON-CHIPPAWA DEVELOPMENT

DEMANDS for greatly increased wages have been presented to the Hydro-Electric Power Commission of Ontario by the laborers on the Queenston-Chippawa power canal. The officials of the commission have vainly endeavored to effect a settlement, and declare that it is impracticable to meet the demands A mass meeting of the workmen is to be held to-night and a strike vote will be canvassed.

Large extensions are being made at the Angus shops of the Canadian Pacific Railway Co. These extensions will add 250,000 sq. ft. to the available floor area and will cost approximately $1,000,000.

Announcement has been made of the reorganization of the Rust Engineering Co., of Pittsburgh, which is represented in Canada by F. H. McKechnie, of Montreal. The partnership formerly existing between S. M. Rust, of Pittsburgh, E. J. L. Rust, of Birmingham, and E. M. Rust, of Washington, has been dissolved and three separate firms have been incorporated, viz., the Rust Engineering Co. of Pittsburgh, the Rust Engineering Co. of Birmingham and the Rust Engineering Co. of Washington. The three former partners will form the majority of the directorate of each of the three companies.

## OPERATING DATA ON LARGE SHOVELS AT QUEENSTON DEVELOPMENT

By L. C. McLure

RECORDS made in excavating the Queenston-Chippawa power canal by the Hydro-Electric Power Commission of Ontario have fully shown the value of large electric shovels. Over 20,000 cu. yds. of earth and rock are removed daily in digging this canal, the major portion of this being accomplished by means of three 8-cu. yd. electric shovels.

Not only have the volume records indicated the success of these shovels—which, by the way, are the largest in the world—but the operating economies have also proved conclusively the value of this equipment.

The operating economies were found by making a thorough test on shovel No. 1 while being used as shown in Fig. 1. This Bucyrus shovel is of 300 tons weight, has a 90-ft. boom, uses either 5, 6 or 8-cu. yd. bucket, and works on a 40 to 50-second cycle of operation. There are four Westinghouse 440-volt, 3-phase, 25-cycle motors in this shovel, used as follows: Two 250-h.p. motors for hoist; one 150-h.p. motor for thrust; and one 150-h.p. motor for swing. The controllers are of the master-switch, magnetic type, and the

RESULTS OF TEST ON WORLD'S LARGEST ELECTRIC SHOVEL, QUEENSTON-CHIPPAWA POWER DEVELOPMENT

| | |
|---|---|
| Total yards, whole test | 24,706.5 |
| " " day work only | 15,380.0 |
| " " day and night | 9,326.5 |
| Kilowatt-hours, whole test | 20,436.0 |
| " " day work only | 12,216.0 |
| " " day and night | 8,220.0 |
| K.w.h. per yard, whole test | 0.826 |
| " " day work only | 0.794 |
| " " day and night | 0.882 |

whole operation is handled by two men. This shovel was working 90 ft. below the surface and loading material on cars approximately 70 ft. above its own base when the photograph reproduced in Fig. 1 was taken.

Tests were made with a graphic wattmeter connected in the 4,000-volt circuit near the shovel. A high-speed clock in the meter allowed the chart paper to pass the pen at the rate of about 5.5 ins. per minute. Fig. 2 is a typical load

FIG. 1—BUCYRUS SHOVEL WORKING AGAINST 90-FT. CLIFF DURING POWER-CONSUMPTION TEST

curve of the shovel taken while loading three trains during one morning of the test. A check was made against the chart by noting the starting time of each operation during the entire test. The test covered a period of seven days, work being done only during the day for the first five, and both day and night for the last two.

From the accompanying table it is seen that the power required for each cubic yard dug and lifted 70 ft. and loaded into a car, was approximately 0.8 kw.-hr.

The graphic chart shows the energy consumption under actual working conditions and gives an accurate figure for energy consumption per cubic yard excavated. Fifty seconds were required to make the entire cycle. During this period a maximum power demand of 800 h.p. was reached. The average was 320 h.p. for the entire cycle.

An interesting feature of the operation of these shovels is the fact that regenerative braking is utilized whenever possible. In this particular instance it is used when the

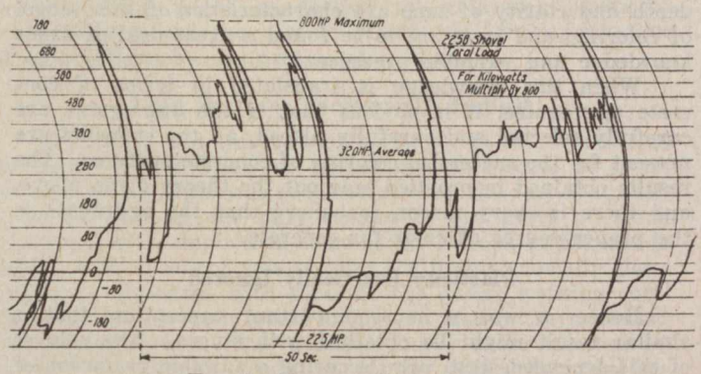



FIG. 2—TYPICAL LOAD CURVE

shovel is lowered the 70 ft. after it has been raised that distance in order to load the cars. This is accomplished as follows: When the operator is ready for the bucket to come down, the motors are connected to the power supply and the bucket falls with the motors running at slightly above synchronous speed. When such a condition is reached, the motors operate as induction generators. Although, as can be seen from the curve, some energy is generated and pumped back into the line, this item is not the main feature of this operation. This method of lowering saves mechanical wear and tear, as the brakes are required only for stopping and holding the bucket, requiring less repair work and making the whole equipment more reliable.

## SUMAS LAKE RECLAMATION PROJECT

*(Continued from page 460)*

elevation of 25 feet above ground level. Exterior dykes will have a crest width of 8 feet and slopes 2 to 1 on the water side and 2½ to 1 on the land side.

It is estimated that the project will cost $1,800,000, or an average of $60 per acre capital charge.

The 10,000 acres of land lying in the bed of Sumas Lake will be sold and the proceeds used to reduce the capital charge, and it is confidently hoped that these rich lands will bring $150 per acre, thus liquidating the capital cost.

The British Columbia government are acting as trustees for the district, and the project is handled under the land settlement board, department of agriculture; E. D. Barrow, minister of agriculture.

The project was first mooted in 1872, and has been exploited many times since that time, but owing to lack of security it has been found a difficult matter to interest private capital.

This wonderfully rich area lying at the very gate of Vancouver—the Pacific port of Canada—will at last be brought under cultivation, adding millions to the wealth of the province of British Columbia, and developing a valley that will in a short time become the "Garden of Western Canada."

Thomas Adams, town planning adviser to the Dominion government, spoke last evening on housing and town planning at a mass meeting in the City Hall, Toronto.

# The Canadian Engineer

Established 1893

*A Weekly Paper for Civil Engineers and Contractors*

**Terms of Subscription, postpaid to any address:**

| One Year | Six Months | Three Months | Single Copies |
|---|---|---|---|
| $3.00 | $1.75 | $1.00 | 10c. |

**Published every Thursday by**

**The Monetary Times Printing Co. of Canada, Limited**

President and General Manager JAMES J. SALMOND — Assistant General Manager ALBERT E. JENNINGS

**HEAD OFFICE: 62 CHURCH STREET, TORONTO, ONT.**

**Telephone, Main 7404. Cable Address, "Engineer, Toronto."**

Western Canada Office: 1206 McArthur Bldg., Winnipeg. G. W. Goodall, Mgr.


PRINCIPAL CONTENTS



## ALUMINA IN MECHANICALLY FILTERED WATER

EXHAUSTIVE work carried out in the laboratories of the Toronto filtration plant appear to indicate that it is impossible to remove completely decomposed alum from mechanically-filtered water. The experiments undertaken involved the examination of numerous samples of mechanically-filtered water, and both artificial and practical tests were embodied in the research work. All samples showed a positive alumina reaction. In the laboratory tests it was observed that six thicknesses of the most sensitive filter paper temporarily decreased the reaction, but as saturation became complete and the negative charges of the filter paper became neutralized, alum passed through freely.

The contention that colloidal alumina cannot be removed from the effluent of mechanical filtration plants was seemingly proven in a most illuminating manner when a solution of the positive colloid, methylene blue, was passed through filter papers and identical results obtained. Variations in the rate of filtration produced no differences in the reaction.

At present there is probably no more complex study in chemistry than that of colloids. Sanitary engineers and chemists, particularly those engaged in the purification of water supplies, will read with much interest the article by Messrs. Howard and Hannan on page 461 of this issue.

The whole question of the ultimate fate of decomposed alum, or the actual form which it finally takes, is largely a matter of conjecture. Sanitarians seem to be satisfied, however, that whatever the nature may be which it finally assumes, the ultimate product is harmless. No doubt the opinion expressed by the authors of the valuable article above mentioned, that residual alum cannot be completely removed, will not be accepted by all water engineers and chemists, but it at least appears to have been clearly demonstrated that its removal from the Toronto water is impossible unless further knowledge of the subject becomes available. However, the subject is being by no means abandoned by the laboratories of the Toronto filtration plant. The active research work that has been carried out for the past nine years by the city of Toronto in these very efficient laboratories is being continued, and the study of the colloidal properties of aluminium will be one of the many highly technical problems which will be further investigated.

## GEN. CURRIE AND McGILL UNIVERSITY

IN an "Associated Press" despatch from Montreal it is stated that Gen. Sir Arthur Currie, inspector-general of the Canadian forces and formerly commander of the Canadian Corps in France, has been offered and has accepted the appointment as principal of McGill University. No official announcement has as yet been made by the authorities of the University, but it is stated that the Board of Governors met last Monday to consider the matter.

If confirmed, this appointment will create a precedent, as Gen. Currie is not a graduate of any university, although he had an education which qualified him as a teacher in a high school in British Columbia, which position he held for six years before entering the real estate business. This was, of course, long before he found his real metier as a soldier.

Gen. Currie's appointment would undoubtedly be immensely popular and of distinct advantage to McGill University, not only because of his military record, but also because of his business and executive ability, his commanding personality, his talent as a speaker and a writer, and the warm place which he occupies in the hearts of the Canadian public, who will long remember his valiant, indefatigable services during the war.

The Board of Governors of McGill University cannot possibly make any other appointment that would meet with the general approval that will be shown throughout Canada if the newspaper announcement is officially confirmed. They are to be congratulated if Gen. Currie has agreed to accept the position, for they will have secured the services of one of the greatest characters in Canada's history; and Gen. Currie also is to be heartily congratulated, for the prestige of McGill is great, and his election as its head will be second to no other honor that he has yet received, many though they have been.

# Letters to the Editor

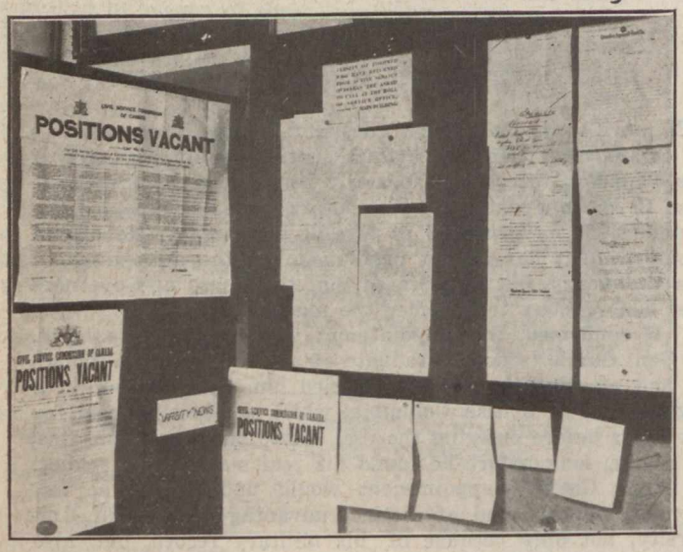
## BIG DEMAND FOR ENGINEERS

Sir,—I was much interested in reading amongst the "Letters to the Editor" in your number of the 15th April, a letter from Mr. Heywood, of the Toronto Harbor Commission's staff, commenting upon my recent address to the High School teachers of Ontario, extracts from which you published in the same number.

Two extracts from my address were selected by Mr. Heywood and quoted in his letter, which, as I remember, are correctly reported. Taking these, to which he makes objection, I do not think that anyone who has vision for the development of Canada in her great resources both material and human, can deny that there is a future for our young men in those pursuits "wherein applied science and engineering knowledge and ability are required." If we are to keep our young men in Canada—and we all want this, I am sure—we must educate the right type and educate them properly, and that is why I said in my address that "a special effort should be exerted to direct the proper type into these professions."

Mr. Heywood considers that the statement is incorrect and misleading wherein I said that "Fear that various branches of the engineering profession may become over-

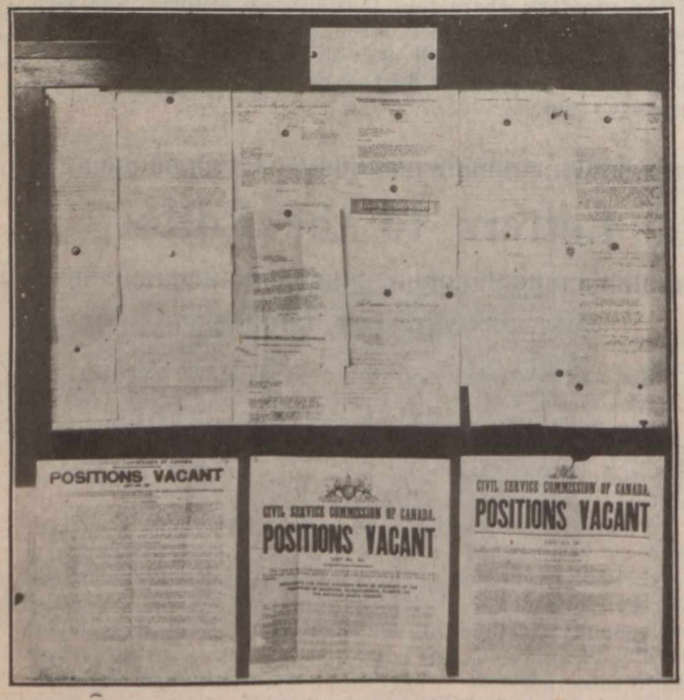
crowded need not be seriously considered." It is to be regretted that he has found it so. For my part I have made a considerable study of this question throughout the country during the period since I returned from the war last summer, and allowing for the dislocation of reconstruction and the common tendency to restrict our viewpoint to a small horizon, I came to the conclusion that taking all branches together, there is now and will continue to be a very great




NOTICE BOARD, ENGINEERING BLDG., UNIVERSITY OF TORONTO

demand for engineers. And so I repeat, we must be ready to meet it, not only now but in the future, and not "wait and see" how great the demand will be.

We all know that in the many branches of civil engineering, to which group Mr. Heywood doubtless refers when he thinks of the overcrowding of the profession, there has been much less demand for engineers than before the war. This is to be expected when we consider the tremendous



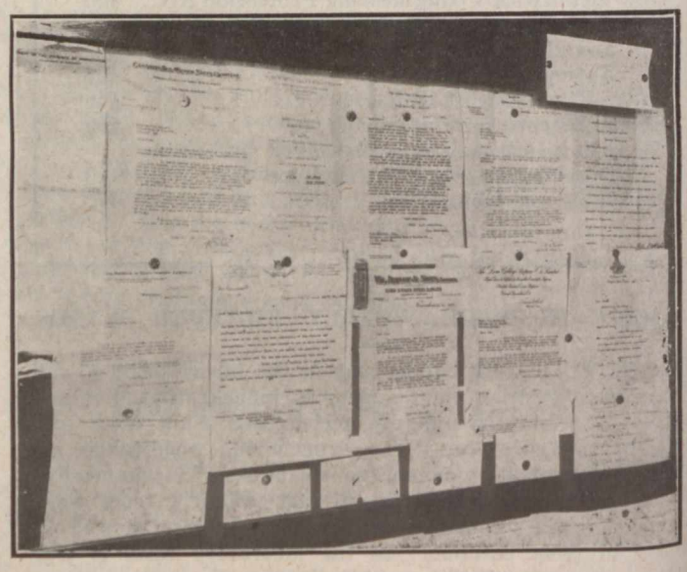

ANOTHER SECTION OF THE NOTICE BOARD

activity in railway and public works in the years 1908-14. It was to these branches of the profession that I referred when I said "The fear is rather that the present small monetary attraction in certain purely professional directions may, unfortunately, deter promising young men and . . . . they may drift from professional occupations." But we must realize that civil engineering work must be resumed with considerable activity in Canada before long, especially after the long period of inaction during the war.

But there are many other branches of engineering required in Canada for the next ten or twenty years than those of civil engineering. There are those of electrical, mechanical, mining, metallurgical and chemical, to say nothing of the miscellaneous specialized industrial branches and the newer branch of aerodynamics and those various rapidly increasing semi-engineering pursuits in connection with present-day undertakings which lie between pure engineering and the business world. And when one considers, too, the broad requirements of civil engineering itself, with its municipal, highway, water power and structural branches, who is going to say that we will not continue to want engineers more and more as the country develops?

It may be interesting for your readers to know that there have been constant requests coming in to this office for graduates in this Faculty who are required for various appointments and positions in public and private undertakings throughout the country, many of which have not been filled. This is particularly the case in electrical, mechancial and chemical work. Various enquiries made to us throughout the past year have indicated that there is a very great demand for engineers in these latter branches, with the result that rather than unemployment there is a marked shortage. A study of all the far-reaching conditions indicates also that this state of affairs is likely to continue for some time to come.

With reference to the several branches of civil engineering in which perhaps the so-called unemployment is said to



MORE LETTERS SEEKING U. OF T. ENGINEERS

be more noticeable, I would be glad to show those interested the files of applications and requests from public and private employers of engineering assistance which have come to this office during the past few months. These have been passed on to the students and have been made known to the unemployed graduates in various ways. Perhaps there is no better way of indicating the volume of these requests so far as students are concerned than by reference to the notice boards in the Engineering Building—with which all graduates are familiar—whereon are posted dozens of applications from employers, many of which I understand, are yet unfilled. It may interest you, Mr. Editor, to have a photograph of these three boards, and I enclose one of each, which I have had made to-day.

In conclusion permit me to repeat that I consider that there is and will continue to be a large demand for highly educated engineers in nearly all branches of the profession, and to submit that I make this statement after an extended study and knowledge of the situation and the prospects of development in this country.

C. H. MITCHELL,
Dean, the Faculty of Applied Science and Engineering,
University of Toronto.
Toronto, Ont., April 30th, 1920.

## ENGINEERING INSTITUTE'S COMMITTEE ON POLICY

Sir,—May I call your attention to the article in *The Canadian Engineer* of April 22nd, respecting the special conference held at Montreal by members of council, the chairman of the Toronto branch and the secretary of the Ontario provincial division of the Engineering Institute of Canada. Your article is not in accordance with the facts, as there is a very plain implication that no definite conclusion was reached at the meeting in question. As a matter of fact, a very definite and positive conclusion of far-reaching importance to the engineering profession was unanimously arrived at respecting the policy of the institute. The conclusion was embodied in the following resolution, which has since been formally approved by the council of the institute:—

"Resolved: That in addition to the Committee on Remuneration of Engineers already appointed by council, a further Committee on Policy should be appointed to prepare for the consideration of council a statement of the policies and objects of the institute.

"Further that the council authorize this Committee on Policy to include in its statement the council's approval of establishing by the institute of rates of remuneration for its members both by fees and by salary, which rates the institute will endeavor to uphold."

No decision was reached that would be at all comparable to that mentioned in your article, but it was decided, after discussion, that this matter was of immediate and urgent importance, and should be referred for further consideration to a Committee on Policy. Since the conference referred to, all of the resolutions passed thereat have been implemented by definite action of council. Special committees on remuneration of engineers and on policy have been set up and are now actively at work.

J. B. CHALLIES,
Chairman,
Ontario Provincial Division,
Engineering Institute of Canada.

Ottawa, Ont., May 5th, 1920.

## PERSONALS

JAS. H. FRINK has been appointed commissioner of public works of the city of St. John, N.B.

J. B. DETWEILER, of Brantford, Ont., representative in that city for the Steel Co. of Canada, Ltd., has resigned to take charge of the Bluebird Mfg. Co., of which he is president.

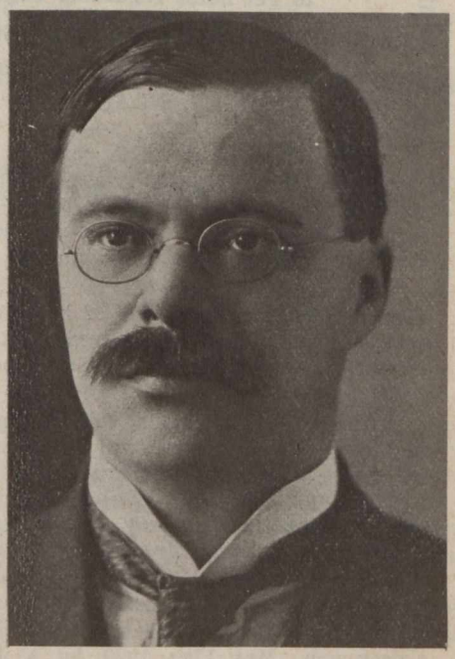
W. H. MCINTYRE has resigned as assistant general superintendent of the Ottawa Electric Co. and the Ottawa Gas Co. to become general manager of the Ottawa Car Mfg. Co., Ltd.

HENRY B. GILBERT, of Windsor, Ont., has been appointed architect and manager of the Border Housing Co., which is in charge of the housing scheme at Windsor, Walkerville and adjoining municipalities.

A. H. HILL, of Francis Hankin & Co., Ltd., Montreal, will sail for England next Saturday on a business trip. Francis Hankin & Co. are the Canadian representatives of Adams Hydraulics, Ltd., of York, Eng., and the Leeds Meter Co., of Leeds, Eng.

JULIAN C. SMITH and HOWARD MURRAY, vice-presidents of the Shawinigan Water & Power Co.; SIR HERBERT HOLT, president of Montreal Light, Heat & Power Consolidated; GEO. CHAHOON, JR., president of the Laurentide Co.; and H BIRCHARD TAYLOR, vice-president of the Wm. Cramp & Sons Ship & Engine Building Co., of Philadelphia, Pa., have been elected to the board of directors of the Dominion Engineering Works, Ltd., the new subsidiary of the Dominion Bridge Co. which has been formed for the purpose of manufacturing hydraulic and pulp and paper machinery. The board will also include members of the present board of directors of the Dominion Bridge Co., Ltd.

GEORGE DOUGLAS MACKIE, who has been appointed to represent the city of Moose Jaw on the Saskatchewan Water Supply Advisory Council, has been city engineer-commissioner of Moose Jaw, Sask., since 1914. Mr. Mackie was born March 8th, 1878, in Perth, Scotland, and was educated at the Perth Academy and the Glasgow and West of Scotland Technical College. From 1893-9 he was trained in the city engineer's office in Perth, and in 1900 received an appointment as town engineer of Crieff, Scotland. Five years later he became water works engineer of the Clydebank and District Water Trust, of Clydebank, Scotland, where he remained four years and carried out over $100,000 extensions to water mains. While in charge of the Clydebank work, Mr. Mackie visited all the water filtration plants in Great Britain, and also visited France to inspect the laying of five miles of reinforced concrete water mains. In 1910 Mr. Mackie came to Canada and joined the John Galt Engineering Co. During the two years he spent with this firm, Mr. Mackie was in charge of the construction of water supply works for Coldwater, Ont.; road work for Wetaskiwin, Alta.; sewers and grading for Red Deer, Alta.; sewerage system and water supply works for Gleichen, Alta.; and sewerage system and sewage disposal works for Cranbrook, B.C. In 1912 Mr. Mackie was appointed city engineer of Swift Current, Sask., but resigned two years later to become city engineer-commissioner of Moose Jaw. Mr. Mackie served as a member of the Royal Commisison which was appointed a few years ago to inquire into the construction of roads and bridges in Saskatchewan. He is a member of the Institution of Municipal and County Engineers, of London, Eng., and of the Engineering Institute of Canada.



## OBITUARIES

J. W. LYNCH died last week at the Montreal General Hospital after an attack of pneumonia. Mr. Lynch was born 55 years ago in Newfield, N.H. For many years he was connected with the Metropolitan Water Board of Boston, and for a time was an official in the water works department of the city of Toronto, under C. H. Rust, who was then city engineer. For the past nine years Mr. Lynch has been general superintendent at the Rockfield plant of Canadian Allis-Chambers, Ltd.

CLARENCE I. DE SOLA, of Montreal, died last Monday in Boston. As managing-director of Comptoir Belgo-Canadien, Mr. De Sola carried out some noteworthy public works in Canada, including the locks on the Trent and Soulanges canals. He was a director of Swan, Hunter & Wigham Richardson, Ltd., ship-builders, and was consul for Belgium. Mr. De Sola was born in 1858 in Montreal, and was educated in the Montreal high schools and McGill University. For his services to Belgium, Mr. De Sola was created a Chevalier of the Order of Leopold.

# 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 proposed, contracts awarded, changes in staffs, etc.**

## BRIDGES, ROADS AND STREETS

**Acton Vale, Que.**—The chamber of commerce of the county of Bagot, passed a resolution advocating the construction of roads between Sherbrooke and Nicolet, via Richmond, and via Acton Vale, between Richmond, St. Hyacinthe, Chambly and the Montreal highway.

**Albert, Man.**—Tenders for supplying two 12-ft. blade graders and engine capable of hauling same, and all necessary equipment, will be received by R. W. James, secretary-treasurer, Tilston, Man., until 6 o'clock p.m., Monday, May 24th.

**Albert, Man.**—Tenders for grading the whole or portion of 36 miles of roadway will be received by R. W. James, secretary-treasurer municipality of Albert, Tilston, Man., up to Monday, May 24th. Specifications may be obtained at the office of the Highway Commissioner, New Parliament Buildings, Winnipeg, Manitoba, or at the office of the Secretary-treasurer of the Municipality, Tilston, Man.

**Beloeil, Que.**—Tenders for the repair of the bituminous macadam on the Richelieu Road, will be received up to 6 o'clock p.m., May 17th, 1920, by A. M. Cormier, secretary-treasurer, Beloeil, Que.

**Bienville, Que.**—Important paving work will be undertaken this year by the municipal council.

**Calgary, Alta.**—The Calgary Automobile Club's plans for the improvement, in co-operation with the city, of the main roads running north, south, east and west, have been announced by H. Newcomb, secretary of the club.

**Chatham, Ont.**—Tenders will be called within two or three weeks by the Suburban Roads Commission for the construction of a reinforced concrete pavement on approximately two or three miles of Queen St. Commissioner also plans paving of the Wallaceburg and Longwoods Roads. Chairman, Mr. McGeorge.

**Chipman, N.B.**—Provincial Department of Public Works let contract for the Coal Creek Mouth bridge, superstructure and approaches, to Whitman Brewer, of North Devon, N.B., the contract price being in the vicinity of $15,000.

**Como East, Que.**—Tenders addressed to W. Sanderson, secretary-treasurer, municipality of Como East, Que., and endorsed "Tenders for Roads, at Como East, Que.," will be received until 6 p.m., Thursday, May 20th, 1920. Plans and specifications may be seen on application to the secretary-treasurer.

**Edwardsburg Tp., Ont.**—Tenders will be received by W. A. McLean, Deputy Minister of Provincial Highways, Parliament Buildings, Toronto, until twelve o'clock, noon, on Monday, May 31st, 1920, for earthwork and other necessary work on the Provincial Highway in the Township of Edwardsburg. Plans and specifications may be seen at the office of the Resident Engineer, Cornwall, Ont., and at the office of W. A. McLean.

**Ellice R.M., Man.**—Tenders for draining and grading 10½ miles of roads will be received up to 4 p.m., May 29th, 1920. Secretary-treasurer, J. E. Selby, St. Lazare, Man.; District Engineer, D. J. Miller, Minnedosa, Man.

**Elora, Ont.**—Wellington county council let contract for the construction of a new reinforced concrete Irvine River bridge, to G. G. Reid, 34 Victoria St., Toronto, for $13,300.

**Fredericton, N.B.**—City Council will call tenders for the construction of one mile of permanent pavement on Brunswick Ave., from Church to Smythe St., and from York to Smythe St. Council also decided to repair the present pavement on York St., at a cost of $12,000. City Engineer Mr. McDowell.

**Hamilton, Ont.**—Hon. F. C. Biggs, Minister of Public Works and Highways (Ontario), has notified the city that it must at once construct an entrance to the city for the Toronto-Hamilton highway. If the city fails to act at once, the Highway Commission will do the work and charge the cost to the city.

**Hamilton, Ont.**—Plans for the new Mountain Road, for which the citizens voted $50,000 last January, will be presented to the board of control within the next two weeks. City engineer, E. R. Gray.

**Hamilton, Ont.**—Works committee recommended the city council to proceed with the paving on King St. to Bay St., and on York St. to Queen St.

**Harriston, Ont.**—Town council plans paving of Market and Hill Streets. Clerk, H. J. Hucks.

**Kingsville, Ont.**—Tenders will be received by W. G. Long, clerk, Kingsville, until two o'clock, May 31st, 1920, for furnishing all labor, tools and materials, and constructing sewers and pavements on Main St., west, and on Division St., north, according to plans, etc., prepared by R. W. Code, C.E., Windsor, Ont. Plans are on file at the offices of the engineer and clerk.

**Lasalle, Que.**—Tenders, addressed to F. Lafleur, secretary-treasurer, Town Hall, Lasalle, Que., will be received until five o'clock p.m., May 21st, 1920, for the construction of waterbound macadam on Lafleur Ave., length approximately 0.94 mile; bituminous filled macadam on Lasalle Road, length approximately 4.9 miles; cement concrete on St. Patrick St., length approximately 1.6 mile. Plans and specifications at Paul A. Beique's office, 516 Transportation Building, Montreal.

**Middlemiss, Ont.**—Tenders will be received by Jas. A. Bell and Son, civil engineers, Court House, St. Thomas, Ont., until noon, Tuesday, May 18th, for supplying the material and laying a creosoted wood floor on the McIntosh bridge, over the Thames River, about 1½ miles from Middlemiss. The work consists of laying about 292 lineal feet of 3-in. creosoted plank and about 487 square yards of creosoted block. Plans and specifications may be seen at the office of Jas. A. Bell and Son, and at the office of Chas. Talbot, county engineer, London, Ont.

**Montreal, Que.**—Contract for the supply of twelve motor-driven automatic flushers and cleaners has been awarded by the Administrative Commission to the Maple Leaf Manufacturing Co., of Montreal, their price of $8,790 per machine being the lowest. The tenders ranged from this figure up $14,250.

**New Toronto, Ont.**—The town council has instructed the E. A. James Co., Ltd., Toronto, to prepare plans and specifications and call for tenders for sidewalks on 17th, 20th and 21st St., from Lake Shore Road to Birmingham St., on 5th St., from Lake Shore Road to Emerald Crescent, and 24 feet of concrete pavement on 8th St., from Lake Shore Road to Morris St.

**Oakland, Man.**—Tenders will be received by Frank Capel, secretary-treasurer, municipality of Oakland, Nesbitt, Man., up to 2 o'clock Tuesday, May 18th, 1920, for the grading of roads. Specifications may be had at the office of the secretary-treasurer, or at the office of the highway commissioner, Winnipeg.

**Ottawa, Ont.**—John Gleeson, of Ottawa, announces the incorporation of Standard Paving, Ltd. This new company