

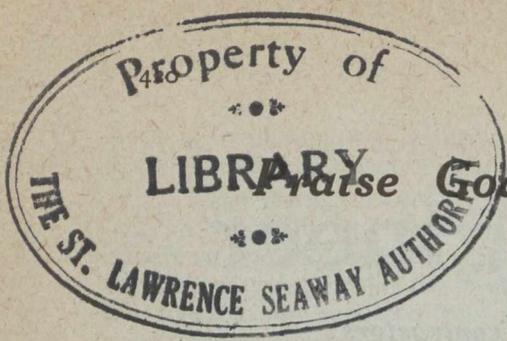
**PAGES**

**MISSING**

# The Canadian Engineer

A weekly paper for Civil engineers and contractors





*Praise God from Whom all blessings flow!*

Rule, Britannia!  
Britannia, rule the waves!  
Britons never will be slaves.

# Text of Historical Armistice

## Signed by Germany to Take Effect on the Eleventh Hour of the Eleventh Day of the Eleventh Month, 1918—Ends the War

1.—Cessation of operations by land and in the air six hours after the signature of the armistice.

2.—Immediate evacuation of invaded countries, Belgium, France, Alsace-Lorraine, Luxemburg. So ordered as to be completed within fourteen days from the signature of the armistice. German troops which have not left the above-mentioned territories within the period fixed will become prisoners of war. Occupation by the allied and United States forces jointly will keep pace with evacuation in these areas. All movements of evacuation and occupation will be regulated in accordance with a note annexed to the stated terms. [NOTE.—Also see "Amendments to Armistice Terms" on page 422.—EDITOR.]

### Repatriation

3.—Repatriation beginning at once, and to be completed within fourteen days, of all inhabitants of the countries above-mentioned, including hostages and persons under trial or convicted.

4.—Surrender in good condition by German armies of the following equipment: Five thousand guns (two thousand five hundred heavy, two thousand five hundred field), thirty thousand machine guns, three thousand minenwerfer, two thousand airplanes (fighters, bombers—firstly, D; seventy-three's and night bombing machines). The above to be delivered in situ to the allies and the United States troops in accordance with the detailed conditions laid down in the annexed note.

### Evacuation of Rhine Bank

5.—Evacuation by the German armies of the countries on the left bank of the Rhine. These countries on the left bank of the Rhine shall be administered by the local authorities under the control of the allied and United States armies of occupation. The occupation of these territories will be determined by allied and United States garrisons holding the principal crossings of the Rhine, Mayence, Coblenz, Cologne, together with bridgeheads at these points in thirty kilometre radius on the right bank and by garrisons similarly holding the strategic points of the regions. A neutral zone shall be reserved on the right of the Rhine between the stream and a line drawn parallel to it forty kilometres to the east from the frontier of Holland to the parallel of Gernsheim and as far as practicable a distance of thirty kilometres from the east of stream from this parallel upon Swiss frontier. Evacuation by the enemy of the Rhine lands shall be so ordered as to be completed within a further period of eleven days,

in all twenty-five days after the signature of the armistice. All movements of evacuation and occupation will be regulated according to the note annexed.

6.—In all territory evacuated by the enemy there shall be no evacuation of inhabitants, no damage or harm shall be done to the persons or property of the inhabitants. No destruction of any kind to be committed. Military establishments of all kinds shall be delivered intact as well as military stores of food, munitions, equipment not removed during the periods fixed for evacuation. Stores of food of all kinds for the civil population, cattle, etc., shall be left in situ. Industrial establishments shall not be impaired in any way, and their personnel shall not be moved. Roads and means of communication of every kind, railroad, waterways, main roads, bridges, telegraphs, telephones, shall be in no manner impaired.

7.—All civil and military personnel at present employed on them shall remain. Five thousand locomotives, fifty thousand wagons and ten thousand motor lorries in good working order with all necessary spare parts and fittings shall be delivered to the associated powers within the period fixed for the evacuation of Belgium and Luxemburg. The railways of Alsace-Lorraine shall be handed over within the same period, together with all pre-war personnel and material. Further material necessary for the working of railways in the country on the left bank of the Rhine shall be left in situ. All stores of coal and material for the upkeep of permanent ways, signals and repair shops left entire in situ and kept in an efficient state by Germany during the whole period of armistice. All barges taken from the allies shall be restored to them. A note appended regulates the details of these measures.

8.—The German command shall be responsible for revealing all mines or delay-acting fuse disposed on territory evacuated by the German troops, and shall assist in their discovery and destruction. The German command shall also reveal all destructive measures that may have been taken (such as poisoning or polluting of springs, wells, etc.) under penalty of reprisals.

9.—The right of requisition shall be exercised by the allies and the United States armies in all occupied territory. The upkeep of the troops of occupation in the Rhineland (excluding Alsace-Lorraine) shall be charged to the German Government.

10.—An immediate repatriation without reciprocity, according to detailed conditions, which shall be fixed, of all allied and United States prisoners of war. The allied

powers and the United States shall be able to dispose of these prisoners as they wish.

11.—Sick and wounded who cannot be removed from evacuated territory will be cared for by German personnel who will be left on the spot with the medical material required.

12.—All German troops at present in any territory which before the war belonged to Russia, Roumania or Turkey shall withdraw within the frontiers of Germany as they existed on August 1, 1914.

13.—Evacuation by German troops to begin at once, and all German instructors, prisoners and civilian, as well as military agents, now on the territory of Russia (as defined before 1914) to be recalled.

14.—German troops to cease at once all requisitions and seizures and any other undertaking with a view to obtaining supplies intended for Germany in Roumania and Russia (as defined on August 1, 1914).

**Abandonment of Treaties**

15.—Abandonment of the Treaties of Bucharest and Brest-Litovsk and of the supplementary treaties.

16.—The allies shall have free access to the territories evacuated by the Germans on their eastern frontier either



Allies Will Occupy Big Slice of Germany, as Black Area Shows

through Danzig or by the Vistula in order to convey supplies to the populations of those territories or for any other purpose.

**Clause Concerning East Africa**

17.—Unconditional capitulation of all German forces operating in East Africa within one month.

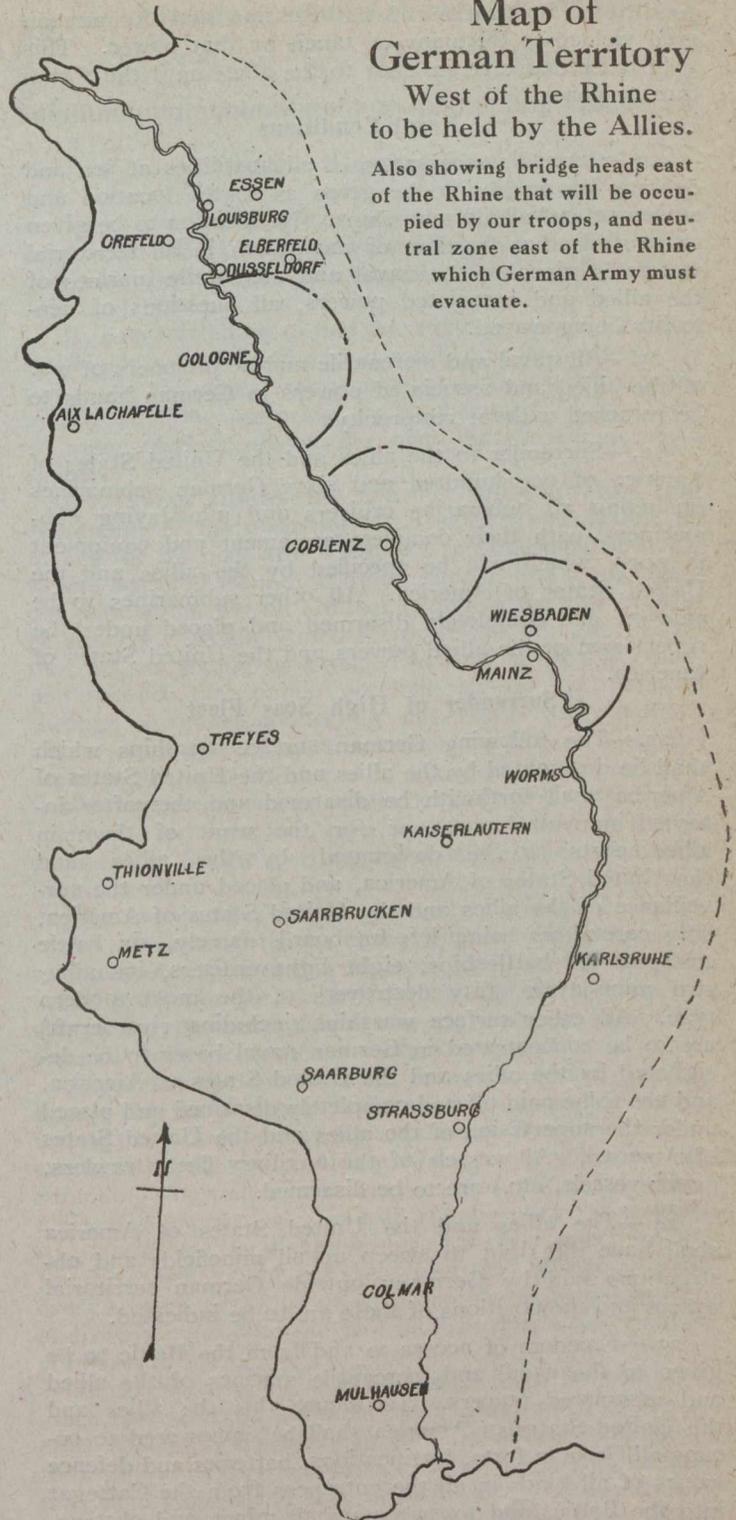
**General Clauses**

18.—Repatriation, without reciprocity, within a maximum period of one month in accordance with detailed conditions hereafter to be fixed of all civilians interned or deported who may be citizens of other allied or associated states than those mentioned in Clause III., paragraph 19, with the reservation that any future claims or demands of the allies and the United States of America remain unaffected.

19.—The following financial conditions are required: Repatriation for damage done. Whilst such armistice lasts no public securities shall be removed by the enemy which can serve as a pledge to the allies for the recovery or reparation for war losses. Immediate restitution of the cash deposit in the National Bank of Belgium, and in general immediate return of all documents, specie, stocks, shares, paper money, together with plant for the issue thereof, touching public or private interests in the invaded

**Map of German Territory West of the Rhine to be held by the Allies.**

Also showing bridge heads east of the Rhine that will be occupied by our troops, and neutral zone east of the Rhine which German Army must evacuate.



- German Frontier.
- ==== Rhine River.
- - - - Boundary of Neutral Zone east of which Germans must retire.
- - - - Limits of Bridge Heads to be held by Allies.

The territory west of the Rhine to be occupied by the Allies is approximately 20,000 square miles in area and has a population of about 9,000,000 people. It includes some of the most important mining and manufacturing districts in Germany. The territory embraces the Rhine Province of Prussia, the Palatinate (part of Bavaria), Alsace, Lorraine, the principality of Berkenfeld, and fully one-third of the Grand Duchy of Hesse. In the neutral zone east of the Rhine River are Essen (where the huge Krupp works are located), Dusseldorf, Mannheim, Duisburg, Mulheim and many other important industrial centres

countries. Restitution of the Russian and Roumanian gold yielded to Germany or taken by that power. This gold to be delivered in trust to the allies until the signature of peace.

#### Naval Conditions

20.—Immediate cessation of all hostilities at sea and definite information to be given as to the location and movements of all German ships. Notification to be given to neutrals that freedom of navigation in all territorial waters is given to the naval and mercantile marines of the allied and associated powers, all questions of neutrality being waved.

21.—All naval and mercantile marine prisoners of war of the allied and associated powers in German hands to be returned without reciprocity.

22.—Surrender to the allies and the United States of America of one hundred and sixty German submarines (including all submarine cruisers and mine-laying submarines), with their complete armament and equipment in ports which will be specified by the allies and the United States of America. All other submarines to be paid off and completely disarmed and placed under the supervision of the allied powers and the United States of America.

#### Surrender of High Seas Fleet

23.—The following German surface warships which shall be designated by the allies and the United States of America shall forthwith be disarmed and thereafter interned in neutral ports, or for the want of them in allied ports, to be designated by the allies and the United States of America, and placed under the surveillance of the allies and the United States of America, only caretakers being left on board, namely, six battle cruisers, ten battleships, eight light cruisers, including two mine-layers, fifty destroyers of the most modern type. All other surface warships (including river craft) are to be concentrated in German naval bases to be designated by the allies and the United States of America, and are to be paid off and completely disarmed and placed under the supervision of the allies and the United States of America. All vessels of the auxiliary fleet (trawlers, motor vessels, etc.) are to be disarmed.

24.—The allies and the United States of America shall have the right to sweep up all minefields and obstructions laid by Germany outside German territorial waters and the positions of these are to be indicated.

25.—Freedom of access to and from the Baltic to be given to the naval and mercantile marines of the allied and associated powers. To secure this the allies and the United States of America shall be empowered to occupy all German forts, fortifications, batteries and defence works of all kinds in all the entrances from the Cattegat into the Baltic, and to sweep up all mines and obstructions within and without German territorial waters, without any question of neutrality being raised, and the positions of all such mines and obstructions are to be indicated.

#### Blockade Remains

26.—The existing blockade conditions set up by the allied and associated powers are to remain unchanged and all German merchant ships found at sea are to remain liable to capture.

27.—All naval aircraft are to be concentrated and immobilized in German bases to be specified by the allies and the United States of America.

28.—In evacuating the Belgian coasts and ports, Germany shall abandon all merchant ships, tugs, light-

ers, cranes and all other harbor materials, all materials for inland navigation, all aircraft and all materials and stores, all armaments and all stores and apparatus of all kinds.

29.—All Black Sea ports are to be evacuated by Germany; all Russian war vessels of all descriptions seized by Germany in the Black Sea are to be handed over to the allies and the United States of America; all neutral merchant vessels seized are to be released; all war-like and other materials of all kinds seized in those ports are to be returned and German materials as specified in Clause 28 are to be abandoned.

30.—All merchant vessels in German hands belonging to the allied and the associated powers are to be restored in ports to be specified by the allies and the United States of America without reciprocity.

31.—No destruction of ships or of materials to be permitted before evacuation, surrender or restoration.

32.—The German Government will notify the neutral Governments of the world, and particularly the Governments of Norway, Sweden, Denmark and Holland, that all restrictions placed on the trading of their vessels with the allied and associated countries, whether by the German Government or by private German interests, and whether in return for specific concessions, such as the export of shipbuilding materials or not, are immediately cancelled.

33.—No transfers of German merchant shipping of any description to any neutral flag are to take place after signature of the armistice.

#### Duration of Armistice

34.—The duration of the armistice is to be thirty days with option to extend. During this period, on failure of execution of any of the above clauses, the armistice may be denounced by one of the contracting parties on 48 hours' previous notice.

### AMENDMENTS TO ARMISTICE TERMS

ABOVE is the text of the armistice terms as they were read to the United States Congress last Monday by President Wilson. They were evidently the terms that had been submitted to Marshal Foch by the Versailles conference, and a copy of which had been sent to President Wilson. Later press despatches, however, indicate that Marshal Foch made a number of changes in the terms before he presented them for the signatures of the German envoys.

The agreement as finally concluded specifies the delivery to the Allies of all of Germany's submarines, instead of the 160 specified in the original draft.

Another amendment specifies that the countries on the left bank of the Rhine evacuated by the Germans shall be administered by the local troops of occupation, instead of by the local authorities under the control of the armies of occupation. Instead of immediate withdrawal of German troops from Russia, as originally provided, the amended terms specify that they shall be withdrawn as soon as the Allies, taking into consideration the internal situation of Russia, shall decide that the time for this has come.

#### Treble Railway Cars

Reduction is made in the amount of certain military equipment to be delivered by the Germans to the Allies,

including 25,000 instead of 30,000 machine guns and 1,700 aeroplanes instead of 2,000.

The number of railway cars to be delivered, however, is increased threefold—from 50,000 to 150,000. It is against the delivery of this amount of rolling stock that Dr. Solf, the German Foreign Secretary, he protested to President Wilson, asserting that the distribution of food in Germany to the civilian population will be greatly hampered.

Another amendment provides that "the Allies should give consideration to the provisioning of Germany during the armistice to the extent recognized as necessary."

To assure the execution of the armistice convention "under the best conditions, the principle of a permanent international armistice commission is admitted." This commission will "act under the authority of the allied military and naval commanders-in-chief."

### Ships to be Interned

An amendment to the naval clause provides that all vessels designated to be interned shall be ready to leave German ports within seven days of the signing of the armistice. Directions for the voyage (to either neutral ports or those of the allied countries to be designated) will be given by wireless.

German troops are required to withdraw immediately from Austria-Hungary, as well as from Roumania and Turkey.

Evacuation by the enemy of the Rhine lands (left and right bank) shall be so ordered as to be completed within thirty-one days in all after the signing of the armistice, instead of nineteen days.

Other amendments include "renunciation" instead of "abandonment" of the treaties of Bucharest and Brest-Litovsk and of supplementary treaties, and evacuation by all German forces operating in East Africa within a period to be fixed by the Allies instead of within one month.

## TRADE OF CANADA AND NEWFOUNDLAND

A report on trade in Canada and Newfoundland for 1917 has been prepared by the British trade commissioners in Canada, and published by the Department of Overseas Trade of the United Kingdom. Reviewing conditions during 1917, it says:—

"Statesmen and business leaders are now urging upon the manufacturers of Canada to look ahead and consider ways and means to organize for an intense production to meet requirements, when the war ceases, of the home and export markets.

"It is impossible to say exactly what effect there will be on Canadian prosperity upon the cessation of the war, but Canadian manufacturers may be expected to bring all possible influence to bear for the increase of tariffs on goods which it is anticipated that Canada can produce.

"United Kingdom manufacturers, when the war ceases and labor is once more available for peaceful purposes, should have no fear that they will not be able to regain the businesses they have been compelled to relinquish during the war, provided they maintain their system of supplying goods above reproach at reasonable prices.

"So far as the Canadian market is concerned, there will probably be large purchasing power available to absorb United Kingdom productions of a kind suitable for this country. The prosperity of Canada will depend:—

- (a) On the happy development of its agricultural and natural resources;
- (b) The extension of its home manufactures; and
- (c) The development of an export trade in goods, which the Dominion may be able to produce more cheaply and economically than its competitors.

## Letters to the Editor

### Circular Housing Plan

Sir,—It was with great interest that I read an article in a recent issue of *The Canadian Engineer* entitled "Engineering Possibilities of a Circular Housing Plan," by Mr. G. J. Lamb.

It is so refreshing to find our existing system of town development questioned and an intelligent and original effort made to suggest something better that one hesitates to offer anything but praise for a scheme which possesses so many obvious advantages over the present accepted system.

Mr. Lamb attacks the housing problem from the standpoint of the civic purse. The economic claims he makes for his plan are based, not on additional national wealth accruing from a healthier, happier and more vigorous population, but on a direct saving in the cost of public services. Briefly stated his proposals are two: First, that houses should be grouped around a circular court, and second, that public services should be supplied through a tunnel connecting one house with another. These two proposals must be treated as quite distinct and separate from one another. It is just as obvious that the tunnel suggestion can be applied equally well to houses in a circle, a straight line, or a square as it is that houses cannot only be grouped around a court when connected by a tunnel.

The advantages to be gained by grouping houses round a court are obvious at first glance. Apart from an admitted economic saving in road construction, etc., the added protection for children's play, the privacy, the seclusion for community and family life would be quite sufficient to recommend such a change in system.

The most obvious criticism, however, of Mr. Lamb's plan is that he proposes to discard one cut-and-dried system of town development for another. The dreariness of existence in the centre of a uniform, rectangular layout, extending for miles, with every street the same width, alike in every particular and all running straight to infinity, staggers the imagination. Life, however, in Mr. Lamb's town would not be free from monotony, with every street a parkway, on which no houses would appear, and every court like the last in size, shape and number of houses.

In the lives of the working world there is necessarily much that is drab, and monotonous, and much of drudgery. While a good deal can be done, and is being done, to brighten the surroundings of the worker at the factory, it is in his home life that he will chiefly benefit from a variety of interest, brightness and freedom from monotony.

Whether Mr. Lamb's plan is to be regarded strictly as a remedy for past mistakes, where the land has already been subdivided and the lots sold, he does not say. One would imagine, however, that even if this were the case, the difficulty of obtaining individual co-operation for such a transference, would be almost as great as those involved in a resubdivision of the whole tract. His suggestion that the houses be rented would pre-suppose private or public control of, at least, each court.

Taking the plan up in detail I do not understand the necessity for central cul-de-sac, or turn-around. The circular drive way, on which the houses front, would seem to provide sufficient service. Mr. Lamb devotes the whole of the centre of the court to vegetable gardens

and yards. On page 195 he says that, "No window would look out onto a neighbor's backyard." The plan seems to suggest that each house would front onto a congestion of back yards.

My own idea is that the whole of the central circle enclosed by the circular drive should be developed as a community park and play-ground under control of the civic park department. The rear end of each lot would allow as much space for vegetable garden as that provided by Mr. Lamb, and some lawn in addition.

Discussion on the utilities tunnel revolves so much around the table of unit capital costs that I could offer no intelligent criticism without a very detailed analysis from the economic standpoint. As this would require more engineering knowledge and experience than I possess, I would leave this discussion in more capable hands.

The table of comparative costs does not seem to be entirely removed from all chance of criticism. How, for instance, does the circular system, or the tunnel, save \$100,000 on cost of houses? This is presumably arrived at by construction of a whole court at once, instead of individual building. Construction of large blocks of houses of the same pattern, however, is perfectly feasible under the existing layout and, moreover, is continually being done.

Mr. Lamb shows a saving of 75% on excavation by means of a steam shovel. Even if all the houses were in line, this would be hard to believe. With the houses staggered the difficulties would be greatly increased. In accordance with modern model housing practice, Mr. Lamb shows his houses wide and shallow. Such houses should find front and rear lighting sufficient. A more architectural grouping of the houses would be more restful and pleasing.

In estimating roads it does not look as though main thoroughfares have been allowed for. Mr. Lamb would also have to provide cross communications between his seven blocks. Trunk water mains, sewers, etc., would have to be included.

Summing up the above remarks, I would point out that the ideal town will never be accomplished by standardization. It takes all sorts of people to make a world and all sorts of different surroundings to happily house the individuals in a town. To disregard the human element is fatal. The human element asks not for standardization but for something more akin to itself. Order, system, and a definite balance of parts it demands, but with them must come variety of interest and subordination working up towards a definite climax.

As Mr. Lamb says, "The housing problem is fast becoming a national one." So much is this the case that one can scarcely pick up a paper without finding a reference to some phase of housing or town planning. This is due partly to congestion resulting from concentration of war industries, partly to a general national demand for better housing conditions, and partly to the universal interest which model housing enterprise, in more thickly populated countries, has aroused.

The period succeeding the war is likely to be one of considerable social reconstruction. Soldiers of all countries returning to their homes will not accept quite so readily existing social systems as the unalterable law. Fundamental anchor principles sanctified by generations of acceptance will be dredged up and laid out for inspection. Civilization has fought for a world worth living in. She will see to it that the new world, to which she returns, is still more worth living in than the old one she left.

H. B. DUNNINGTON-GRUBB

Toronto, Ont., November 11th, 1918.

## England's Roads

Sir,—*The Canadian Engineer* devotes more space and attention to road construction and maintenance than any other journal known to the writer. Obviously conditions in England differ widely from those in Canada, but the essential problems remain the same.

Road construction ceased with the outbreak of war and only the minimum repairs have been made since August, 1914. It speaks well for their original condition that the roadways of England are in as good condition as they are to-day. Obviously, however, a very large sum will have to be spent during the next few years to rehabilitate conditions and further reconstruction. A sum of anything from \$250,000,000 to \$500,000,000 is mentioned as essential.

The following paragraphs clipped from the London Evening News of October 21st, 1918, may be of interest to Canadians engaged in road construction, who may or may not, however, agree with the material advocated:—

"The Broken Roads of England.

"Need for Reconstruction Suitable for Greater Motor Traffic.

"By Francis Wood.

"Editor's Note—Mr. Francis Wood, M. Inst. C.E., the author of 'Modern Road Construction,' emphasises in the following article the need for immediate action in reconstituting the main roads of England, which have fallen into disrepair through the heavy traction of the war:—

"On the return of all the motor vehicles built for the War Department in all stages of disrepair, they will not of necessity be put upon the scrap heap; they will be put in order and used. Previously to 1909 only a small proportion by comparison of the present day number of these vehicles caused such damage to the roads that Parliament passed the Development and Road Improvement Act, the Road Board was formed, and a tax on petrol was imposed to assist in providing the necessary funds to help alleviate the difficulties that had arisen. Since then there had been an improvement, but the war intervened at a critical moment; funds, labor and materials have been in a large measure cut off, and the roads have in consequence been starved. Vast sums of money will be required to bring them into good condition.

"The class of structure that has proved the most successful as regards its wearing capacity and general economy is the two-coat bituminous or asphalt pavement. The standard section of this type of pavement laid by the Road Board at Sidcup has scarcely required any attention during the past seven years, while the majority of the others have failed or required annual treatment to maintain them in serviceable condition. But the price of bitumen, which forms a very important proportion of the composition, has risen to such a figure that unless the post-war price approaches that of the pre-war figure, it will not be as favorably considered as it ought to be. Here is, therefore, a question that should be inquired into.

"On pre-war prices the whole of the main thoroughfares could have been reconstructed with a two-coat bituminous pavement for £70,000,000; on present prices it could hardly be done for £200,000,000.

"The financial aspect of maintenance is a serious one and demands careful examination. Whatever the cost, it will be greatly in excess of the amount that the authorities have been accustomed to provide.

Local authorities know what is before them, but there is no concerted move on their part at the present. It would seem desirable that a committee should be formed by the Government to inquire into:—

"1.—What forms of construction will satisfy the traffic in the most satisfactory manner?

"2.—What will be the cost of such structures?

"3.—What mileage should be constructed in the first year after the war?

"4.—What methods should be adopted to ensure the work being carried out? and

"5.—What are the best methods of financing the scheme?"

A. L. HAAS

London, Eng., October 21st, 1918.

### Labor and the Engineer

Sir,—Dr. Mann, in his report on engineering education, makes note in passing:—"Back in 1914 most people believed that the war could not last long because money enough could not be found to finance it. But three years of experience has made it clear to everyone that, although money is plentiful, it is useless if there is nothing to buy."

A simple and homely illustration that may serve to illuminate another phase of the same idea. Assume that ten men start out together in our Canadian North country to make homes for themselves. They have each a thousand dollars in cash. They are of different trades and callings. The country into which they go is capable of yielding up the necessities of life. They co-operate by performing each the task for which he is best trained and adapted. Each is paid by his fellows for work he does for any of them according to a prearranged schedule of wages. We imagine them isolated from the outside world.

At the end of a reasonable period of time we may imagine them surrounded by buildings, furniture, etc.—everything, in fact, which their peculiar skill and the neighboring resources would permit them to create. Taken collectively, the working capital would evidently be the same as at the outset, though differently distributed among the individuals. We notice that it served a very useful purpose in making adjustments amongst the different individuals and in carrying over value from one period to another but we must admit that, backed by confidence in one another they could have attained the same identical result without it. From this we might concede the time honored conclusion that, while capital is helpless without labor, labor is far from helpless, though handicapped without capital.

We might further suppose, that by laying tribute against the circulating medium in the way of interest or other artifice, one man, like the banker of a roulette wheel, would eventually get control of all the money in the hypothetical community.

We could go on complicating our simple problem by introducing new considerations until we had a case as complex as that of actual present day conditions without gaining much from the viewpoint of our present discussion. We have gone far enough to emphasize the fact that the actual things which these imaginary men created by the work of their hands for their future enjoyment arose without the absolute necessity of the employment of money. We have raised the question of the legitimacy of the private control of the circulating medium and we might suggest that its autocratic control might be neutralized by the simple expedient of letting it alone.

Private supply and control of circulating medium, might be illustrated by the performance of a number of

isolated pumping stations, pumping water from individual reservoirs to supply a community living on a hill. We must impose that the water so energized loses nothing in volume in its travels and returns eventually, after use, to one or other of the reservoirs. We commence with reservoirs full and permit no additions from outside sources. We can imagine the operators of the individual plants at great pains to see that the same amount of water gets back to the tank from which it left and that none be permitted to go dry.

To illustrate Government control of circulating medium we need only imagine the reservoirs connected by pipes in such a way that they have always a common water level. In such a case individual worries would at once be eliminated for the simple reason that all the water would eventually get back to the connected reservoirs because it could possibly get no place else.

Private supply of capital, among other restrictions, carries with it the idea of loss of income to individuals who are capable of feeling in their persons, therefrom, embarrassment, penury and want. No such conception is possible in connection with Government supply. Our illustrations seem to show that it is impossible for a Government to suffer loss in the same way as individuals or yet feel it if it did.

In the mere presentation of the idea, we would not insist that a Government could not bring about much distress by a foolish manipulation of capital and tampering with the amount. Unfortunately, the amount necessary to accomplish a given result under given conditions has never been made the object of public investigation. Until Governments undertook war financing, the amount of money available has been arbitrarily decided, in relation to the amount of gold. Nor do we propose to state that Governments could not suffer loss in their dealing with outside parties.

I suppose that here someone will rise to state that we are not a self sufficient country, and that it would be foolish and impossible to try to be so. The answer must be that, until we have discovered some new form of slavery or mechanical perfection in work, we must be to a great extent self sufficient. It remains to be pointed out and clearly defined just in how much we can be self sufficient and how much we need to depend on outside sources for the things we consider worth while; and having done so to indicate how we are to look upon and govern ourselves in our different relationships and adopt policies to cover the distinct cases.

Having defined our self sufficient relationships, let us look further into what may be expected from a pooling of our capital resources. If we agree that under such conditions no part of our circulating may evaporate and its corollary that the only things we can waste, after all, are time and energy, does it not bring us to some new conceptions of the possibilities of the work of our people? In times of general unemployment, can we not, then, go ahead and develop our doubtful mineral resources? Can we not hire uneducated people to go to school? Can we not pay those in semi-criminal occupations to sit idle? In short, can we not safely embark on the thousand and one enterprises which we all realize to be for the general good of humanity but in which private capital would not be justified in looking for immediate profit? We ask ourselves, in other words, if it is possible to destroy an idle man's time? Can we destroy something that does not exist? We now act as if we believed this possible. Is this fact alone not sufficient to raise the suspicion that there has been operative somewhere a false premise?

For a farmer or manufacturer, times of unemployment are those in which, definite work having been accomplished, he may rest from his labors and take satisfaction in the result. For a community, such times are far different. We have over production. Collectively we are well stocked with all we need to eat and wear. And still such times are those of anxiety and street walking and nickle pinching and feverish job hunting. Before the war unemployment was one of our most serious problems and all events point in the direction of its recurrence. The next such period will be further complicated by the presence of the returned soldier. On all sides there is evidenced a feverish desire to get him on the land and to put him to work. In view of our past experience and the improvements in methods and organization brought about by the war, it is hard to see, in the name of common sense, why these men should ever again be asked to turn a hand. If we can support them in France and supply them with millions of dollars' worth of material to shoot away, why the great anxiety to get them so busy at home? I am not attempting to solve the returned man's problem for him from his own viewpoint. I would not suggest that we seek to force upon him against his will and in order to make our own jobs secure, any species of enforced idleness. But I would voice emphatically the personal opinion that if we permit the worship of any threadbare conceptions regarding capital to stand in the way of giving these men the very utmost of what we can create by our creative genius, in our spare time, with our own raw materials, we shall go down in history as the supreme example of collective selfish boneheadedness.

The best efforts of the engineer are just those which will precipitate times of unemployment, his own included. His work makes for more and better production in less time, less drudgery, more work by machinery and less by hand, more work of a higher order and less of a low order. All of which, without making too fine distinctions, could be boiled down into some such expression as—"More pay for shorter hours." But there are factors which limit his best efforts. An engineering proposal is seldom tested on its ability to increase general prosperity, bring better living conditions or add to comfort and leisure. It will be opposed on one hand if it tends to throw people out of jobs. On the other hand, it must pay individual capital to embark on it.

It is a singular fact that the labor party have the only practical solution of our most difficult problem. It is nothing short of disgraceful that the engineering profession does not come right to the front with the utmost co-operation and solid support. We cannot always defend the spirit in which the demands of labor are made or the opportuneness of the times for their presentation but at that there are many excuses possible.

Engineers can profitably spend much time seeking ways and means of storing present work against future want which will lay no tribute against or restrictions upon the medium which we believe to be so necessary to fruitful industry and endeavor.

A great inventory of the resources of the British Empire is now under way to the end that British goods be sold in every corner of the earth. Canadian engineers might well supplement such an inventory with an engineering analysis of the amount of time, energy and raw material necessary to bring Canadian living conditions up to a certain minimum standard. When reconstruction commences, it would be a calamity if any group of individuals no matter how wise and powerful, would be allowed to stampede us into a subordination of our

internal relationships to our external ones. Home is the place where our friends are, where we laugh and cry, where we feel hot and cold, where we are hungry or satisfied. National policy might be expected to originate there and not in a feverish desire to supply the South Sea Islanders with red handkerchiefs and mouth organs.

The aims of the engineering profession are too little understood. Engineers are too often content to moil on in dumb and dignified silence while big issues go by. They are thankless indeed if they let labor carry their banner. They are as fellow travellers for the same destination, too proud to speak. A little advertising would do no harm. If I had my way engineers would have a bill board at every cross-roads with some legend as follows:—

THE ENGINEERS OF CANADA WISH TO GET ACQUAINTED  
WITH THE PEOPLE

Success to their efforts means higher standards of living and working and more of an intelligent leisure. They are Democratic. They desire to make "The greatest good for the greatest number," an accomplished, practical fact. They believe that great progress in material things has come since man began to apply scientific principles to the manipulation of the inanimate. Of animate things, they believe the human mind to be the highest manifestation of earthly force. They believe the human mind to develop by exercise. They believe that the raising of the standard of our daily tasks will have a profound effect upon the future of the human race. They see certain obstacles in the way of the realization of their ideals. They are making a definite effort to remove them. They are asking the co-operation and support of everyone.

A postscript after the manner of Stephen Leacock might also be in order, somewhat as follows:—

In olden days the people said "See the good Baron. He lets us gather up the dry sticks out of his forests. We live on poor and stony ground but we must be content." Which, being interpreted in modern language, is: There is evidence of great activity in financial circles to the end that vast consolidations of capital may meet all the demands of industrial reconstruction and that the masses may not lack employment.

G. J. LAMB,  
Assistant City Engineer  
of Port Arthur.

Port Arthur, Ont., November 9th, 1918.

Despite labor troubles and strikes British Columbia's coal production for the eight months ended August is estimated at 1,821,681 tons. In September the output of the province is placed at 167,301 tons, bringing the total for the year up to September 30th, or nine months' output, up to nearly two million tons.

The saving of a piece of coal the size of an ordinary egg on each scoopful of coal used in locomotives in the United States would amount to 1,500,000 tons a year. Even when firing a freight locomotive on a heavy grade, one less scoopful of coal every fifteen minutes, or one less scoopful every three or four miles, would effect a similar saving. The Engineering Experiment Station of the University of Illinois has issued a circular, the title of which is "The Economical Use of Coal in Railway Locomotives," to present some suggestions concerning ways in which large coal savings may be made. The circular is printed in four colors. The facts presented in this circular have been compiled by a special committee of the research staff of the Engineering Experiment Station, assisted by an able advisory committee of railway men.

## ENGINEERING INSTITUTE OF CANADA, ELECTIONS AND TRANSFERS

(Continued from last week's issue)

FRENCH, ROGER DE LAND, of Montreal, Que., transferred from the class of associate member to that of member. He was born at North Brookfield, Mass., and received his degrees of B.Sc. and C.E. at the Worcester Polytechnic Institute. In 1905 Mr. French became draftsman with the Standard Plunger Elevator Co. at Worcester, Mass., and in 1916 became assistant engineer with M. A. Howe, Terre Haute, Ind. He was for two years assistant engineer for the Commissioners of Sewerage of Louisville, Ky. In 1911 Mr. French became associated with R. S. & W. S. Lea, Montreal, as principal assistant engineer. He is at the present time partner in the firm of Arthur Surveyer & Co.

McKENZIE, REGINALD JAMES, of Deacon, Man., elected junior member. He was born at Hamilton, Ont., in 1889, and educated at the University of Toronto. He was for four months rodman with the Dominion Government Irrigation Department, at Maple Creek, Sask., and later for two months with Duff & Edwards, at Lethbridge, Alta. In 1913 he became resident engineer on construction with the Kettle Valley Rly. Co., with which company he remained until 1917, when he became office engineer of the Greater Winnipeg Water District.

MILNE, ARTHUR H., of Montreal West, Que., transferred from the class of student to that of junior. He received his education in his native city, Montreal, taking his B.Sc. degree at McGill University in 1917. He served with various engineering concerns during the vacation months, and after leaving college became associated with John MacGregor, Ltd., general contractor, at Montreal, estimating on tenders. He is at the present time designing tools, etc., for marine engines, boilers, condensers, etc., and is engaged in general machine shop work for the Dominion Bridge Co. at Lachine.

MORRISON, JOHN HILYARD TABOR, of Halifax, N.S., elected junior member. He was born at Woodstock, N.B., in 1889, and received his B.Sc. degree at the Nova Scotia Technical College in 1918. Mr. Morrison was for three summers on Canadian Geological Survey, for twelve months with J. W. Roland, C.E., on construction work at the Halifax Ocean Terminals, and was also for one summer with Prof. F. R. Faulkner, checking up alignment, levels, etc., of a large tunnel for the N.S. Steel & Coal Co., Wabana, Newfoundland.

NEHIN, FRANK O'BRIEN, of Montreal, elected junior member. He was born at Buffalo, N.Y., in 1893, and completed a course at McGill University, receiving his B.A.Sc. degree. He was for four summers rodman, instrumentman and assistant engineer with the Montreal Harbor Commission. Since 1918 Mr. Nehin has been chief of field party at the Mount Royal Tunnel.

PEDEN, FRANK, of Montreal West, Que., elected associate member. He was born at Dalhousie, N.B., in 1877, and obtained his B.A.Sc. degree at McGill University in 1899. After serving an apprenticeship with architects for several years he became affiliated with the Dominion Bridge Co. as designer, surveyor, and supervisor of buildings. He was for ten years a member of the firm, Peden & McLaren, architects, and after that became designer and supervisor for the Steel Co. of Canada in connection with their Montreal plants, in which capacity he is serving at the present time.

ROBB, AUBREY GRANGER, of Amherst, N.S., elected member. Mr. Robb was born at Amherst, N.S., in 1870,

and received his education at the Massachusetts Institute of Technology. Since 1890 he has served with the Robb Engineering Co. in various capacities, and is at the present time superintendent and chief engineer of that company.

ROME, ROBERT, of Vancouver, B.C., elected associate member. He was educated at Kilmarnock Academy and at the Royal Technical College in Glasgow. In 1905 Mr. Rome became resident engineer for R. C. Farrell, Glasgow, and later held a similar position with A. Waddell & Son. He was with the G.T. Ry. on masonry design for the Toronto Grade Separation Scheme for one year, and later became a member of the City Engineer's staff at Vancouver. Since 1914 Mr. Rome has been assistant to the city engineer of Vancouver.

ROSS, SIR CHARLES, BART., of Balnagown Castle, Rosshire, Scotland, has been elected member. Sir Charles was born at Balnagown in 1872, and received his education at Eton College, Trinity College, and at Cambridge. In 1896 he became constructing engineer with the West Kootenay Power & Light Co., Ltd., and later engineer and contractor with the same company. He has spent much time in engineering and organizing work in connection with the production of rifles and cartridges, including design machine tools, lay-out of plant operating systems, heat treatment of steels, etc. At the present time he is confidentially conferring with the American Government on the organization of War Industry, and is acting as intermediary between the Government and the American Society of Mechanical Engineers, of which he is a member.

ROWLANDS, JOHN FREDERICK, of Kelowna, B.C., elected associate member. He was born at Wrexham, England, and after completing his education as an articled pupil to G. Riley, Wellington, England, he entered the employ of the Egyptian Government, serving for three years in various capacities of engineering work. He was later with the Provincial Government of British Columbia assisting W. R. Pilsworth on hydrographic surveys. In 1916 Mr. Rowlands entered the Canadian Expeditionary Force. He is at the present time field engineer with the British Columbia Government Water Rights Branch, Lands Department.

SMITH, FREDERICK ROLLS, of Calgary, Alta., elected associate member. He was born at Thorold, Ont., and graduated in practical science from the University of Toronto in 1907. He was for a time assistant engineer, Public Works Department, Georgian Bay Canal Survey, Mattawa to Des Joachims. Mr. Smith has had a varied experience in the practical application of his profession. He is at the present time vocational adviser with the Invalid Soldiers' Commission at Calgary, Alta.

SMITH, WALLACE WYNIARD, of Halifax, N.S., elected junior member. He was born at Lunenburg, N.S., in 1896, and took his degree in science at the Nova Scotia Technical College in 1918. He was employed for two summers on drafting and general survey work with W. P. Morrison, Halifax, and for one summer with F. S. Falconer, of the Canadian Geological Survey at Ottawa, on topographical surveying and secondary triangulation.

SNIDER, ARTHUR MELVILLE, of Sherbrooke, Que., transferred from class of student to that of junior. He was born at Waterloo, Ont., in 1895, and took his B.A.Sc. degree at the University of Toronto in 1917. During his summer vacations he was engaged as draftsman in Waterloo, and subsequently became associated with the Canadian Ingersoll Rand Co. in charge of plan-

ning shipwork. He is at the present time schedule engineer in charge of the production work of two foundries.

STANSFIELD, ALFRED, of Montreal, Que., transferred from the class of associate to that of member. He was born at Bradford, Yorkshire, and took his degree of D.Sc. at London University. In 1890 he became assistant to Sir Wm. Roberts-Austen at the Royal Mint, London, and later on was placed in charge of the metallurgical and assaying laboratories at the Royal College of Science, London. Since 1901 Mr. Stansfield has been Birks Professor of Metallurgy at McGill University. As a representative of the Dominion Government Mines Branch, he made an extensive study of electric smelting of iron ores in Sweden. He has also conducted extensive experiments in electric smelting of zinc and production of zinc oxide paints at Shawinigan Falls, Que. He was for a time associated with J. W. Evans at Belleville, Ont., in the production of electric steel, and also ferro-molybdenum. In 1915 he was appointed a member of the Government by the Minister of Militia and Defence, and reported on the copper and zinc possibilities in Canada for the shell committee.

WAKEFIELD, JOHN ALBERT, of Winnipeg, Man., elected associate member. He was born at Forest, Ont., in 1886, and educated by private tuition in mathematics and physics. He took a course in municipal engineering with the American School of Correspondence, and later took an evening course in reinforced concrete design at the Manitoba University. During the following summer of 1905 he entered the engineer's Department at Winnipeg, and is at present engineer on survey and construction with the same department.

WALL, ALBERT FRASER, of Montreal, Que., transferred from the class of junior to associate member. He received his education at McGill University in Montreal, his native city, and subsequently became associated for eight months with John W. Kendrick Co. on railway examinations and valuations at Chicago and New York. He is at the present time superintendent of construction and maintenance for the Electrical Commission of the city of Montreal.

WATERS, WILLIAM L., of New York, has been elected member. He was born at London, Eng., in 1877, and took his degrees E.E., M.E., and C.E. in 1897 and 1898. Mr. Waters was for a time assistant engineer with Siemens Bros., London, Eng., and later on chief engineer with the National Electric Co., of Milwaukee, U.S.A. In 1912 and 1913 Mr. Waters went on a trip around the world reporting on various engineering projects for New York financial interests. He is at the present time consulting engineer in private practice in Montreal, New York, Chicago and San Francisco.

WELDON, RICHARD LAURENCE, Montreal, Que., transferred from the class of student to that of junior. He was born at Winnipeg, Man., and educated at McGill University, obtaining his B.Sc. degree in 1917. Since leaving college Mr. Weldon was for three months mechanical draftsman on plant construction and alterations with the Canadian Electro Products Co., Shawinigan Falls. He is at the present time demonstrator in the Department of Mechanical Engineering at McGill University, at the same time pursuing a post-graduate course.

WINFIELD, JAMES HENRY, of Halifax, N.S., elected member. He was born at Derby, England, and took an electrical course at the People's Palace Technical School, London. After graduating from college he served in various capacities with the Nova Scotia Telephone Co. until

1901, when he became general manager of the Maritime Telegraph and Telephone Co., Ltd. Mr. Winfield is also at the present time president of the Nova Scotia Society of Engineers.

WYAND, DOUGLAS, of Ottawa, Ont., elected associate member. He was born at London, England, in 1890, and attended for two years the Chelsea Technical School of that city. After leaving school he was for several years with the Can. Nor Ont. Ry., first as rodman and instrumentman, and later for two years as resident engineer of the Toronto-Ottawa line. For the past four years Mr. Wyand has been assistant superintendent and acting superintendent at the Gauge Laboratory, Imperial Ministry of Munitions, Ottawa, Ont.

YOUNG, RODERICK BEARCE, of Toronto, Ont., transferred from the class of junior to associate member. He was born at Minneapolis, Minn., in 1891, and obtained his B.A.Sc. degree at the University of Toronto. Since 1913 he has been associated with the Hydro-Electric Power Commission for two years, doing electrical and mechanical testing and research work, and since 1915 to date, as assistant laboratory engineer.

### THE FUNCTION OF WATERSHED FORESTS\*

SCIENTIFIC data is not required to prove the effect of the forests upon Canadian streams. Every observer who has compared the flow and uniformity of streams under contrasting conditions of forest growth on the watersheds knows that tree life is a conserver of surplus moisture and a mighty aid in the regulation of the spring run-off.

In this connection it will be interesting to many readers to note the conclusions of Raphael Zon, Chief of Sylvics, U.S. Forest Service, Washington, after a very thorough examination of available evidence in the United States and foreign lands:—

"The available observations upon the behavior of streams in this country and abroad have established the following facts:

"1.—The total discharge of large rivers depends upon climate, precipitation and evaporation. The observed fluctuation in the total amount of water carried by rivers during a long period of years depends upon climatic cycles of wet and dry years.

"2.—The regularity of flow of rivers and streams throughout the year depends upon the storage capacity of the watershed, which feeds the stored water to the streams during the summer through underground seepage and by springs. In winter the rivers are fed directly by precipitation, which reaches them chiefly as surface run-off.

"3.—Among the factors such as climate and character of the soil, which affect the storage capacity of a watershed, and therefore the regularity of the streamflow, the forest plays an important part, especially on impermeable soils. The mean low stages as well as the moderately high stages in the rivers depend upon the extent of forest cover on the watersheds. The forest tends to equalize the flow throughout the year by making the low stages higher and the high stages lower.

"4.—Floods which are produced by exceptional meteorological conditions cannot be prevented by forests, but without their mitigating influence, the floods are more severe and destructive."

\*From The Canadian Forestry Journal.

FRENCH RAILWAYS DURING THE WAR\*

ORGANIZATION and management of railways during the war are regulated in France by the law passed December 28th, 1888: According to Article 22 of this law, "In time of war, the control of the railways is entirely in the hands of the military authorities"; and so it was on August 2nd, 1914, all railway officials, from an engineer to a porter were mobilized, and ready at their respective posts. The large private companies and the board of directors of the Etat Railway, in whose hands the control of French railways is vested in times of peace, delegated their powers to the military authorities, merely reserving to themselves the technical supervision of the personnel. A special commission was appointed, consisting of two members; an officer of high rank (the military Commissioner) and an influential representative of the company (the technical Commissioner), to undertake collectively the general management of each different railway.

Their Military Role

Ever since the outset of hostilities French railways have carried out, in an irreproachable manner, the important missions assigned to them at different times by the High Command, and the necessities of mobilization. On the Est Railway the transporting of troops and war material to the points of concentration was effected in a fortnight by 4,000 trains. Since then, notwithstanding the fact that part of the line has been occupied by the enemy, and some works destroyed in battles, or by bombardments, it is still open, and used for transport purposes, etc. The Nord Railway Line was able to save all the material hastily sent down southwards; 2,700 Belgian engines were brought back, while the armies fought heroically to stem the tide of German invasion, and hundreds of trains waited, till the last minute, in order to save the guns. Just before the battle of the Marne, the Nord Railway, uniting its efforts to those of the Est, enabled the different corps to be rapidly transferred from the extreme right to the extreme left of the army, and so ensure victory. On the Nord Railway Lines, which have been reduced from 3,840 kilometres to 1,976, as many as 114,000 military trains were run in 1915. Notwithstanding the fact that they are, comparatively speaking, situated at some distance from the war-zone, the other lines: Paris-Orléans, Paris-Lyon-Méditerranée, the Midi, and Etat Railways, have afforded equally valuable assistance during the period of mobilization; the three first provided for the transporting of men and munitions to the North, the last named, working in conjunction with the Nord Railway Line, ensured the transfer of troops from the West of France, also those of the British armies. Over these lines, considered as a whole, 17,000 train-loads of troops and 250 of siege artillery and ammunition were carried between August 5th and 26th, in 1914.

During the succeeding months, when the front was being extended towards the North Sea, 700,000 men were transported in more than 6,000 trains, over 228 kilometres of line. Later on, the rôle of the railways was changed by degrees according to the kind of operations in hand, though their importance was in no way lessened. They had to carry to the trenches in the North, into Italy, or to the ports available for supplying the armies at Salonika, reinforcements, foodstuffs and munitions—to bring back to the interior of the country civilian refugees, the wounded, repatriated persons and German prisoners; to trans-

port Indian, colonial and American troops, and ensure a postal service, comprising millions of letters and parcels with the armies. The necessities of national defence will not allow of our stating exactly to what extent their valiant self-sacrifice has been carried, how officials have fallen nobly at their posts and the splendid results obtained by close collaboration with our High Command at the battles of Verdun, in the Somme and Champagne, as well as at the time of renewal of fighting in the open, on the Western front, and the stopping of the Great German offensive in March, 1918. The French Government, desiring to acknowledge the valuable assistance given by railway officials, has had a great number of them specially mentioned—and rewarded for distinguished service. It also wished to bring under their country's notice the splendid behavior of the personnel of the Nord and Est Railways and on the army lines; Mr. Clemenceau, the Premier and Minister of War, gave the reasons for such a step in the following terms: "After having displayed from the very beginning of the war, the most splendid endurance, and energy in the fulfilment of duties particularly hard, the personnel (of the above railway companies) gave during the recent military operations and often under the most perilous circumstances, fresh proof of a spirit of self-sacrifice, and of admirable devotion to their country."

From an Economic Point of View

Heavy military traffic, however, only hindered for a short space of time passenger traffic; and the goods transport service has, up to the present, always been able to meet the requirements of civilians in a satisfactory manner. A statement of the returns of the big railway companies enables us to realize the extent of the revival in the economic life of our country. If we examine it since 1914, we see that, setting aside the decrease, at the beginning of hostilities, the receipts have gradually been on the increase, almost rising to, in the case of certain lines not directly connected with military operations, the amount of normal receipts, in spite of a reduction in the length of the lines and a shortage of rolling stock. The following table, showing in millions of francs the large railway companies' returns from 1913 up to 1917, goes to prove this fact.

Railways.	1913.	1914.	1915.	1916.	1917.
Nord .....	336	268	111	125	137
Est .....	305	196	114	133	134
Paris-Lyon-Méditerranée ..	596	455	462	523	531
Paris-Orléans .....	308	244	256	283	301
Midi .....	147	117	122	125	138
Etat .....	324	262	278	296	296

It is as well to call attention to the fact that this rise—which is also noticeable during the same period with regard to receipts in connection with military affairs—does not prevent an important deficit, due to the enormous increase in the cost of running trains, resulting both from the rise in the price of coals, raw materials, labor, wear and tear of rolling stock, and the continual higher salaries, pensions and indemnities. In order to remedy, in a certain degree, the difficult situation into which the prolongation of such a state of things would have inevitably placed the French railway companies, and following the example of all the belligerent countries, parliament, on March 31, 1918, voted a general increase of 25 per cent. on all tariffs except for the army transport service and parcel-post rates. This extra percentage is to be taken off at the end of the sixth year after the cessation of hostilities.

Apart from these general remarks on French railways as a whole, it is interesting to get some idea, gathered

\*Bulletin issued by the Paris Chamber of Commerce, June, 1918.

from official reports, of the work carried on by each railway company respectively.

#### Paris-Lyon-Mediterranee

From August 26, 1914, the P.-L.-M. Railway Co., while having to contend with the very considerable requirements of army transport, was able gradually to resume its goods traffic. Early in 1915 its ordinary traffic had increased 20 per cent. compared to that of 1913. In 1917 the tonnage for goods had risen 32 per cent. compared to what it was in 1913. The future will permit us to give fuller particulars as to how, in the autumn of 1917, the efforts of the company exceeded even those made in 1914, and how by enabling large allied contingents to arrive speedily at a distant front, it merited the praise and gratitude of the country.

#### Paris-Orleans Railway

After having, during the first month of the war, run 3,500 military trains, besides facing the difficult task of re-victualling the entrenched camps around Paris, as well as the transporting of French and American troops, the Orleans Railway Co. has continually encouraged agricultural activity in the regions through which it runs, and repaired the wear caused to its rolling stock by giving large orders for this purpose. In 1917, its receipts amounted to 34 millions more than those of the preceding year, exceeding by about a 100 millions those of 1913. The gross tonnage per kilometre, for goods-traffic, rose to 16 milliards and a half tons (75 per cent. more than in 1913).

#### The Midi Railway

The fertile regions of the South West of France having been specially called upon to convey large quantities of food stuffs for the re-victualling of the armies and the civilian population, the Midi railway has had more than any other line, the struggle against the shortage of rolling stock. The gross receipts for 1917 have nevertheless exceeded by 18 millions those of the preceding year, and by 14 millions those of 1913.

#### The Etat Railway

Owing to the extent of coast line it serves, the Etat Railway constitutes the principal means of transmission for raw material as well as for conveying munitions and overseas-troops. But the chief characteristic of its work during the war has been, above all, the considerable development made in connection with transactions for fuel, for the requirements of the civilian population and this in accordance with a decree signed on December 4, 1914, conferring upon the company the rights of importation and sale. The Etat Railway is also entrusted with the financial side of the question of a relief fleet formed with the object of assuring certain transports connected with supplies for the Allies. It has, moreover, undertaken the running of a private fleet with a view to increasing the freight available for the transport of English coal. This undertaking as well as the military effort accomplished by it, to the same degree as by the other companies, deserves to be looked upon as a valuable factor in the renewal of the economic life of the country.

#### The Nord and Est Railways

Although the Nord and Est Railways are partly in invaded territory and, above all, used for purposes of national defence, it is a remarkable fact that, according to statistics, their commercial traffic is again regularly progressing, and is even on certain lines proportionately superior to what it was in times of peace.

The above brief statements prove that the return of France to an economic régime almost approaching that of normal times is, for the most part, due to French railway companies which have also made it a point of honor to give all the help in their power with the national defence loans, either by their respective subscriptions or the repayment of coupons to shareholders. We must also mention the grants and allowances given as indemnities for the high cost of living to the companies' officials, both male and female. These grants, which were at first made by the government, are retroactively borne by the companies, from the time the rise in transport tariffs voted by parliament comes into force.

Certainly, before the end of hostilities, so as to meet all military requirements, and after the conclusion of peace, to repair the damage done to the railways and assure their financial security in future, there will be many difficulties to contend with and overcome. But it will not be one of the least results of the war, if a solution is found to such an important question by creating between the different companies, interested in the matter, co-ordination of effort, and patriotic emulation eminently conducive to France's economic expansion, which is so closely associated with the prosperous condition of her railway systems.

### DESIGNING STREETS TO ACCOMMODATE TRAFFIC\*

TOO much attention cannot be given to the proper design of streets. Too often is a street laid out with no provision to accommodate an increase in traffic. As a result traffic must accommodate itself to the street, resulting in a loss of time, the aggregate of which is enormous.

A city engineer in determining the width of a new street, should be careful to allow liberally for possible future increase in traffic. In some instances the money available may not be sufficient to pave to the full desired width. This may be overcome by leaving an unpaved parkway in the centre. It is not expensive and gives an attractive appearance.

Engineers are too apt to follow the practices as set by their predecessors, rather than to strike out on new and improved lines. A curb radius of a foot and a half may have been satisfactory for horse-drawn traffic, but with automobiles having a turning radius of about 14 feet, a curb at an intersection should have a radius of not less than 10 feet, preferably much more.

Neither should we lose sight of the advantages to be gained by giving a curb the proper batter, and seeing that the intersection of the curb with the pavement is properly rounded. This point is an important one in the design of streets, for it saves much wear on the tires and rims of automobiles which come in contact with the face of the curb if it does not slant away from the pavement. The rounded gutter line provides a more sanitary pavement for the reason that dust and dirt do not accumulate and are easily removed.

The whole problem of the design of streets must be viewed from the standpoint of accommodating traffic, rather than making traffic accommodate itself to the street. Wider streets, easier turns and battered curbs are three most important points to be considered in the whole problem of street layout.

\*From the Concrete Highway Magazine.

## ENGINEERS' GREAT WORK AT THE FRONT

MUCH of the success of the operations of the Canadian Corps opening on Friday, September 27th, was due to the splendid work of our engineers, says a despatch mailed to the Canadian Press by its overseas correspondent. The engineering preparations for the Bourlon Wood operations were undertaken on five days' notice, and were exceedingly difficult owing to the nature of the ground. On the front over which the Canadian Corps attacked, the way was barred by the Canal du Nord, one hundred feet wide, with banks up to fifteen feet in height, the water in many places being over eight feet deep, and with the River Agache fifteen feet wide and eight feet deep, parallel and close to the canal.

### Demolished Roads

The problem confronting the engineers in preparing for the attack involved the repair of roads demolished by shell-fire; the pushing forward of cross-country tracks for infantry and horse transport to the front line; the pushing forward of light tramways to the front line to facilitate the delivery of ammunition stores and supplies; the provision of engineer material of all sorts, and the construction of new headquarters for battalions, brigades, divisions, etc., and dugout accommodation and shelters as quickly as they could be improvised. A difficult question was the provision of water supply for the large number of horses, approximately forty thousand, assembled in a very congested area.

### In the Face of Barrage

The problem was to get the infantry and the guns over the canal in the face of enemy barrage and to provide sufficient facilities in the way of roads, bridges, tramways, etc., which would ensure the supply of ammunition for the guns being sustained and the supply of stores, munitions and rations for the large number of troops engaged. As it was clear that the enemy's barrage would fall naturally on the canal and be retained there, the following were provided for: Seven infantry foot-bridges of an unsinkable type; ten crossings for guns and horse transport, five of which had to be developed at once for heavy traffic, even while the continuous stream of guns and ammunition wagons was pouring over them. At least ten times Canadian engineer officers, flying at a height of about five hundred feet, traversed the length of the canal involved, reconnoitering for the best spots for tank crossings, bridge sites and infantry crossings.

### Tramways Built

Great was the preparation. Following were the results: Before "zero" hour, eighteen miles of roads had been repaired up to the front line and seven miles of tramways constructed. On these tramways over three thousand tons of ammunition per day were being delivered to advanced dumps and gun positions. The huge concentration of horses was provided with the necessary water supply.

After "zero" all crossings were put through successfully in spite of heavy gun and machine-gun fire. The attack kicked off at 5.20 a.m., and the first guns crossed the canal at 8.40 a.m.

### Worked With Infantry

The engineers went over with the infantry to get their footbridges across, and the engineer wagons, with their six-horse teams, were pushed forward so rapidly that in several cases all the horses were killed by machine-gun fire, and the men got their material down to the bridge

sites by man-handling the wagons. In one case a party of Boche machine gunners, who had been overlooked by the mopping-up parties, emerged from a concealed tunnel, and attacked the engineer party attempting to bridge the canal. The engineer officer in charge took part of his men and beat off the attack, and at the same time kept the work of construction going without interruption.

### Many Kinds of Bridges

The bridges constructed were of all types: Pontoon, trestle, heavy pontoon and heavy steel bridges for all traffic. A remarkable record was made in the erection of two heavy steel bridges of 110 ft. span under heavy fire. The materials were got on the sites at 2 p.m., and the approaches were prepared and the bridges erected and open for heavy work in twelve hours' actual labor.

### Wounded Over Tramways

By two in the afternoon three new pumping installations had been installed on captured ground and sufficient horse troughs to water five thousand horses an hour. All materials were got forward to the infantry and the positions gained consolidated. About three miles of tramways were constructed and in operation, and over one thousand wounded were evacuated on returning ammunition trains operated by Canadian Corps' Tramways.

### An Engineers' Battle

The battle of Bourlon Wood was an engineers' battle. The success of the whole operation depended on the speed with which the necessary crossings of the Canal du Nord were provided, and the way in which they were maintained and improved during the day, so as to enable the guns and infantry to be maintained in the positions which they had reached in their advance.

## ILLNESS AND QUEBEC COMPENSATION LAW

Is a workman's illness, if contracted in the course of his work, an accident within the meaning of the Workmen's Compensation Act? The question was submitted in the Superior Court in Quebec Province in four cases before Mr. Justice Tellier for adjudication. His Lordship's conclusion was in the negative, and the actions as entered were dismissed.

Early in 1917 Joseph Brabant, Arthur Charron, Ernest Charron and Edmond Charron were engaged to work for the Canadian Pacific Railway Company in the sorting yard, near Lachine. They contracted typhoid fever, and Arthur Charron died. His widow, Dame B. Paquette, authorized by judgment of the court to enter in justice, took an action against the railway company under the Workmen's Compensation Act, claiming \$2,025 damages in her own behalf and that of her minor children. It was alleged that deceased's illness was contracted while he was at work through drinking impure water supplied to him.

Ernest and Edmond Charron and Joseph Brabant recovered from their illness, and likewise took action against the company for damages under the Workmen's Compensation Act, alleging liability on the ground mentioned in the widow's plea.

Justice Tellier ruled that the actions would not legally lie under the statute in question. Employers, his Lordship pointed out, were liable under this measure for injuries resulting from accidents sustained by workmen in the course of their labor. Even if the men in question had contracted their illness through drinking water supplied for drinking purposes by the employer—and the Court said this had not been proved in any instance before him—but even if the proof were there, he said action in damages under the Workmen's Compensation Act could not succeed. The men's illness would then have resulted from something apart from their labor. It had not been shown that one of the conditions of their work was that the company should supply them with meat and drink. That was a matter entirely their own. The germ of the disease might have come elsewhere than from the source of the water supply in the railway yard.

## PREPARING FOR OTTAWA CONFERENCE

**T**HIRTY representatives of Toronto firms associated with building industries attended an open meeting on Wednesday, November 6th, in the rooms of the Builders' Exchange in order to promote interest in the conference of Canadian building industries that will be held November 26th to 28th, in Ottawa. Among the organizations represented were the Toronto Builders' Supply Association, the Sanitary and Heating Engineers' Association, the Toronto Builders' Exchange and the Master Painters' Association. The meeting was called to order by W. E. Dillon of W. E. Dillon & Co., Ltd., who explained that the idea of holding a conference had originated with the president of the Montreal Builders' Exchange. He requested Mr. Maxwell, the president of the Sanitary and Heating Engineers' Association, to take the chair.

### Want All to Attend

Mr. Maxwell called upon Arthur H. Dancy, of H. N. Dancy & Son, Ltd., to report what had transpired at the preliminary meetings held September 4th in Toronto and October 7th in Ottawa. Mr. Dancy also read the proposed list of subjects to be discussed at the conference (see *The Canadian Engineer*, page 219, September 5th issue) and the tentative program (see *The Canadian Engineer*, page 390, October 31st issue).

H. Elgie discussed the prospects of contracting as a business in Canada, and urged that as many as possible should attend the Ottawa conference. W. E. Dillon strongly urged co-operative effort by all the different trades and their branches. R. L. McIntyre, of McGregor & McIntyre, Ltd., approved of the new organization, and agreed with Mr. Dillon that more co-operation in the building industry is urgently needed. The president of the Master Painters' Association spoke on behalf of that association and pledged its support of the conference.

### To Improve Contractors' Status

The problem of raising Toronto's share of the required money for organizing the conference was raised by Mr. Thomson, of Thomson Bros., and it was decided to solicit private subscriptions from the various interested firms.

When a suggestion was made that delegates to the conference be selected, it was pointed out that the object of the conference is to improve the status of all contractors in Canada, and that everyone who is interested in that object will be welcome at the conference.

### General Committee

Following are the members of the general committee in charge of arrangements for the Ottawa conference:—

J. Penrose Anglin, Montreal (chairman); David K. Trotter, Montreal (secretary); G. A. Crain, Ottawa (Treasurer); W. E. Ramsay, Montreal; J. D. Johnson, Montreal; W. E. Dillon, Toronto; H. Elgie, Toronto; J. Davidson, Toronto; W. A. Mattice, Ottawa; T. D. McFarlane, Ottawa; Harry Hayman, London; H. Hazelton, Winnipeg; T. Hooper, Winnipeg; E. A. Sanders, Halifax; A. H. Dancy, Toronto; J. E. Stocker, Toronto.

The Dominion Bridge Co., Ltd., Montreal, has received an order for two 5-motor, 40-ton-capacity, 60-foot-span electric travelling cranes from the British America Nickel Corporation, Ltd., of Sudbury, Ont.

## ESTIMATING SEWER SYSTEM COSTS\*

By Stanley D. Moore

**B**EING connected with the contracting business, largely in a financial way and not being an engineer, I have been able to observe the operation of the construction of municipal improvements from a semi-detached point of view. It has often occurred to me that there has been a deplorable lack of co-operation between all of the elements entering into the execution of a successful engineering project.

A sewer system successfully constructed, might be described as one that properly meets the present and immediate future needs of the community, conceived and designed by an engineer who is competent and whose remuneration is commensurate with the service he should render; built by a competent and responsible contractor, under a contract that is fair to all concerned, and at a price that makes it possible to carry out the intent and spirit of the undertaking without friction or litigation. Many projects will not come under such a classification. The fault is not all with the contractors, nor all with the engineers, or the communities, but each contributes a share.

### Co-operation Needed

Trouble could largely be avoided if each of the elements mentioned could recognize that their interests are mutual, and if the work was undertaken in a spirit of co-operation instead of the too often prevailing attitude of antagonism.

There has been too much secrecy on the part of contractors, lack of frankness and a failure to give real information; too much suspicion on the part of communities, and a regrettable lack of consideration of the rights of the contractors by both engineers and communities. There has been too much guessing as to cost on the part of both contractors and engineers. It has been customary among engineers to figure costs of labor and material, taken from actual observation, plus ten per cent. as a basis of estimates. Contractors being a little closer to conditions have been adding 15 to 20 per cent. to such costs. Hence the usual discrepancy between the engineer's estimate and the bids received. I say usual, because for the present I wish to ignore the ridiculous bids of irresponsible and uninformed contractors, and the misguided efforts of responsible men who feel it their duty to meet such competition. Responsible engineers should not allow contracts to be let below their estimate. They should be broad gauged enough to know the fallacy of attempting to get something for nothing and should protect the community from inevitable trouble.

### Overhead Is Very Deceptive

Recently the Federal Trade Commission conducted an exhaustive study of corporations in the United States and made the astounding discovery that less than five per cent. of them were profitable. A similar study of the business of engineering and contracting would show that less than one per cent. of those engaged are successful, or even solvent, and the answer to all this is "Overhead."

Overhead is very deceptive, because in this age of quantity production we have kept our eyes only on the lessened cost of the actual operation, and have forgotten that much of this saving is eaten up in overhead charges

\*Paper before Iowa Engineering Society.

that did not formerly exist. That is why the price of commodities regulated by the Government after scientific study of cost is usually raised, or at least, established on a higher basis than the prevailing level. For instance, the unit basis for moving dirt by hand may be 25 cents per cubic yard. The same operation may be performed by machine for 10 cents per cubic yard; but the overhead charges on the machine amount to all, if not more than, the saving of 15 cents per cubic yard, the only advantage of the machine being a gain in time and an escape from labor shortage.

I have here an analysis of overhead charges taken from a compilation of actual records during the last five years of one-half million dollars in sewer contracts, running better than the average in soil conditions, at better than the average price, handled with better than the average efficiency by a well equipped, well financed and well organized concern. I have purposely omitted the year 1917 from these records, because of unusual conditions and extra expense that would increase these overhead costs so much as to destroy their value as a record of average conditions.

TABLE 1.

Based on contract price which turned out to be gross cost as business yielded no net profit

Items of overhead.	Average cost for 5 years in per cent. of gross cost.	Estimated cost for 1918 in per cent. of gross cost.
Job expense .....	1.4	1.7
Maintenance .....	.6	.6
Plant repairs .....	1.5	1.8
Small tools and repairs .....	1.1	1.3
Depreciation .....	1.0	2.0
Incidental material .....	2.4	2.4
Bonds .....	.7	1.7
Insurance .....	1.6	1.9
Interest on jobs .....	1.1	1.3
Discount .....	1.0	2.0
Promotion expense .....	1.8	1.8
Office expense .....	.6	.7
Salaries .....	2.3	2.3
Traveling expense .....	1.3	1.5
War tax .....		.5
Interest on investment .....		.5
Total .....	18.4	24.0

In table 1, I have divided the overhead costs on one-half million dollars worth of sewer work and have predicted the probable increase in these costs for the year 1918. I should like to explain these items as follows:

**Job Expense:** This is the cost of freight on equipment, miscellaneous drayage, the transportation of men, the expense of lost time for men receiving steady pay, the cost of bunk houses, storage and job office rent.

**Maintenance:** Getting the job ready for acceptance after the main construction is completed, and daily cost sheets stopped; care of streets and trenches, repairs under guarantee.

**Plant Repairs:** The cost of repairs to machines and equipment, small tools and repairs, cost of tools lost and stolen, blacksmith repairs.

**Depreciation:** This is a cost that every contractor has on his machinery and equipment. This item should be doubled at least to meet the average conditions.

**Consumed Material:** This item represents the cost of lumber, jute, dynamite, coal, gasoline, kerosene, cement, sacks that are lost, rubber boots, etc.

**Bonds:** This item represents the cost of surety bonds, the rate for which is high because so many bond com-

panies have had to finish contracts for bidders who did not know how to estimate.

**Insurance:** This item represents the cost of workmen's compensation and public liability insurance, and will likely increase very materially every year.

**Interest on jobs:** This is not interest on investment, but interest only on money borrowed to carry on construction.

**Discount:** This item should be five times as much as it is to meet the average conditions of the average contractor, but as this is a true record of actual costs of one firm it is thus set out, and is probably a much smaller amount than can be shown by any other contractor doing business in this territory.

### Other Items of Overhead

**Promotion Expense:** This item covers the expense of promoting jobs, dues to associations, etc.

**Office Expense:** This item represents postage, telephone and telegraph bills, and other expense of a like nature that every business must pay.

**Salaries:** This item is entirely too small to cover average conditions and is intended only to represent a very small salary drawn by the head of the firm who is sole owner of the business and gives his entire time to it. It probably should be called expense rather than salary.

**Traveling Expense:** This item represents the expense of traveling to bid on jobs that you do not get, the expense of trips to jobs under construction, and the many trips necessary to the town after the work is completed in order to get a final settlement.

**War Tax:** This item must be a part of all estimates for 1918 and represents taxes not only on profits, but also on postage, telegrams, telephone and freight bills.

**Interest on Investment:** This item must be a part of all estimates of cost. Even the tax department of the Government admits it is a legitimate cost.

With these proven figures for overhead, assuming that we have accurate data on quantities, costs of material and labor, there remains in an estimate but one item, profit.

Bearing in mind that a portion of the profit must be represented by investment in equipment on a reasonable basis of depreciation, what is a fair profit? The accepted basis of 10 per cent. This means that on a contract for \$100,000 there should be a profit of \$10,000 even though a portion of this is represented by equipment. I do not think this is enough to cover the hazards involved, but for the purpose of illustration we will use it.

### Computations From Costs

In almost all lines of business except the construction business all computations are made back from the selling price and not up from the costs. As it seems necessary for us to work on the net cost of labor and material as a basis, we must make adjustments of percentage to produce the same result.

The table shows that overhead for 1918 is 24 per cent. of the gross cost. Then the net cost of labor and material was 76 per cent. of the given cost. 24 per cent. equals 31.7 per cent. of 76 per cent. In other words, using net cost as a basis, the overhead charge is 31.7 per cent. of the net cost of labor and material.

In order to yield 10 per cent. net on the contract price the following computation must be used, although an engineer would express the same thing in an algebraic formula:—

TABLE 2.

Net cost of labor and material .....	100.0%
Overhead 24% of 76% of given cost .....	31.7%
<hr/>	
Gross cost percentage of net cost .....	131.7%
10% of 100/90 of 131.7 .....	14.7%
<hr/>	
Contract price percentage of net cost of material and labor .....	146.4%
Contract price to yield 10% net equals net cost plus .....	46.4%

But a contractor cannot afford to do this business on a 10 per cent. margin for the reason that an increase of 10 per cent. in labor cost, which is as close an estimate as can be made, and which is many times unavoidable, is enough to wipe out his entire profit. He cannot afford to figure less than 15 per cent., which means adding 53.9 per cent. to his net cost instead of 46.4 per cent.

The following list of items all enter into the cost of building sewers. The black faced type indicates those which the contractor usually takes into account in making up his figures, but many items remain, all of which he must pay for but which he fails to get into his estimate.

TABLE 3.

<b>Sewer Pipe</b>	Maintenance	<b>Association Dues</b>
Jute	<b>Labor</b>	Promotion Expense
<b>Bonds</b>	Bad Weather	Bad Luck
<b>Insurance</b>	Freight on Tools	Travelling Expense
City Council	Straight Time	Hope
Cement	Storage	Water Pipes
Tools	<b>Discount</b>	Gas Mains
Inefficiency	Lumber	Salaries
Depreciation	Repairs	Bad Work
Interest	Shipping Delay	Attorney Fees
Errors	Office Expense	Taxes
<b>Engineer's Delays</b>	Manholes	Transportation
Engineer's Estimates	Drayage	Engineer's Errors

The question of overhead, while perhaps a recent development is just as sure as death or taxes. No contractor can get away from it.

He may be able to save on a few of the items but will go wrong on others. If he looks only at the saving he is hiding his head in the sand. Many items of overhead have recently increased from 50 to 300 per cent. That is why many contractors have gone wrong, who have their overhead included in their estimating tables and have figured increased cost on a general percentage. This charge for overhead may seem high but is not comparatively with similar commercial enterprises. For instance, the manufacturing business is similar to the contracting business. They take material and labor and sell a finished product, and the average cost of overhead and selling expense in manufacturing is 70 per cent. over the factory cost. The retailer who has no labor to contend with has an established overhead of 20 per cent., but no contractor can hope to equal such figures. Furthermore the contractor's rate of turnover is slow and below the average.

#### Must Confer With Engineer

To better his condition the contractor must first confer with the engineer. As a class the engineer is not unreasonable. He is open to conviction, and the contractor must show him frankly the whole situation and convince him of his mistakes in estimating. A number of engineers have recently told me that they had never been able to get any real information from contractors, and would be glad to have a basis to work from.

The next trouble is with the communities, although they usually get their ideas from the engineers. If the price is too high, let them wait until they are ready to pay

it. That is what other business men do, and it is better to let the job wait than to do it for nothing. Every community is better off if they pay a fair price and get a good job satisfactorily executed than if they try to get something for nothing and get skinned.

#### The Irresponsible Competitor

The irresponsible competitor is another factor that often originates with the engineer, who many times has a mistaken idea that the contractor is making a lot of money, and who therefore encourages some inexperienced person to enter the field of competition. It is unfortunate that engineers are not compelled to do two years of contracting before they are allowed to practice their profession. They then would not get wrong ideas in their heads, and would not spend a life time trying to prove that their first impressions were right. Many methods of overcoming unreliable competition may suggest themselves; none of which, however, justify the wrong idea that a contractor had better do work, even if there is nothing in it, than to be idle.

The last and greatest trouble is with the contractor himself. Let him get out of the old rut and start estimating properly, discarding all his old estimating tables, retaining only his record of labor and material cost for his first basis in estimating; making proper allowance for increases in wages and material, and the ever decreasing efficiency of labor; then include a proper percentage for overhead and profit.

#### PUBLICATIONS RECEIVED

**Quebec Streams Commission.**—Annual report for year 1917. Published by the King's Printer of Quebec Province, Quebec, P.Q. 140 pages and cover, 6½ x 10 ins., also a number of folding plates, diagrams and illustrations.

**Somewhere in the U.S.A.**—Sixteen-page folder, issued by the Armco Iron Culvert and Flume Manufacturers' Association, 608 South Dearborn Street, Chicago, Ill., showing a number of views of corrugated iron culverts used in United States army cantonments.

#### HELP POST-WAR WORK

An important conference between representatives of the Canadian Manufacturers' Association and the labor committee of the Dominion reconstruction committee was held in Ottawa on October 23rd, when Senator Robertson presided. The Canadian Manufacturers' Association was represented by T. P. Howard, Montreal, first vice-president; C. Howard Smith, chairman, Montreal branch; R. E. Jamieson, E. Matheson, Major Anthes, chairman Toronto branch; W. H. Miller, H. Banfield, T. H. Murray, general secretary; H. Macdonald, assistant secretary, Montreal branch. Hon. T. W. Crothers, minister of labor; Tom Moore, president of the Labor Congress of Canada, and Dr. McFall, commissioner on the cost of living, were present.

A discussion took place on the way in which the manufacturers could co-operate with the government in the solving of reconstruction problem. The most pressing problem at the close of the war will be to find employment for all available labor. The manufacturing industry will be more seriously affected than any other, and the desire was expressed that the government take immediate steps towards increased production, without which Canada cannot hope to cope with the situation. It was agreed that a further conference be held between manufacturers and labor leaders.

Senator Robertson thanked the deputation for the valuable contribution they had made to the catalogue of ideas, some of which were already receiving the careful consideration of his department. Major Anthes replied on behalf of the delegates.

## REVIEW OF STUCCO TESTS BY BUREAU OF STANDARDS\*

By J. C. Pearson

U. S. Bureau of Standards, Washington, D.C.

THE first stucco tests were started in 1911, and consisted of small panels of metal lath, the majority of which were covered with cement and lime stucco in the approximate proportions of  $\frac{2}{3}$  part cement, 3 parts sand, and  $\frac{1}{3}$  part hydrated lime, by volume. These panels were erected primarily for the purpose of determining the effectiveness of various treatments or protective coatings of the metal itself in preventing corrosion. These tests (which are still in progress) have demonstrated conclusively that galvanizing is the most effective treatment of metal lath for its preservation, and that a coating of asphalt or "dip" offers a sufficient degree of protection to the metal to ensure its satisfactory durability under average exposure conditions. Many of the painted or dipped lath panels are still in excellent condition after nearly seven years' exposure, notwithstanding the fact that the metal is exposed on the inside and the construction not entirely weatherproof. Perhaps the most important lesson from these original tests, especially in view of later experience, was that corrosion of metal lath is one of the minor obstacles to the development of a successful stucco.

The tests made in 1915 were carried out on a large scale, under conditions that simulate actual construction. The test panels were large enough to contain window or door openings, and to allow the plasterer the same freedom of action that he would have in a regular wall. Regardless of the distribution of stuccos, the concrete panels as a group have the highest rating, the plaster board panels the lowest. In these tests, the back-plastered metal lath panels probably take second place, and the gypsum block panels are near the bottom of the list.

### Method of Finishing Cause of Cracking

There were certain outstanding facts which furnished suggestions for future work. In the first place there was evidence that the prevalence of craze and map cracking on most of the 1915 panels was due to the method of finishing. It has been specified that a sand float finish should be used, and that this finish should be given in the shortest possible time after laying on the finish coat. The purpose of this was to avoid disturbing the so-called initial set of the cement. In consequence the very great majority of the panels were floated when too soft, which resulted in bringing to the surface a rich mixture of cement or cement and lime, subject to high shrinkage upon drying out. We believe now that this accounted largely for the general and early appearance of fine cracks on most of the panels, with some contribution also from the use of too rich mixtures.

### Cracks Resulting from Shrinkage of Sheathing

Another peculiarity that impressed itself upon us was the appearance of large and prominent cracks on all the panels over diagonal sheathing. These cracks invariably first appeared off the corners of the windows and running across the direction of the sheathing, and there is no question that they were brought into prominence, if not actually produced, by the shrinkage of the sheathing. The fact that these characteristic cracks did not appear on the back-plastered panels, and that the latter were largely free

from prominent cracks, resulted in a higher rating for this group than for the metal lath panels over sheathing.

### Weak Base Common Cause of Stucco Failure

One other consistent development in these 1915 panels is of special importance, viz.: It was noted that the stuccos on the plaster board and gypsum block panels and on the monolithic concrete panel coated with bituminous waterproofing were in poor condition, especially after they had passed through the second winter. All of these were stuccoed with the standard mixture of 1 part cement,  $\frac{1}{10}$  part hydrated lime and 3 parts sand, with only slight modifications in the method of applying. The results obtained on these panels indicate, not that this stucco is bad, but that the combination of this stucco and a weak base is bad. Field observations which I had an opportunity to make last year demonstrated this fact conclusively, that a strong cement stucco on a weak base is a common cause of stucco failure, and in practice this seems to occur most frequently in the application of brown and finish coats much higher in cement than the scratch coat, which logically should be the strongest portion of the stucco. The explanation of this failure must be sought in the well-known shrinkage of cement mortar upon drying out, and in the subsequent movements caused chiefly by varying moisture conditions.

### The 1916 Tests

In laying out the programme for the second year's work it was found most feasible to erect a sort of monitor or penthouse, providing 22 additional panels, on the roof of the original building. This, of course, precluded all but frame construction. The back-plastered panels had shown up so well in 1915 that it was decided to include a larger proportion of these in the new layout, and only one-half the monitor or annex, as it is more commonly called, was sheathed. To minimize the shrinkage effects 6-in. diagonal sheathing was used, alternating in direction on adjacent panels. It was decided also to change the method of finishing, partly in the use of less water on the under coats, and partly in waiting for the stiffening of the finish coat to develop before finally floating. This procedure, together with the use of a number of leaner mixtures, was adopted in the hope that craze and map cracks would be largely overcome. A number of special features were also included in certain panels with a view to minimizing the effects of movement of the wood frame.

### Deductions from 1916 Tests

The deductions from the 1916 tests may be summarized as follows:—

1. Diagonal sheathing of unseasoned wood is apparently an unsatisfactory backing for stucco. With only unseasoned wood available horizontal sheathing would appear to better construction, provided sufficient bracing of the wood frame is assured.

2. Back-plastered construction appears to be best for frame structures, so far as the integrity of the stucco is concerned. This carried with it, however, a need for fuller information regarding the insulating qualities of walls so constructed.

3. Lean mixtures promise better cement stuccos, provided the necessary plasticity and density can be maintained by proper grading of the aggregate.

4. There is still need of further information as to the value of wood lath and high lime stuccos. To date the tests indicate that wood lath is not as satisfactory as metal lath, and there is no conclusive evidence that a modern hydrated lime stucco will endure satisfactorily in severe climates.

\*Excerpts from paper presented at last annual meeting of American Concrete Institute.

# The Canadian Engineer

Established 1893

*A Weekly Paper for Canadian Civil Engineers and Contractors*

Terms of Subscription, postpaid to any address:

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

Published every Thursday by

The Monetary Times Printing Co. of Canada, Limited

JAMES J. SALMOND  
President and General Manager

ALBERT B. JENNINGS  
Assistant General Manager

HEAD OFFICE: 62 CHURCH STREET, TORONTO, ONT.  
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## PUBLICITY FOR HEALTH FACTS

MACNUTT, in his "Manual For Health Officers," says: "Almost every community is under the impression, fostered perhaps by the utterances of prominent but uninformed citizens, that it is one of the healthiest spots in the country. This impression is strengthened in numerous ways and is usually left untouched, if it is not supported, by the public press. It is an impression which people unconsciously wish to have strengthened, just as the individual likes to minimize any ailment he may have and avoids consulting the doctor, who, he knows, may prescribe some radical change in regimen. The average community will put up with a great many surface indications of radically bad conditions before it will turn its attention to the conditions themselves and their remedies. For one reason, such indications are usually scattered. One citizen or group of citizens has but a very limited view, and so long as there is no general 'survey', conditions in the mass are unknown to the citizens as a mass. If a citizen or society with the reform spirit rises and proclaims the salient results of investigation, he is likely to be treated at first to the same old indifference. If, however, he perseveres in urging a few striking points in such a way as to move his public without antagonizing it, he will eventually get a hearing. The problem then is to get a thorough survey and study of the facts, not a mere passing 'investigation' which leaves fundamental conditions untouched; and, finally, to get permanent remedial action."

A recent report issued by the city engineer of Atlanta, Georgia, points out that the great difficulty lies in obtaining this remedial action. Any detailed report must bring out facts that reflect more or less discreditably on a city; and there are many who deprecate their ventilation on the

ground that "it is bad for business," and that "it will hurt the city's fair name."

"It is high time," says the Atlanta report, "that we no longer endeavor to conceal these facts or discuss them in whispers. Any such policy but postpones the evil day, and continued tolerance of the conditions will in the long run injure the city."

One of the best assets that a community can have is a low death rate, and a well-earned reputation for cleanliness. Open-minded discussion of the health needs of a community is the prerequisite to their cure, just as diagnosis must precede treatment in any disease.

## ENGINEERING SCHOLARSHIPS

WAR scholarships in the Faculty of Applied Science, Toronto University, have been inaugurated by the Toronto Branch of the University's Engineering Alumni Association, of which P. H. Mitchell, consulting engineer, is president and E. D. Gray, manager of the Imperial Oil Company's asphalt department, secretary-treasurer. In a circular letter to members, Mr. Mitchell says:—

"Through this association's close affiliations with the Faculty of Applied Science, Toronto University, and all the engineering societies and associations in the country, it has become appallingly apparent to us that our supply of engineers for both war work and peace work has become exhausted, with no prospect whatever of replenishing the supply, as our universities are practically empty.

"With a view to meeting this unfortunate condition, and as a means of stimulating the enrolment of engineering students, this association has undertaken to provide funds for eight scholarships. We are writing you in the hope that you will not only appreciate and approve what we are endeavoring to do, but will give us your hearty and much needed support in our endeavor."

The province of Ontario has been divided into four districts with approximately equal population. One scholarship of \$100 per annum and one scholarship of \$50 per annum have been allotted to each section, these scholarships to be paid for four consecutive years. A sum of \$600 is required for the scholarships this year, but this will be doubled next year and tripled in 1920; while in 1921 and succeeding years, \$2,400 per annum will be required. Subscriptions will be solicited from interested firms and individuals when money is needed. It is particularly stipulated that no subscriber need look upon previous subscriptions as a precedent; in other words, he need not consider his subscription an annual obligation.

## ACKNOWLEDGMENT

TO that great-hearted, patriotic Toronto firm, the T. Eaton Co., Ltd., we acknowledge our indebtedness for the permission to photograph the "Victory" statue which they designed and constructed. The statue stands in front of the City Hall at Toronto, having been presented to the Victory Loan Committee by Sir John Eaton. The illustration on page 419 of this issue is an exact reproduction of the photograph of the statue excepting as regards the base, which has been slightly altered. The employees of the T. Eaton Co. who are responsible for this inspiring statue, are to be congratulated upon their artistic and skilful work. It is the opinion of a number of experts that this is the best "Victory" figure yet produced.

## Victory!

**N**OVEMBER 11TH, 1918, will stand out as the greatest day in the history of civilization. The armistice concluded on the morning of that day, between the vanquished German armies and the victorious allied forces, proves once more the impotency of might without right.

**N**O sympathy need be wasted on the defeated Hun. He did every damnable thing that he could imagine in order to force the British Empire to its knees. That he has surrendered at last does not mitigate his crimes. His surrender was not voluntary; his attitude toward Britain and Canada has not changed. Starvation forced him to throw up his hands. With ample food supplies there would have been no revolution in Germany; the war would have continued until next summer at least. The German mind has not altered; the German body is starved. Food will be supplied and further starvation alleviated so far as possible. That much is called for by the humanitarian standards of the Allies. But no humanitarian arguments can be advanced which would in any way justify resumption after the war of commercial relations between Canadians and our late enemies. Let the Huns severely alone. We want none of them. The first whining, apologetic German commercial traveller who calls upon you should be unceremoniously kicked out of your door.

**I**N September, 1914, *The Canadian Engineer* editorially declared its intention of refusing all advertisements of machinery and materials made in Germany or Austria-Hungary, whether the advertisements were offered by Canadian firms or foreign agents. This prohibition will not be removed after peace is declared. Other Canadian journals have made no declaration of policy in this regard, so far as we are aware. They should do so. The columns of every paper in Canada should be closed to all German, Turkish, Austrian, Bulgarian and Hungarian goods for the present generation. So far as we are concerned, we will sink or swim without the aid of the Hun's advertising. We will be no party to the German commercial penetration which undoubtedly will begin throughout the world before the ink is dry on the peace contract.

**E**NGINEERS can hold their heads high with pride in the part that their profession has played in the world's greatest war. Military authorities everywhere have conceded that it has been an engineer's war. Science and engineering skill have counted throughout far more than personal bravery on the battlefield. Just as the Allied troops have shown their courage in facing enormous odds, so have the Allied engineers proven their

superiority in scientific attainments in countering the devilish ingenuity of the Hun. In transportation by land and sea, in aeroplane production, in artillery work, in resisting gas attacks, in planning and intelligence work, in munition production and in all of the many other engineering phases of the war, Canadian engineers have attained enviable reputations.

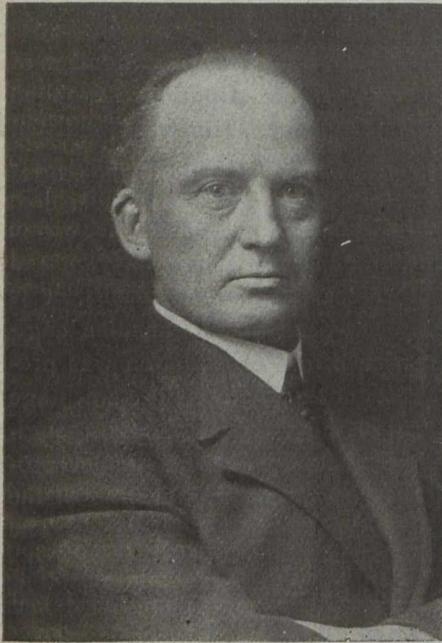
**N**O accurate estimation can be made of the number of Canadian engineers at the front or engaged in essential war work at home. Hundreds enlisted in other branches of the service than the engineering corps. Judging from the record of the Engineering Institute of Canada, one-third of whose members enlisted in the army or navy, and from the records of other technical organizations, it is almost certain that fully one-third of all Canadian engineers were in active service before conscription was proposed. In fact it is questionable whether the percentage was not over fifty instead of thirty-three. Of those engineers who remained in Canada, by far the greater proportion have been engaged in war work, and most of the others are in essential work, if not in war work. The members of no other profession can look down upon the engineers' part in the victory just achieved. The war has been a great illustration of the value of the engineer to the welfare of his fellow men.

**I**F the armistice terms are fully carried out by the Germans, the dragon's teeth will have been drawn. From a military standpoint, they will be powerless to do much further damage. They surrender all submarines, 25,000 machine guns, 1,700 aeroplanes, 5,000 locomotives, 150,000 railway cars, 5,000 cannon, 10,000 motor trucks, and a large part of their navy. Bottled behind the Rhine, having surrendered such vast quantities of material, and with the allies in possession of all strategic points and in command of most of the sources of munition supplies, there will be slight likelihood of the enemy's resuming war in thirty days. Every period and comma of the final peace terms will be dictated by the allies.

**P**EACE on earth to men of good will. Neither the Hapsburgs nor the Hohenzollerns are men of good will. There can be no peace on earth for murderers. Remember Belgium, the poison gas, the liquid fire, the treatment of the captured British, the Lusitania, the murderers of Capt. Fryatt and Nurse Cavell, and the thousands of other equally great iniquities wrought by the Central Powers,—in many of which the crowned heads were active accomplices.

## OBITUARIES

T. AIRD MURRAY, a well-known consulting engineer of Toronto, Ont., died November 5th in the Grey Nuns Hospital, Regina, Sask., after being ill for five days with influenza. Mr. Murray was born June 3rd, 1866, in Dumfries, Scotland. He was educated at the Royal College Grammar School, Newcastle-on-Tyne, at the Armstrong School of Science and at the Durham College of Science. He was articled to Alfred S. Dinning, a consulting engineer of Newcastle-on-Tyne, although it cannot be said that he completed his education with Mr.



Dinning, inasmuch as he was a keen student and an indefatigable reader of all literature pertaining to his profession. Mr. Murray's father was editor of the Newcastle "Daily Journal," and he no doubt inherited his father's journalistic ability, as he was an apt writer. When Mr. Murray came to Canada in 1908, he contributed to *The Canadian Engineer* some articles on sanitary work which

were so well received that arrangement was made whereby he became an associate editor of the paper, and every week contributed several pages dealing with sewage and water. This arrangement was discontinued when Mr. Murray entered private practice with the then firm of Macallum, Murray & McAllister. In 1911 he was appointed consulting engineer to the Saskatchewan Board of Health. About the same time he opened his own consulting office. From 1911 to 1916 Mr. Murray was engaged in various responsible engineering capacities by a considerable number of municipalities throughout Canada, chiefly in connection with filtration, sewage disposal and sewerage schemes. Mr. Murray, through the columns of *The Canadian Engineer*, was the first advocate in Canada of the chlorination of water supplies, and it was he who persuaded the city of Toronto to adopt the process which has since been taken up by many other municipalities throughout Canada, and which has undoubtedly prevented thousands of cases of typhoid fever and other water-borne diseases. He was one of the promoters and a past vice-president of the Canadian Health Association, and in 1909 became a member of the Canadian Society of Civil Engineers. He was also a member of the American Public Health Association, the Engineers' Club of Toronto and the Assiniboia Club of Regina. For more than two years, Mr. Murray had suffered greatly with cancer of the throat, for which he had undergone several operations in Toronto. A couple of months ago he went to Rochester, Minn., for an operation at the Mayo Institute, but the surgeons advised him to return to Toronto for electrical treatment. Mr. Murray was on a hurried trip west to confer with the Saskatche-

wan government regarding sanitary matters in that province when he became a victim of the epidemic. He had expected upon his return to Toronto to close his office and to go south for the winter in order to attempt to recover his health. He is survived by his widow, who lives at Oakville, Ont., his only son having been killed in action two years ago. Archdeacon Davidson, of Regina, conducted the funeral service, interment taking place in that city.

LIEUT. JOHN CARR NEWCOMBE, a graduate of the School of Practical Science, who was recently killed in France, was the author of a pamphlet highly esteemed by the British Government. This pamphlet, which was entitled, "Man and Vehicle Loads for R.E. Stores," contained tables generally used by engineers at the front, such as loads which could be carried by men, mules, lorries, etc. The publication had become an authority on the subject with which it deals, and has been adopted for use by all the allied armies.

## PERSONALS

DR. J. G. RUTHERFORD, of Calgary, has been appointed a member of the Board of Railway Commissioners for Canada, in succession to D'Arcy Scott.

W. H. SAMPLE, of Victoria, B.C., has been appointed general superintendent of motive power and car departments at the Montreal headquarters of the Grand Trunk Pacific Railway Co.

C. HAYWARD, who is a graduate of S.P.S., Toronto, has resigned from the engineering staff of Morris Knowles, Ltd., Windsor, to join that of Frank Barber, Toronto.

W. J. ROBIDER, heretofore master car builder with the Central of Georgia Ry., Savannah, Ga., has been appointed general master car builder, C.P. Ry., vice C. W. Van Buren, deceased.

GRANT HALL, of the C.P. Ry. Co., formerly vice-president and general manager of the western lines, Winnipeg, has been appointed vice-president, with jurisdiction over all lines, vice Sir George Bury, resigned. Mr. Hall has also been elected as a director.

ALLAN PURVIS, of the C.P. Ry. Co., heretofore general superintendent of the Quebec District, Montreal, has been appointed general superintendent of the Ontario District, vice J. T. Arundel, who has retired from the service.

W. J. PICKRELL, of the C.P. Ry. Co., formerly assistant superintendent of the Farnham Division, Quebec District, Farnham, Que., has been appointed master mechanic of the New Brunswick District, vice C. Gribbin, transferred.

CAPT. RAYMOND RICE KNIGHT, formerly city engineer of Fort William Ont., has joined the engineering staff of the Canadian Incinerator Co., Ltd. The head office of the company is in Toronto, but Mr. Knight will be located temporarily at the Detroit office.

RICHARD V. LOOK, president of the Canada Creosoting Co., Ltd., of Toronto and Trenton, Ont., left Canada November 1st to go to Jeffersonville, Ind., where he has received a commission as captain in the quartermaster's department of the United States army. Mr. Look was given leave of absence by the board of directors of the company. W. E. Doan, secretary-treasurer of the firm, is acting as general manager during Mr. Look's absence.