

**PAGES**

**MISSING**

# The Canadian Engineer

A Weekly Paper for Civil Engineers and Contractors

## Design of York Township Sewerage System

Description of Methods Adopted in Preparing Report Recently Submitted to Township Council—General Plan for Sewerage of Large Area Adjoining City of Toronto—Paper Read Before Toronto Branch, Engineering Institute of Canada

By J. M. M. GREIG

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YORK township almost encloses the city of Toronto, consequently, there was at one time a rapid growth of houses and streets in the township lands immediately adjoining the city limits. The people on the margin expected to obtain water, etc., from the city, and the tendency up to a certain stage was to look in that direction for all improvements. A few streets in the township have been sewered in the last few years, and these sewers have their outlets in the adjoining city sewers.

The populous parts of the township are now no longer the mere margin of the city, but the population has spread itself out to such an extent that the time has arrived for the township to look into the possibilities of sewerage of the whole area. The township council called for a preliminary report on a comprehensive sewer scheme. R. O. Wynne-Roberts, who is affiliated with Frank Barber, the township engineer, has prepared a preliminary report on the whole area. This paper gives some notes on the methods adopted in the preliminary investigation of the possibilities of the comprehensive sewer scheme.

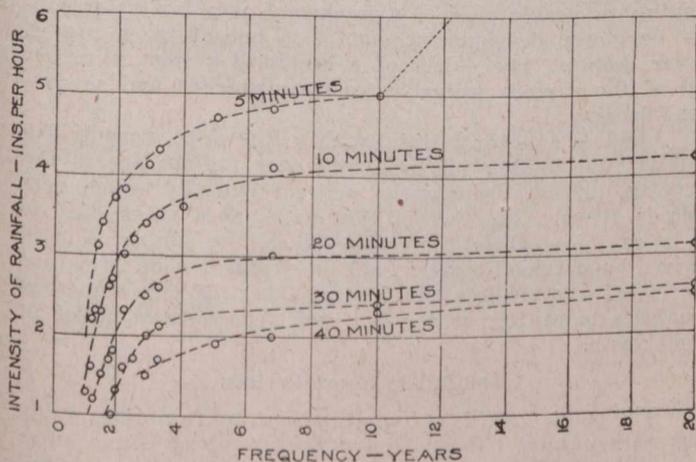


FIG. 1—RELATION BETWEEN FREQUENCY AND INTENSITY OF RAINFALL, STORMS OF VARIOUS DURATIONS, BUFFALO, N.Y.

Note.—Intensity of 9.5 ins. per hour in a storm of 5 minutes' duration was recorded in 1897.

Generally speaking, the greater part of the township slopes towards the lake. The next most important slopes are those towards the rivers Humber and Don, but the general trend of part of the western area is cut into by creeks which rise in the high ground and run diagonally from northwest to southeast, right through the city.

The city and township meet, not on any natural watershed or stream course, but along arbitrary lines, the outcome of real estate subdivision considered in local patches.

The city limits east of the Don are, for almost their entire length, on a line which is the lower edge of a plane sloping down from the north to the city, the Woodbine area between Yonge street and the Humber river being an exception.

In the west, north of St. Clair, the city boundaries are roughly two lines at right angles, and where they meet the corner is the lowest point of the general slope towards the city of nearly half the area of the township in this division.

In going west from Yonge street along Eglinton ave., the summit is reached about Dufferin street, and the Black

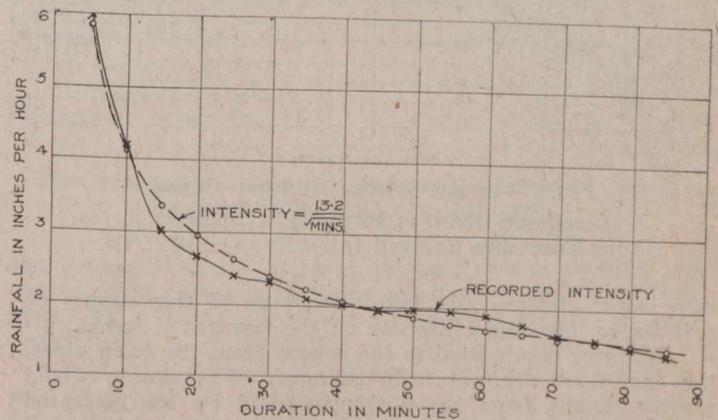


FIG. 2—RECORD RATES OF RAINFALL AT TORONTO

creek drainage area begins roughly from Dufferin street and Vaughan Rd. W.

The Swansea division is not put to any great disadvantage by the city boundaries except that the projection of the block between Annette street and Bloor cuts across the natural slope.

The township of York almost surrounds the city, and the streams rising in the township flow towards the lake through the city. The effect of this is obvious. It means that many parts of the township must be sewered against the natural grade if they are to be clear of the city. The Black creek watershed, Swansea district and the small section north of Danforth and east of Woodbine heights are the only localities in which it is possible to drain naturally away from the city.

It is not the object of this paper to deal with the actual reports submitted to the council, but rather to state the methods adopted in arriving at the data for these reports, so districts and boundaries may be left out of consideration for the present. The first consideration, then, is the quantity of sewage to be dealt with.

The township is, broadly speaking, a residential district, and the population is not likely to be dense. Forty persons per acre, using 80 gals. of water per day, with half of this drawn off in 8 hours, gives a flow per acre of something less than one-hundredth of a cubic foot per second. One hundredth c.f.s. was taken as the figure for sewage. It was possible to design a scheme dealing with sewage alone with comparatively small pipes, and at first sight this would seem the obvious plan for the township in its early stages of development. One difficulty which confronted us was the flat gradients required to get out of the valleys sloping towards the city.

It was necessary, in some cases, to take the trunk sewers through the ridge dividing watersheds at, of course, great depths. Though small diameter sewers would carry the sewage on reasonable gradients, when working against the disadvantages mentioned, much larger diameters were necessary, with the consequent increase in cost. These disproportionately large sewers would have too low velocities and would likely cause much trouble by prolonging the time the sewage must remain in the sewer. These considerations caused us eventually to abandon the idea of a separate system of sewers for most of the scheme.

In the separate system no allowance is made for rain water from roofs of houses, so unless the householders have

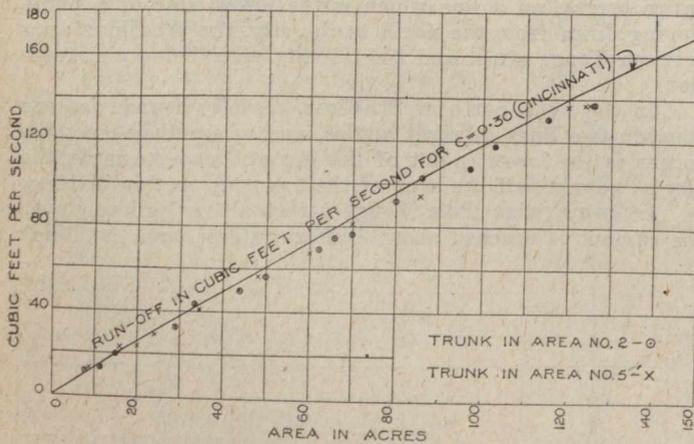


FIG. 3—STORM WATER RUN-OFF CURVE  
Cincinnati Rainfall Intensity,  $I = 16/(t)^{1/2}$ ;  
York Township Rainfall Intensity,  $I = 13.2/(t)^{1/2}$ .

rain water cisterns and take advantage of this supply of soft water, flooding will occur on the lawns and yards.

If water is admitted to the sewers from the down pipes, the conditions are naturally changed. The sewers would receive benefit from the flushing caused by the increased quantity of water during rainstorms, which would be of assistance where the grades are flat, but on the other hand, the sewers would have to be much larger.

Investigation showed that six or seven houses was a fair average per acre, and the area of house-roofs would then be 0.075 of the total area. With a rainfall intensity of 1.6 ins. per hour, the run-off from roofs would be 0.12 cu. ft. per second per acre; that is, twelve times the dry weather flow. This "roofwater and sewage" in the same sewer looks like a pretty good scheme for the developing district, but like the "sewage only" scheme, it is not a final solution. There is still the storm water to deal with, from roads, lawns and backyards.

As a district gets built up, sidewalks are laid, pavement put down, and the proportion of land which will absorb rain as it falls becomes less. In time, every heavy rainfall will mean flooded ground. How is this to be dealt with? The trunk sewers of the system might be paralleled by additional trunks or relief sewers which would receive from the original trunks, by overflows, such excess rainfall which they could not carry, but the lateral sewers in each individual street would not be large enough to deal with the rainfall were connections to be made to them from the catch-pits, etc. So, to deal with the storm in addition to the

sewage and roof water, it would be necessary to have a second sewer in each street.

These storm sewers might be laid in shallower trenches, and so be less costly, also their installation might be delayed for a good many years and so keep down the initial capital charges but on the other hand pavements would be cut up by them, and house connections already in might, in crossing, coincide with the adopted grade of the storm sewer and cause much trouble. There is also the danger of house drains being connected to the wrong sewer.

Where a district slopes towards a stream into which storm water can be discharged at many points on its course, that is to say, where nearly every street running towards the river could deliver its storm water into it, probably a separate system would be the least costly, both in the developing stage and ultimately. In York township the conditions are not very favorable to this system, for in most cases the outfall for storm water would be into the city area, into which it now flows from the land.

**Rainfall and Run-off**

In the district east of the Woodbine heights, in the Black creek area and in the Swansea district, it is possible to keep down the size of the main trunks by overflows at certain points. Short relief sewers taken from these overflows to the stream.

In the lower Black creek area immediately adjoining the creek, and in the lowest parts of Swansea where the lack of fall compel the use of pumps, sewage only is dealt with in the present proposal, as these areas lend themselves to the separate system, and short storm sewers could deal later with any part likely to be flooded.

A few reasons have been given for the adoption of the combined system and now it is necessary to ascertain what we may expect in the way of rainfall and run-off. The volume of storm water will be so large as compared with the sewage flow that it is, in most cases, unnecessary to consider sewage except from one angle, namely that of fixing gradients so as to make the sewers self-cleansing with dry weather flow.

Until comparatively recent times, rainfall gauges simply recorded the total fall, and if they were examined daily the record taken was that of the precipitation for each day, usually stated in inches.

This information is very useful in estimating the monthly or yearly yield of a catchment area for water supply or power development, but it is not of much use in sewer design. The object of a combined system is to get rid of the surface water as soon as possible and so prevent flooding.

Land in a natural state, with a fair slope, permits the falling rain to flow off in a film over the surface to the streams, and it also absorbs a great quantity which percolates directly into the soil, but with paved areas, etc., as in a city, less absorption takes place, the surface film is barred by artificial objects, and the result is that roads are converted into rivulets and flooding takes place in numerous localities before the water can reach the natural outlet in the stream.

**Rainfall in Short Periods**

The point, then, is not what is the total rainfall in a day but rather what happens every five minutes. Many cities now have self-recording rain gauges which give rainfall over short periods. From these we find that some storms may be so intense that 1/2 in. falls in one particular five minutes; that is, at the rate of 6 ins. per hour. A total precipitation of 6 ins. in 24 hours is a very severe storm.

Taking these short period gaugings, maximum rates have been found for 5 minutes, 10 minutes, etc., and so on over a period of years. The highest rainfall occurring in each year, or period of years, has also been found, and from this information it is possible to say, for instance, that every five years there may be a storm intensity of 4.7 ins. per hour lasting for a period of 5 minutes.

Fig. 1 is for rainfall in the city of Buffalo. The Toronto records so far as they go correspond very closely with

this set of curves. The irregular line in Fig. 2 shows the recorded rates of rainfall for Toronto.

Mr. Wynne-Roberts developed the dotted curve, which is derived from  $I = 13.2 \div (\text{minutes})^2$ , representing the rainfall intensities as recorded by the meteorological department at Toronto, and the values given by this formula have been used. The rates given by this formula have been equalled or just exceeded at several points once or twice in 10 years. That is to say, the sewers designed for this rainfall might be working to their limit or overtaxed once every 5 years.

These are definite figures for rainfall, but it is hard to estimate the amount of run-off, as so much depends on the state of the surface on which the rain falls. In a residential district about 30% of the total area will be impermeable when fully developed. The remaining 70% of the area will, at the start of a storm, absorb a good deal of the rain, and the roughness of the lawns, etc., will hold up a film of water and act as storage tanks, delaying the progress of the water towards the sewers. Only very careful gauging of existing sewers in conjunction with short time rainfall measurements will enable us to solve the problem of run-off. For the preliminary report on York township sewers, the following coefficients of run-off were adopted:—

**RAINFALL RUN-OFF COEFFICIENTS**  
(Impervious area taken as 30%)

Time in minutes.	Intensity of rainfall.	Run-off from impermeable area.	Run-off from permeable area.	Total run-off as percentage of rainfall.	C.f.s. per acre.
5	5.90	80%	....	25.0	1.50
10	4.11	95%	....	28.5	1.20
15	3.40	100%	....	30.0	1.10
20	2.95	100%	5%	33.0	.98
30	2.41	100%	10%	37.0	.89
60	1.70	100%	20%	44.0	.75

Rain falling at the rate of one inch per hour, if all collected, would mean a rate of run-off from one acre of nearly one cubic foot per second. The coefficients of run-off are roughly 30% of the rainfall for the first 20 minutes. After 20 minutes, some allowance has been made for the flow from the previous area, as by this time it is probable the ground will be so soaked that the surface run-off will be considerably increased. This table of run-off coefficients gives a ready method of estimating the quantity of water to be dealt with, but in using these it is necessary to know the time of concentration for each point in the sewer.

**Run-off Curve Plotted**

Fig. 3 shows the coefficients of run-off adopted by the city of Cincinnati. The quantity of run-off was worked out on the principle of applying the rate of rainfall corresponding with the time of concentration at each point in the line of a trunk sewer. Thus, if the storm water took ten minutes to reach a certain point A, then the area tributary to this point in acres was multiplied by the rain-fall rate for a 10-minute storm and reduced by the percentage of impermeable area. By plotting, the results arrived at in this way for a number of sewers, the curve was obtained which gives directly the run-off to be expected from any acreage. The crosses and circles show similar results for two of the York township sewers, using the Toronto rainfall curve, which is slightly lower than that for Cincinnati. With this curve it is possible to estimate the run-off from any acreage without going into the time required for water to flow through the sewer. Thus, for fifty acres the run-off would be 60 cu. ft. per sec.

[NOTE.—Mr. Greig here showed a graphic method of working out the probable quantity of storm water in a trunk sewer. This method, suggested by Mr. Wynne-Roberts, was the subject of articles in *The Canadian Engineer* several years ago.—EDITOR.]

All the proposed sewers in the scheme have been worked out on the "rational method," taking the time of concentration into account, and their sizes fixed by the quantities arrived at in this way. When it comes down to making

working drawings, it would be well to try out each trunk by the diagrammatic method.

Plans to a scale of 200 ft. to one inch were prepared, and contours drawn on them from lines of levels run on street lines. A study of the contours brought out the best lines for trunk sewers, and then the direction of flow of all laterals was indicated on each street. The watersheds being thus defined, every street intersection was given a number. The information on these plans was then transferred to a calculation sheet of the form shown in Fig. 4. It will be noticed that the data from the plan reads as follows: Street, name, from, to, distance, length (for area), width (for area), and surface elevations. From this the acres tributary to each section can be worked out, and as the length of sewer increases, the acres accumulate in Column 9.

**Design Sheet**

The surface elevations give an indication of the gradients available. The elevations for the inverts were entered in the table as if the sewers were lying on the surface of the ground or near to it, so that at a glance it was observable how nearly the adopted grades paralleled the surface. After working through the calculations in this way, it was only necessary to take 10 ft. off all elevations to arrive at the real invert levels. It was possible by taking the data from the plans into the calculation sheets as indicated, to settle the gradients and sewer sizes without fur-

Design Sheet for Sewers on CHISHOLM, GATWICK & DONCASTLE

SECTION	STREET	FROM	TO	DISTANCE	LENGTH FOR AREA	WIDTH FOR AREA	AREA IN ACRES	ACCUM. AREA IN ACRES	COEFF. OF RUN-OFF	Q. IN CU. FT. PER SEC.	FULL SIZE	GRADE IN	DIAM. OF SEWER	VELOCITY FEET PER SECOND	TIME TO SECOND STREET	TIME IN SECTION	TOTAL TIME	INVERT IN	INVERT OUT	DIFFERENCE IN FEET	DEPTH OF CUT
17	CHISHOLM	24	25	220	220	300	1.52	1.50	2.28	10	220	12"	3.3	300	67	367	423.36	423.36	0	10'	
20	GATWICK	25	30	300	225	260	1.34	1.50	2.01	2.0	150	12"	4.0	300	75	375	423.36	423.36	0	10'	
29	CHISHOLM	25	27	260	260	300	1.70	1.50	2.01	2.0	150	12"	5.8	375	52	427	423.36	423.36	0	10'	
30	DONCASTLE	29	31	300	225	260	1.34	1.50	2.01	2.0	150	12"	4.0	300	75	375	423.36	423.36	0	10'	
31	CHISHOLM	27	29	260	260	300	1.70	1.50	2.01	2.0	150	12"	5.4	494	46	542	423.36	423.36	0	10'	

FIG. 4—DESIGN SHEET FOR SEWERS IN DISTRICT No. 1, EASTERN DIVISION, YORK TOWNSHIP

ther reference to the plans or plotting of any profiles. Of course, when working drawings are got out, profiles will be used and probably many minor modifications and improvements made on the gradients.

Following through the form of calculation it will be seen that from 24 to 25 the acres are 1.52, and allowing 5 minutes for water to reach the sewer in volume, the coefficient of run-off is 1.5, and the quantity 2.28, and this requires a 12-in. pipe at the adopted gradient of 1 in 220.

The "from" and "to" column show just how the areas are coming into each section. These are branch or side lines to the main trunk, as indicated by the repetition of manhole numbers. The underlined figures are those of a small trunk.

A circular slide rule prepared by R. O. Wynne-Roberts proved very useful on this work, as it gave velocity and discharge for any size and any gradient when running full or at any proportional depth.

Illustrations printed in *The Canadian Engineer* in the issues of Dec. 18th and 25th, 1919, and Jan 22nd, 1920, show the lines of sewers and laterals worked out for each particular district. The amount of work involved in fixing the grades and sizes of the many lines of sewers was considerable, but those illustrations gave the framework of a comprehensive scheme.

The report sent in was purely a preliminary one, but having built up this general scheme it is possible to try out various modifications with some idea of how they will effect the building as a whole. In a sewerage scheme comprising many drainage areas, artificial and natural watersheds contiguous to one another, it is a very intricate problem to ar-

range the design so that they be in co-relation. Whatever one takes from one area must be added to another, with the corresponding changes made in sewer sizes, etc., involved thereby.

The most serious problem is to so design the sewers that they will serve the present needs without an undue financial burden, and yet form part of a greater scheme capable of taking future requirements. This side of the problem will need further study, and it is possible we shall find it a financially sound policy to lay certain portions of trunk sewers now, the capacity of which will be quite inadequate for final conditions, and arrange to parallel them, possibly ten years hence, with relief sewers. The history of a great many cities has shown this to be the method actually carried out, but how much of this was due to lack of foresight and how much to financial considerations, we cannot tell.

It is to be hoped that the town planning authorities will exercise their powers to prevent promiscuous subdivision of land in the future, and to regulate building operations, so that houses are built in more or less compact districts, ever growing from their margins instead of our present system, which leaves the sewerage engineer with the problem of connecting up groups of houses separated by stretches of undeveloped land. Another point is, that subdivisions might sometimes be laid out on the natural contours of the ground and a break away made from the rectangular system of street planning when the latter involves absurd street grades and arbitrary interference with watersheds. Subdivisions should also be so arranged that accommodation for sewers and transportation might be provided on the most suitable lines.

This is a brief description of some of the work done in framing a sewerage scheme for a large area. I have not touched on the disposal of sewage, as that is a problem in itself. In conclusion, I would like to thank Mr. Wynne-Roberts for his permission to write this paper, the initiative for much of the work here described having been his.

#### "COST-PLUS" DISCUSSION IN TORONTO

IN the "Toronto Star" of February 26th, there appeared the following editorial, evidently written by someone whose knowledge of "cost-plus" forms of contract is extremely limited:—

"There is talk of building the Mount Pleasant car-line on the 'cost-plus' system. That is, some contractor takes the job on condition that the city guarantees him his costs plus a definite percentage of profit thereon. No more profligate way of spending the ratepayers' money could be imagined.

"'Cost-plus' is a system which bonuses waste, for the contractor is paid a profit upon the money which he wastes, as well as upon that which he expends legitimately. He is encouraged, moreover, to pad his costs in every possible way, because he not only gets that much money additional, but a percentage of profit on it. Instead of the incentive being to do the work economically and honestly, the temptation is to do it wastefully and dishonestly.

"If the proposed temporary Mount Pleasant car-line is to be built at all, it might far better be constructed by the works commissioner under the day labor system, than handed over to a contractor who would be paid for employing the most extravagant methods, and rewarded financially if he inflated his costs above the actual figure."

John E. Russell, a well-known Toronto contractor, has kindly mailed to *The Canadian Engineer* a copy of a reply which he sent to the "Star," and which ably defends the integrity of contractors, although avoiding any technical discussion of the merits of "cost-plus" contracts and the methods adopted for preventing their abuse in any manner such as alleged in the editorial above quoted. Mr. Russell's letter to the "Star" was as follows:—

"Your assumption that 'cost-plus' is always to be interpreted as being cost plus a percentage of that cost, is er-

roneous, as contracts on that basis are only occasionally entered into. There are many forms of contract wherein the commission collected by the contractor is fixed or limited, such amount usually being arrived at by making an estimate of the probable cost.

"Now, as to the desirability of that form of contract, you should be fair enough to take into consideration the circumstances of tendering. Referring to the particular topic of your article, you must surely realize that conditions are abnormal when no lump sum tender was received. When so many features of a contract present substantial variation of cost, possible or even probable to occur, that contractors are compelled to guess instead of estimate, and if during construction the unavoidable or uncontrollable happens, who should in all fairness pay the difference, the owner or the contractor?

"It might rather be expected that a newspaper favoring uplift principles would frown upon a huge gambling venture, and what else is a lump sum bid for work under existing circumstances?

"You mention padding costs, etc., therein reflecting on the honesty of contractors, inspectors and accountants. The Canadian law is clear on that form of stealth. Is it unreasonable to expect honest efficient service from a contractor?

"You refer to day labor as a better means of doing city work. In that you assume that some salaried foreman or superintendent will do more to control the cost than a contractor who has his reputation to maintain and who has a large amount of money invested in plant and who has the ability to keep a complete working organization.

"It must be borne in mind, that in former times, when costs were normal, contractors could estimate closely, and by their ingenuity and better methods of doing work, compete fairly; but why it can be expected that contractors should take all the chance is hard to understand. If, submitting a lump-sum bid, a contractor protects himself against all contingencies and some of these do not occur, who suffers in payment?

"Should not contractors be compensated for their service just as any other class of business men, and is it not fair to let contracts on the basis of the owner getting the advantage of savings or paying increased costs, as the case may be, while the contractor gets a fixed fee or sliding scale of profit?"

The Draftsmen's Association, which was organized several months ago in Toronto, has decided to disband, as the members intend to form a trade union instead of an association. Those who are forming the union claim that more than 2,000 draftsmen in Ontario will join.

The Engineering alumni of Toronto University held a meeting in Montreal last month and decided to form an association. The following officers were elected: President, W. J. Francis, Montreal; vice-president, Dr. T. K. Thomson, New York; secretary, C. E. Macdonald, Toronto. The following will be the council: J. M. Robertson, consulting engineer, Montreal; J. B. Challies, Ottawa; E. R. Gray, Hamilton; J. L. Morris, Pembroke; G. R. Munro, Peterborough; W. G. Chace, Winnipeg; and W. A. Buck, Toronto. Arrangements were made for a general reunion of the Alumni Association to be held next October in Toronto.

Permanent headquarters for the Asphalt Association, an organization representing the producers and users of asphalt for paving purposes, have been established in the new National Association Building, 25 West 43rd St., New York. From its main headquarters and its branch offices at Washington, Chicago and Toronto, the association intends to continue its educational and research work. J. R. Draney, of the United States Asphalt Refining Co., is president of the association, and J. E. Pennybacker, formerly chief of management of the United States Bureau of Public Roads, is secretary. A feature of the association's activities is a brochure series, explaining approved methods of constructing asphalt pavements, including asphalt macadam, asphaltic concrete and sheet asphalt.

**NEW JOINT COMMITTEE TO PREPARE STANDARD CONCRETE SPECIFICATIONS**

**I**N order to make a thorough study of all available data on the subject of concrete, concrete materials and reinforced concrete, and to incorporate the most modern information and experience into a general specification which may serve as a pattern for detailed specifications covering specific types of concrete construction, a joint committee on standard specifications for concrete and reinforced concrete has just been organized in the United States. The committee consists of five representatives from each of the following organizations: American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, Portland Cement Association and American Concrete Institute.

The new joint committee may be considered as the successor of the "Joint Committee on Concrete and Reinforced Concrete" which was organized in 1904 through the co-operation of the same engineering and technical societies. The original joint committee presented its final report to the parent organizations in 1916.

**Membership of Committee**

The membership of the present "Joint Committee" is as follows:—

*American Society of Civil Engineers.*—H. P. Miller (chairman), consulting engineer, New York; W. K. Hatt, professor of civil engineering, Purdue University, LaFayette, Ind.; A. E. Lindau, general manager of sales, Corrugated Bar Co., Buffalo; W. A. Slater, Bureau of Standards, Washington, D.C.; S. E. Thompson, consulting engineer, Boston.

*American Railway Engineering Association.*—J. J. Yates (chairman), bridge engineer, Central Railroad of New Jersey, New York; G. E. Boyd, division engineer, Delaware, Lackawanna & Western Railroad, Buffalo; F. E. Schall, Bridge engineer, Lehigh Valley Railroad, Bethlehem, Pa.; C. C. Westfall, engineer of bridges, Illinois Central Railroad, Chicago; H. T. Weltey, engineer of structures, New York Central Railroad, New York.

*American Concrete Institute.*—S. C. Hollister (chairman), consulting engineer, Philadelphia; R. W. Lesley, Philadelphia; A. R. Lord, Lord Engineering Co., Chicago; E. J. Moore, Turner Construction Co., New York; L. C. Wason, Aberthaw Construction Co., Boston.

*Portland Cement Association.*—F. W. Kelley (chairman), president, Helderberg Cement Co., Albany; Ernest Ashton, chief chemist, Lehigh Portland Cement Co., Allentown, Pa.; J. H. Libberton, manager, Service Bureau, Universal Portland Cement Co., Chicago; E. D. Boyer, cement expert, Atlas Portland Cement Co., New York; D. A. Abrams, professor-in-charge, Structural Materials Research Laboratory, Lewis Institute, Chicago.

*American Society for Testing Materials.*—R. L. Humphrey (chairman), consulting engineer, Philadelphia; L. S. Moisseiff, consulting engineer, New York; H. H. Quimby, chief engineer, Department of City Transit, Philadelphia; A. T. Goldbeck, engineer of tests, U.S. Bureau of Public Roads, Washington, D.C.; E. E. Hughes, general manager, Franklin Steel Co., Franklin, Pa.

**Nine Sub-Committees Organized**

The organization meeting of the committee was held at the Engineers' Club, Philadelphia, February 11th, 1920. The following officers were elected: R. L. Humphrey, chairman; J. J. Yates, vice-chairman; and D. A. Abrams, secretary-treasurer.

The following committees, consisting of five to seven members each, have been organized: Concrete materials, metal reinforcing, proportioning and mixing, forms and placing, design, details of construction, waterproofing and protective treatment, surface finish, and form of specification.

A number of the committees have organized and are actively engaged in the preparation of their preliminary reports. The next meeting of the committee will probably be held at Asbury Park, N.J., about June 22nd, during the annual convention of the American Society for Testing Materials.

**NEW KING EDWARD HOTEL, TORONTO**

By VICTOR J. BLACKWELL

Watt & Blackwell, Architects, Toronto and London

**T**HE addition to the King Edward Hotel, Toronto, which is to be erected immediately east of the present building, will have a frontage on King street of 82 ft. 8¼ ins., and will extend back along Leader lane a distance of 196 ft. 9 ins. The total area of floors and roof for the structure will be approximately 270,600 sq. ft. The building will be 18 stories above ground, with a basement and sub-basement below ground. The distance from the ground floor level to the top of the tank-house roof will be 236 ft.

The frame of the new building will be of structural steel, with a reinforced concrete floor system throughout. The wind bracing will consist of a combination of internal diagonal braces and external portal braces.

The ball-room is 50 by 120 ft. in the clear, and is to be on the top floor; the roof overhead is to be carried on steel trusses, with a suspended ceiling.

The foundations will consist of concrete caissons carried to bed-rock approximately 45 ft. below the surface of the ground. Reinforced concrete retaining walls will be used



ARCHITECT'S DRAWING SHOWING PROPOSED 18-STORY ADDITION TO KING EDWARD HOTEL, TORONTO

from the ground level to the sub-basement floor level. The outer curtain walls of the building are to be 13½ ins. solid brick, carried on the steel frame from floor to floor.

The entire addition will be independent of any structural connection with the present King Edward Hotel, the east wall of which, however, will be used as a party wall between the old and new buildings.

Essenwein & Johnson and Watt & Blackwell are the associate architects for the building. A. H. Harkness and R. E. W. Hagarty are their consulting engineers on structural steel and reinforced concrete.

The new building will contain 500 rooms, a number of stores on the ground floor and offices in the mezzanine. The entrance on Leader lane will be in close proximity to six passenger elevators, three of which will be express elevators making no stop before the 9th floor. Used as a banquet hall, the roof garden will seat 1,000; as a convention hall, 2,000.

The property on which the new structure will be built was taken over last month by the United Hotels Co., owners of the King Edward Hotel, and the demolition of the old stores on the site will be commenced at a very early date. Construction will be rushed as much as possible. Tenders for clearing the site and for the structural steel work were opened last Tuesday afternoon and awards will likely have been made by the time this article is published.

## Letter to the Editor

### INCRUSTATION IN VANCOUVER SEWER PIPE

Sir,—In a "Letter to the Editor" which appeared in your issue of November 7th, 1918, entitled "Incrustation in Vancouver Sewer Pipe," I described the results of investigations made by myself and the Charles A. Newhall Co., of Seattle, as to incrustation that was taking place in machine-made cement sewer pipe in the city of Vancouver. It was stated that the presence of this incrustation was most marked where the pressure of ground water was most evident. As probably 90% of the 145 miles of sewers constructed in the city of Vancouver under my supervision were constructed by day labor forces under my direct control, I had an intimate knowledge of the locations where ground water was met with, and had no difficulty in verifying this contention in sewers large enough to permit of internal examination.

When writing in 1918, no sewer had actually collapsed; the incrustation and disintegration was ascertained by internal inspection and by chance removal of an occasional pipe for connection purposes. Just recently a 10-in. sewer constructed of this material, which was laid about eight years ago, has collapsed, and I was not surprised to find that this was at a place where excessive ground water had been met with. In examining this pipe, the scale and encrustation in the crown is most marked, and as Mr. Newhall's analysis disclosed nearly 31% of calcium oxide in this encrusted scale, and as the ground is a glacial drift, with practically an entire absence of lime content, it was only reasonable to infer that the encrustation was derived from a dissolution of the cement, which would eventually lead to the destruction of the pipe.

In pipes made by this machine process, strong emphasis has been laid on the glazed effort obtained for the interior by a revolving core, but experience shows that it is really more essential to make the outside of the pipe impervious to water.

I believe that it is possible to make a cement pipe that will be satisfactory and practically permanent for the carrying of sewage; but I think that by the usual machine process, permanence and suitability have been sacrificed in the desire to secure rapidity of output and economy of material.

The associated cement industries have gone to great pains to secure the proper use of their product in highway construction, and I think they are far-sighted enough to see that the misuse of their product for sewer construction is not a good policy.

A. G. DALZELL,  
Consulting Engineer.

Vancouver, B.C., February 20th, 1920.

The annual meeting of the Commission of Conservation was held last week in the Windsor Hotel, Montreal.

W. C. Kirkpatrick, industrial commissioner of Hamilton, Ont., in his annual report to the board of control of that city, states that 32 new industries located in Hamilton last year. They are capitalized at \$15,670,000, and will provide work for nearly 5,000 employees.

The International Joint Commission, at a meeting recently held in New York, discussed ways and means of giving effect to its recommendations for the prevention of the pollution of the St. Clair and Niagara rivers. The commission favored the drafting of a new treaty for adoption by the governments of the United States and Canada. Joint legislation by the two countries was deemed to be inadequate, and the calling of a convention of municipal representatives to devise effective measures was characterized as impracticable.

### ROAD-BUILDING IN ONTARIO DURING 1919\*

By GEORGE HOGARTH

Chief Engineer, Department of Highways, Ontario

EARLY in the construction season in 1919, labor conditions and the prices of materials affected the prompt letting of contract work, and it was August before the road construction program for the year was actively taken up by municipalities. Good progress was made in construction in the face of difficult conditions.

In the township roadbuilding program, standards of construction have been improved, due to the better standard set in the townships by the county road system work, and better work is now being done by the townships.

#### County Construction Greatly Increased

County road construction during the past year has greatly increased, and this is best shown by the fact that the expenditure made by the counties in 1919 was two and one-half times greater than the expenditure of 1918. The types of road being constructed by the counties are macadam, bituminous macadam and concrete, and a fair mileage of each type, approximately 16 ft. wide, has been constructed during the past season. The replacement and rebuilding of many bridges and culverts has been completed, together with extensive hill-cutting and grade reduction on a number of roads. In some sections the relocation of roads has been taken up and an improved alignment obtained. Over the entire county road system, maintenance has been given closer attention, and the surfaces of all the roads kept in more satisfactory condition for travel.

The Northern Ontario Development Branch continued work throughout all the districts of Northern Ontario. Good progress has been made on the main trunk roads in resurfacing with gravel, and a considerable mileage of macadamized surface has also been built. In the newer farming settlements, roads have been constructed in the districts that are just now opening up. As years go on, it is found that there is a demand for better roads, owing to the increased use of the auto.

The trunk road south from North Bay to Severn Bridge is well under way, and the season of 1920 will probably see it completed.

The trunk road from Sudbury to Sault Ste. Marie will probably be completed early in 1920, when there will be a continuous road from Sault Ste. Marie to Toronto.

The international highway between Port Arthur and Duluth is now in first-class condition, and numbers of tourists from the United States now visit Port Arthur during the summer season.

Work has also been carried on on a trunk road between Wabigoon and Vermilion Bay, on the Canadian Pacific Railway, and also between Vermilion Bay and Quibell, on the Grand Trunk Pacific. A trunk road has also been started easterly from Port Arthur to Nipegon. Work has also been started on a trunk road between Mattawa and Pembroke.

The Colonization Roads Branch reports a larger expenditure during the past year, and the opening up of new roads, together with drainage, grading, gravelling and macadamizing of sections of highway under the authority of that branch.

#### Provincial System Extended

The provincial highway system has been extended so that there is now, except through towns and cities, a continuous road easterly from the county of York line to the Quebec boundary, also from Ottawa to Prescott and from the Niagara river westerly to London, making in all a total system of approximately 423 miles.

The work during the past year on this system has consisted mainly in grading and earth work, together with the

\*Report of Committee on Roads and Pavements (Mr. Hogarth, chairman), to the Association of Ontario Land Surveyors, presented at the annual meeting, February 17th-19th, Toronto, Ont.

construction of concrete culverts and the replacement of a number of bridges. The surface of the roads has been kept up by the application of gravel and crushed stone, and on some sections macadam road has been built.

The increase in the number of motor vehicles has been extensive during the past year. Passenger cars have increased in number roughly 25%; trucks, 50% and motor cycles, 10%. The influence of this traffic on the highways of Ontario must result in steps being taken to provide suitable types of roads for such traffic.

Toll roads have been given attention by the authorities during the past year, and a number have been purchased and tolls removed from such highways.

The Canada Highways Act, by which the Dominion government has authorized aid to the road construction program of the different provinces, is in operation, and the benefits from this federal aid will shortly be apparent.

### PROPOSED WATERWORKS EXTENSIONS AT TORONTO

IN the estimates of the Works Department of the city of Toronto for the coming fiscal year, there is an item of \$600,000 for a 20,000,000-gal. concrete reservoir at Toronto Island to store filtered water during the night as a reserve supply for the period of maximum consumption in daytime.

Commissioner Harris also makes his annual proposal to extend the high pressure system, and asks \$735,000 to cover the territory between Sherbourne St. and Spadina Ave. as far north as Dundas St. The total proposed expenditure on that system approaches a million dollars, including a new pump and a new main from the John St. pumping station. Four additional mains to carry the domestic supply from the John St. station are also suggested, and a main costing \$262,000 on Davenport Rd. from the high level station, to increase the pressure and supply throughout West Toronto.

There is apparently to be no extension of the metering practice. An item of \$63,950 for new meters will no more than cover replacements and routine installations. Details of the estimated expenditure for which funds are requested, are as follows:—

Current Expenditure	
Maintenance .....	\$ 865,046
Main extension .....	44,456
Distribution .....	307,650
Marine section .....	24,342
Total current expenditure, .....	\$1,241,494
Special Items	
Air chambers at main pumping station \$	50,000
Re-arrangement of transformers at main pumping station .....	130,000
New electric pumps, etc., at main pumping station .....	110,525
Other special items .....	132,201
Total special expenditure, .....	\$ 422,726
Capital Expenditure	
Reservoir at Island .....	\$ 600,000
Nine residences for employees at Island .....	46,800
Valve chambers at Island .....	11,579
New water works machine shop .....	300,000
High pressure system—extension, \$735,000; new main, \$120,000; new pump, \$85,000 .....	940,000
Various mains on general system .....	503,200
Total capital expenditure, .....	\$2,401,579

The east intercepting sewer recently built by the Essex Border Utilities Commission was placed in operation last week.

### MAY BUILD STORAGE DAMS AT OUTLETS OF LAKES ST. JOHN AND KENOGAMI

COMPLETE studies are being made by the Quebec Streams Commission of the possibilities of Lake St. John and Lake Kenogami as storage reservoirs. Additional storage is also contemplated in the watershed of the St. Anne de Beupré river, the minimum flow of which has already been increased from 165 sec. ft. to over 200 sec. ft. by a dam at the outlet of Lake Brulé. A report is being prepared by the Commission on the possible prevention of floods such as caused disaster in the Beauce district, when the Chaudière river rose 32 ft. in less than 24 hrs. in July, 1917, after heavy rains. Several undeveloped water powers in the province of Quebec are also being studied by the Commission, including possible developments on the St. Maurice, St. Francois, Bell, Harricana, Manicouagan, Aux Outardes and Natashquan rivers. Systematic gauging of a number of rivers in Quebec has been started by the Commission and this field of investigation is being enlarged every year, with the intention of extending it ultimately to all important streams in the province.

The above information regarding the present activities of the Quebec Streams Commission was given by Olivier Lefebvre, chief engineer of the Commission, in a paper which he read in Montreal at the recent general professional meeting of the Engineering Institute of Canada. Mr. Lefebvre's paper described the St. Maurice storage project, which was completed in 1917, and the St. Francois storage scheme, which was the Commission's second undertaking, but he also reviewed the regulations of the Quebec Hydraulic Service and touched briefly upon present activities. Regarding the St. John and Kenogami schemes, Mr. Lefebvre said:—

#### Could Develop 600,000 h.p.

"The Commission has made a complete study of the possibilities of Lake St. John as a storage reservoir. It was found that by a suitable control at the outlet of this lake, it would be possible to keep the minimum flow of the Saguenay river at 22,000 sec.-ft. without causing any damage to lands, wharves, etc., around the lake. Such a storage would make possible the development of 600,000 h.p. on the River Saguenay, above the town of Jonquiére. Lake St. John has an area of 350 sq. mi., and drains a watershed of 30,000 sq. mi.

"The Commission has also made a complete study of the possibilities of creating a storage reservoir in Lake Kenogami, west of the towns of Chicoutimi and Kenogami. This lake has an area of 12 sq. mi., and there is at present partial regulation under the control of the Chicoutimi Pulp Co. Lake Kenogami has two outlets: One into the River Chicoutimi, which flows into the Saguenay river at Chicoutimi, about ten miles from Kenogami; the other outlet is through the River Aux Sables which flows into the Saguenay at Kenogami. Lake Kenogami is about 475 ft. above the level of the Saguenay river; its two outlets are well provided with falls and rapids. On the Chicoutimi river, water powers have been developed and are being used by the Chicoutimi Pulp Co. to operate their large pulp mills. On the river Aux Sables, Price Brothers, Ltd., have developed water powers for the operation of their pulp and paper mills at Kenogami. The cost of storage in Lake Kenogami was estimated at \$1,800,000 in 1916 but, under present conditions it is believed that its cost would be nearly \$3,000,000. The question as to whether this work should be carried out or not, is now under consideration.

#### Water Conservation Created Industries

"Beneficial results have been already obtained through the water conservation policy inaugurated by the provincial government. Very important industries have located in the St. Maurice valley, namely at Shawinigan and Three Rivers, owing to the large increase in the power possibilities of this valley. On the River St. Francois, plants are now being constructed at Drummondville, Richmond and Sherbrooke in which several million dollars must be invested and where two or three thousand hands will be given employment."

## REGIONAL PLANNING AND WATERSHEDS

BY THOMAS ADAMS

*Town Planning Adviser to the Commission of Conservation*

IN connection with the development of water power, J. B. Challies, superintendent of the Water Power Branch, Department of the Interior, is making regional studies of territories adjacent to rivers. In this case, there is scope for the selection of groups of areas likely to be developed as a result of the utilization of the water powers for industrial purposes,—and for linking up the towns and villages so created with a park system along the river banks. Such a scheme has been considered by Mr. Challies in connection with the Winnipeg river, where there appears an opportunity for carrying out a comprehensive regional scheme.

**Watershed is Appropriate Boundary**

The watershed is an appropriate boundary for large regional areas, and if the river flowing through such an area is suitable for the generation of power, it becomes a kind of vertebral column on which an industrial region grows.

If the river is navigable, it may become the channel of trade to a great port, and industrial development will take place over a scattered region along its banks. For example, the Delaware river has created an extensive industrial district far beyond the boundaries of Philadelphia.

But there are other reasons that make necessary the preparation of regional surveys adjacent to rivers in developing new territory or in considering plans for re-development. The valleys that lie on each side of the river are often suitable for intensive agricultural development or for establishing new manufacturing centres.

In new countries the watersheds and rivers are among the natural features that need to be studied as a basis for rural development schemes. Even in old countries attention should be given to these natural features of a region.

An English journal of October 31st, 1919, re-called the fact that the Ouse, which extends for 160 miles through England from the hills of Northamptonshire to the sea, has through a great part of its course become almost derelict as a waterway. Moreover, as a traveller through central England in the spring months knows, the river periodically swamps thousands of acres where every acre of good land is needed for production.

The cause is ascribed to the absence of central administration of the regions affected by the river, and to the conflict of rival authorities having jurisdiction over the adjacent land.

The various county and borough authorities have realized at last that they cannot deal with the problem without a central drainage board. It is, therefore, proposed to create a board to control the river and to deal with the huge area of half a million acres in ten counties that are affected by the river.

**Should Suggest Development Scheme**

The land adjacent to the Ouse is among the most fertile in the country and skilled advice shows that to get it properly administered there must be intelligent and effective control by a single drainage board. This is a step in advance but the board is likely to be created merely to get rid of an evil and not to develop a constructive program.

Such a board should not only suggest the engineering scheme necessary to bring the river under control but should study the area affected by the river and put forward plans for its further development before the local authorities interested.

The Ouse touches the following industrial towns: Brackley, Buckingham, Stony Stratford, Newport Pagnell, Olney, Sharnbrook, Bedford, St. Neot's, Godmanchester, Huntingdon and St. Ives, where it debouches upon the Fens with a fall from this point of little more than 20 ft. in a distance of 55 miles to the sea. Here drainage cuts have been made diverting the waters of the Ouse, which, however, by the confluence of other tributaries collects water forces again and becomes tidal below the Denver sluice, 16 miles from the mouth.

## THE OUTLOOK FOR SURVEYORS

BY J. R. AKINS

*Topographical Surveys Branch, Ottawa*

SURVEYORS are given too much to looking at their own work,—of considering their own profession. They do not give much consideration to other professions or occupations of mankind. They are in danger of becoming narrow. They have been in too much of a rush in the past.

Most of the Dominion land surveyor's work is for the government, and in the past he has received his instructions in the spring, often none too early to avail himself of the ice and snow necessary to enable him to reach the scene of operations. He rapidly gathered a party, without taking much time for selection or choice. He made a dash for the field, and by the mercy of God he got there. While in the field his days were occupied with such strenuous labor that at night he was too tired to read or think. It was then a scramble to get the work done before the frost and snow put an end to operations, and when he returned, he had lost touch with—and, too often, interest in—current events outside his own little sphere. He made a re-union with his family, and by the time they had gotten sufficiently acquainted again to call each other by their first names, he was called to the field again.

**Authorities Upon Natural Resources**

These conditions were caused by the great demand for land, for settlement, when the tide of emigration was at its height; and under these conditions how could anyone expect a surveyor to consider the idealism of the profession or to develop into a Kant or Swedenborg? Spencer was an engineer, but the times could not have been so strenuous when he practiced his profession.

We hope that this rush is over, and that the surveyor will have more leisure in practicing his profession and carrying out his work, so that he may be able to give more time to observing; I do not mean observing Polaris, but observing the conditions surrounding his work, keeping constantly in mind the development of this wonderful country, the making of it more habitable for our people and future generations, and the best manner and means of wresting from nature all her stores. He should have time for reading and reflection, so that he may keep himself posted on what is being done the world over in this regard.

The surveyor is in a position to become an authority on the natural resources of the country and the policy that should be followed in their development. It is from the ranks of our profession that that great corporation, the C.P.R., selected two of its most highly paid men,—men who could give it first-hand information on its own natural resources and of the natural resources of Canada. There are also other men who are holding high positions of responsibility and they got their training as Dominion land surveyors. We should all aspire to become authorities of equal or greater importance. Emerson says, "Hitch your wagon to a star. Let us not fag in paltry works which serve our pot and bag alone."

**Should Develop Literary Talent**

Not only should a surveyor train his observing powers, but he should also develop his literary talent. He should record all he observes and afterwards write it up with great care. What is the use of a man having a great amount of knowledge or experience if he is not able to impart it to others or convince them that he has it? Our duty in this life is not to obtain knowledge for ourselves or seek our own pleasure, but to do our part to add to the sum total of human knowledge, to fill our niche in the general evolution of things, and if possible to make this world a better place because of our having lived in it.

All other things being equal, the man who has a good command of English will far outstrip him who has not.

\*Excerpts from presidential address at the 13th annual convention of the Association of Dominion Land Surveyors, February 4th-6th, Ottawa, Ont.

This is a thing that many surveyors lack, and the nature of the profession is not conducive to its development. We should, therefore, place special emphasis on it. There is no man who should arrive at more sound conclusions than a surveyor. He is generally removed from the thickly populated centres, and is not, therefore, subject to mob psychology or influenced by the subtle wave forces of the minds of others. His conclusions are arrived at by reading and quiet reflection, unhampered by outside influences. The first problems that demand his special attention are how to make more accessible to the people the wealth of our soil, our minerals, our forests; and the wealth of our waters, for on these the development of prosperity and life of the nation depends.

#### Canada's Future Greatness

Now, what is the future outlook for our profession? The outlook is as wide as our mental horizon. The profession is what we will make it. Canada has great areas of fertile lands, mountains of mineral, great stretches of forests and 40 per cent of the water power of the world. We have enormous deposits of coal, but our water power is more valuable. The coal will in time become exhausted, but the "white coal," derived from our water powers is inexhaustible. Who would dare to place a limit on the future greatness of Canada? and it is no strain on the imagination to see what part surveyors should and will play in this development.

The meaning of the word "survey" is not limited to the laying out of legal boundaries or the erection of monuments. It has a far wider application, but the end of that particular work has been by no means reached. There must be a complete geodetic system extending from coast to coast. There is an enormous amount of levelling to be done, and not half of our lands have yet been surveyed. It is true that most of our agricultural lands have been sub-divided, but there are vast areas that have not yet been traversed by transit and chain, and they are likely to come into their own. Mr. Stefánsson says that there is vast wealth to be derived from these lands in the form of reindeer and muskox meat. So we may yet be sub-dividing the barren lands into large caribou, reindeer and muskox farms. Oil and minerals are almost certain to be found and developed in the north, which will also make a demand on the surveyor.

In the rush of the past, inaccuracies crept into the surveying operations; the work was too hurried to allow time for the erection of very permanent monuments. So, to save much trouble and litigation for future generations, a re-survey should be made of the northwest and permanent monuments established. This should be done as soon as possible, so that use may be made of any original monuments that are still in existence before they are entirely obliterated.

#### Surveying Possibilities

If we consider surveying in a wider sense, what is there to be done? Here the surveyors must use all the powers of initiative. There are reclamation schemes to be suggested and carried out, and there is land classification to be effected. There is room for improvement in our system of land tenure. Our homestead system is not a perfect one; the classification of the lands suitable for profitable agriculture is important and has not been considered in the making of our homestead laws. Our system of land tenure should be based upon the use of the land. This would prevent thousands of acres of fertile lands from being retained in an idle condition by speculators; and as the future of Canada primarily depends on agriculture, a scientific investigation of the soil should be made, so that an intelligent direction may be given to settlement and a proper use made of the soil by the settler.

There is a demand for community settlement which is based on the principle that agricultural workers deserve an even chance with the manufacturing worker. Just as with factories, so it is with farms,—they should be equipped for work before operations begin.

There is also the field of road-making and town planning, both of which will give great benefits to all. With all these

needs of the people to be met, and all this work to be done, this body of trained and thinking men will surely give an account of itself. This organization is not on the decline, but we have to accept our responsibilities and get our shoulders to the wheel.

#### HIGHWAY DRAINAGE\*

BY U. W. CHRISTIE  
*Orangeville, Ont.*

**D**RAINAGE of a road is not materially different from drainage of a farm, as the same outlets are used and the same drainage acts are applicable. There is, however, in some localities an erroneous idea that because proceedings are initiated by the statutory owners of the road, that the municipality or municipalities should pay a greater proportion than would be the case if proceedings were initiated by a private owner. The benefits are quite different and are much greater in the case of the road.

The main purposes of farm drainage are the removal of surface water in order that crops may be sown in their proper season, and to leave a seed bed not too cold and damp for seed germination. Under-drains, besides carrying off water from a saturated soil, also supply moisture to a hot, dry soil.

Drainage, besides carrying off surface water from the road, is intended to improve the foundation. Road failures have largely been the result of weak foundations at the time frost is coming out of the ground, when the water content of the soil is high and foundations are consequently weakened. If we except the Telford and probably some of the Roman roads, foundations have not been built with large enough interstices to resist capillarity. Hence, since we have not yet been able to control capillarity, we must meet it. The water level must be lowered; just how much depends on the character of the subsoil.

#### Capillarity

The following data shows the height to which capillary water rises in certain soils in 24 hours: Decomposed granite (loam), 21 ins.; gravelly soil, 16 ins.; heavy granite loam, 16 ins.; heavy lava ash, 16 ins.; light sandy soil, 14 ins.; heavy clay loam, 11 ins.; pure sand, 9 ins.

In one day the capillary water moves upward about one-half its apparent final limit. In three days it moves about two-thirds its apparent final limit. In some soils the movement upward in the first two hours is as high as one-third of its movement for 30 days. In pure sand it rises in one-half hour approximately one-half as high as in one day, and in one day about 70% as high as in twelve days. The movement is more rapid at the start in light soils, and slows down rapidly. After three days the movement is exceedingly slow in pure sand. In heavy soils the movement is uniformly slower and more sustained. In light soils the percentage of water in the soil decreases rapidly with the height above the source of water, while in some heavy soils the water content is strikingly uniform at different depths.

Horizontal capillarity occurs with much faster water movement and greater uniformity of moisture content. The speed and distance vary with different soils and range from 7 to 33 ft. in the first 24 hours. The rapidity with which capillary action occurs when there is a free source of water, makes it necessary to remove this source with the greatest promptness if a substantial road foundation is to be maintained.

If it is absolutely necessary to allow water to stand or flow along a road embankment, for even a few hours, the height of the sub-grade above the surface of the water and its distance horizontally from the water source must be considered.

Should we have a wetter side drain for only one day at a time, a height of subgrade of 18 ins. will in all probability be sufficient; and should the horizontal distance

\*Paper read at the annual meeting of the Association of Ontario Land Surveyors, February 17th-19th, Toronto, Ont.

to the drain be large, the 18 ins. may be reduced; but if the wetted drain is to remain for a considerable time, the height might have to be increased as much as two or three times the above figure.

It has been the practice to excavate from the sides of the road to raise and level the grade; if these trenches have not a continual fall to outlets where water will run away freely, they are not drains but elongated ponds which hold the water and permit it to soak into and soften the roadway. Water must be made to flow from the road as quickly as possible. Trenches should not be carried along the side of the road past outlets, as has frequently been done. Water should be discharged in small quantities into frequent outlets. It is the accumulation of water that causes wash-outs.

Roads are not intended for use in draining adjacent lands. To construct deep and dangerous drains along the roadside for this purpose, carrying water out of its natural course, is objectionable, and much damage has resulted through this practice. The side ditch has its place in carrying water off the road, but it should not be required to carry foreign water, and if necessity demands a deep side ditch to secure a proper grade, it is well to build a tile drain below the open ditch, if the velocity of flow of water be not too great; and if the velocity be too great, the tile drain had better be placed at the side of the open drain.

Culverts should be so placed that water carried across the road will be carried off the road directly from the culvert. Pipe culverts with a diameter less than 12 ins. should never be used, as the smaller culverts choke up too easily. In a position requiring something larger than a 30-in. diameter pipe, it will generally prove more satisfactory to build a reinforced concrete culvert.

#### Tile Drains

During the dry summer season, most of our country roads will carry any ordinary load we desire to haul over them, while in the spring and fall some of these same roads are quagmires. The difference is simply one of water content. If we could cover this subgrade when dry with a material which would shed and keep out surface water, and if we could prevent moisture getting in from the bottom, we would undoubtedly have a firm road for ordinary traffic at all seasons. Proper tile drainage of bad spots will accomplish much toward keeping moisture out of the subgrade, and will often make the difference between a bad and good foundation.

In the spring, in those localities blessed with an abundance of snow, open ditches are practically useless for a time, owing to their being blocked with ice and snow. This condition is worse if the open ditch happens to be beside an old-fashioned rail fence. The snow, after filling the ditch, is often piled up many feet above it. The snow melts on the neighboring roads and fields, and often ponds along the ditch and over the fields and roads. This is a condition that is hard to cope with, but could be helped by having a tile drain in the bottom of the open drain if an outlet can be secured for it.

#### Ice May Save Road

The road may be saved if covered with a layer of ice that lasts a little longer than the ice in the ditch, and in this case a well-travelled road that has had the snow beaten down the full width between ditches will have a better chance than a road with a pair of tracks only. Rolling the roads in the winter has been suggested, to cover them with an ice pavement which will last longer than the snow and ice in the ditch, and when the road ice melts through, there will be an open ditch to carry it away. There are, however, many cases in which the bulk of the snow blows off the road, and an ice pavement would then be impossible.

Tile drains should be used to carry water away from all springy or soft spots in the foundation, and to intercept water likely to reach the foundation. The latter condition will be encountered on slopes and hillsides. A tile drain should always be placed on the higher side of a side-hill road if there are any indications of water trouble, and often on

the face of a hill. In the case of the face of a hill, the drain may be in the centre or to the side of the road; and in all cases tile drains should be at least 3 ft. deep, should be laid carefully to grade, and should be covered with an open material such as gravel, crushed stone or cinders. If in quicksand, the tile should be laid on boards, and cinders should be used as a covering in preference to gravel and stone.

Porous tile or vitrified pipe may be used. The size will depend upon conditions, but a pipe smaller than a 4-in. diameter should not be used, as it is too apt to fill up. At or near the upper end of a drain in a hill, there should be a pipe or some opening to lead to the surface, to allow a free passage of air. Roughly speaking, a 4-in. diameter tile will do for a drain seven or eight hundred feet long, and a pipe with an increase of diameter of one inch will be sufficient for an additional length of drain from 350 to 400 ft.

#### Catch-Basins

A tile drain required to carry off surface water should not be less than 6 ins. in diameter, and for this purpose should be vitrified pipe in lengths of not less than 2 ft. The surface water should enter through catch-basins, the floor of which should be 2 ft. below the invert of pipe. The catch-basins may be built by placing 24-in. diameter concrete or vitrified pipe in vertical column, and placing 4 ins. of concrete in the bottom and a cast grid on top. Catch-basins should be cleaned out frequently to insure the tiles remaining open.

The road should be crowned to shed water to the sides as rapidly as it falls or forms on the surface. The crown will vary with the kind of surface. A clay road after consolidation should have a fall toward the side of one inch per foot; a greater fall would be better if it were not that it would tend to concentrate traffic to the centre of the road and aggravate the rut trouble. A water-bound macadam road surface should have a fall toward the sides of  $\frac{1}{2}$ -in. to the foot; and concrete and tarred macadam roads, a slope towards the side of  $\frac{1}{4}$ -in. to the foot.

Drains and culverts should be kept free of all obstructions that will impede the free flow of water. A special effort should be made each fall to remove all trash and debris collected at entrances and outlets of culverts, and to remove fences and other obstructions in open drains.

#### Economy in Drainage

The regulations of the Department of Public Highways of Ontario contain the following recommendation:—

“Stone and gravel roads should have an adequate foundation adapted to the strength of the subsoil and the probable weight and frequency of traffic. The upper 4 ins. of consolidated material is to be regarded as the wearing surface, and the remainder of the road crust with the subsoil is to be considered as the foundation.”

If we consider the maximum load allowed on country roads,—that is, a vehicle weighing 12 tons, with a maximum pressure of 650 lbs. per inch of tire width—and that two-thirds of the load is carried on the rear axle, we have a weight of 4 tons per rear wheel, which would require a tire width of over 12 ins. Now, if we assume that the pressure is carried down at an angle of 30 degs. with the vertical, and that a gravel subsoil will support 8 tons per sq. ft., firm clay 4 tons per sq. ft., damp clay 2 tons per sq. ft., wet clay 1 ton per sq. ft., and wet yielding soil  $\frac{1}{2}$  ton per sq. ft., we would require a depth of crushed stone of approximately 3 $\frac{1}{2}$ , 6, 9 $\frac{1}{2}$ , 16 $\frac{1}{4}$  and 25 ins., respectively, in addition to the wearing surface.

Now, if by draining we are able to convert damp clay, capable of carrying 2 tons per sq. ft., into firm clay, capable of carrying 4 tons per sq. ft., we are able to effect a saving of 3 $\frac{1}{2}$  ins. of crushed stone, which, in an 18-ft. roadway one mile long, would mean a saving of approximately 1,300 cu. yds. of stone (loose measure), which, at a moderate cost, would represent a value of \$2,600; and if we were able to convert wet clay, capable of carrying 1 ton per sq. ft., into firm clay, capable of carrying 4 tons per sq. ft., we would be able to effect a saving in the stone of a depth of 10 $\frac{1}{4}$

ins., which, at the same moderate value, would amount to \$7,500 per mile; or in other words, we could afford to spend in drainage in the first case \$2,600 per mile, and in the second case \$7,500 per mile, and break even. In many cases but a small percentage of the latter amount will be sufficient to drain efficiently one mile of quite wet road if use be made of all available outlets.

### A PLEA FOR RE-SURVEYS\*

BY E. T. WILKIE

*Chairman of Committee on Land Surveying, Association of Ontario Land Surveyors*

**D**URING the three years that the writer had been chairman of the Committee on Land Surveying, he has had a number of letters from members of the Association of Ontario Land Surveyors calling his attention to the general situation in which the surveyor finds himself in regard to local surveys,—a situation which is constantly growing more difficult and unsatisfactory.

The retracing of lines laid down many years ago, either for the purpose of defining such boundary itself or for further sub-division of the tract in question, engages a large share of the activities of many of our members. In the older parts of the province at least, the monuments planted in the original surveys, and all other marks indicating their position, have long ago disappeared, and no satisfactory evidence can now be obtained as to their former location. The generation that knew the originals has passed away, and with the succeeding generation evidence sinks into tradition getting ever thinner until it fades into unsubstantial myth and can no longer be relied upon as a basis for action.

It is upon this unstable structure that the surveyor now stands, and unless he can contrive a firmer foundation for his work, his credit must inevitably suffer as a consequence. The legal gentleman who faces him in court has only to talk, an exercise which can be performed with great accuracy and to any number of decimal places, while his unfortunate victim knows only too well that he cannot lay down with any measure of certainty even his probable working error, much less prove his case to the multifractional degree of accuracy required of him.

#### Permanent Monuments Needed

A good deal has been said and written about filing field notes of private surveys, but as such surveys are not indisputable, the only value these notes would have would be to show what was done in any particular case, but would most likely be valuable in making adjoining surveys at a later date; but all the plans and field notes in creation are of no avail unless the points to which these records refer can be established by evidence or identified on the ground. In the lack of permanent monuments whose validity cannot be disputed, rest nine-tenths of the troubles of the land surveyor. Given such monuments upon which to base his surveys, the working error as between different surveys would be negligible, and the credit of the profession would correspondingly increase.

This matter is well exemplified by a question just submitted by H. J. Beatty, of Pembroke, Ont., which shows the great amount of work that has to be done now to establish the post required to start the side line from, and how little would actually be required if some form of permanent posts had been planted in the original survey. In his letter forwarding the question, he points out that in some localities where there are still unpatented lands, the purchaser will be required to go to considerable expense, perhaps a greater amount than the land cost him, to establish the true corner of the property he has just acquired, and he thinks that the government should establish the posts, or failing that, the least they should do would be to establish the corners of the block in which the lot is situated.

\*Address at annual meeting of the Association of Ontario Land Surveyors, February 17th-19th, Toronto, Ont.

Mr. Beatty also says: "As you are doubtless aware, the Dominion government has practically re-surveyed the whole of the northwest, and I understand in the province of Quebec the government there makes certain surveys by which they establish the road allowances along the old travelled roads, making these the new boundaries. I know that there is a great deal of this county (Renfrew) in which it is practically impossible to make a correct survey to-day. The only thing to do would be to accept the travelled roads, for as a matter of fact, they now form the actual boundaries."

The government might be approached by the Association of Ontario Land Surveyors and asked to re-establish the township boundaries, to begin with, and when that work was well under way, they might be induced to extend operations to the interior of the townships where required.

#### Charbonneau vs. McCusker

In this connection the writer would like to call attention to the case of Charbonneau vs. McCusker, reported in 22 Ontario Law Reports, page 46, in which he made a survey having to work from a municipal survey of the township boundary where ordinary field stones were used and not marked, and was unable to get any evidence to the monument most particularly needed. This case went through two courts and the survey was upheld. The trial judge, in his judgment, said: "There must come a time when surveyors' monuments will speak for themselves, as evidence of witnesses who saw them planted cannot be got; it is for this purpose that such monuments are planted of stone or other durable materials." The writer thinks the time has arrived when greater efforts should be made towards getting more such monuments planted.

In the line of practice above referred to, two legislative acts are of special importance: First, the Surveys Act; and second, the Registry Act, with its side partner the Land Titles Act. The first of these acts deals with the ground itself, or the thing; and the second with the plans purporting to represent the ground, or otherwise the symbol; and around this symbol, and depending upon it for accuracy, are written deeds and other documents upon which the validity of property titles depends, and likewise the security of many millions of invested capital.

In the framing of the above acts too little care has been exercised to see that they are reciprocal and in conformity, and thus friction is engendered in operation. It is an unfortunate fact that many of these registered plans do not truly represent the facts as they exist on the ground; and as many and irregular subdivisions have been made of the original lots by metes and bounds descriptions largely prepared in the office of solicitors and without actual survey, much confusion has resulted. Properties have been conveyed from holder to holder over a long term of years, which, if subjected to survey, would be found not to conform to the description contained in the holder's deed, and his title would be faulty. Indeed, it would not be surprising to find that our registry offices contain a larger percentage of fiction on their files than Andrew Carnegie would permit on the shelves of his libraries. The clearing up of this situation can only be accomplished by working from the ground up, and the sections of the Surveys Act dealing with municipal surveys are alone competent to effect this change.

#### Should Encourage Municipal Surveys

If the making of municipal surveys under the Surveys Act had been carried on more extensively in the past, when evidence was more easily obtainable, a lot of the difficulties now existing would have been overcome; but, as is said, "Better late than never." We should make an effort to have more such surveys performed in the future, and so try to overcome the difficulties with the best means at our disposal. With that end in view, the writer would suggest that when surveyors meet with cases where lack of monuments make the work difficult and expensive to individual owners, they try to have municipal surveys made to establish the missing points required to work from, and thus not only help the present case but leave something sure and available for future surveys in that locality.

Another member of the Committee on Land Surveying opposes the method of running lines in the centre of the allowance for roads, which, after being well blazed and marked when the survey was made, are all destroyed when the roads are made. It is suggested that it might be a better plan to run the lines along one limit of the road allowance, as is done in the Dominion land surveys, so that the marks would not be destroyed when the roads are being made. The writer is glad to say he understands the department has made a move in this direction, and understands that in new surveys now the lines are run on one limit of the road allowance.

The writer is also pleased to note that the agitation of the past for a better and more permanent class of monuments used in new surveys has borne fruit.

### BOUNDARY MONUMENTS\*

By DR. E. DEVILLE

*Surveyor-General, Department of the Interior, Ottawa*

**E**VER since the world has existed, land has been man's most precious possession; from it he derives his subsistence. From the earliest times, the greatest care was taken to define the boundaries of property and to prevent their displacement. A special curse is pronounced in the Old Testament against the man who shall remove his neighbor's landmark, while a very large part of the Book of Joshua is occupied by the description of the various pieces of land allotted to the different houses of the Israelites. At the time of the Roman Empire, a festival called Terminalia was celebrated on February 22nd in honor of Terminus, the god of landmarks; it took place at the boundaries where sports and dancing were indulged in.

The ancient custom of "Beating the Bounds," still observed in many English parishes, probably originated from the Roman Terminalia; it is as old as Anglo-Saxon days, as it is mentioned in laws of Alfred and Athelstan. The priest of the parish, with the churchwardens and parochial officials, headed a crowd of boys who, armed with green boughs, beat with them the boundary stones. Sometimes the boys were themselves whipped or even violently bumped on the stones to make them remember. Obviously, boys were selected to ensure that the witnesses to the boundaries should survive as long as possible.

#### Early Surveys Often Crude

In the early days of Canada, when land had very small value and little money could be spared from the necessities of life, the surveys were often very crude, and little attention was given to the establishment and maintenance of boundaries. The general practice in Eastern Canada was to mark a corner by a squared wooden post, bevelled at the top so as to turn off rain, and to witness it by several blazed trees in close proximity. Although not absolutely permanent, a 6-in. cedar post, witnessed by large pine or spruce trees, can be identified after a great many years unless the place is swept by fire. Even then, it is often possible to identify the charred end of the post in the ground. A great defect of wooden posts is that they can be so easily removed.

At the inception of the surveys in Manitoba, the practice of the eastern surveyors was continued, but there was a wide difference in the conditions. Poplar, usually of small size, was the prevailing timber, and very few trees were large enough to be used as witness trees. A single fire was sufficient to obliterate all trace of posts and witness trees.

In prairie, a corner was perpetuated by a mound built around the post, and by four pits. Even after the post had disappeared, the mound crumbled and the pits filled in, the spot could be recognized for many years by a peculiar difference in the vegetation of the virgin prairie and of the

four pits, but this difference disappears when the spot is ploughed over, and there is nothing left to indicate the corner. The faults of the system were well recognized, but the government of the day would not sanction the expenditure necessary for the improvement of the surveys. All that could be obtained was to substitute in lieu of the wooden post a 3-ft. length of ½-in. iron pipe, pointed at one end and squared at the other end, but it could be so easily removed that a great many disappeared. One must bear in mind that in the early eighties, the revenue of Canada was not much over thirty millions of dollars and the expenditure for surveys was nearly a million dollars; and any amount of land could be bought for less than a dollar an acre. The reluctance of the government to increase its surveys' expenditure may therefore be understood.

The most important feature of a land survey is the boundary monuments. The object of the survey is to define the boundaries of the several parcels laid out in such a manner that there shall be no possible dispute between the respective owners. Though the survey may be inaccurate, there is not room for dispute so long as the boundaries are marked by permanent monuments. If, however, a monument is lost, its re-establishment may become an extremely complicated problem leading to expensive litigation. To find the position of the monument is no longer an operation in surveying; it is a question of fact to be determined by evidence. It has passed from the hands of surveyors into the hands of lawyers. The permanency of boundary monuments is thus of paramount importance; it deserves the utmost care and attention from the surveyor.

#### Cut Stone Best Mark

The best boundary mark is undoubtedly a cut stone, of fair size, and sufficiently long, in our climate, to reach below frost line. It seems preferable that the mark, whether a stone or anything else, should not project above ground, because it would be liable to be disturbed by traffic; if it is necessary to make its position conspicuous, it can be done by placing something else near it,—for example, a post, a mound or a blazed tree. A concrete monument is nearly as good as cut stone, and if sand or gravel is not too far away, it is not so expensive. Such monuments were found very satisfactory for the Alberta-British Columbia boundary, but the commissioners have now reached a point where gravel has to be brought from such a distance that it costs \$60 to build a monument.

Evidently the use of cut stone or concrete is restricted to special cases; it is not adapted to township surveys. What is wanted is some kind of post which, although substantial and permanent, is neither too heavy nor too bulky. Once placed in position, it must be difficult to displace or remove it, and impossible to do so without tools. The inscriptions for denoting the corner must be easily and quickly made, neat, perfectly legible and not subject to deterioration. It must also be conveniently packed for transportation.

#### The D.L.S. Post

The post adopted for the surveys of Dominion lands fulfils these requirements fairly well. It is made of one piece of standard 1-in. iron pipe, 30 ins. in length. On the top is a bronze cap, 3 ins. in diameter, into which the iron pipe is forced; it bears a crown and the inscriptions "Dominion Lands Surveys" and "Seven years imprisonment for removal." There is room in the centre of the cap for all the inscriptions necessary to identify the corner; these are made with steel dies. A malleable iron foot-plate, 3½ ins. in diameter, is fastened to the bottom of the pipe. The post is coated inside and outside with Mexican asphaltum and then filled with concrete consisting of equal parts of sand and portland cement. The posts are packed in tens in well finished basswood crates, reinforced with iron straps and bolts. The post weighs 7½ lbs.; the complete crate with the ten posts weighs 85 lbs., making a neat and convenient package for transportation. It is the intention to change, in the next lot of posts, the mode of fastening of the bronze cap and bottom plate. Both will be soldered to the iron pipe by means of the oxy-acetylene blowpipe, using

\*Paper read at the annual meeting of the Association of Ontario Land Surveyors, February 17th-19th, Toronto.

spelter for soldering the bronze cap and then bars of cast iron for the foot-plate.

A hole 30 ins. deep is made for receiving the post; the bronze cap is flush with the surface of the ground. In ground free from stones and not frozen, a convenient tool for digging the hole is a post-hole auger. In stony or frozen ground, a bar of octagonal drill steel with chisel ends is a good tool for loosening the earth and cutting roots. A spoon shovel can be used for removing the earth from the hole. After inserting the post, with crown turned towards the north, the hole is filled with earth which is well tamped around the post. To all intents and purposes, such a post may be considered as everlasting; even if the iron were to be entirely destroyed by rust the concrete core and the rust would remain in the ground as evidence of the monument.

Where a corner falls upon rock, the short bronze post is used. It has the same top as the long post, but the shank is of smaller diameter and only 3 ins. long. A hole  $\frac{7}{8}$  in. in diameter is drilled in the rock; all dirt and foreign matter is carefully removed and the hole filled by adding  $1\frac{1}{2}$  ounces of water to  $2\frac{1}{2}$  ounces of portland cement. The post is then inserted and pressed down until the cap rests upon the rock surface.

#### REORGANIZATION OF THE B. BLAIR PLANT

**R**EORGANIZATION of the plant of the B. Blair Co., Woodstock, Ont., manufacturers of concrete pipe, has been completed, and the plant is now turning out a large quantity of pipe daily. The plant is now the property of the Independent Concrete Pipe Co., Ltd., which was formed a few months ago by John E. Russel, of Toronto, and others, and which purchased Mr. Blair's plant and business. Since that time the plant has been considerably enlarged and new machinery installed. Mr. Blair has been elected president and manager of the new company.

John E. Russel Co., Toronto, are the general sales agents of the company, which will manufacture bell-end sewer pipe, pressure pipe, culvert pipe, drain-tile and other concrete products. A McCracken machine for the manufacture of cement-glazed sewer pipe has been installed, all pipe being manufactured in accordance with the specifications issued by the American Society for Testing Materials. McCracken pipe is being extensively used by Milwaukee, Kansas City, Oklahoma City and other municipalities in the United States, and is now being used in Ontario by cities of Galt, Guelph and Woodstock, and by the Toronto Harbor Commission.

The Independent Concrete Pipe Co., Ltd., has also been successful in obtaining the right to manufacture Lock-Joint pipe in Ontario. Lock-Joint pipe has been extensively used as pressure pipe, and there have been many installations of large sizes in the United States and Canada, some of which are subject to high heads. The Independent Concrete Pipe Co., Ltd., will manufacture pipe from 6 to 108 ins. in diameter, and intends to stock all sizes under 48 ins., inclusive.

The city engineer's department of Brantford, Ont., has been invited by the minister of public works of Ontario to tender on the construction of portions of the provincial highway near that city.

The Toronto branch of the Engineering Institute of Canada has forwarded to the councils of the various municipalities throughout Ontario the recommended schedule of salaries for engineers.

A bill to amend the "Manitoba Civil Engineers' Act" has been introduced in the Manitoba legislature and given its first reading. The bill is under the auspices of the Manitoba branch of the Engineering Institute of Canada and provides for registration and licensing in accordance with the model legislation recommended by the legislative committee of the institute. J. G. Sullivan, Wm. Scott, Guy C. Dunn, J. M. Leamy, W. J. Dick, and W. P. Brereton are named as the provisional council of the "Association of Professional Engineers of the Province of Manitoba," which body is to have control of the operation of the act.

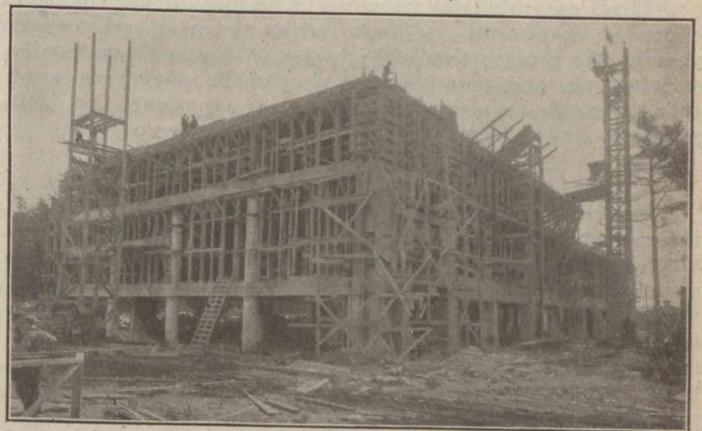
#### DYNAMITE USED UNDER FIRST-STORY FLOOR DURING CONSTRUCTION OF WAREHOUSE

By P. D. VAN VLIET

Wells Bros. Construction Co., Chicago and Halifax

**O**CCASIONALLY the speed requirements in building construction are such that only unusual methods bring success. Such was the case with the five-story reinforced concrete warehouse of the Robert Simpson Co., Ltd., at Halifax, N.S. Decision to build was made in June, 1919, foundation plans were delivered July 25th, and from that time construction was as rapid as the delivery of materials would permit. The last passenger elevator went into service December 20th.

Due to the plans being developed co-incidentally with the construction, it was impossible to excavate the tunnel for heating and water supply pipes and electric wires prior to the concreting of the first-story floor. Rock outcropped



SIMPSON WAREHOUSE AT HALIFAX DURING CONSTRUCTION, SHOWING STAGE OF WORK AT WHICH DYNAMITE WAS USED UNDER FIRST-STORY FLOOR

over most of the building area, and the tunnel was to run to a corner of the property, tapping the Halifax water supply, and to the power-house at some distance from the main building. The maximum cut was 10 ft.

In blasting beneath the floor slab, small charges were used, and well blanketed so that no injury occurred and little extra cost or time was involved.

Face brick was not to be had closer than Cheltenham, Ont., involving freight charges of \$13.25 per thousand on \$18 brick. Prism glass used in the upper two lights of the steel sash was ordered out of stock in England, and cabling was resorted to in order to speed shipment.

At the Canadian Good Roads Association's seventh annual convention, to be held next June in Winnipeg, a feature of the program will be the construction of a model roadway, showing drainage, preparation of sub-grade, foundation, construction of wearing surface, etc. Specifications under which the road is built will be distributed to the delegates.

Vessels operating on rivers which form a part of the international boundary between United States and Canada must hereafter be equipped with sewage and garbage disposal apparatus, so as to avoid pollution of the rivers, according to a ruling of the International Joint Commission.

The attitude of the state of New York toward the canalization of the St. Lawrence river is reflected in the annual report of Frank M. Williams, state engineer, which was submitted last week to the legislature at Albany. Mr. Williams objects to the St. Lawrence scheme, and states that if a ship canal is to be built, the most logical route is that known as the Oswego river-Oneida lake-Mohawk river route, which was favored in a report by the United States Deep Waterways Commission about 1902.

## PROBLEMS CONFRONTING SURVEYORS\*

### Their Part in the Good Roads Movement—National Organization of Surveyors Needed—No Positions to Which Old Surveyors Can Retire

BY C. FRASER AYLSWORTH

*Ontario and Dominion Land Surveyor, Madoc, Ont.*

**M**ANY years ago, members of the Association of Ontario Land Surveyors were among the first to expound the doctrines of scientifically constructed roads, or what were then and are now known as "good roads." We all remember with what scepticism and uncertainty those doctrines of good roads were received by the great majority of our people. But what a difference we find to-day; instead of scepticism and uncertainty, there is an unanimous Canadian-wide demand that all the good roads that money can in any way be found to pay for, shall be constructed with as little delay as possible.

If all goes well, the province of Quebec alone will have expended thirty million dollars during the past and present year on the construction of highways. This is all eminently satisfactory, and demonstrates that while surveyors were then branded as visionaries, we are now proven as both practical and scientific.

#### The Highway Engineering Field

In this good roads field, surveyors should quite naturally infer that there should be splendid opportunities for service by them. If we cannot round off our gradually diminishing surveying practice in some such field as highway engineering, then why is it? After bearing the burden of the propaganda that has finally resulted in this unprecedented demand for good roads, why are surveyors not called upon to construct them? We are quite accustomed to the management of labor; from the earliest days the integrity of surveyors has been unquestioned; again, I submit, why are surveyors not in on the ground floor of this good roads program? A few are, but the great majority are not. In unity there is strength; united we win, divided we fall. I am of the opinion that we should broaden our organization by assisting towards the formation of a Canadian-wide organization, consisting of all the members of all the provincial associations throughout the Dominion, for defensive purposes in order that the organization may possess an effective kick and punch.

Why should an Ontario land surveyor be permitted to collect only \$5 per day as a witness while attending court on a survey case? Why should the Canadian Civil Service Commission be permitted to offer only \$1,200 per annum as salary for a college-bred Dominion land surveyor? Why should politicians continually be permitted to secure positions of emolument that only surveyors should occupy by virtue of their technical experience, which would result in economical and efficient benefits to the public?

#### Traditionally Handicapped Position

I shall merely generalize here, by not specifically enumerating those positions, as surveyors are only too painfully aware of their traditionally handicapped position in this regard. The practice of surveying is more exhausting to the body than the practice of any other profession. It becomes very trying and hazardous to the older surveyors, and in the proverbial nutshell, it is a case of "Go it while you are young, for when you get old you can't."

Apparently at present there are no retiring positions dangling before the surveyor, to which his qualifications should entitle him to aspire, such as are continually in the foreground of the members of other professions.

Do not all those conditions that I have pointed out clearly indicate that there is something deficient in our organization? And I am merely touching the fringe of this feature of our affairs.

\*Presidential address at the annual meeting of the Association of Ontario Land Surveyors, February 17th-19th, Toronto, Ont.

It has been observed that members of such an association as ours will suddenly become very regular attenders of our annual meetings. They will take an enthusiastic and lively interest in all its affairs and proceedings, they will be nominated for office, they will be annually promoted until they reach the highest honor within the gift of our association,—the presidency. Then, presumably exhausted through past strenuous efforts, they suddenly extinguish their lights in so far as our association is concerned. Many past presidents, however, have not thus forsaken our association and have not thus deprived our annual meetings of their much needed ripe experience and fund of knowledge. Their regular attendance and lively interest and assistance is highly commendable and indispensable to the life of our association.

Organization needs no defence to-day. It is the all-inspiring spirit of the age, and Ontario land surveyors would surely be professional laggards, compared with members of other professions, if they permitted their organization to lag behind. Hence I trust that the young surveyor and the old surveyor will always recognize that it requires both to round off the profession, and that they will both work together with their shoulders to the wheel of progress, thereby promoting our individual and general interests and thus elevating the standard of the profession. It is more than ever the duty of past presidents to continue their active interest in our association.

As your president, I attended the last annual meeting of the Association of Dominion Land Surveyors, at Ottawa; while there I learned that there are distinct rumblings in the mulberry bushes, suggesting that steps be taken to broaden our organization. One educating and delightful part of their program was the carefully prepared lecture on the "Engineering Problems of the Great War," by General Sir Arthur Currie. This acquisition to their program was a complete "scoop" by our sister association.

#### Permanent Posts for Ontario

We are pleased to learn that in the future the Department of Lands, Forests and Mines will place permanent iron posts at the corners in the new surveys. Let us not neglect to follow this up with a continuance of the educational campaign to have the governing township boundaries, in the older settled portions of Ontario, resurveyed and their astronomical bearings accurately determined and permanently marked. Along this line, I would suggest that an effort be made to have the interesting paper on "Boundary Monuments" that has been prepared by Dr. Deville for this meeting, published in the press.

I am sure we are in hopes that our remodelled and amended "Survey Act," which has been held in abeyance for the past three years, will receive the favorable consideration that it deserves and become our governing law during the coming session of our legislature.

I am sure I am giving expression to the complete satisfaction all our members entertain towards Willis Chipman, our worthy chairman of "Repository and Biography." The work in connection with his report involves an almost endless amount of correspondence and time, but I trust he will not discontinue this good work until he has secured a sketch of all the deceased surveyors.

The Administrative Commission of Montreal has voted \$25,000 for the preparation of plans for the completion of the aqueduct for water supply purposes only, as recommended by R. S. and W. S. Lea, consulting engineers. The cost of the project is estimated at \$1,683,000.

Hon. Obadiah Gardner, formerly United States Senator for Maine, and chairman of the United States section of the International Joint Commission, states that the development of the St. Lawrence river between Lake Ontario and Montreal will probably cost \$250,000,000. He says that it will cost more than \$50,000,000 to make the river navigable for ocean-going steamers, and that the development of 2,000,000 h.p. will cost about \$200,000,000, according to rough estimates with which he says he has been provided.

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## NATIONAL ASSOCIATION OF SURVEYORS

AT the annual meeting of the Association of Dominion Land Surveyors held last month in Ottawa, initial steps were taken toward the formation of a national association of surveyors. The opinion of the majority of surveyors appears to be decidedly in favor of the formation of a Dominion-wide association. There seems to be much good work that could be accomplished by the co-operation of all surveyors in Canada, and there appears to be no good reason why such an association should not be formed.

At the present time there are a number of independent provincial associations, but there has never been very much reciprocity between them, and there has been very little concerted action toward improving the general status of the surveyor in Canada. The surveyors in the various provinces have rights and privileges that have been granted to them by various provincial acts, and it is not likely that the surveyors in the older provinces will consent to accept a certificate of membership in other provincial associations in lieu of their own final examinations. This is not regarded, however, as any barrier to the formation of a national association for broad, general purposes.

The trend, in Ontario at least, is toward requiring graduation from a recognized college of civil engineering, to be followed by a year's work with a qualified Ontario land surveyor. In the case of surveyors from other provinces, the preliminary examination is generally waived, but not the year's residence and work. Dominion land surveyors are exempt from the year's apprenticeship, but must pass the final examinations.

These requirements are held to be only just and proper in order to protect the public and to make certain that all Ontario land surveyors are fully familiar with the laws and methods of that province. Continuation of these requirements need not interfere with the formation of a national

body whose entrance standards would be fully equal to any provincial preliminary examination. It is only through a national association that surveyors throughout the country can co-operate to the best advantage.

Besides those who are in private practice and those who are in the employ of the various provincial governments, there are surveyors in the topographical surveys branch, the geological survey, the office of the surveyor-general, the geodetic survey, the water power branch, the reclamation branch and other offices of the Dominion government. If all these men could be induced to join one association, it would probably have a membership of nearly 1,000. It is obvious that such a large organization would have much greater prestige than has any of the provincial associations.

## ENGINEERING SOCIETY SETTLES CIVIC DISPUTE

LOCAL organizations of engineers can confer a real benefit upon their communities by active participation in civic affairs. This fact was again demonstrated by the recent action of the Tacoma chapter of the American Association of Engineers in making a report on the types of paving used in Pierce county, Wash., which county recently bonded itself for \$2,500,000 for paving roads. When the first call for bids was issued, a controversy arose concerning the type of pavement to be used. This resulted in a warm argument, although the local newspapers were impartial.

The report of the chapter did not recommend any particular type of paving, but discussed various types from a standpoint of construction cost and depreciation. Comparative data were included in the report, which holds that "power to determine the type of pavement should be vested in the engineer. The engineer alone should select the type, form and thickness of the pavement to be used, and should be permitted to vary the plan of construction even in the several parts of the same highway so as to best overcome difficulties and take advantage of local conditions."

This report resulted in an editorial in the "Tacoma Ledger," favorable to the policy recommended. "We take it," said that editorial, "that they do not advocate that every road be paved with concrete, or that every road be paved with bitulithic, but that all roads be paved with horse-sense. One cannot read the report without feeling that whoever wrote it was doing the work without prejudice.

"If the spirit of this report is carried out, it would not be necessary for any paving trust to attempt to program the entire paving of the county. It would obviate the possibility of one county commissioner going into office predisposed to one type of pavement, and another county commissioner predisposed to still a different kind. It would take the paving question out of the sordid political muddle. It would save the county commissioners the embarrassment which arises from the importunities of their particular political friends. In short, we believe it would bring about the only contention for which the "Ledger" has been fighting in the paving proposition,—that is, that there be good judgment used to the end that the taxpayer gets a dollar's worth of paving for every dollar expended."

## HONOR TO DR. W. H. ELLIS

IN presenting to the University of Toronto an oil portrait of Dr. W. H. Ellis, his associates paid an appropriate tribute to his services as an educationist, and to the respect and admiration which his personality has always inspired. As professor of applied chemistry in the School of Practical Science, and recently also as dean of the Faculty of Applied Science and Engineering, the title by which the school was known after its union with the University in 1906, he devoted 33 years to the cause of applied science in Canada, and the inauguration of the School of Engineering Research, established within the faculty at his suggestion in 1917, may be regarded as a fitting climax to his work. Sir Edmund Wal-

ker, who accepted the gift on behalf of the university, expressed pleasure that Dr. Ellis was present at the unveiling of the portrait in recognition of his distinguished services. The pleasure will be shared by graduates, students and friends, who hope that Dr. Ellis, in his retirement, will enjoy for many years the rest which his labors deserve.—Editorial in the "Toronto Globe."

### PERSONALS

WILLIAM GEORGE SWAN, who was recently appointed chief engineer of the Vancouver Harbor Commission, was born in 1884 at Kincardine, Ont. He was educated at the Kincardine public and high schools and at the University of Toronto, Faculty of Applied Science and Engineering, where he graduated in 1905 with the degree of B.A.Sc., subsequently



obtaining the C.E. degree. In the summer of 1903, Mr. Swan served as an assistant hydrographic engineer in the employ of the Dominion government. In 1904 he was employed by the C.N.R. as a transitman. After graduation Mr. Swan was an instructor in mechanics of building materials at the University of Toronto, which position he held for three academic terms. He then rejoined the C.N.R. staff, becoming successively resident engineer, bridge engineer, division engineer, terminal engineer and district engineer, at New Westminster, B.C. For three years before the war he was in charge of construction of the C.N.R. mainland terminals on the Pacific coast, including the Port Mann wharves, which he designed, and the reclamation of the False creek flats. When war was declared, Mr. Swan was an officer in a militia regiment at New Westminster, and he took an active part in the formation of the 131st Battalion. He served in France for 27 months, at first as major of the 2nd Battalion, Canadian Railway Troops, and later as Light Railways and Tramways Engineer for the 2nd British Army. He was twice mentioned in despatches and was awarded the D.S.O. and the Croix de Guerre. It may be noted that A. D. Swan, of Montreal, consulting engineer for the Vancouver Harbor Commission, is not related to the commission's new chief engineer.

J. A. HOUSE, of St. Catharines, Ont., has been appointed manager of the Guelph Radial Railway Co.

J. SMYTHE has been appointed superintendent of water works at Cornwall, Ont., succeeding C. A. Lount, who recently resigned.

HENRY SHEARER has been appointed general manager of the Michigan Central Railway, and J. H. LECKIE, general superintendent.

J. ORTIZ has been appointed town manager of Grand Mere, Que., and is engaged in organizing various branches of the municipal service.

R. H. FISH has been appointed general superintendent of eastern lines, Grand Trunk Railway. Mr. Fish's headquarters will be in Montreal.

HON. W. C. EDWARDS is acting as chairman of the Commission of Conservation in the place of Sir Clifford Sifton, who resigned the chairmanship last year.

RICHARD D. WAUGH, chairman of the Greater Winnipeg Water District and formerly mayor of Winnipeg, has been appointed to represent Canada on the Saar Valley Commission.

OSCAR MORIN, deputy minister of municipal affairs of the Province of Quebec, has been appointed director of housing for that province, succeeding Dr. Emile Nadeau, who recently resigned.

H. H. WHITTENBERGER, formerly general Ontario superintendent of the Grand Trunk Railway, has been appointed general manager of the Grand Trunk lines in the United States, west of Detroit.

SERAPHIN OUMET will continue in private practice as a civil engineer and land surveyor at 76 St. Gabriel St., Montreal. Mr. Oumet was a partner in the firm of Oumet & LeSage, which partnership was recently dissolved.

GORDON PERRY, president of the National Iron Corporation, Ltd., Toronto, who is in England, is said to be negotiating with British firms for the sale of the patent rights for a new and highly advantageous method of manufacturing iron pipe.

L. A. THORNTON, city commissioner of Regina, Sask., has been appointed to represent that city on the commission that will investigate the proposed water supply from the Saskatchewan river. The chairman of the commission is Maj. A. J. McPherson.

C. C. SUTHERLAND has been appointed assistant city engineer of Edmonton, Alta. Mr. Sutherland is a graduate of the University of Toronto, Faculty of Applied Science and Engineering, class of 1909, and has been on the city engineer's staff at Edmonton for several years.

D. R. FRANKLIN has been appointed permanent architect on the staff of the Board of Education, Toronto, at a salary of \$4,500 per annum. Mr. Franklin was the successful architect when competitive plans were submitted for the John Ross Robertson and the Glenholme Ave. schools.

H. VICTOR BRAYLEY, who for several years has been in private practice as an industrial counsellor and engineer, has formed an association with Kenneth F. Dewar, and Sherwood W. Stevenson, incorporating the firm of Brayley, Dewar & Stevenson, industrial counsellors, Montreal.

J. M. M. GREIG, who for the past year has been assistant engineer on the staff of Frank Barber and R. O. Wynne-Roberts, consulting engineers, Toronto, has rejoined the Sherwood Construction Co., Ltd., from whose staff he resigned a year ago. Mr. Greig will be principal assistant to Mr. Clark, the estimating engineer of the Sherwood company.

LIEUT.-COL. W. P. WOOTEN, of the United States Army Engineering Corps, has been named by the United States government as its engineering representative in connection with the investigation of the St. Lawrence river ship canal and power development project. The Canadian government has not yet appointed its engineering representative, but will do so at a very early date.

ROBERT A. BROWN, electric light superintendent of Calgary, Alta., has been recommended by the city commissioners as city electrical engineer and street railway superintendent, to take the place of T. H. McCauley, who recently resigned in order to accept a position in New Brunswick. Mr. Brown has been with the city of Calgary for the past ten years, previous to which he was electrical superintendent at Nelson, B.C. Robert McKay, assistant superintendent of the electric light department, will be promoted to Mr. Brown's present position.

JOHN W. DORSEY, assistant professor of electrical engineering at the University of Manitoba, has announced the discovery of a device simplifying the long distance transmission of electric power. Prof. Dorsey has applied for patents covering his invention. He states that it will cut the cost of long distance transmission in half. He has offered his invention to the province of Manitoba and the city of Winnipeg for free use in their electrical development work, provided that they will assist him in the practical application of the invention. Prof. Dorsey graduated in

electrical engineering, class of 1908, at Lehigh University, and served in France as a captain in the United States army.

FRANK S. RUTHERFORD has been appointed organizer for the industrial and technical educational board of the Ontario Department of Education, at a salary of \$3,500 per annum. Mr. Rutherford is a graduate of the Faculty of Applied Science and Engineering, University of Toronto. He enlisted in 1914 with the 2nd Field Company, Canadian Engineers, and went to France with the first contingent. He returned to Canada as a casualty and was assigned to duty in the school of trench warfare. In February, 1919, he was appointed officer in charge of the Professional Employment Bureau of the Department of Soldiers' Civil Re-establishment.

### OBITUARIES

GEORGE P. MAGANN, a well-known railway contractor, died last month at his residence at Toronto at the age of 71 years, a victim of the influenza epidemic. Mr. Magann was born in Ireland and was brought to Canada when three years of age. He was educated in Hamilton, Ont. Mr. Magann had contracts at various times on most of the leading railways in Canada. He was one of the inventors of the Magann air brake in use in street railway operation.

MICHAEL J. STACK, president of the M. J. Stack Paving & Contracting Co., Montreal, died last Sunday at his residence in Westmount, after a week's illness with pneumonia. He was 42 years of age. Mr. Stack had carried out many important contracts in the vicinity of Montreal, including a large part of the Montreal-Quebec highway, and the underground conduits at Verdun. At the present time, his company is engaged in the construction of St. Augustin's Roman Catholic Church in Notre Dame de Grace. Mr. Stack was educated in the public school of Montreal, and entered the contracting business with his father's firm in 1890, continuing the business after his father's death.

G. REID MUNRO, sales manager of the Wm. Hamilton Mfg. Co., Peterborough, Ont., died last Monday after an attack of influenza. Mr. Munro graduated from the Faculty of Applied Science and Engineering, University of Toronto, with the class of 1905. He was elected to membership in the Engineering Institute of Canada in 1911, and was largely instrumental in the absorption of the Peterborough Engineering Society as a branch of the Engineering Institute. Mr. Munro was one of the organizers of the Peterborough Engineering Society and was its president when it was taken over two months ago as a branch of the institute. He was elected as the first chairman of the branch. Mr. Munro had been with the Wm. Hamilton Co. for a number of years, specializing in the design and installation of hydraulic turbines. He was well-known throughout Canada among engineers engaged in hydro-electric work. He was in attendance at the annual meeting of the Engineering Institute last month and was at that time elected as one of the councillors of the newly-formed Engineering Alumni Association of the University of Toronto.

A monumental museum as a Canadian war memorial has been recommended by the Royal Society, the Royal Canadian Academy and the Town Planning Institute. It was also recommended that the work be placed in the hands of a special commission, and that architects be asked to submit competitive designs.

At the recent annual meeting of the Association of Ontario Land Surveyors, Col. A. J. VanNostrand, J. S. Dobie and C. Fraser Aylesworth were appointed as a committee to confer with committees of other associations of surveyors concerning the practicability of the formation of a national association of surveyors. The majority of the members of the Ontario association favored the formation of such a national association. The Association of Alberta Land Surveyors originated the movement in favor of the national association and secured the endorsement of the Association of Dominion Land Surveyors at the latter's recent annual meeting.

### NOVA SCOTIA BILL INTRODUCED

ORGANIZATION of the Nova Scotia Society of Professional Civil Engineers was completed recently, with C. E. W. Dodwell, of Halifax, as president, and D. H. McDougall, of New Glasgow, as vice-president. The provisional councillors are: J. R. Allan, Dartmouth; T. J. Brown, Sydney Mines; F. A. Bowman, Halifax; F. W. Doane, Halifax; A. F. Dyer, Halifax; F. R. Faulkner, Halifax; I. P. Macnab, Halifax; W. G. Matheson, New Glasgow; W. P. Morrison, Dartmouth; C. M. O'Dell, Glace Bay; D. W. Robb, Amherst; J. W. Roland, Halifax; F. H. Sexton, Halifax; K. H. Smith, Halifax; and L. H. Wheaton, Halifax. This society has been formed in anticipation of the passing by the Nova Scotia legislature of the bill which calls for the registration and licensing of professional engineers, and which requires the formation of such an association of engineers within the province to administer the act. Within six months after the passing of the bill a permanent council of the society will be elected or else the election of the provisional council will be confirmed.

### B. C. SURVEYORS OPPOSE BILL

OPPOSITION by the British Columbia Land Surveyors' Association to the bill introduced in the British Columbia legislature for registering and licensing professional engineers, was revealed when H. A. MacLean, K.C., accompanied by the president of the surveyors' association, appeared this week before the private bills' committee and claimed that the bill would prevent surveyors from advising regarding development of mining claims. The bill was supported by a delegation of a score of prominent members of the Engineering Institute of Canada, headed by E. G. Matheson, of Vancouver, who claimed that it was in the interests of the miner to employ a properly qualified engineer to direct him in development work. C. F. Nelson, M.P.P., of Slocan, objected to the bill on the ground that it limits to three months the time within which an outside engineer could practice in British Columbia without becoming a member of the "Association of Professional Engineers of British Columbia." Mr. Nelson thought that this time should be extended sufficiently that engineer could be brought in from outside the province and have time to plan big undertakings without becoming a member of the association. The private bills committee decided to recommend the bill to the legislature with amendments covering these objections.

John Anderson, Jr., chairman of the good roads committee of the county of Peel, whose address is Macville, Ont., is seeking applications from engineers qualified to supervise the construction of county roads.

According to reports from St. Catharines, Ont., engineers of the Welland canal staff have been notified to prepare for the resumption of work, as it is expected that parliament will pass a large appropriation at an early date.

Sir George Foster, acting prime minister of Canada, has declared that it is the Dominion's intention to negotiate with J. D. McArthur for the purchase of the Edmonton, Dunvegan & British Columbia Railway. If the government purchases the railway, it will be extended and incorporated as a part of the C. N. R. system.

The new \$5,000,000 plate mill recently built by the Dominion Steel Corporation at Sydney, N.S., has been placed in operation. The first steel plate rolled was subjected to all tests by Lloyds' inspectors and found to be equal to the highest standard required for ship construction. The mill has a capacity of 100,000 tons of plates per annum.

Ald. F. Fowler, chairman of the works committee of the Winnipeg city council, told the other members of his committee at a recent meeting that he estimated the damage done to the water mains of Winnipeg by electrolysis at \$500,000 annually. Ald. Winton stated that in his opinion much of the damage attributed to electrolysis is due to alkali.

# 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.

## ADDITIONAL TENDERS PENDING

### Not Including Those Reported in This Issue

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

PLACE OF WORK	TENDERS CLOSE	ISSUE OF	PAGE
Armstrong, B.C., erection of school	Mar. 8.	Feb. 19.	45
Brantford, Ont., erection of 10 houses	Mar. 10.	Feb. 26.	48
Brantford Tp., Ont., concrete pavement	Mar. 23.	Feb. 26.	54
Calgary, Alta., construction of public building	Mar. 5.	Jan. 22.	48
Cornwall, Ont., road construction	Mar. 12.	Feb. 26.	49
Cornwall, Ont., road making equipment	Mar. 12.	Feb. 26.	46
Darlington Tp., Ont., work on highway	Mar. 9.	Feb. 12.	45
Exeter, Ont., concrete pavement	Mar. 20.	Feb. 19.	50
Halifax, N.S., construction of highway	Mar. 6.	Feb. 26.	54
Hamilton, Ont., sewer construction	Mar. 18.	Feb. 12.	45
Iroquois, Ont., supply of stone	Mar. 16.	Feb. 19.	52
Kerr Robert, Sask., extension of telephone line	Mar. 5.	Feb. 19.	48
Kingston, Ont., crushing stone	Mar. 6.	Feb. 26.	46
Lancaster, Ont., bridge construction	Mar. 9.	Feb. 12.	52
Louth Tp., Ont., work on highway	Mar. 16.	Feb. 19.	50
Moose Jaw, Sask., construction of bridge abutments and culverts	Mar. 5.	Feb. 26.	47
Niagara Falls, Ont., motor pumper	Mar. 15.	Feb. 19.	50
Pittsburg Tp., Ont., work on highway	Mar. 16.	Feb. 26.	52
Richmond Tp., Ont., work on highway	Mar. 9.	Feb. 19.	52
Stewart, B.C., construction of wharf	Mar. 5.	Feb. 26.	50
Toronto, Ont., asphaltic road oil pumps	Mar. 15.	Feb. 19.	45
Toronto, Ont., street cars	Mar. 16.	Feb. 19.	50
Toronto, Ont., concrete culverts	Mar. 17.	Feb. 26.	52
Toronto, Ont., concrete culverts	Mar. 17.	Feb. 26.	52
Toronto, Ont., flushing tanks and centrifugal pumping outfits	Mar. 9.	Feb. 26.	47
Toronto, Ont., road oil	Mar. 23.	Feb. 26.	52
Toronto, Ont., crushed stone	Mar. 22.	Feb. 26.	56
Toronto, Ont., centrifugal sewage pump	Apr. 20.	Feb. 26.	48
Tyendinaga Tp., Ont., work on highway	Mar. 9.	Feb. 12.	45
Walkerton, Ont., erection of bridge	Mar. 15.	Feb. 26.	49
Whitby Tps., Ont., work on highway	Mar. 16.	Feb. 26.	56
Whitby, Ont., erection of school	Mar. 10.	Feb. 26.	50

PLACE OF WORK	TENDERS CLOSE	ISSUE OF	PAGE
Winnipeg, Man., two rotary oil pumps and electric motors	Mar. 8.	Feb. 19.	45
Winnipeg, Man., extension to power-house	Mar. 8.	Feb. 19.	45
Winnipeg, Man., rotary oil pumps and electric motors	Mar. 8.	Feb. 26.	48
Winnipeg, Man., erection of buildings	Mar. 5.	Feb. 26.	50

## BRIDGES, ROADS AND STREETS

**Assiniboia, Man.**—The erection of a general traffic bridge into Assiniboia is projected; also erection of a foot bridge. Clerk, C. L. Richardson, St. James, Man.

**Banff, Alta.**—Although Bennett and White, of Calgary, were awarded the contract by the Dominion government for the construction of the bridge across the Bow River here, they have declined to accept same, for the reason that when they were tendering they stipulated that they should be informed within 10 days whether their tender was accepted, and the government exceeded this time limit by 20 days. Bennett and White's tender was \$190,000. An Ottawa concern was next, their tender price being \$204,000.

**Belleville, Ont.**—Deputation will wait on Hon. F. C. Biggs, Minister of Public Works, Toronto, in connection with proposed bridge across Bay of Quinte.

**Brantford, Ont.**—Tenders are being called by the Provincial Highway Department for construction of a concrete road from Brantford to Gainsville.

**Brisco, B.C.**—Tenders will be received by Hon. J. H. King, Minister of Public Works, Victoria, up to noon of Saturday, March 13, 1920, for the construction of a highway bridge over the Columbia River, near Brisco. For information re plans and specifications apply to Public Works Department, Parliament Buildings, Victoria; the district engineer, Court House, Vancouver, B.C., or to the district engineer, Golden, B.C.

**Calgary, Alta.**—City council let contract for construction of Hillhurst bridge to the Fegles Construction Co., of Fort William, Ont., at \$208,113.

**Cayuga, Ont.**—Contract has been awarded by Haldimand county council for the construction of 22½ miles of road to MacConnell and Hicklin, 171 Sherwood Ave., Toronto.

**Edmonton, Alta.**—Tenders addressed to the City Commissioners, 301 Civic Block, Edmonton, will be received until twelve o'clock noon on March 25th, 1920 for approximately two hundred tons of asphalt. Specifications may be obtained at the office of the City Engineer, but bidders may submit tenders attached to their own specifications.

**Erieau, Ont.**—A by-law for the construction of a concrete road from the western extremity of the village to the pier, will be submitted. Clerk, P. S. Shillington, Blenheim, Ont.

**Hamilton, Ont.**—Suburban area commission will secure prices on road oil.

**Hamilton, Ont.**—T. H. and B. Railway will replace bridge across Main St.