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The Canadian Engineer

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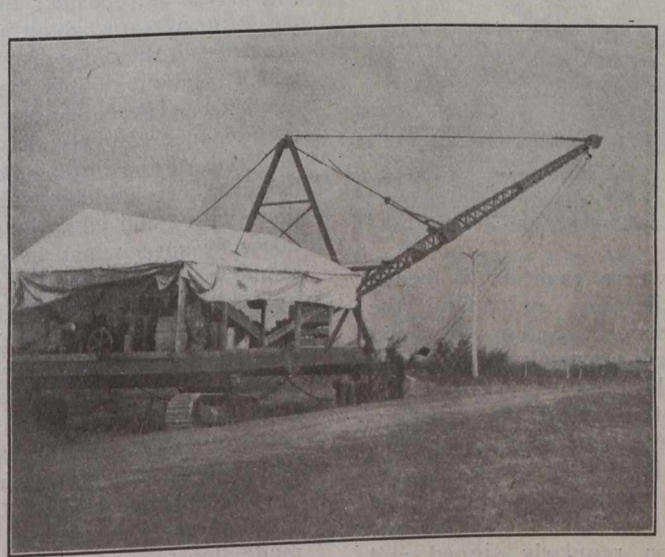
DRAINAGE PROBLEMS IN SASKATCHEWAN

HOW THE CAPACITIES AND LOCATIONS OF THE DRAINS ARE DETERMINED —GRADES AS LOW AS 0.02 PER CENT. HAVE BEEN USED WITH SUCCESS—EXPLANATION OF THE NEW DRAINAGE AND DITCHES ACTS

By CHARLES S. CAMERON, A.M.Can.Soc.C.E.
Dominion and Saskatchewan Land Surveyor, Regina, Sask.

TO discuss the problems or difficulties in connection with drainage work in this province it will be necessary to refer to the laws governing such work, and also give a synopsis of construction already carried out.

Prior to 1909, all drainage was done under the provisions of a North-West Territories Act which was described as "The Public Works Ordinance." This was in force between 1897 and 1909 and was succeeded by "The Drainage Act" and "The Private Ditches Act" of the latter year. The Public Works Ordinance was designed to permit the construction of drains for the benefit of highways only, and it did not provide for any assessment on private lands which might be improved and therefore an equitable distribution of the cost of such work was the chief object in view when the acts of 1909 were passed in the legislature.



The Lount Drag Line Excavator at Canora, Saskatchewan.

The only works done under the ordinance were in districts where it was impossible to proceed with road construction without drainage. A few of these might be mentioned: The Yankee Swamp drain, near Prince Albert; the Dundurn drain, west of Dundurn; the Birch Hills drain, north of Birch Hills; the Kinistino drain, north of Kinistino; the Melfort drain, near town of Melfort; the Yellow Grass drain, south of Yellow Grass.

There was no particular difficulty in the construction of any of these; the average size was from 3 to 6 ft. bottom with side slopes of 1½ to 1 and cost approximating 25 cents per yard. All work, with the exception of a part of the Yellow Grass ditch, was done with teams or by hand labor. The Melfort work was peculiar in the fact that it drained a wet plateau in the centre of which was a small lake. The ground for several miles beyond the ridge surrounding the wet land sloped sharply downward and there was therefore no surface inlet to the lake. No investigation was made at the time or since to discover the source of supply of this water. The deepest cut on the constructed drain was 6 ft., as it was not intended to completely drain the lake. However, when inspection was made in the following spring it was found that the ditch had gouged out to a depth of over 20 ft., and had made a thorough job of drainage.

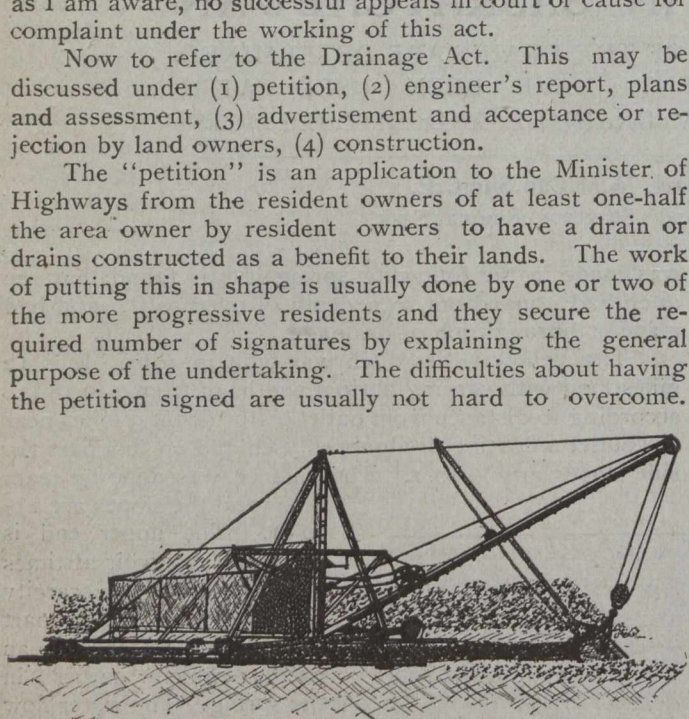
The Yellow Grass ditch was built in 1915. It is 12 miles long with varying bottom widths of from 7 to 18 ft., according to distance from outlet. For about 3 miles near the outlet a floating dredge was used and on this part the side slopes are ½ to 1. The balance was done by team labor and the slopes are 1½ to 1. The upper end is used as a reservoir at times because there is a scarcity of water in the latter part of summer instead of an excess which occurs in the spring. The water flow is regulated by a gate similar in idea to a canal lock. There was no trouble experienced in construction and the only complaint is a claim that the drain should have followed the meanderings of the old creek channel, instead of taking a direct line and straightening the water flow, as was done in some parts.

In referring to the work carried on under the Drainage and Private Ditches Acts it may be pointed out that these regulations are very similar to the laws of the older provinces, especially Ontario, where the Municipal Drainage and the Ditches and Watercourses Acts are in effect; the chief difference being that the municipal councils attend to the administration of both Ontario Acts whilst in this province the provisions of the Drainage Act are carried out by the provincial government. The rural municipality councils of Saskatchewan have charge of the reinforcement of the Private Ditches Act. This is designed to deal with the construction of small ditches, such as those to cost not more than $2,000, and that affect not more than 10 quarter sections of land. The procedure is simple and takes very little time to put into effect. On petition of at least one interested owner the municipal council appoints an engineer to report, and if desirable to proceed, he lays out the work and awards the amount of construction to be done by each land owner or the proportion of cost to be borne by him in the event of the work being done by contract. The chief difficulty with

these ditches is, of course, to get the owners to do their proper share, or in the case of a contractor, he is usually a local man and frequently attempts to use his neighborly influences with the council in order that something "just as good" may be replaced for the real article in the contract. This is ordinary experience and the remedy is in the hands of the engineer. There have not been many private ditches constructed in Saskatchewan, and insofar as I am aware, no successful appeals in court or cause for complaint under the working of this act.

Now to refer to the Drainage Act. This may be discussed under (1) petition, (2) engineer's report, plans and assessment, (3) advertisement and acceptance or rejection by land owners, (4) construction.

The "petition" is an application to the Minister of Highways from the resident owners of at least one-half the area owner by resident owners to have a drain or drains constructed as a benefit to their lands. The work of putting this in shape is usually done by one or two of the more progressive residents and they secure the required number of signatures by explaining the general purpose of the undertaking. The difficulties about having the petition signed are usually not hard to overcome.



Bay City Land Dredger at Lewvan, Saskatchewan.

New settlers from countries where taxation is heavy sometimes hesitate to sign until they understand the method of assessment and collection. A few look upon this class of work as a government undertaking and think that cost should be borne by the province at large, but when it is pointed out that the fair method of apportioning this cost is for the people benefited to pay for the improvement and the province is giving assistance by financing and carrying out the work, their objection is nearly always withdrawn.

On receipt of this petition regularly signed and properly verified, the Minister appoints an engineer to prepare a report, plans, specification and estimate of cost, together with an assessment (or apportionment of cost) to be borne by each parcel of land affected.

The engineer usually arranges to make this survey in the fall or early winter immediately after freeze-up, when he will be able to go over any part of the wet land with the least difficulty and before there is snowfall to any extent to prevent inspection. At this time the location of line through sloughs can be made more accurately as the topography of the lake or slough bottoms can then be easily determined by test holes through the ice.

When on the ground, he first makes an inspection of the wet land, estimating the acreage which might be benefited and securing a rough valuation of the improvement if drainage were effected. A preliminary estimate of cost is obtained by level and stadia survey and this information can usually be secured in three or four days' time on an ordinary survey. In connection with collecting this data, it is not at all wise to depend upon the knowledge of residents as to flow of water as it is quite a common occurrence to hear arguments between neighbors regarding which way the run-off occurs in water courses within a mile or two of their homes and usually each person is quite emphatic in his views and convinced that he is correct, whilst his neighbor may be equally certain that the flow is in an opposite direction. However, when the engineer is satisfied with the main points a comparison is made to determine whether the cost of the proposed work will exceed the benefit to be received and if this is the case it is his duty to discontinue the survey and report adversely regarding the scheme. In the event of the work appearing to be feasible and of advantage a detailed survey is made.

From the information already obtained the main route in general is determined. It is usually best in this province to select the deep points in the lakes or sloughs and establish the route by connecting these points and carrying the drain to an outlet by a line which will make the least yardage excavation and be the most efficient from a standpoint of maintenance. It is of advantage to have this main drain as direct as possible but if this entails a yardage figure very much in excess of following another line on which the ground levels are lower but which is more circuitous, it may be doubtful as to which is best to adopt. The latter route may be objectionable in cutting of land into parts which are awkward to farm but the engineer must consider the valuation of the land, which is, on an average, about 35 per cent. in Saskatchewan of the price in the older provinces, and also excavation cost, which is about double the cost of work in Minnesota or Ontario. These factors, along with any differences in maintenance estimate, have largely to do with the main direction of the drain. Before finally disposing of this, however, he should consider whether the drainage can be done with good effect by ditching along the road allowances because it may be practicable to build a grade for public travel at the same time as the drain work is done by using the excavated material for road purposes. Therefore, the difference between the cost of drainage with and without improvements to roads should be figured on to find if the extra road work is warranted by the extra benefit which might be received. In drains constructed under the Act so far, it appears to be good practice to build the drains along the road allowances only where the district is very level and the roads on low-lying ground. In many cases where fairly deep cuts have been made along the road allowances, it has been found necessary to go to considerable expense in cleaning; and the presence of large open ditches along travelled roads are undesirable from a standpoint of safety.

The main direction having been decided, the engineer proceeds with an exact location; that is, where best to commence and the extent of the work, also how much outlet work is to be done. The outlet may be a lake, river or watercourse of any kind. Levels should be taken for a considerable distance beyond the point necessary to discharge the water in order to make certain that damage should not be done through flooding, or if any is done, to ascertain the extent of this. Notes should be made as to whether banks of outlet streams or lakes are well confined, also if there are any flats or low-lying ground below the outlet and this information may be conveniently shown on a contour sketch plan and retained as a reference in event of any later action for damages through flooding, or the information may be used in case it is decided in later years to extend the drain. In Saskatchewan it has been considered the better plan on the engineer's part to carry the drain to an outlet sufficiently safe to avoid any probability of damage resulting, rather than attempt to

economize in outlet construction by saving yardage cost and paying compensation to the landowners. This latter method entails a direct valuation of property and also the effect which the drain will have (or has had) may not be clear to the owners and for these two reasons a dispute is almost sure to occur. Therefore, to avoid this difficulty, particular attention should be paid to the termination of the drain.

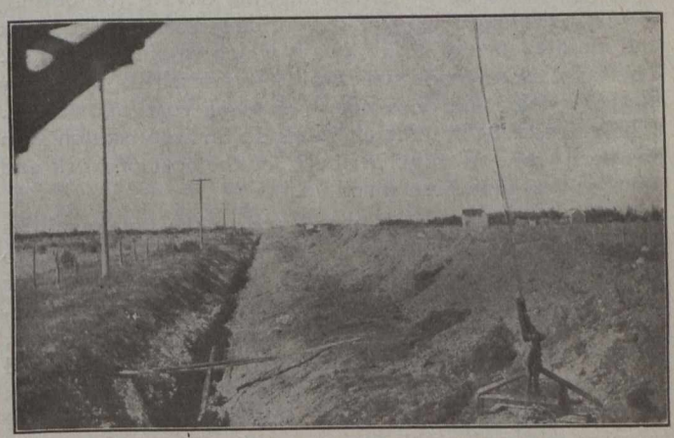
The amount of main ditching on the wet land and also the number of laterals to be constructed is primarily dependent upon the amount of wet or flooded lands in the watershed; also the slope to the outlet and the feasibility of connecting such lands. If there are numerous sloughs separated from the main body of water or much land to be benefited by connections to the main drain or drains, the engineer should consider the extent of minor work and whether this can be done to best advantage by a contractor or by the land owners. Owing to the lack of knowledge of handling the construction of these laterals by the residents and frequent difficulty in securing local labor to attend to this minor ditching work, it is generally advisable to have all laterals dug as part of the contractor's work. There is one drawback to this by reason that the laterals frequently have to be dug after construction of the main drain and this means delay for the contractor and possibly a higher yardage price for the job. Therefore, full information as to class and cost of local labor as compared to regular contract work is necessary before deciding the extent of ditching.

Another difficulty occurs at places where the flow of water in a watershed is interfered with by railway grades. In many cases these grades have been built at times of high water and culverts have been placed too high as well as being omitted where required. The result is that an extra cost in drain crossings of railways is incurred by having to put these improvements on the railway right-of-way. In doing this work the drainage district is put to expense in paying for something that the railway company should have done in their original construction work. It is nearly always difficult to assess the railway company so that they will pay their proper share of such work because of lack of definite information regarding such matters as maintenance-of-way cost in this province. Therefore, the presence of a railway grade is a drawback to the development of drainage work unless the company appreciate the value of the work and assist in bearing a share of the construction cost as well as facilitating the work around their right-of-way. The rights and attitude of the railway company in each case should always be investigated before finally deciding on details near their grade.

Another factor to be noted is the permeability of the soil. In the case of some bodies of water the percolation is very rapid and by noting this the amount of ditching required may be reduced. If the water levels on unconnected sloughs (that is, on the surface) are the same or very nearly so after heavy rains, it may be safely assumed that the lowering of the water level of one will quickly affect that of the other. Test borings of the soil should be taken to make certain if the engineer is considering whether such ditching is necessary.

The above points, along with the general rule of making all laterals "pay for themselves," will largely help to decide the length of the drains. The capacity and design of the drains, also of the culverts and bridges necessary, is usually the most difficult to determine. These points, along with the grade to be used, are decided by the following: Size of the drainage area or watershed; the topography of the area; information as to rapidity of run-off obtained by gauging discharge of watercourses in the watershed; the soil, firmness and permeability; presence of timber, brush or vegetation; rainfall and evaporation; availability of means of construction, whether dredge, dry land excavators, ditching plows, teams or manual labor.

In deciding upon the grade it has been noted that as low as .02 per cent. has been used with success. This is on account of head acquired through rapidity of run-off. This is in turn due to absence of timber and brush and a sharp slope of drainage district to the drain or drains. In the case of one drain with above conditions it has several times become filled with fine particles of summer fallow but the first rush of water cleaned it out as thoroughly as if the grade of the drain had been many times as steep and therefore there would be no advantage in this particular case in having a greater fall. The average condition in the province calls for about .05 per cent. and this has been used most frequently with the size of drains so far constructed.



Drainage and Road Work at Canora, Saskatchewan.

In considering the cross-section area of drain and also size of culverts, it is not at all safe to apply formulæ derived from a knowledge of conditions elsewhere to arrive at the amount of water that will be delivered to the drain from a known watershed area in a given time. By doing this it is altogether likely that the engineer will have the capacity too small, as the early run-off is generally much faster than in the drainage areas from which the standard formulæ were obtained. At present we have not enough data to adjust the formulæ to suit conditions in this province and must therefore rely largely upon information obtained by measuring the discharge of watercourses in the locality and the size of the drain can be computed by a comparison of the respective watersheds.

The above-named points will be important in deciding the details of the plans and profiles, and it is then necessary for the engineer to make up an assessment to cover the cost of the work.

The assessment is an apportionment of cost based upon the benefit received by the owners of the land drained. The method employed is very similar to the Ontario regulations, the main difference being that in Ontario the engineer usually bases his assessment on amount of benefit to be done, together with individual estimates of the cost for doing separate sections. That is, a parcel which is near the outlet on which there are 100 acres of wet land which might be easily drained, would be assessed considerably less than the same area further away and more difficult to drain. It has been customary in assessments in this province to regard direct benefit

almost solely, and not to consider the cost of individual sections. This is a debatable point and we have so far no legal decisions to interpret the exact meaning of the governing Act.

Another point which causes difficulty is to determine the location of the line where benefit from drain ceases. It has been sometimes suggested that only the wet or flooded area can be properly assessed, but this is not equitable, especially in a flat district, and therefore agricultural lands which are made more useful by subsoil drainage should be made to bear a share of the cost. In making assessment on such lands, the engineer should be particularly careful to have very complete information as to land levels, valuations and suitability of soil for agricultural purposes, and be able to supply data to prove that such lands would be benefited. This is, in my opinion, the most likely point in the assessment to be disputed.

In making assessments on municipalities, they are usually arrived at by estimating the saving (or benefit) through drainage in grading, bridge and culvert work and maintenance of all highways which would be affected. This applies to roads which are considered as necessary in the district and does not refer to all road allowances. (The assessment on municipalities so far in Saskatchewan has been from 20 to 40 per cent. of the cost of work and none so far have been disputed.)

The benefits to each parcel and to the municipalities affected are then totaled and this amount is divided into the cost, giving a percentage rate, and the assessment for any individual parcel can then be arrived at by multiplying the estimated benefit by this percentage. The plans, profiles, estimate of cost and assessment are then prepared and submitted to the Minister of Highways, who notifies all interested owners by advertisement that it is proposed to carry out such work and as to what the cost to each parcel is estimated to be. It is now necessary for an owner to appeal against the carrying out of the work if he has any objection and provided that the resident owners of at least one-half the area of resident owners still desire the improvement, it is proceeded with. It might be noted that the resident owners have the entire authority in deciding whether they secure the improvement or not. The difficulty in this is that the resident owner must estimate what effect the drain will have, as he must satisfy himself on this point in order to pass upon the scheme intelligently.

In the construction work there has been no peculiarities different from construction elsewhere, the main drawback is the short season, as ditch work can only be successfully carried on between May 15th and about November 10th. This explains the high excavation cost in this province.

The floating dipper excavator, the dryland dipper excavator and the Lount drag line excavator, have been used with success and it is not necessary to describe the details of these machines as they are in common use in various provinces.

There have been twelve drains constructed under the Act so far and the effect of these is being recorded by inspection from time to time in order that improvements may be made in future work. In connection with the carrying out of certain proposed works the question of method of assessment from lands which have not yet been filed on (owing to these being lake or slough bottoms) has not been finally settled and when this is arranged for several large undertakings will be proceeded with, and with these being carried out we may look forward to valuable additions to the agricultural lands of this province.

THE CANADIAN RAILWAY PROBLEM.*

By Sir Henry L. Drayton, K.C.,
Member of the Railway Inquiry Commission.

THE Canadian railway problem is a vast one and cannot be shelved by any temporary expedient. Mere drifting, the gift of a few more millions here and there will merely add to the difficulties of the situation when the final day of settlement comes, as come it will. The subject is too large for me to attempt to cover in the time at my disposal but I desire to specially call your attention to a few outstanding considerations.

In the first instance, I draw your attention to the great investment the country has already made in railways. Including subsidies, gifts, guarantees, moneys realized from land grants by companies and also the sum expended in government construction, the country's investment amounts to $968,451,737. In these days of terrific war efforts and expenditure, millions and even billions are apt to lose their proper significance. The total amount I have quoted is not final, as it does not include the value of unsold lands granted as bonuses, the value of which is over $100,000,000.

Let us, however, deal with round figures and take one billion dollars as representing the total amount the country has provided for railway purposes. The significance of this sum is hard to grasp.

Toronto is no mean city. Toronto's present total assessment for land is $289,084,898, and for buildings $218,434,573. Notwithstanding the city's area, improvements and importance according to the valuation of your assessment department, it takes two Torontos to cover the country's transportation contributions.

Notwithstanding these enormous contributions, railway necessities were never since Confederation greater than they are to-day. The people of Canada to-day own the National Transcontinental, costing $159,881,197; the Intercolonial, costing $116,234,204, and the Prince Edward Island, costing $9,496,567, resulting in a total of $285,611,968. Deducting this from our total of $1,000,000,000, you have no less than $714,388,032 supplied either by the public credits, moneys or lands for the purposes of railway companies privately controlled and more, much more, is required.

We stand at the parting of the ways. Shall the country again accept the estimates of the companies and supply them with further fortunes, or shall the railway facilities of the country be co-ordinated to the fullest extent necessary to meet the exigencies of the situation and the wasteful duplication of lines and terminals at the country's expense cease? Can the country afford, in view of war obligations—in view of the necessity universally admitted of the strictest national economy—to supply all the money required for company expansion? I confidently submit that to state the question gives the answer. Because the issue is so large and important it is all the more necessary that it be faced boldly and with courage by the country. Every citizen ought to acquaint himself with the facts. It is your business, it is your money, and your future that may in no small regard depend on an honest, fair and proper solution of the question.

I would like everyone to carefully read and consider the railway reports—Mr. Smith's just as carefully and sympathetically as that signed by Mr. Acworth and myself.

*From address before the Canadian Club, at Toronto, May 10th, 1917.

We, Mr. Acworth and myself, have given our honest opinion and best judgment. Mr. Smith has undoubtedly done the same. No conclusion ought to be made until all aspects have been fully and fairly considered.

But I plead for fair consideration for that and nothing else. My only interest is that the right conclusion be arrived at after full consideration and with a full knowledge of the matter by the people of this country. Among other matters this surely means that all party and political bias be abandoned and that the question of whether the Conservative party was wrong here or the Liberal wrong there can have nothing to do with the proper solution of our present difficulties.

Nor can the question be properly settled, as I notice it already has by at least one writer, on the ground that the only practical railroader in the commission was Mr. Smith, and that as Mr. Acworth and myself were merely students of and theorists in railway matters, Mr. Smith's conclusions must perforce be adopted. May I at this point ask what is responsible for the present situation? Too much study and consideration of the problem from the country's standpoint or too many practical railroad builders anxious to build railways anywhere or everywhere when the essential government assistance could be obtained?

Let me at once say that in my view the government could not have found a better or more efficient railway operator than Mr. Smith. As to myself I say nothing; except that for months past my time has been very much taken up in looking after the supply of coal, grain, flour and other necessaries of life, of agriculture and of the manufacture of munitions and other essentials. I can at least say that in no instance did the shippers or consignees look either upon their necessities or my intervention on their behalf as theoretical or academic.

I would like, however, to acknowledge the assiduous and thorough work of Mr. Acworth, whose training, disposition and ability particularly well fitted him to pass on the question. I admit that Mr. Acworth is a student. I go further and say that he is a great student of and a recognized authority on the whole question of railway economics, that he has written leading text books on the subject and that in the opinion of the practical railway managers of America his knowledge and his standing is such that he has been engaged by them to give evidence this very week on their behalf before the Congressional Committee on Transportation at Washington on the evils of political railway management. I attach the very greatest importance to Mr. Acworth's conclusions, particularly in view of the fact that he is very familiar with company management and English finance, and that he himself is a director of the Underground Railway of London, which controls the bulk of the transportation facilities, both street and underground, and omnibuses in and around the metropolis.

The whole issue is, what is right, what is in the best interests of the country, not what is popular and the most easy to put into effect. Public opinion may roughly be divided into two classes: Those who believe in public ownership and operation of all public utilities and to the fullest extent, and those who believe that only proper results can be obtained by individual initiative and effort in the hope of individual gain, and who also believe that everything that the government takes in hand will be more or less muddled. In some sections of the country the one view is popular and in others the other.

We have made no attempt in our report to meet the views of either section. We deal with conditions and not theories. Our report leaves the Canadian Pacific standing as it is. This naturally affords the thorough-going public ownership advocate a ground of complaint and also enables pro-corporation adherents an opportunity for attack. Let us for a moment consider what public necessity and right now insistently calls for.

The most urgent necessity is better and more efficient transportation. The most pressing failures that have taken place are attributable to the Grand Trunk and to the Canadian Northern. It is common ground that both systems urgently require many more locomotives and many more freight cars. The report made by Mr. E. E. Loomis and Mr. John W. Platten, as I understand it, at the instance of the Canadian Northern, points out that the Canadian Pacific has two and two-tenths times rateably the number of locomotives owned by the Canadian Northern and has nearly two and three-tenths times rateably the number of freight cars. No such case is made out against the Canadian Pacific, but again every one has conceded that that company is giving an efficient public service and is well and efficiently organized.

The Canadian Pacific stands well in the world's financial circles and has a great borrowing power as well as liquid assets held in reserve. At a time like the present it is undoubtedly in the best interest of the country that the company's borrowing power and financial ability to increase its facilities be not impaired, and further, that any new capital that may be required for the Canadian Pacific undertaking ought not to be obtained on the credit of the country generally, as might be the case should the company be taken over and its liquid reserves divided among its shareholders. More or less difficulty attends any change—mistakes of detail invariably occur. The Canadian Pacific service is good and satisfactory. It is certainly not necessary under the present conditions to jeopardize it.

In so far as the other systems go, the conditions are reversed. Service is poor. Transportation failures have taken place, and no company funds are available to make them good. In addition to this, no further capital investment would be saved by taking in the Canadian Pacific whose service and facilities are, speaking generally, complete both in the East and West. On the other hand, the Grand Trunk is well-established in the East but lacks necessary feeders and terminals in the West, while the Canadian Northern has a well-laid-out system in the West, but is sadly lacking both terminals and lines in the East. The two systems combined, as we suggest. renders unnecessary Grand Trunk work in the West and Canadian Northern work in the East.

Two objections have been made to our conclusions. The one that it is impossible for the new National System to compete with the well-established and efficient Canadian Pacific and that public ownership must under such unfair conditions fail. All I can say is that if the National Railway System cannot stand in competion with a privately owned system, the sooner the fact is demonstrated the better. We seek to improve conditions and not to create an inefficient substitute merely for the purpose of making a change.

The other objection, equally strongly taken, is that the competition of the National System would be unfair to the Canadian Pacific. Manifestly the one objection answers the other. I believe neither are well taken. The competition would be unfair to the Canadian Pacific if the National System were not run on business principles and rates were not levied having regard to the cost and value of the service, but were in part covered by the

general tax levy. With the safeguards we suggest observed, no dishonest competition can or will take place.

Then again, is it not well to have a yard stick with which to measure the performances of your railway administrators? Railways—successful railways—never can stand still. Facilities must from time to time be enlarged, practices changed to meet new conditions, extensions of usefulness in all directions made in order to properly cover the ever-increasing demands of public service. The country's successful line, the Canadian Pacific, is an illustration of this fact. Undoubtedly its usefulness will increase in the future as it has in the past. The National Railway System will not properly serve the public unless progress and increased facilities and potentialities characterize all its activities. There will be but little danger of lack of effort in this direction under the spur of an intelligent and effective competition and little danger of paralysis and dry rot resulting from political interference and the patronage system. Over and above all other considerations the underlying public necessity, transportation, will not be unnecessarily jeopardized.

As I have already pointed out, we deal with conditions and not theories. The conclusions we have arrived at are the logical results of existing conditions, not of the application of theories. The Grand Trunk itself says it is at the end of its tether. It is impossible for it to carry the burden of the Grand Trunk Pacific. The cost of that system, as returned to the government February, 1916, amounted to $197,129,590, and of this sum $123,000,000 represents the commitments of the Grand Trunk proper, either cash or credits. The only other financial interest, ranking as it does for the most part in priority to all Grand Trunk claims, is that of the country. The application of public ownership is hardly in question. The country, in fact, owns the system already. Its position is in effect that of a first mortgagee whose security is hopelessly in default with no hope of a redemption. Shall the country assume the interest obligations and the responsibility for operating losses on this line, which, standing by itself can yield no proper returns to the country, or shall the property be made valuable and useful by including with it the Grand Trunk, the necessary eastern connections?

The original scheme certainly contemplated one system, construction in the West to supplement the system in the East. Separated from the West, the Grand Trunk itself cannot discharge the full measure of public service. The recognition of this fact caused Mr. Hays and his company to build their western system. Undoubtely in the public interest the system which was intended to be one and complete must be so operated and this the Grand Trunk itself says it cannot do. In view of essential public necessity you are driven by the acts of the Grand Trunk itself to public control.

Then as to the Canadian Northern. The total amount of public assistance, direct and indirect, amounts to the sum of $298,253,263. This sum is over $12,000,000 more than the country's investment in the National Transcontinental, Intercolonial and Prince Edward Island railways. Again the country is in the position of the mortgagee, not only with securities in default, not only without any present hope of redemption, but faced with the fact that to put the system in working order, experts reporting for the company report that new capital required for a minimum program for three years amounts to $54,000,000, and for their maximum program for a five-year period, $86,000,000.

Parliament in 1914 authorized the guarantee of the company's securities to the extent of $45,000,000. The guarantee was secured by mortgage and under the provisions of the Act the Governor-in-Council has power, when authorized by parliament, to declare by order, if default is made by the company in payment of interest, that the equity of redemption of the company is absolutely barred and foreclosed and thereupon the whole property becomes vested in the Dominion. Defaults have been made, defaults continue. Why should the company not be held to its obligations? Why should it, particularly at a time like the present, receive further bounty? Why should the country's money be expended in the construction of eastern lines and terminals largely unnecessary if the system be operated in conjunction with the Grand Trunk?

We all recognize the evils of political management of public undertakings. Under our plan these evils are entirely eliminated. We propose the application of business methods—the most approved company methods—to the transportation problem. It ought to be run on business lines. There ought to be no cabinet or parliamentary interference, there ought to be no political patronage. I am confident these results can be obtained. If they cannot, then the defects of our system of government must indeed be grave, our common honesty and fixity of purpose sadly lacking.

I do not believe that one parliament will wrongly undo the work of another, as is suggested. Our plan is termed by the opponents of the system, "fantastic." It is the plan adopted almost universally by the companies themselves in order to obtain a proper continuity of policy and efficient management. Company directors themselves nominate their successors for election by the shareholders. We simply adopt company methods where tried and found effective in carrying out the public business.

MANY MONTREAL ENGINEERS VOLUNTEER TO AID IN RESEARCH WORK.

The Montreal members of the Canadian Society of Civil Engineers held a meeting last Thursday evening at the headquarters of the society for the purpose of discussing the collection of information for the Honorary Advisory Council for Scientific and Industrial Research. Members of the Canadian Mining Institute and of the Society of Chemical Industry also attended, as these societies are co-operating in the work.

Prof. E. Brown explained that a list of 1,500 manufacturers in Montreal had been received. These had been subdivided into wards and districts and thirty teams would be appointed from the three societies, each team comprising about six members, to make a personal canvass of these manufacturers in order that the full information asked for in the questionnaires may be obtained so far as possible. Prof. Brown will have charge of the work of the teams.

The captains of the teams are as follows: E. Marceau, A. Surveyer, J. C. Smith, J. M. Robertson, R. M. Wilson, deGaspe Beaubien, J. T. Farmer, J. S. Costigan, O. O. Lefebvre, H. Rolph, K. B. Thornton, F. B. Brown, R. E. Fraser, W. D. Black, F. H. Pitcher, A. F. Byers, deL. French, G. R. McLeod, W. W. Plumb, Lieut.-Col. C. N. Monsarrat, M. Beullac, A. R. Roberts, H. Y. Russell, J. W. Bell, J. A. Dresser, Capt. J. G. Ross, Dr. Milton Hersey, Leo. Ryan, C. A. Hazen and J. A. DeCew.

AMERICAN WATERWORKS CONVENTION.

(Staff Correspondence.)

Richmond, Va., May 11th.—The Thirty-seventh annual Convention of the American Waterworks Association opened Monday evening, May 7th, in the auditorium of Hotel Jefferson, Richmond, Va.

It is exactly eighteen years since the association last held a meeting in the historic city of Richmond. At that meeting only ninety-three active and fifty-four associate members were present, while at the meeting just closed there was about five times that number present. Among the active members who were elected at the 1900 meeting, and who are still enthusiastic members, are Howard A. Dill, of Richmond, Indiana; James M. Caird, the present treasurer, and F. J. Connor, of Fariboult, Minn.

The address of the retiring president, Leonard Metcalf, of Boston, was devoted in large part to the need for a greater spirit of co-operation on the part of the entire membership in the effort to solve the problems incidental to the work of the average waterworks engineer. It was a plea for the "get together" spirit in the work of an association, which now numbers about 1,350, of which bteween 70 and 80 are resident in Canada. In his address Mr. Metcalf deplored the lack of complete co-operation among officers, committees and members, and warned against the creeping in of local cliques.

Among other things, he suggested that larger powers be given to the officers; that the committees be assigned more definte duties; that committees be instructed and authorized to carry on all correspondence in manifold; that all meetings of the sections be attended by at least one member of the executive committee of the mother organization.

Following President Metcalf's address, R. E. Milligan, president of the American Waterworks Manufacturers' Association, presented—on behalf of the Manufacturers' Association—a very handsome silver cup, which is to be competed for annually in a golf tournament. The successful contestant at each annual meeting of the American Waterworks Association is to receive a miniature reproduction of the large cup, and is also to have his name engraved on the large cup, which is to be retained by the American Waterworks Association.

The program for the first day of real convention, May 8th, included announcement of officers elected for 1917-1918, and also eight papers, with discussion. Officers for the ensuing year are as follows:—

T. A. Leisen, Detroit, president; A. W. Cuddeback, Paterson, N.J., vice-president; James M. Caird, Troy, N.Y., treasurer; D. A. Cramer and B. C. Little, trustees.

The first paper was by John W. Alvord, entitled, "Recent Tendencies and Progress in Waterworks Practice." While he admitted that much of the improvement in standards is due to inspection, he expressed the opinion that those improvements are more due to filtration.

Having been called into active service, John D. Kilpatrick was not able to read his paper, entitled, "Water Supply for Military Camps."

Clarence Goldsmith's paper, "Reliability in Pumping Station Design," judging by the discussion wihch followed, was almost too ideal to be practical. That, at least, appeared to be the opinion of those who took part in the discussion.

Leonard A. Day's paper, "Improved Efficiency of the St. Louis Pumping Station," was illustrated by lantern slides.

O. A. Doane, by his paper on "Pumping Station Costs," brought out a considerable amount of discussion.

W. C. Hawley's paper, "Relation between Water Departments and the Public," was presented by Mr. R. S. Weston, of Boston, in Mr. Hawley's absence.

Tuesday evening a reception was held in the auditorium of the hotel. Music, dancing and refreshments were provided by the Waterworks Manufacturers' Association. Mrs. Claire Spencer, formerly of the Manhattan Opera Company, sang a number of Irish songs, while Clinton Inglee, of the National Water Main Cleaning Co., delighted the company by singing several times.

Wednesday morning's session was devoted to the reading of technical papers, the election of nominating committee, and selection of place for holding the 1918 convention.

The Nominating Committee for 1918 was chosen by districts as follows: Western States and Canada—H. Hymmen, Superintendent Waterworks, Kitchener, Ont.; New England—R. S. Weston, Boston, Mass,; Middle States—C. R. Wood, Millville, N.J.; Southern States—J. A. Steele, Vicksburg, Miss.; Central States—John W. Alvord, Chicago.

The contest for next place of meeting was between St. Louis, Mo.; Detroit, Mich., and Evansville, Ind. St. Louis won by a large majority.

Wednesday afternoon was given over to a social time. Special cars took about 300 delegates and ladies to the Richmond Country Club.

Thursday morning the superintendents carried on a topical discussion, while the chemical and bacteriological sections held sessions simultaneously. All groups were well attended and much of practical interest was brought out.

These same sections also held afternoon sessions, while in the evening reports of officers and standing committees were received and discussed.

There was only one session on Friday. Reports of special committees were followed by a general discussion of subjects pertaining to the welfare of the association. Friday afternoon the delegates were the city's guests at the Richmond Pumping Station, where luncheon was served.

There were about 430 active and associate delegates present, and about 100 guests, or 530 in all.

Attractive Exhibits.—The Palm Room of the Jefferson Hotel, which was devoted to the exhibits, was filled with displays of waterworks supplies and material of all kinds. Every available foot of space was occupied. There could be seen the latest improvements in filter models, hydrants, pumps, valves, chlorinating and sterilization plants, etc.

PITOMETER CO., NEW YORK.—In charge of exhibit, E. S. Cole, E. D. Case and A. W. Hogeland. Showing Cole Recording Pitometer, new aluminum-case, field type of pitometer for waterworks survey. This is a type recently put on the market.

NEW YORK CONTINENTAL JEWELL FILTRATION CO., NEW YORK.—Represented by R. E. Milligan, Arthur M. Crane and Gilbert H. Matt. This firm's exhibit included a model of a typical concrete gravity filter plant, a model of the Wheeler filter bottom, samples of strainers and laterals, etc.

SIMPLEX VALVE AND METER CO., PHILADELPHIA.—Represented by C. C. Behney, mechanical engineer, and W. F. Harveson, assistant secretary. This exhibit included Simplex indicating, recording and registering Venturi meters, portable pitot tube recorder,

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manometer, rate-of-flow controller and other Simplex devices.

R. D. WOOD CO., PHILADELPHIA.—Represented by C. R. Wood, C. H. Becker and John Wistar. Hydrants, valves and fittings.

WALLACE & TIERNAN CO., NEW YORK.—Represented by W. F .Tiernan, A. R. Murphy and R. C. Donnelly. This exhibit showed manual and automatic control chlorinators. They also exhibited for the first time their automatic chlorinator, operated by the pitot tube, also an automatic chlorinator for intermittent use. By the use of a circulating pump much of the apparatus was shown in actual operation.

ELECTRO BLEACHING GAS CO., NEW YORK.—Represented by E. D. Kingsley, J. A. Kienle, G. R. Ellis and H. W. Gochnauer. Among the features of this exhibit were "model C" and "model F" manually controlled portable chlorinators for emergency purposes. A big photo of the newly-enlarged chlorine gas plant of this company at Niagara Falls, N.Y., attracted great attention. It is said to be the largest plant of its kind in the world, having a capacity of over 60,000 pounds per day.

R. U. V. CO., NEW YORK.—Represented by A. T. Smith, sales manager, and H. A. Stillwell, eastern representative. A typical filtration plant sterilizer was shown in such manner as to explain clearly the method of sterilization by bringing the water into close contact with ultra-violet rays.

EAST JERSEY PIPE CO., NEW YORK.—Represented by Grant A. Peacock, showing two sections of lock-bar pipe, one of them dipped, the other dipped and wrapped. This pipe is made in sizes from 20 in. to 72 in. in diameter, and in thickness of plate from 3/16 in. to ½ in.

BIRCH-HINZ MFG. CO., CHICAGO.—Represented by W. T. Birch. A very complete line of specially constructed pump valves with metal inserts.

ROSS VALVE CO., TROY.—Represented by Wm. Ross. "Trojan" pressure regulator valves and reducing valves constituted the main features of this exhibit.

H. MUELLER MFG. CO., DECATUR.—Represented by C. T. Ford. Display of water meter testers, with a multiple tester attached, waterworks brass goods and waterworks tools.

MARITIME COATING CORPORATION, NEW YORK.—Represented by J. Willoughby Mitchell, president. A composition which can be applied cold and forms an anti-corrosive paste. Can be applied either by trowel or dauber.

ALEXANDER MILBURN CO., BALTIMORE.—Represented by C. R. Pollard. Portable lights for trench work.

CARBIC MFG. CO., DULUTH.—Portable lights for trench work.

MULTIPLEX MFG. CO., BERWICK.—Represented by J. F. Casey, manager. Crispin slip joints and Crispin air valves for water mains, pipe lines, etc., attracted considerable attention.

LEADITE CO., PHILADELPHIA.—Represented by Geo. Mackay, Jas. P. Mackay and J. H. Glanding. This firm provided demonstrations of the merits of Leadite as a jointing material for water mains.

CHRIS. D. SCHRAMM & SON, PHILADELPHIA.—Represented by J. W. Gleeson. Portable air-compressors for rock drill work, pipe-caulking and diaphragm-pumping outfits.

PITTSBURGH FILTER MFG. CO., PITTSBURGH.—Represented by F. B. Leopold, general manager, who explained special plants installed by that firm, using drawings and pictures of these plants for the purpose.

KENNEDY VALVE CO., ELMIRA.—Represented by E. Kennedy and Harry Overbaugh. This concern showed "New Type" hydrants and valves.

RENSSELAER VALVE CO., TROY.—Represented by Geo. M. Keefer and John S. Warde, Jr., showing working models of the Corey fire hydrant and of valves.

NATIONAL WATER MAIN CLEANING CO., NEW YORK.—Represented by Clinton Inglee and Burt B. Hodgman. Exhibit consisted of a large number of samples of pipe before and after cleaning.

BUFFALO METER CO., BUFFALO.—Represented by Chas. Bassett and W. J. Chellew. Various sizes and styles of Niagara and American meters.

NEPTUNE METER CO., NEW YORK.—Represented by D. B. McCarthy, Chas. Buchmann and H. F. Bown. Attractive display of "Trident" meters.

PITTSBURGH-DES MOINES STEEL CO., PITTSBURGH.—Showed illustrated catalogues and photographs of elevated steel tanks.

BUILDERS IRON FOUNDRY, PROVIDENCE.—Represented by F. N. Connett, chief engineer, and A. B. Coulters. This firm showed a Venturi meter, set up in connection with a water tank and geared pump.

Canadian Members Who Attended.—The following Canadian members of the association attended the convention: F. C. Laberge, Montreal; F. H. Pitcher, Montreal; H. Hymmen, Kitchener; R. L. Dobbin, Peterboro'; C. D. Brown, Walkerville; Jos. Race, Ottawa; Jas. J. Salmond, Toronto; W. H. Moore, Peterboro'; and W. E. McDonald, Ottawa.

INVESTIGATIONS OF RESEARCH COUNCIL.

That the Canadian Research Council is at present engaged chiefly in determining the extent to which lignite can be used as fuel, was a statement made by Professor A. B. McCallum, chairman of the council, in a recent interview.

"In the United States, Italy and Germany," said Mr. McCallum, "it is made usable by carbonizing. It is put into the form of briquets with the aid of pitch or tar. The question we have to solve is how to make these lignites economically usable. One would think that the same process employed elsewhere would be a success here, but that is not so because lignites are not all the same. The material, for instance, is poor in Saskatchewan and good in Alberta.

"The Commission is also investigating the possibility of utilizing Alberta's tar sands in connection with road paving. Reforestation is another subject of inquiry, as is also the production of potash. "Previous to 1870 the chief sources of potash were seaweed and burnt forests," said Prof. McCallum. "Since 1870 our supply has come chiefly from the potash beds in Germany. This is now cut off. Feldspar rock is looked to as our source of supply, but there is no method at present for putting it in shape for use. Then we have the question of phosphates and their treatment for fertilizers.

"We are gathering information on nitrogen fixation. By that I mean the process of getting nitric acid and ammonia from the air to replace Chilean saltpeter. Nitric acid and ammonia are needed for explosives and for fertilizer. The Imperial Munitions Board has asked us to take up this particular problem."

ROAD LAWS OF ONTARIO.*

By W. A. McLean, M.Can.Soc.C.E.,
Deputy Minister of Highways, Province of Ontario.

THE twentieth century is pre-eminently an age of rapid transportation and intercommunication. The advantages of modern railway, steamship, cable, telegraph and telephone systems would have seemed like Arabian Nights tales to those of our ancestors who crossed the Atlantic less than one hundred years ago. Auspiciously, the advanced road legislation of Ontario had its inception in 1901, thereby taking its proper place in "The Century of Transportation" in which we live.

The road laws of Ontario are based on the excellent municipal system which grew up in the 19th century, and which has created excellent and progressive local self-government throughout the province. Towns, villages and cities are responsible for the up-keep of streets within their boundaries; but the care of roads in the open country constitutes one of the chief duties of township and county councils.

Provision for municipal organization is made by the Municipal Act; which Act defines the general authority of municipal councils with respect to roads. Township councils usually consist of a reeve and four councillors. A county comprises a group of townships, and the county council is composed of the reeves (and deputy reeves) of the townships, towns and villages included within the area of the county.

Township Roads.—Township councils, in the earlier history of the province, depended largely on statute labor for road improvement; this system having been created by the first parliament of the province (then Upper Canada) in 1796. Money expenditure, raised by general levy on the township assessment, has been steadily increasing. At the present time townships are spending annually over $1,400,000 in cash and 1,100,000 days of statute labor, having a total estimated value of $2,500,000 annually.

Township councils have authority to pass by-laws to abolish statute labor. About one-quarter of the townships have done so, while the number is steadily increasing.

The Highway Department is encouraging all townships to place their road expenditure in charge of a permanent road superintendent or foreman, and to this end will pay (under the Ontario Highways Act, 1915) one-quarter of the salary of such an official, the provincial grant not to exceed $150 annually.

County Roads.—Provincial aid to road construction is given principally through county road systems, under the Highway Improvement Act. Twenty-five counties, out of thirty-seven which are eligible, are carrying on construction; having assumed over 5,000 miles of road, of which over 2,000 have been substantially built. Expenditure to the end of 1915 has amounted to $6,000,000 including $1,200,000 for bridges. Work is now being carried on at the rate of $900,000 annually. It is anticipated that all counties will be operating under this plan within a few years, and that the annual expenditure will be doubled. The chief features of this Act are as follows:

A county council is authorized to assume by by-law a system of roads for construction and maintenance, the province contributing 40 per cent. of the expenditure on construction and 20 per cent. of the cost of maintenance.

A by-law adopting such a system may be passed by a two-thirds majority of a county council representing at least one-half of the total equalized assessment of the county.

The roads assumed are usually such as will accommodate the greater part of local market travel, creating a system of main market roads. They are the roads radiating from local market centres and shipping points. They should be connected as far as practicable to serve the needs of through traffic of the locality.

The mileage of roads assumed by a county is usually from 12 to 18 per cent. of the total mileage of the county.

The direction and superintendence of the work is placed in charge of a county engineer or capable superintendent appointed by the county council. A committee of the county council should co-operate with, advise and direct the road superintendent.

Roads are to be built in accordance with the regulations of the Department of Public Highways. The construction should be suited to local material and traffic. A standard type is regarded as a roadway well drained, graded to a width of 24 feet between ditches, with broken stone or gravel in the centre to a width of from 9 to 18 feet, and consolidated by rolling. The cost varies with local conditions, but is in general proportionate to the width and kind of metal. The system of roads assumed, and the by-law fixing the plan of improvement, are subject to approval of the Provincial Department.

When roads are assumed by a county council under this Act, township councils cease to have control over them, nor should they make any expenditure on them. The county council is thereafter responsible for construction and maintenance.

The provincial grant is paid annually, and is based on a statement of expenditure for the year, submitted to the Minister of Public Works and Highways by the county council, and includes all costs of labor, material, engineering services, salary of road superintendent, machinery, and bridges on the designated system of county roads.

The county council may finance their work by issuing debentures for a term not exceeding thirty years; or by sums raised from year to year in the annual county rate. The cost of purchasing and reconstructing toll roads may be included in the expenditure. The county council may by by-law make grants to towns and villages not separated from the county, for the improvement of extensions or connecting links of county roads in such towns and villages, and certain of such grants may be included in the statement of annual expenditure. Grants eligible for a provincial subsidy are those made to villages having a population of 1,500 or less; and those made to municipalities with a population of over 1,500, provided the improvement is carried out on suburban streets.

Suburban Roads.—Provision is made under the Ontario Highways Act, that a city may co-operate with the county council in improving the leading county roads adjacent to the city, and thereby obtain a more substantial type of construction for such suburban roads. The procedure is as follows:

A county council, by resolution, makes application to the Lieutenant-Governor-in-Council asking that a commission be authorized to deal with the suburban roads or portions thereof in the county system adjacent to the city and towards the construction and maintenance of which the city in question should contribute.

The Department of Public Highways submits the application to the city in question and considers their views in the matter. Should the commission be recommended

*Abstract of paper before Canadian and International Road Congress, Ottawa, April, 1917.

by the Department and authorized by Order-in-Council, it is made up of representatives chosen by the city and county council. In the case of a city having a population of less than 50,000, it would be composed of three persons, the county council selecting one member, the city selecting one, and the two agreeing upon a third. In the case of cities of over 50,000 population, the commission would be composed of five persons selected in a similar manner.

The first duty of the commission would be to determine the roads, and the length of each adjacent to the city, to which the city would contribute; the commission forming a board of arbitration for that purpose. It is then the duty of the commission to determine the work to be undertaken each year and to estimate the amounts required for construction and maintenance.

The county council would first approve or amend this estimate and authorize expenditure. It is then the duty of the county council, not later than the first day of March in each year, to notify the city of the amounts required.

For construction the province contributes 40 per cent. and the county and city each 30 per cent.; for maintenance and repair the province contributes 20 per cent. and the county and city divide the remainder equally between them.

The section of county road designated as "suburban" remains a county road for which the county is responsible; the work of construction and maintenance to be carried on under the county road superintendent but subject to the instructions of the special commission.

Provincial Highways.—A system of provincial highways has been authorized by a recent Act of the legislature, with a view to the construction and maintenance, under the Highways Department, of a net-work of leading highways throughout the province. A highway from east to west across the province would be the main artery of such a system, with suitable connecting branches leading to other parts of the province, and joining up county towns, cities or other important terminal points.

The Act gives the Provincial Highways Department, with the approval of the Lieutenant-Governor-in-Council, power to take over on behalf of the Crown any public highway by filing a route plan of the road in the local registry office and giving notice in the Ontario Gazette.

The department, through its officers, is thereafter responsible for the proper construction and maintenance of the highways so assumed. For this purpose the department has the usual powers of municipal corporations to widen or deviate the road allowance, procure material for construction, purchase machinery, and in general to control the use of the highway under the usual responsibilities placed upon municipalities.

Adjacent to cities the cost is borne in the proportion of 40 per cent. by the province, 30 per cent. by the city, and 30 per cent. by the municipality through which the road passes. Outside of the suburban section, the province assumes the proportion levied on the city, thereby paying 70 per cent., and the local municipality 30 per cent. In the case of bridges, the local municipality is placed on the same basis as in the case of a county road, *viz.*, the local municipality pays 60 per cent. of the cost of a bridge suitable for county purposes, and the province pays the balance. In cases where a special type of pavement is desired by a locality, provision is made for levying any excess part of the cost on a frontage basis. Various contingencies are provided for; with, in general, a right of appeal to the Ontario Railway and Municipal Board.

All cost of surveys, the purchase of machinery, plant and equipment, land for widening or deviating, general overhead and staff expenses are to be borne entirely by the province. Thus the local municipalities will be, in effect, required to pay less than 30 per cent. of the total cost.

A fundamental basis upon which the cost is thus distributed is that each local community should be required to pay for a road suited to local requirements. It is unfair to the rest of the province to levy less than that amount. It is unfair to the local municipality to require it to pay the entire cost of a road carrying an excessive amount of through traffic. The difference between the cost of a road suited to local requirements, and one of a character suited to the traffic of a main road, is therefore to be levied upon cities immediately served, or is to be met by the province from the revenue from motor vehicles. A main road from the county of Essex to the Quebec boundary, with branches to St. Catharines and Ottawa, passes through urban and rural municipalities having half the population of the province and over 60 per cent. of the assessment.

The building of the provincial highway system will not be undertaken as a huge work of continuous construction, but will be a matter of gradual development and extension. Wherever conditions are favorable, systematic maintenance will be applied so as to make the most of any reasonably good sections as they now exist. Construction will be taken up in sections where traffic is especially heavy, or where the road has heretofore been neglected. One type of pavement throughout is not contemplated. An effort will be made to construct in proportion to traffic, making the best possible use of local materials.

The immediate need is for a reasonably good trunk road system, joining up cities and local road systems, and making it possible for each local community to be a unit in such a trunk system without carrying an excessive or burdensome share of the cost.

Provincial County Roads.—Co-operative with provincial roads, but under county control, certain roads may be designated by the Highways Department as "Provincial County Roads." To such roads the province will contribute 60 per cent. of the cost of construction, and maintenance. These roads are intended to enable the more equitable maintenance of certain county roads, carrying a considerable proportion of through traffic, but which the county may efficiently maintain, and which are not of sufficient importance to be classed as provincial, or which it is not desirable or expedient for the province to assume as provincial highways. They continue to be county roads, but because of heavy through traffic, receive an increased subsidy.

Cities Share in the Cost.—Suburban roads and the assessment of cities for main road improvement is a feature of Ontario legislation that is new to most parts of the province, and the reasons for such requirements are of interest.

The development of main highways has, in every county required the co-operation of cities. This has been true in countries of Europe, such as England, France and Belgium. In the United States, the city of Detroit is paying 85 per cent. of the cost of roads in Wayne County. Cleveland is paying $800,000 annually for road construction outside of the city. In New York, the cities are paying 85 per cent. of the State expenditure. Similar conditions exist in other States.

In the case of cities in the United States, they are as a rule not separated from township and county or-

ganization, so that a considerable part of their expenditure on main roads is automatically arranged. In Ontario, however, with cities separated from township and county organization, it has been necessary to devise the system of suburban road contributions provided for in the Ontario Highways Act, in order that the existing municipal organization might not be disarranged.

Roads should be built and maintained in proportion to the traffic over them. Roads within two or three miles of a city may cost two or three times the ordinary expenditure of the county on roads, and this extra cost is difficult for the county to finance without co-operation from the city.

The object of a city's contribution would not be to relieve the county of the expenditure which they are now making, or which they may equitably be called upon to make, but rather to improve the standard of roads radiating from the city, and to permit them to be maintained in a condition suited to the traffic over them. Traffic accumulates to a considerable density on the main roads immediately adjacent to the city, and it becomes an unfair charge upon rural districts to construct and maintain roads suited to such accumulated traffic.

Thus the county with provincial aid may be spending for ordinary roads $5,000 per mile; made up of $3,000 from the county and $2,000 from the province. By calling upon the city to contribute equally with the county, the two provide $6,000, which entitles them to a provincial subsidy of $4,000. In this way, roads costing $10,000 (or $20,000) per mile become possible, to the very great advantage of the cities.

Municipal boundary lines are purely arbitrary and accidental. It cannot be maintained that the true interests and obligations of cities do not extend beyond their boundaries. That city councils are inclined to think of their interests as terminating with the city boundaries is purely a traditional attitude of mind, and in considering the advantages of good main roads, is without basis of fact. Good main roads are a means of rural development and are a source of local trade, as well as a convenience to city residents. The construction of main highways radiating from a city is so clearly of advantage to the city, that artificial boundary lines must necessarily be disregarded in providing equitably for the cost.

It has been suggested that the province should contribute to the cost of continuing main roads through a city. But wealth is concentrated in cities. Cities in Ontario have an assessment of $1,033,117,544 and a population of 1,019,627; whereas townships have an assessment of $687,372,853 and a population of 1,027,220. With the comparatively small amount which cities are asked to pay to the construction of main roads radiating from them, we believe that ample consideration is given to the construction of connecting links within the city at the cost of the city.

A man's farm bears a somewhat similar relation to a public highway that the streets of a city bear to the system of county roads. We aid a farmer to build roads to the boundary of his farm, but do not aid him to construct lanes and driveways on his farm. If a farm of 100 acres with a single family residing on it, and distant two miles from a county road, is taxed for the construction of such a main road, it would seem only fair that an area of 3,000 acres and containing a population of 25,000 with a valuation equal to 6,000 farms, should pay something to the cost of main roads radiating from it.

The building of expensive pavements within a city does not absolve the city from its obligations with respect to main roads in the open country. City pavements are not designed for traffic requirements; but are expensive largely because of the advantages of curbing and good boulevards to adjacent property; the cost being reflected in increased property values. Comparing a $4,000 per mile road in the country with a city pavement costing $60,000 per mile, under ordinary conditions of land occupation in Ontario, with four farms per mile on each side of the road, the cost, if levied on a frontage basis, would be twice as great to the farmer as to the owner of a 40-foot city lot.

As a matter of self-interest, due to the benefits which good roads bring to a city, it is clearly a matter in which the cities of the province should heartily co-operate with the province. There is no industry which cities can bonus with so much advantage to themselves as farming. Good roads increase the produce, the saleable produce, from the farms, all of which adds to the prosperity of the city.

Under the systems of taxation in vogue in the United States, a much larger proportion of the cost of main highways is met by the cities than is being considered in this province. The maximum rate to be levied upon a city for those main arteries is restricted to one-half mill, and the county roads to be designated as "suburban" under the Act, would necessarily be restricted to such mileage as could be adequately improved with the expenditure becoming available through the combined contributions of the city, county and province.

The mileage of radiating roads to which each city should contribute will depend somewhat on local conditions. Consideration may be given to the local trade traffic entering the city; or to points of local interest close to the city; or to an area approximately that required to maintain the city with local farm produce. It is estimated that one square mile, as commonly farmed in Ontario, will support a population of about 300 persons; from which the radius of the supporting area may be estimated. Broadly, it would appear feasible to require the smaller cities to give proportionate support to about six miles of road for each mile of radius of supporting area; or on another basis, two miles to each million of assessment.

The Ontario Highways Act came into effect in January of last year, and there is considerable negotiation to be carried out in order to effect organization in all cases.

The counties in which suburban roads have been settled are York, in which Toronto contributes to the entire county road system, with a special grant of $250,000 to the Toronto-Hamilton Highway; Frontenac, in which Kingston contributes to approximately 60 miles of road; Waterloo, in which Galt contributes to 25 miles, and Kitchener to 12 miles; Essex, in which Walkerville has contributed to about 8 miles (negotiations are now in progress with Windsor). Hamilton has contributed $50,000 to the Toronto-Hamilton Highway, and negotiations are in progress with the county with respect to other suburban roads.

Department of Public Highways.—The road organization of Southern Ontario is vested in the Department of Public Highways, under the Minister of Public Works and Highways, and is in charge of a deputy minister, chief engineer, and staff. The duties of the department have a considerable range, including:

The administration of the Highway Improvement and Ontario Highways Acts, which provide for subsidies to county and main roads.

The administration of the Motor Vehicles Act, including the issuance of permits for motor vehicles, licenses for chauffeurs, etc.

The administration of the provisions of the Municipal Act with respect to plans and specifications for steel and concrete bridges.

Consultation with town, city and township councils with respect to road and street improvement.

The construction of model and experimental roads.

Educational measures such as the publication of reports and bulletins, addressing public meetings, and the instruction of county road superintendents.

Miscellaneous matters such as traffic census, the testing of road materials, road surveys and estimates.

Three-fold Classification.—It will be seen that the general trend of recent road legislation in Ontario has been toward a three-fold classification, so desirable for management and distribution of cost, and which is being evolved in the following manner:

(1) Local or Township Roads, each carrying the traffic or little more than the traffic which is created by the farms adjoining the road; such roads to be controlled by and at the expense of township councils under a township superintendent.

(2) Leading Market or County Roads, the roads radiating from local market or shipping points, which carry a considerable accumulation of traffic; such roads to be controlled by, and to be at the expense of, county councils and cities, aided by a provincial subsidy.

(3) Main Roads between important cities and other terminal points, under the control of the Provincial Department of Public Highways.

The Imperial Munitions Board and the United States Shipping Board have been in consultation recently with regard to co-operation in the production of wooden ships in Canada and the United States. Standardized types of vessels have been agreed upon, and there will be a common schedule of prices and contracts. Arrangements are now being made to have a considerable number of wooden ships for ocean transportation built on the Pacific coast. In Canada, R. P. Butchart, of Victoria, will take charge of the business organization of the industry for the Imperial Munitions Board.

Following two years of reaction and shrinking traffics the railways of Canada established new high records in the statistical year ended June 30th last, according to the annual statement of the Comptroller of Statistics. In the 12 months 1,852 miles of new lines were brought into operation, making the total in Canada 37,434. In addition a considerable proportion of 3,150 miles, classified as under construction, was really in operation by permission of the Railway Commission. Railway capital was increased during the year by the issue of $468,387 in stocks and $17,598,499 in bonds, bringing the total up to $1,893,877,819. In addition, there was a further liability of $81,481,504. The Dominion Government was operating 4,178 miles of road, the capital cost of which was $306,053,937, although they had no stocks or bonds outstanding. Railways received from the Dominion Government in the statistical year cash subsidies amounting to $1,240,435, making the total of such aid given by the Dominion, the Provinces and the municipalities $240,062,359. Many high records were established in 1915-16 for freight and passenger traffic. The number of passengers carried was 49,027,671 and the quantity of freight 109,659,088 tons, an increase over the previous 12 months of 2,705,636 passengers and 22,454,255 tons of freight. Gross earnings in 1915-16 amounted to $263,527,157, as compared with $199,843,072, and operating expenses to $180,542,259, as against $147,731,099 in the previous year. The number of railway employees in the country increased from 124,142 in 1915 to 144,770 in 1916, and their remuneration from $90,215,727 to $104,300,647.

OPERATION OF THE ONTARIO HYDRO-ELECTRIC NIAGARA SYSTEM.*

THE operation of the Niagara System for the year 1916 was attended with gratifying success. In no other year, and especially since the war commenced, have the lines and apparatus of this system been called upon for such extraordinary duty. This condition was occasioned by the rapid recovery of industry, together with the enormous development of the manufacture of war munitions in Canada.

During the months of November to April, inclusive, and from July to October, power was purchased for transformation and transmission from two, and indirectly three, sources, the supplying plants being linked together by the Commission's transforming station at Niagara Falls. On April 30th the temporary contract with the Toronto Power Company expired, and from this date until July 26th, when the first generating unit from the Canadian Niagara Power Company was connected, the total load of the Niagara System was carried by the Ontario Power Company. On August 21st a second unit at the Canadian Niagara Power Company's plant was paralleled with the first, and from this date until the end of October the amount of power available from this company amounted to approximately 25,000 horse-power. As these generating stations were operating at maximum capacity, extreme caution was necessarily exercised in the operation of the system in order to preserve equilibrium at all times.

Electrical storms during the past year were much more frequent and severe than in previous years. The Niagara System was subjected to these storms on sixty different days. On eight days these storms traversed practically the entire system, and were particularly severe. The balance of the storms traversed only portions of the system, mainly in the Niagara Peninsula, Preston, Stratford and Chatham districts, and were more or less severe. No total system interruption occurred from lightning causes during the summer, and when it is considered that the Commission has in operation approximately 1,200 miles of high and low tension lines overstretching a strip of Ontario approximately 215 miles long and averaging 60 miles wide, all lines being subjected to the accumulation of electrical discharges, which must be dissipated by passage to ground, the efficiency of the protective apparatus is strikingly evident.

Work of a special nature carried out by the Line Maintenance Department, and required by reason of the rapid increase of load, included the erection of a temporary 12,000 volt double circuit pole line of No. 4/0 copper conductor between the power house of the Canadian Niagara Company's station and a point (on the present line between the Hydro and Toronto Power Company transforming stations) approximately 1,800 feet south of the Commission's station. Both circuits of this pole line are still in service pending the installation of the balance of the underground feeders to the Canadian Niagara Power Company's plant.

The erection of a fourth No. 4/0 copper, three-phase circuit 15.5 miles long, on the 46,000 volt tower line between Niagara Falls and Welland was completed and placed in operation.

The single or three-phase circuit of No. 2 aluminum between the high tension station and the municipal

*From the ninth annual report of the Ontario Hydro-Electric Power Commission.

station at Dundas was replaced with a double circuit of No. 4 copper.

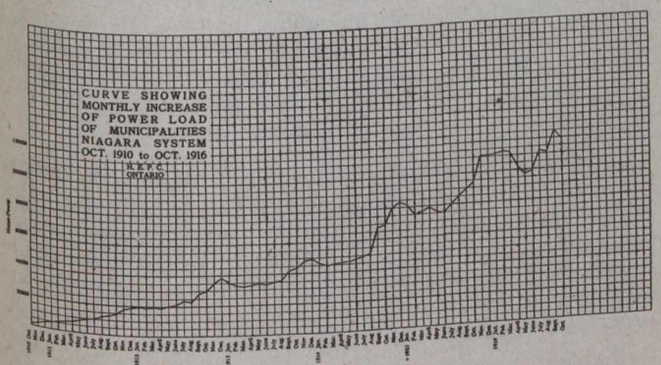
The wood pole line from the Dundas high tension to the city of Hamilton, which was replaced by a steel tower line during the summer of 1915, was taken down.

Short stretches of single circuit 26,400 volt lines were constructed to supply the Lake Erie and Northern Railway Company's sub-stations at Brantford and Simcoe from the outgoing circuits of Brant high tension station.

In view of the many new customers added in the Stratford district, and the length of line necessary to serve them, it has been decided to raise the transmission voltage in this district from 13,200 to 26,400. To this end considerable rearranging of the power and telephone lines was carried out in preparation for this change.

Some relocation of the 13,200 volt line feeding the Mimico distribution station from the Cooksville high tension station was necessary, due to the construction of the Toronto-Hamilton Highway. The portion of line affected extended from Port Credit to New Toronto.

A twenty-five "pair" lead-covered telephone cable, approximately 13,500 feet long, was installed between the high tension station and the Commission's new office building at Toronto. The cable was laid in the Toronto



Hydro-Electric System duct line to the corner of Queen and William Streets and from thence to the office building on the concrete poles.

Few failures of any of the electrical or mechanical equipment of the high tension stations occurred during the year. As the Commission, in common with other enterprises in Canada, was severely handicapped in obtaining delivery on additional apparatus required to cope with the abnormal demand for power, the present equipment in some of the stations was subjected to overload for short periods, but without any depreciating results. The difficulty, mentioned above, was partially met by the transfer, where feasible, of transformers from one station to another.

Considerable time has been spent in perfecting refinements in connection with the measurement of power, which has been to a great extent apparently considered unnecessary heretofore by the majority of other organizations. These refinements extend from the periodic comparison of the Commission's portable standard meters with ultimate standards to the determination of the characteristics of instrument transformers of various types.

A concrete roadway, approximately 300 feet long and 6 inches thick, was laid across the flats at Preston, from the fair grounds to the Commission's property. It is expected that this roadway will be unaffected by the heavy spring floods in this vicinity, which previously rendered impassable the original gravel-topped roadway.

An increase was made in the supply of cooling water for this station by the sinking of a well just outside the station and the installation of a deep-well pump for pumping the water directly into the cooling system. The supply originally obtained from the small creek in the flats had latterly become inadequate.

The plotted curve shows the monthly increase in the load supplied on the Niagara System from October, 1910, to October, 1916.

CIVIC ENGINEERING IN VICTORIA, B.C.

CITY Engineer C. H. Rust, of Victoria, B.C., has submitted to the city's aldermen the annual report covering the past year's work of his department. Following are some abstracts from the report:—

The expenditure, owing to the war, has been very much below that of the previous year, the total being $372,155.15, divided as follows:—

Local improvements, $29,501; sewer loan construction, $61,633; maintenance of streets, bridges and sidewalks, $61,725; street cleaning, $46,348; garbage collection, $40,540; waterworks, $45,518; parks, $14,547; sundries, $64,222; removing snow, $8,117.

Number of square yards of streets oiled during year, 537,110.

Number of cubic yards of garbage collected during year, 25,581.

Total mileage of concrete sidewalks	132.4	miles
" " " boulevards	65.2	"
" " " sewers	120	"
" " " water mains	134.25	"
" " " surface drains	83.21	"
" " " asphalt pavements	55.0	"
" " " wood block pavements	3.5	"
" " " concrete pavements	1.1	"
" " " macadam pavements	11.0	"
" " " tar macadam pavements	1.0	"
" " " vitrified brick	0.6	"
" " " macadam pavements	11.0	"
" " " unpaved streets	78.0	"
Total length of B.C. Electric Railway Company's pole lines carrying lighting and power cables, approximately	125	"
Total length of B.C. Electric Railway street railway lines	20	"
Total length of B.C. Telephone Company's pole lines, approximately	100	"
Underground main conduits on streets	8	"

The average costs for labor and material on sidewalk and road construction during the year were as follows:—

Grading, per cubic yard (earth)	36c. to $0.91
Curb and gutters, per lineal foot	.42
Concrete base 5 ins. thick	.82
Macadam, per square yard 7 ins. thick	.65
Sheet asphalt, 2 ins. thick, per square yard	.48
Sheet asphalt, 2 ins. top, 1 in. binder, per sq. yd.	.61
Concrete pavement, 7 ins. thick, per square yard	1.30
Concrete retaining walls, per cubic yard	6.15
Sidewalks, per square foot	.11

These amounts do not include any overhead charges.

The cost of maintaining our macadam roadways has been low, owing to the treatment of the surface with heavy oil.

Considerable relief has been given to the residential sections by the construction of macadam trails on unimproved streets.

During the year the Streets Committee decided that untreated wood blocks manufactured by local firms should be used in place of procuring treated blocks from Vancouver. This was carried out against the engineer's advice, and it remains to be seen how the life-time of these blocks will compare with that of the treated ones.

The total expenditure for street cleaning during the year amounted to $46,134.43. All cleaning was carried out by hand-brooms, pick-up carts and cans. The average cost was $0.116 per 1,000 square yards daily. The cost last year was $0.134 per thousand square yards. The business districts were covered more frequently.

During the past year 537,110 square yards of street surfaces were oiled, of which 27,326 square yards were given a second treatment. The unit cost per square yard was $0.012. The total expenditure was $6,438.98, divided as follows:—

Preparing street for oiling .....$1.10 per 1,000 sq. yds.
Oiling street, including cost of oil 7.21 per 1,000 sq. yds.
Sanding streets after oiling, including sand ..... 3.92 per 1,000 sq. yds.

The cost last year was $0.0123 per square yard.

Not only has the oiling of the streets practically stopped the dust nuisance which formerly existed in this city, but has added very much to the life-time of the macadam surface. These streets have now been oiled for the past four years and the surface has become in many instances practically impervious, thus prolonging the life-time.

During the winter of 1915-1916 some damage was done to Ross Bay sea-wall by southeasterly storms. To prevent a recurrence of this damage a contract was awarded for the driving of sheet piles at the toe of the wall. 1,370 feet were thus treated, and opposite 450 ft. of this wall heavy rock was deposited. The piling was carried out by Watson, Hall & Huntley, of Victoria, and $4,130.50 was expended on this work, which has not yet been completed.

The north-west main sewer is now completed, 2,071 feet having been laid during the year. The entire work has been carried out by day labor. 7,449 feet of the sewer was in tunnel, of which 6,390 lineal feet was in rock, at an average depth below the surface of 44 feet. The work also included the laying of a submerged 36-inch steel pipe for the outfall and inverted siphons under Selkirk water, a distance of 491 feet.

The labor cost of tunnel work during the first couple of months was $8.75 per lineal foot of tunnel. This was steadily reduced until during the last two months it was $4.75 per lineal foot. The estimated cost of the entire work as prepared by the engineers of the three interested municipalities, was $365,223, and the total cost of the work has been $298,853.

The total length of the sewer is 16,578 lineal feet, or 3.139 miles.

This completes the main part of the north-west sewer. Two branch mains, however, are now in progress. The average cost for open cut work for an average depth of 16 feet for the whole north-west main sewer was as follows (for labor only):—

Rock, for labor only, $3.65 per cu. yd.; hardpan, $1.69 per cu. yd.; dirt, 89c. per cu. yd.; backfill, 22c. per cu. yd.

The average cost per lineal foot for similar tunnel work was:—

Labor, excavating only, $8.50; all labor, $12.98; 36-in. sewer complete, $24.92.

Exclusive of the north-west sewer 14,467 ft., or 2.74 miles of sanitary sewers were constructed, bringing the total mileage in Victoria up to 120.

In October a number of leaks developed in the Sooke Lake conduit line. This occurred after a sudden change in the temperature, which during the day time was 60 degrees in the shade, and as low as 26 degrees at night. When the temperature rose and averaged about 40 degrees, the majority of these leaks stopped. The largest leaks, however, were on the big siphon at the east branch of the Sooke River, and were caused primarily by the settlement of one of the concrete bents. We propose during the coming year to take steps to prevent, if possible, a recurrence of this trouble.

During the year engineers, representing the Department of Agriculture of the U.S. Government, made a series of tests on the concrete flowline for the purpose of obtaining accurate records of the flow of water in concrete pipes.

The average amount of water passing through the meter at Humpback Reservoir is 5,050,741 Imp. gallons daily, equal to 100 gallons per head of population supplied, whilst the average amount actually sold as recorded by the various meters, including the water supplied to Saanich, Oak Bay and the Empress Hotel, averages 2,200,000 Imp. gallons daily, or an average per capita of 40 gallons.

Making liberal allowance for the leakage on mains, the use of water for sewer flushing, water for fire purposes and for boulevards, there is still about 1,000,000 gallons daily not accounted for. Fortunately we have an ample supply of water and the city is put to no expense for pumping or filtration. We are now taking steps to ascertain, if possible, where this loss occurs.

MARCH RAILWAY RETURNS.

Comparisons of the Canadian Pacific Railway's returns of March gross and net earnings during the past eight years, are given in the following table:—

March.	Gross.	Net.
1917	$11,846,542	$3,937,317
1916	10,380,981	3,421,330
1915	7,852,989	2,973,014
1914	9,447,461	3,099,239
1913	11,111,892	3,855,416
1912	10,519,319	3,718,401
1911	8,800,640	3,156,566
1910	7,796,337	2,711,173

The Grand Trunk Railway's net returns for the first quarter of 1917 are as follows:—

January	$691,763	inc. $135,866	24.44%
February	241,796	dec. 304,556	55.7 %
March	948,299	inc. 62,034	7 %

Canadian Northern Railway's statement of earnings and expenses for March is as follows:—

	1917.	1916.	Increase.
Total gross earnings ..	$ 3,273,200	$ 2,607,000	+ $ 666,200
Operating expenses ...	2,655,100	2,240,600	+ 414,500
Net earnings	618,100	366,400	+ 251,700
Aggregate gross earnings from July 1st	30,095,900	24,134,600	+ 5,961,300
Aggregate net earnings from July 1st	7,504,500	6,275,700	+ 1,228,800

Letters to the Editor

Canadian Engineers.

Sir,—During the last few years considerable has been said and written by members of the Canadian Society of Civil Engineers regarding the status of the engineering profession in Canada. Mr. W. F. Tye, in his address at Ottawa on March 29th last referred to the engineer's standing and gave some advice for improving our status before the public and to demand a greater share than now given on government engineering commissions. It is only too true that Canadian engineers are being too often overlooked by our governments when they make appointments to important public engineering works and commissions. Most emphatically it can be said that there is no valid reason whatsoever for any Canadian government to go outside of Canada for engineers. There are no problems or projects in Canada which cannot be more capably handled by Canadian engineers than by engineers from other countries. We are at least on a par with them as far as education and abilities are concerned, and we have the advantage that we are in our own country and hence undoubtedly more intimately acquainted with all its conditions. The preference often shown to outsiders is certainly somewhat inexplicable.

It is, however, difficult, in fact impossible, for the most of our engineers to participate in the actual government of the country by becoming members of parliament and senators. Lawyers, doctors, farmers and merchants have always a fixed place of residence. The avocation of the engineer does not render his life so fortunate as to allow him a permanent place of abode, nor does the fact that he is an employee allow him time or opportunity to participate in the political affairs of the country. Only the comparatively small number of engineers who are in private practice are justified in aspiring to become members of parliament or senators. So it appears that the bane of the engineering profession is its non-independence and the nomadic mode of life to which its members are compelled to accommodate themselves. I have no suggestions of improvements to make at present, but would think that herein lies an opportunity for our society to become more useful to its members, namely, by evolving a new basis for the profession whereby its members could more easily situate themselves so that they could take a more active part in the public affairs of the country.

A. J. MACDONALD, A.M.Can.Soc.C.E.

St. Irénée, Que., April 16, 1917.

Inspecting Engineers.

Sir,—In these days of the great world war, an army of inspectors of every classification has grown in our midst. Are they to stay professionally, and be received into the engineering world? There are two classes of inspectors,—those that make a profession of inspection, and the second-year student with the influential pull and a library of books which he believes will direct him in the practical works of engineering. The latter class has belittled the inspector's position of to-day.

What are the duties of the inspector? He is engaged to carry out the duties of the clerk of works, and must have a good working knowledge of plans and a technical training, and must be essentially practical in all things to obtain results to the satisfaction of all concerned.

The leading architects of Canada all have staffs of inspectors, with one man as chief inspector who goes over all work for its final acceptance, but receives little, if any, reimbursement for his discretion.

Do engineers realize that when they call for the services of an inspector and place him in charge, that all the responsibility is in reality on the inspector? Should any bad work or oversight in construction arise at the finish, he is dismissed, but when all is O.K. then you do not see Mr. Inspector or hear of him.

In your issue of April 19th you have an article by Mr. C. A. Mullen. This gentleman states that inspection and testing is a sound investment. I fully agree from every point of view except one, and that is,—it is a very poor investment for the inspector. He is underpaid, and he must be honest. Keep him honest, for his services are essential.

G. H. LOVETT,
Inspecting Engineer.

Quebec, P.Q., April 23rd, 1917.

[NOTE:—The above letter is unique in that it represents the thoughts of one of a class of men who seldom express their viewpoints in print but from whom we would like to hear oftener. Mr. Lovett's plea for better treatment of inspectors—particularly chief inspectors—will find fertile ground among engineers, as the latter realize how important is intelligent inspection in all contracts.—EDITOR.]

Municipal Consulting Engineers.

Sir,—I am sorry that in your editorial of March 15th, 1917, you attributed to my article on "Consulting Engineers' Fees" a meaning it was not intended to, and does not, convey.

You say that, stripped of excess verbiage, I assert that consulting engineers *purposely* underestimate. I said no such thing, but I did state that on the percentage system a temptation is placed before the engineer to underestimate. My article further stated that in many cases which have come before me, the preliminary estimate bore little relation to the final cost. You say it is hardly likely that I can give chapter and verse in substantiation, which is precisely what I am able to do in a good many instances. I am prepared to give, and to substantiate, many cases of underestimating, in which, as I stated in my article, the preliminary estimate bears little relation to the final cost, but I do not think you should suggest the Canadian Society of Civil Engineers as the tribunal, as however fair-minded its members may be, it could scarcely be called an impartial tribunal. Probably the Canadian Union of Municipalities could better appoint a tribunal to consider the matter, and if you wish it carried further, the following is one of the cases I have in mind.

In the town of "X" a well-known Eastern consulting engineer prepared a preliminary estimate for a waterworks system, which was to include delivery to the town and the laying of mains, to cost, as per the estimate, say, $100,000. The report continued: "Laterals and house connections will, of course, be paid for by the properties served." In other words, this latter sentence would lead anyone not familiar with municipal finance to believe there was no need to borrow money for laterals and house connections, and that $100,000 was all the capital required. What was the result? The town, having endorsed the preliminary estimate, had to go on, and spent

more than twice $100,000 in completing the work covered by the preliminary report. This year the Local Government Board held an enquiry to see whether this town could pay its fixed charges or not, and every ratepayer interrogated said that the preliminary report had misled him as to the cost of the proposed works.

That "mild amusement" is not the effect on the engineering profession, is evident from an article appearing in a Western journal this month, by a well-known consulting engineer, Mr. T. Aird Murray, M.Can.Soc.C.E. He says: "The method of charging upon a percentage basis has often been criticized both by engineers themselves and others, but no other satisfactory method has been formulated. The danger in engineers underestimating the value of work chiefly exists at the time when the preliminary report and estimate are prepared, and this is more so when two or more engineers may be competing against one another for the work."

Again, in the "Engineering Record" of March 24th, 1917, Sir Maurice Fitz-Maurice, in his inaugural address as president of the Institution of Civil Engineers, is reported to have asked the question, "Are engineers too optimistic in designing their work, and in their estimates of time and cost?" Answering the question, he says that engineers must plead guilty to the charge sometimes at least. Further, I believe that an American engineering weekly recently adversely criticized the percentage system. What further justification do I need?

I also perused, with interest, another letter to you from Mr. Underwood, of Saskatoon, criticizing my article. I wonder if Mr. Underwood ever heard of the case of a town in the southern part of this province, for which an engineer he may wot of, estimated the cost of a waterworks system at a certain figure, and who, when the bids for the work were found to be in excess of his estimate, and that the money to proceed with the work would not be forthcoming, pared his estimates and received bids within the amount available, after assuring all concerned that his first figure was an overestimate for the work proposed.

You overlook entirely the other phase of my article. In it I blame councils for the lax manner in which they enter into arrangements with their engineers, and I attribute many existing municipal financial embarrassments to this cause. One case came within my notice where the only document relating to the engagement of an engineer was a telegram from him stating his terms. And this for work estimated at over half a million, and as a result, when the final settlement came to be made, the engineer did not apparently know to 25 per cent. the exact cost of the work, having merely taken the annual financial statement as a basis for commission, so that he might be claiming on his own fees, legal fees, debenture discount, and all sorts of other things.

I still contend that a fixed sum for the work covered by the original estimate is the fairest all round, and of course councils would expect to pay extra for any additional work performed by their instructions. Can you tell me any good reason why an engineer should receive $600 extra commission if, between the date of the report and the acceptance of the tender for cast-iron piping and specials estimated to cost $60,000, the market should suddenly soar, so that the lowest tender was $72,000; or why, on the reverse, if the market should drop so that the material could be bought for $48,000, the engineer's commission should be reduced by $600?

There is a provision in the Municipal Acts of this province, that where special work is performed for municipalities by members of my profession, the bill can be submitted to the government for approval before payment. My profession sees no objection in this. Would the engineering profession be satisfied with a similar provision?

Happily, nowadays in Saskatchewan, capital expenditure by municipalities is under very strict control, and we do not think we shall have the same trouble in the future from engineers' and councils' extravagance that we have had in the past. Other provinces please note.

Now, in concluding an article already too long, may I say that I am proud my father was an English civil engineer, my brother is, or was, president of a society of civil engineers in China, and that I and all my brothers are, or have been, municipal men. It is not likely, therefore, that I should make an "unjustified attack" upon a profession of which my nearest and dearest relatives are members, unless I felt that an evil existed for which my municipal experience, not merely in my own province, seemed to fit me to draw attention. It is only natural that you, as the mouthpiece of the engineering profession, should to some extent resent my article, but if you are typical of your profession, you are a sportsman and will bear no ill will.

O. J. GODFREY, F.C.A.

Indian Head, Sask., April 23rd, 1917.

[NOTE:—No ill will whatever, Mr. Godfrey. Our previous editorial served an excellent purpose if it did nothing more than to bring forth this interesting and instructive letter from you. Had your previous article been as gently worded as your present letter, our resentment would have been milder.

In your original article you plainly accused consulting engineers generally of succumbing to the temptation to underestimate in order to get appointments on work which would not be undertaken if correctly estimated. Yet now you disavow any intention of saying that engineers purposely underestimate. We all admit the possible existence of the "temptation." What we objected to was your inference that engineers usually succumb to it and that you "have yet to see my first case of the actual cost of waterworks or electric light coming within the original estimate of the consulting engineer."

Also, how about your statement that "with due deference to the engineering profession, I make bold to say that if a limit had been placed on the engineer's fee for the completed work, much of the over-expenditure would not have occurred"? Was that not accusing engineers of dishonesty by inferring that they allowed "over-expenditures" in order to collect their percentages on same? Your meaning was certainly clear, because you elaborated on the point in the following manner:—

"In other words, if on an estimated cost of, say, $100,000 the council engaged the engineer to supervise the work proposed by his plan, irrespective of cost, at 5 per cent. on expenditures, the total fee not to exceed $5,000, I feel sure that the work would be done at much nearer the amount of the original estimate than has been the case in the past."

How does this agree with your illustration of the cast-iron pipe purchase? Supposing that the market soared after the date of the engineer's report, and the pipe cost $600 too much, would the engineer be supposed to "skimp" other parts of the work to make up that $600?

We recognize your standing in the municipal field, and it was for that reason that we thought your article sufficiently important to require editorial comment. Had your remarks come from a municipal accountant of less prestige and experience, probably no attention would have been given to them.

Mr. Murray's article, Sir Maurice Fitz-Maurice's opinion, and the views of the American engineering journal, to all of which you refer, may be absolutely correct. We never expressed any opinion differing from them. We took exception merely to your reflections upon the integrity of the engineering profession, and held no brief for the percentage system.—EDITOR.]

WELLAND CANAL WORK SHUT DOWN.

Work on the Welland Ship Canal was completely closed down May 2nd, 1917, when the services of all the engineering staff were dispensed with, including those of J. L. Weller, engineer in charge, to whose initiative the building of this great work is due. The contracts for four sections, comprising about eleven miles of canal and all of the seven lift locks and amounting to about $25,000,000, are about half completed.

The contractors were instructed last January to close down all their works for a period of one year and at the end of that time a further period of closing down would probably be specified. They are not allowed to sell their plant or remove it from the work without special permission from the department.

Chief Engineer Weller has been building and operating canals for 34 years, and having made a special study of this subject, has been able to effect great improvements in the Canadian canal system. He is responsible for very many of the better features of design now in use on canals.

MANITOBA BRANCH, CAN. SOC. C.E.

A meeting of the Electrical Section of the Manitoba Branch of the Canadian Society of Civil Engineers was held in the University Building, Winnipeg, on Wednesday evening, May 9th, when two papers were read. H. McConkey described the Morkrum Duplex Telegraph Printer, a wonderfully intricate device that increases tremendously the speed at which telegraph messages can be received. The machine responds to the incoming message by perforating a continuous paper tape and this tape, later run through a special mechanism somewhat resembling a typewriter, automatically types out the message. Mr. McConkey had the complete device on exhibition and an operator gave demonstrations of its speed and accuracy. F. S. Griffin then read a highly technical paper on an efficiency test on a large water-wheel connected with an electric generator. There was a good attendance. The president, W. G. Chase, was in the chair.

KITCHENER'S NEW ENGINEER.

The city council of Kitchener, Ontario, last week voted by 8 to 7 in favor of the appointment of Mr. B. E. Michel as city engineer at a salary of $1,800 to fill the position which was still being occupied by City Engineer Johnston, who has been receiving a salary of $2,250. No charges of incompetency have been preferred against Mr. Johnston.

A report received by the finance committee from Mr. Willis Chipman, consulting engineer, Toronto, who drew the plans for the new sewer beds, stated that some of the work had suffered from the frost, but apparently put the blame on the contractor. He declared $1,000 will remedy the walls which are damaged.

MONTREAL AQUEDUCT REPORT.

Covering forty-three typewritten pages, the report of H. E. Vautelet, A. St. Laurent and J. B. McRae, on the Montreal Aqueduct was presented last week to the Montreal city controllers. The report was referred back to Mr. Vautelet for translation into French before being given out for publication. It is understood, however, that the recommendations are as follows:—

"1st. That the south wall of the aqueduct be at once extended to the rock section and that the west earth section be completed with paving where needed, as this should be done for all enterprises.

"2nd. That no work be done on the rock section or on the east earth section, until the final scheme is decided upon. This also applies to the tailrace.

"3rd. That you immediately ask the several companies furnishing electric power in the city, for firm bids on power. Carefully worked out specifications should be furnished to the power companies setting forth the exact conditions of the service required.

"Prices should be, at the same time, obtained from the contractor for all changes and additions to the present contract.

"As soon as this is done (and it should be done in a couple of weeks) you shall be able to come to a decision with full knowledge of the costs of operation of all schemes.

"As all our figures will be in the hands of your chief engineer, he will be able to place before you the exact cost of each scheme.

"In the meantime, studies should be started and designs made for the proposed electric motor-driven pumping station. This station should be designed to pump the output of the proposed new filter plant, which is to be 100,000,000 Imperial gallons per day. Provision should also be made for future extensions. The equipment of this station will be the same whether you generate your own electric power, or buy it. The plans for the steam standby station should also be put in hand. We have suggested that the new pumping plant be located on the south side of the aqueduct near the filters.

"This should provide a most convenient location for all piping connections. It also facilitates the connection of the steam standby to the heating system that is proposed for the filters.

"No addition or alterations to the present steam pumping plant should be made.

"The plans for the hydro-electric station may be delayed until you have come to a decision regarding the course of power.

"4th. That the lands required be secured at once, so as to prevent further delays to the work.

"5th. That the addition to the filtration works at a cost of $900,000 be proceeded with."

DOMINION HEALTH DEPARTMENT SUGGESTED.

Dr. Michael Steele, South Perth, has submitted a resolution to the Dominion Parliament calling for the organization of a separate department of government to have "supervision over all matters relating to the physical welfare of the people of the Dominion." No conflict with the provincial jurisdiction in health matters is contemplated. Hon. Martin Burrell, Minister of Agriculture, said the time would come when it would be necessary to co-ordinate all activities in regard to human health, medical research work, national health, and health as it affects international problems, as well as sanitation.

INTERNATIONAL NICKEL PLANT.

Considering the bad weather, much progress has been made on the new plant of the International Nickel Company at Port Colborne. On April 20th it was reported that with the exception of the power plant, the foundations were practically all in, the steel work on the main building was nearly completed, three of the smaller brick buildings were almost complete and with good weather and no labor troubles it is expected that the first nickel will be turned out in December of this year. The estimated cost of the completed refinery will be about $4,000,000.

The plant is situated east of the entrance to the Welland Canal and consists of 350 acres, with a frontage of about one mile on Lake Erie. Transportation facilities are good, connection being established with the Grand Trunk and the Welland Canal may be utilized for the transportation of materials if necessary.

The entire construction is in the hands of the Foundation Company, Limited, Montreal, with whom the operating and engineering departments of the nickel company are co-operating, who have employed four hundred men during the winter and have made preparation to enlarge this number to one thousand this spring.

The initial output of the refinery will be 15,000,000 pounds of refined nickel a year, but provision has been made so that the capacity can be increased to two or even four times this amount, if necessary. The operating force will be about four hundred men. The two main stacks will be 350 feet high and 12 feet across the top, the whole resting on heavy concrete bases 40 feet square. Most of the supplies for the construction have been purchased in Canada, very little being imported.

In operation, the plant will consume 100,000 tons annually of bituminous coal, coke, cordwood, fuel oil, nitre cake, charcoal, silica, rock salt, soda ash, soda nitrate, sulphuric acid, fire clay and fire brick, in addition to the copper-nickel matte which will be supplied from the company's mines at Sudbury.

That every stage of nickel production should be carried out in Canada from the quarrying of the ore to the chemical and mechanical processes involved in making the scientific appliances and metal products which nickel alone can supply, is now the general conviction. This conviction is founded on the fact that roughly speaking eighty per cent. or more of the world's nickel is mined in Canada and the percentage is increasing rather than diminishing.

GRAND TRUNK'S FINANCIAL POSITION.

President E. J. Chamberlin, of the Grand Trunk System, speaking in regard to the government commission's report on the Canadian railway situation, said:—

"I have read the majority report of Sir Henry Drayton and Mr. W. M. Acworth, who with Mr. A. H. Smith, president of the New York Central Company, were appointed a special commission to examine the Canadian railway situation, I have not, however, seen the report of Mr. Smith, dissenting from the views of the other commissioners.

"I am extremely surprised at some of the statements made in the report with regard to the position of the Grand Trunk Railway Company of Canada, which, with all respect to the commissioners signing the majority report, I am compelled to say are inaccurate and misleading. So far as that company is concerned, its credit at the present time is high and its financial position not at all as stated in the report.

"During the past five years the Grand Trunk has borrowed in New York for capital purposes over $15,000,000, and had it not been for the war, which created abnormal conditions, further capital would have been procured and expended if prices had been satisfactory and deliveries could have been obtained.

"In view of statements contained in the report, and calculated to impair the credit of the company, I think it only just to the holders of Grand Trunk securities that they should be assured of the absolute safety of their investment.

"At a later date a full statement with regard to the company's position will be made."

TO DIRECT STEEL SHIPBUILDING.

Mr. W. I. Gear, of the Robert Reford Company, Montreal, has been appointed to take charge, under the Imperial Munitions Board, of steel merchant ship construction in Canada for the British government. Mr. Gear will establish an office at Ottawa and assume his new duties. It is understood that Sir Robert Borden on his return to Canada will at once take up the question of further stimulating shipbuilding in Canada.

MORE PAPER MILL ACTIVITIES.

The paper plant at Port Mellon, Howe Sound, established some years ago, but which has been idle for a long time, is being altered for the manufacture of kraft paper. The Rainy River Pulp and Paper Company has been organized by a syndicate of New York capitalists, headed by Mr. Robert Sweeny. Kraft paper will also be manufactured by the Pacific Mills Company, Limited, which has nearly completed its plant at Ocean Falls. A second and larger unit is now under construction directly across Link River from the present plant.

RAILWAY MATERIAL FOR FRANCE.

Another request for railway materials to construct roads behind the lines of the armies in France for use in the military operations on that front has been received by the Canadian government from the British authorities. This time enough rails to lay 300 miles of railway are required. These will be secured by dismantling a stretch of about 200 miles of the Grand Trunk Pacific Railway where it parallels the Canadian Northern west of Edmonton.

BRITAIN MAY BUILD AT TORONTO EXHIBITION.

The Dominions Royal Commission have recommended in their fifth and final reports to the imperial government that that government should erect a building at the Canadian National Exhibition, Toronto. "We think," says the report, "that the governments of the other dominions might well follow suit in this respect, and that similar encouragement might be given to National Exhibitions in other parts of the Empire as soon as they have, by results, justified their existence in the same manner as has that at Toronto."

WINNIPEG ELECTRIC RY. CO.'S EARNINGS.

The annual report of the Winnipeg Electric Railway, just issued, shows a net surplus of $445,251 for the year's operations, equal to 4.9 per cent. on the capital stock, compared with 5.5 per cent. the previous year. The gross earnings for 1916 were $3,311,169, compared with $3,663,895 for 1915 and $4,101,302 for 1914. Operating expenses were $1,939,041, compared with $2,332,158 for 1915 and $2,416,200 for 1914.

ENGINEERS' CLUB, PETERBOROUGH.

Mr. J. A. Shaw, of Montreal, chief electrical engineer of the C.P.R., delivered an illustrated lecture on "The Electrification of Steam Railways," before the Engineers' Club of Peterborough on Friday evening, May 11th. The lecture was preceded by a dinner at the Oriental Hotel.

R.U.V. CO. APPOINTS CANADIAN AGENTS.

The R. U. V. Co., 50 Broad St., New York City, announces that the Northern Electric Co., of Montreal, will hereafter have exclusive Canadian selling rights for Ultra-Violet Ray Water Sterilizers. These sterilizers have been installed for purifying water for municipalities, industrial institutions, residences, swimming pools, bottlers, breweries, etc.

Editorial

PARLIAMENT AND THE TRUSTEES.

One of Mr. A. H. Smith's chief objections to the report of his two colleagues on the Railway Inquiry Commission, is that "there is no means by which one parliament can bind its successors to a given policy, especially in so simple a matter as changing the organization of a government board." *The Canadian Engineer* does not believe that any parliament would dare to change the organization of such a board appointed under present circumstances.

Should the Drayton-Acworth report be approved by parliament, and the board of trustees formed along the lines suggested, no government could afford to throw a political monkey-wrench into the wheels. Appeal to the people by the opposition or by the trustees themselves, would be instantaneously effective, and that government would suddenly cease.

Another great safeguard is the fact that the five members are to hold the entire stock of the Dominion Railway Co., all shares being registered in their own names jointly with that of the Minister of Finance, and that they are to hold it in trust for the Dominion and not transferable to any other person excepting a successor in office. And the latter must be another trustee duly elected according to the provisions of the charter of the company. The Drayton-Acworth system of organization of the board of trustees appears to be ingenious. It is not infallible nor parliament-proof, but at all times public opinion must be depended upon to check parliament. One might argue that parliament would hand over the Dominion Railway Co. and all its assets to Sir Wm. Mackenzie, or some other person, free of charge.

Public opinion, properly roused, is a greater safeguard than any constitution, by-laws or Parliamentary Acts. We believe that Mr. Smith, in his objection to the majority report of the commission, has failed to rely sufficiently upon the force of public opinion.

MACKENZIE AND MANN.

Many people have labored for years under the impression that Sir William Mackenzie and Sir Donald Mann, or the firm of Mackenzie, Mann & Co., Limited, made fat cash profits on their contracts for the construction of the Canadian Northern Railway. To those people some of the revelations of the Railway Inquiry Commission will be a pleasant surprise.

In the Drayton-Acworth report it is made clear that all charges of misappropriation of railway funds by Mackenzie and Mann are entirely unfounded. Mr. Hanna, the vice-president of the railway, and Mr. Mitchell, its comptroller, both gave evidence on oath before the commissioners, both stating that neither the contracting firm, nor Mackenzie nor Mann personally, ever made any profit on their work for the Canadian Northern Railway other than certain "fully paid" common stock. No contractor's commissions were deducted. All work was turned into the railway company at cost and there was no allowance for the main contractors. It was stated that the subcontractors were not affiliated interests. Mr. Hanna swore that neither Sir William Mackenzie nor Sir Donald Mann drew any salary and that neither of them was ever on a Canadian Northern voucher list, nor on a voucher list of any of the Canadian Northern subsidiaries, to the extent of a dollar.

The report says, "The result of our inquiries leads us to the conviction that both Sir William Mackenzie and Sir Donald Mann had a firm belief in the ultimate success of their undertaking and in their own ability to carry it to a successful conclusion." On another page the report says that the Canadian Northern Railway was skilfully financed and economically constructed, the big mistake consisting entirely in the road's too rapid extension out of its original profitable field in the prairie provinces.

To sum up, it appears that Mackenzie, Mann & Co., Limited, turned in $204,000,000 worth of work to the Canadian Northern Railway at exact cost, taking as sole profit on same, some portion of the $100,000,000 common stock of the railway which they now hold. The remainder of this common stock was probably taken for other services to the road. It is evident that in any settlement of the railway problem, the Canadian Northern common stock should not be treated as mere "water." The stock was not paid for in cash, but it represents services of undoubted value,—whether to the full extent of a hundred million dollars or not is debatable,—but certainly some large value which, in justice to the builders of the road, should be treated as partially ranking with the system's other securities.

RAILWAYS AND THE PUBLIC DEBT.

In referring to the Drayton-Acworth report, Mr. A. H. Smith says in his minority report: "Their plan would add about a billion dollars to the direct debt of Canada." We cannot see how Mr. Smith arrives at this conclusion. It is even possible that the Drayton-Acworth scheme might more nearly result in deducting a billion dollars from the *real* national debt of Canada.

What Mr. Smith, no doubt, refers to is that Canada has invested $968,451,737 in railways, and he infers that if the country were to take over direct liability for all these roads, it would add that sum to the country's debt. As a matter of fact, the country has already expended, and now has or has had included in its debt, the sum of $442,906,297 out of this $968,451,737. This sum of $442,906,297 is made up of $157,294,329 subsidies to the C.N.R., G.T.P., G.T.R. and C.P.R., and $285,611,968 cost of roads now owned outright by the government. Another considerable portion of this $968,451,737—a sum amounting to $158,189,933—is the result of the sale of lands given by the government, and while perhaps properly included in the total of public aid to railways, this cannot be properly considered a part of the debt of such railways. As a matter of fact, most of this land would have been practically worthless had there not been built the railways to which the land was given.

The only real increase of the national debt would come in the direct assumption of the outstanding loans and guarantees to existing private corporations, plus that portion of the new capital expenditure of the Dominion

Railway Co. which would be raised on the credit of the government's railway properties as they now exist.

The total of the loans and guarantees outstanding is $367,355,507. Assuming that initial capital expenditure to the extent of $132,644,493 were to be required by the Dominion Railway Co., the amount really added to the direct liabilities of Canada would be half a billion dollars, —not a billion dollars. But is not the $367,355,507 loans and guarantees, as at present existing, really and practically a part of the national debt, even though it does not appear as such in the national balance sheet? Because, under existing conditions, would not the government be required to make good on most of its guarantees? or will it have reasonable chance of collecting its railway loans, or even interest upon them, if some radical change is not made in the handling of the assets that have been created by those obligations? If the Dominion Railway Co., as outlined by the Drayton-Acworth report, can pay its own way, might it not be better for the government to have the half billion dollars added to its direct debt and at the same time acquire assets fully corresponding to that debt—assets to be so managed as to earn interest on the debt—than to continue as at present?

PERSONAL.

Major E. G. M. CAPE, president of E. G. M. Cape, Limited, contractors, Montreal, has been reported wounded in the recent heavy fighting following the battle of Arras. The most definite information is that he is on sick leave in London. Major Cape raised one of the first units that left Montreal, which was known as Cape's Battery, Heavy Artillery.

E. S. COLE, of the Pitometer Co., New York, was recently elected president and treasurer of that firm, succeeding John A. Cole, resigned.

Maj.-Gen. GEO. W. GOETHALS, of Panama Canal fame, has become the head of a new consulting engineering firm known as Goethals, Jamieson, Houston & Jay, Inc., with offices in New York City.

F. P. GUTELIUS, M.Can.Soc.C.E., general manager of the Canadian Government Railways, has been offered the position of vice-president of the Delaware and Hudson River Railway, and it is understood that he will accept.

RUDOLPH HERING, M.Can.Soc.C.E., announces that he is continuing in practice as a consulting engineer in New York City. The firm of Hering & Gregory has been dissolved, Mr. Gregory also continuing in practice individually.

Gunner THOMAS VINCENT McCARTHY, of Toronto, a graduate of the School of Practical Science, class '13, has been wounded in action. He was formerly employed as a civil engineer in the Works Department at Toronto.

Lieut. STEWART H. PEPLER, who was engaged as an engineer by the Toronto Harbor Commission before enlistment, has been wounded in action. He is a son of Dr. W. H. Pepler, of 600 Spadina Avenue, Toronto.

SYDNEY F. RICKETTS, A.M.I.E.E., has joined the staff of the Canadian General Electric Company, Toronto office. He was with the Ross Rifle Company until the government took over the factory, and has also been engaged in engineering work in England and China.

I. J. TAIT, formerly chief engineer at the Windsor Station, Montreal, has recently become associated with J. T. Farmer, Canadian sales representative for the Green Fuel Economizer Co., the Combustion Engineering Corporation of New York, Glenfield & Kennedy of Scotland, Drysdale & Co. of Scotland, and other well-known firms.

FRED W. WARD has been appointed chemist, A. CLIFFE assistant technologist, and G. H. CHAPMAN media maker, at the filtration plant laboratory at Toronto Island.

Lieut. A. M. WEST, city engineer of North Vancouver, B.C., has been wounded in action. Mr. West left North Vancouver in charge of a draft from the Sixth Engineers about August, 1915.

OBITUARY.

Major J. A. DeLANCEY, A.M.Can.Soc.C.E., reported missing and believed killed, was a member of the firm of Lighthall & DeLancey, Vancouver. He went to the front with a Nova Scotia regiment, was twice wounded, twice mentioned in despatches, and was recently awarded the Military Cross. Major DeLancey was at one time in charge of one of the plants of the Panama Canal.

Lieut. GORDON M. PEARCE, of Toronto, 21 years of age, who left the School of Applied Science to go overseas in August last with the "Pals" Battalion, is reported to have been killed in action on April 25th. He is a son of Mr. W. K. Pearce, manager of the Dominion Bank. His brother, Lieut. Rex Pearce, was among those who fell at the Somme in September last.

Lieut. CECIL V. PERRY, a graduate of the School of Practical Science, was killed in action on April 23rd. He had been two years in France and was recently decorated with the Military Cross. He was 22 years of age, and a son of R. S. Perry, 40 Howland Avenue, Toronto. He was a civil engineer in Northern Ontario at the time of enlistment. He joined the Eaton Machine Gun Section as a private and on arrival in England was granted a commission with the Royal Engineers.

S. R. SHELDON, vice-president and chief engineer of Sheldon's, Limited, Galt, Ont., manufacturers of heating and ventilating equipment, passed away recently after an operation for appendicitis. Mr. Sheldon was born in Bucharest, Rumania, in 1877, and moved to Galt when 7 years of age, and has lived there ever since. After receiving his education at Galt public and collegiate schools he attended Ridley College and the School of Practical Science. Mr. Sheldon was originally with the McEachren Ventilating Co. and about fifteen years ago took over the business with his brother, W. O. Sheldon. The company was at a later date incorporated as Sheldon's Limited.

Lieut. THOMAS NEWELL VICARS, of Renwick, Ont., a student of the School of Applied Science, 1911, is reported as having died of wounds.

Lieut. W. J. WITHROW, a graduate of the School of Practical Science, University of Toronto, and a son of the late Rev. Dr. Withrow, of Toronto, has been reported killed in action. On graduating he received an appointment in the Civil Engineering Department at Ottawa, but on the outbreak of war he enlisted with a machine gun detachment in Toronto. When he reached the front he was placed at the head of the topographical department at headquarters.