PAGES

MISSING

The Canadian Engineer

A weekly paper for Canadian civil engineers and contractors

Engineering Possibilities of Circular Housing Plan

Direct Saving of Over Thirty Per Cent. Is Claimed—Advantages Include Economy of Fuel, More Sunlight, Better Surroundings, Increased Safety for Children, Known Traffic Requirements — Economy in Water Mains, Sewers and Maintenance

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

THE accompanying illustrations show a layout for a block of twenty-one houses. Fig. 2 shows a method of laying out the lots radially from a common centre as has often been proposed. The houses are staggered about a given circular line. This line is the centre line of a tunnel which is constructed of connecting links and an additional basement partition in each house. The tunnel carries sewer, water and gas mains, electric light and telephone wires and heating pipes. It may also be used as a private entrance to the various basements. The various utility mains and wires enter this tunnel from the main street at the point where it intersects the road running to the centre of the block. The heating plant is situated near the same point. The lots may also be intersected by a semi-private drive, as shown, or they may be entered from the common centre or hub. The corners, cut off from the square by the circular layout, are allotted to park purposes. The design shown is tentative. The scheme offers itself readily to an endless variety of effects and modifications without giving up anything of the general principle. As it stands, the block is the unit of

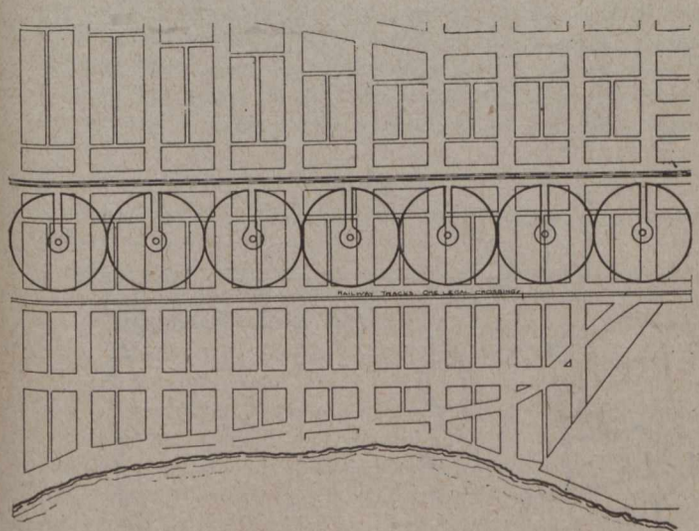


Fig. No. 1—How the Circular Blocks of Houses Can Be Fitted Into Rectangular City Blocks

ownership. By proper legislation, individuals might become owners of single houses if so desiring.

Fig. 3 shows the possibilities of a pair of individual lots. An illustrative floor plan of one building is shown. The other could be used as a two-family dwelling, each tenant having his own lawn.

Fig. 1 shows a portion of Port Arthur as at present sub-divided. Over the old blue-print layout is drawn in seven blocks, as here proposed. This shows at a glance

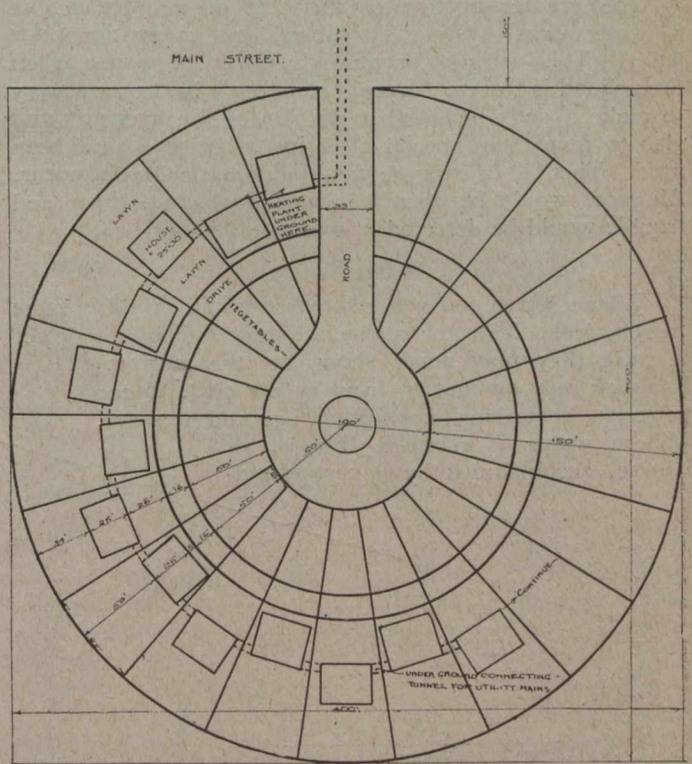


Fig. No. 2—Layout for Block of Twenty-one Houses

the big saving in the matter of roads and other local improvement necessities. A hasty consideration of this drawing might give one the impression that an unduly favorable location has been chosen to illustrate the new scheme, but by going into the matter minutely, this is seen to be a wrong impression and that the particular spot is, if anything, unfair to the plan.

By the adoption of this plan, some common engineering difficulties are at once eliminated. Under the present block system, the engineer is compelled to forecast the probable future traffic of each road and walk. He is compelled to design for traffic much in excess of immediate requirements and the needs of the individual block. This

excess must be carried as an added burden to the adjoining property or the city at large till such time as the traffic designed for actually develops. The same thing may be said in a general way about sewer and water mains and other utilities. The proposed plan does away with guesswork. The engineer would know at the outset the exact requirements of the block and would govern himself accordingly. Definiteness would characterize the whole scheme.

The smallest size commonly used for street water mains is 6-inch. This is much above the requirements for domestic purposes, but fire needs demand it. The large mains extend the whole way around a block served with water. Fig. 2 calls for a 6-inch main from the main road to the utilities tunnel only. A fire hydrant would rise from the tunnel at that point. The domestic supply could be carried by a much smaller pipe, reducing in size as it gets farther from the main. Pressure-reducing valves could be installed if necessary on the domestic supply line, conserving the pressure for fire-fighting purposes, reducing the proportion of leaks and saving much wear and tear on the whole domestic system. As the fire hydrants extend into the tunnel, frost jackets would not be required.

Maintenance

The greater portion of the cost of maintenance of a waterworks system is caused by excavations for leaks. This work is particularly costly in winter when the ground is frozen. In cold climates it is also necessary to make a daily personal inspection of fire hydrants and also to give them special attention after they have been used. This bill of expense would automatically disappear. All pipes would be open for inspection at all times and trouble would be detected at once.

Water Waste

Where sewer and water mains are laid in the same trench, leaks in water mains are very difficult to detect because they may never show at the surface. Leakage may amount to from 15 per cent. to 200 per cent., according to condition, age and pressure. Where water is pumped this is, of course, accompanied by a corresponding loss of coal or electrical energy. Detection of waste is a live issue with most municipal engineers. Cutting off waste means deferred extensions to pumping plants and equipment at a time when such are exceedingly costly. This source of expense and trouble would not be possible under the proposed system. Leaks would be detected and repaired at once without excavation.

House Connections

These connections carry water, sewage, electrical energy, gas and telephone service from the house to the street mains. They represent a big portion of the capital cost of housing and require much attention. They require much energy to operate them. They would be entirely unnecessary with the proposed layout.

Construction

These houses could be built to a given standard without making them identically alike and a big saving could be effected in this manner, but it is not legitimate to hold this out as an added attraction of this plan. It may be said, however, that owing to the connection of the buildings, excavation could be done with a steam shovel, effecting a saving of a substantial amount over the hand-shovelling method.

Heating

A heating authority has given it as his opinion that, with fuel at present prices, these houses could be heated at a cost of about five dollars per month for fuel. A central heating plant of the general design he proposes, could use soft coal or wood. With individual heating plants it is extremely doubtful if the same result could be obtained for less than twelve dollars per month for the winter months. The price of five dollars per month is estimated for the most severe weather.

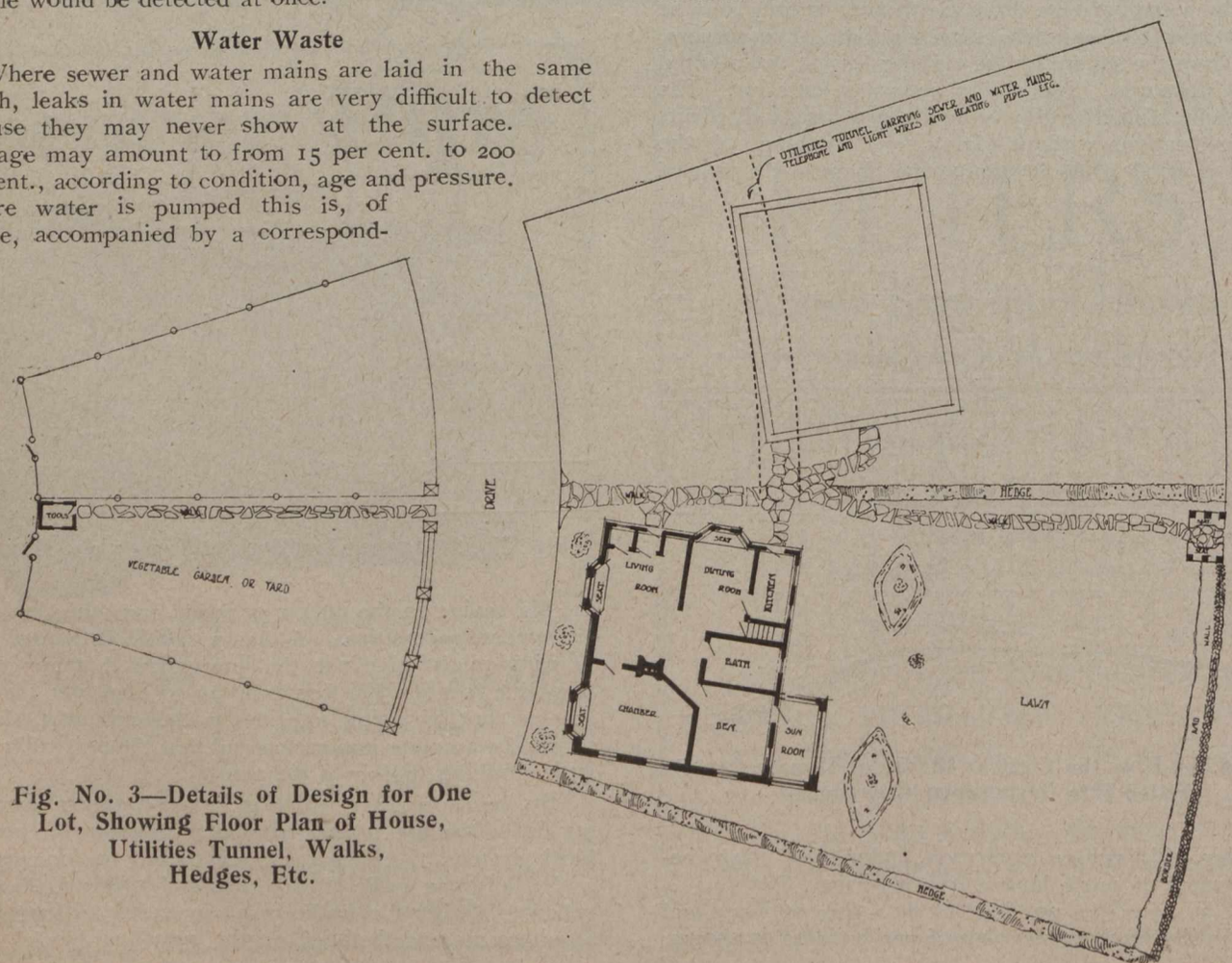


Fig. No. 3—Details of Design for One Lot, Showing Floor Plan of House, Utilities Tunnel, Walks, Hedges, Etc.

The same authority advises the use of high-pressure steam. This is impracticable for ordinary installations but where it can be used it is economical of fuel, pipes and radiators. The layout lends itself admirably to this method. A saving of one-third could be made on the capital cost of house-heating fixtures alone.

In the ordinary house, the house plumbing is connected to the street plumbing at the line of the front wall. The lines ascend into the house at the rear. This means carrying the sewer and water pipes the full length of the house before they come into service. Under the proposed plan, this expense is eliminated.

Public Safety

It can be seen at once that the houses, lawns and yards are more or less isolated from main arteries of traffic. This would give children freedom to play in private lots and in public parks without undue exposure to danger from passing vehicles.

Traffic Regulation

It would be no hardship to restrict traffic within individual blocks to a speed limit of five miles an hour. The relatively short time spent on internal roads and drives would justify this. This restriction would further increase the safety of children at play. It would also make possible a very cheap kind of construction for these internal roads and drives.

As no house would front directly on a main road, they would be at a distinct advantage in the matter of dust and street noises.

Abundance of Light

The plan shows the position of the houses staggered. This means light in abundance on all four sides. By taking the houses one after the other and studying the problem from the viewpoint of hours of actual sunlight, it can be seen what this arrangement means in comparison to the block system. When the radial system was first proposed, this was the greatest advantage claimed for it. Compare one of these houses with its maximum of actual sunlight and daylight on all four sides with the ordinary house in a block, shut off by its neighbors on two sides from daylight and sunlight alike, one of the other sides possibly shut off from the sun the year round and the other taken up by the woodshed. Or compare it with an apartment block, with some of its tenants never getting any sun or partly dependent on a narrow light shaft.

Main Roads

Main roads in a district built up of such blocks would traverse a series of parks.

Having adopted the idea of an intersecting drive, the vegetable garden, chicken run or more ordinary part of the property would be separated from the houses and lawns by that drive. No window would look out on a neighbor's back yard.

Set apart from main roads, each block would be more or less self-contained and would have an air of privacy quite impossible to realize under any block system surrounded on all sides by the main routes of public travel.

Community Interests

The layout of the block in itself is a direct encouragement to the growth of various community interests. The central space or hub has great possibilities in the way of library, reading room, athletic, social or other public welfare interests which people hold in common. With many parks close at hand, they could be laid out with a wide range of purpose and to meet a variety of health-giving and pleasant sporting aims.

An example of the advantage to be gained in actual dollars and cents appears below. It has a purely local coloring. It should be carefully borne in mind that this saving would not be made on a block of shacks. It would at once appear where the ordinary conveniences and improvements were introduced. The actual saving would increase very slowly as the costs of buildings increase. In other words, the saving would be as much on a house costing two thousand dollars as on one costing ten thousand. Once admit that people must be warm and comfortable and have proper sanitary protection, and that these are required at a minimum of expense, and we are forced to a realization of this plan. The saving accomplished is not on frills and follies which may be avoided, but on the stern necessities. The less elaborate the house, the greater the percentage of gain. It is a saving which strikes directly at the root of the matter of the "high cost of living." That this saving in capital cost and in fuel cost can be effected at a time when money is so much in demand and fuel so scarce, should have a special significance.

Real Estate Speculation

Before this plan can have any very widespread application in incorporated towns, the matter of re-subdivision of land will have to be taken up by the various legislative bodies. They, therefore, have the matter in their own hands. They can see to it that those for whose benefit the redistribution is to be made, have an honest intention to build and can see to it that they do build. It will have a tendency towards compactness which in itself is a tendency away from wild-cat speculation in outside subdivisions.

Comparison of Cost of Two Systems

ITEM	BLOCK SYSTEM Quantity	BLOCK SYSTEM Cost	CIRCULAR SYSTEM Quantity	CIRCULAR SYSTEM Cost
Lots	333	$ 83,250	333	$ 83,250
Houses	333	566,100	333	466,200
Excavation	60,000	60,000	60,000	15,000
Heating plants	333	66,600	7	28,000
Heating instal'ns	333	166,500	333	99,900
Plumbing	333	99,900	333	66,600
Other fixtures	333	33,300	333	33,300
Roads	4,620	23,100	1,600	2,400
Lanes	5,280	5,280	0	0
5-ft. walk	8,778	13,778	588	888
Water mains	4,260	27,720	588	3,528
Water mains	0	0	6,244	1,874
Sewer mains	0	0	6,244	1,874
Drives	0	0	4,752	4,752
Concrete walk (private)	10,961	8,791	2,664	3,330
Concrete wall	0	0	1,200	3,122
Elec. light mains	4,620	4,620	588	588
Telephone mains	4,620	4,620	588	588
Sewer and water connections	333	33,300	0	0
Electric light and telephone	333	3,300	0	0
		$1,200,159		$815,190
Total cost per house		$ 3,604		$ 2,447
Annual charges—				
Capital		$360.00		$240.00
Taxes		25.00		20.00
Fuel		96.00		40.00
*Light and water		24.00		12.00
		$505.00		$312.00
Per month		42.08		26.00

*Operated at a loss.

The form in which these notes are here presented is the same as that originally drawn up. It was in this form I first prepared them and sent them to several authorities for criticism. For this reason I have thought it best to leave them as they are in order to deal better with the comments on them.

My first critic, passing lightly over the alleged saving, went on to deal with the general difficulties connected with the operation of model communities. He pointed out that the scarcity of model communities exists, in the first place, because they cannot pay such a high rate of interest on capital invested as does the slum; that those who have money to invest in houses are now in that business, and that the number of people who have to live where they can, are as "the sands of the sea." He also spoke of the restrictions and rules necessary to keep any community up to a given standard.

A Champion of "Liberty"

To use his exact words, he said: "And the folks who live in slums, if they have dirt and filth and disease, they also have something they would not have in the model settlement—liberty. In the slum there are no rules to break, other than those made by the corner policeman, and the slum policeman is human. A man can quarrel with his wife, discipline his family, get drunk, do anything short of burning down the blasted place that he feels like doing. Everything he couldn't do in the model settlement is permitted in the slum. The nature of man changes slowly, and the change comes from within. It is a mistake widely held by uplifters that externals are a great influence. Show a man a cake of soap where no soap was before and immediately he is seized by a passion for being clean, internally as well as externally. If not prevented, he'll eat the soap."

I am dwelling particularly on this criticism because it is typical of a good many I have received and I am willing to admit, frankly, that I am not very well qualified to answer it. However, the comment arises out of a misconception of my object in submitting the plan for which, possibly, I am to blame in the matter of statement. My main object was to investigate the engineering possibilities of a circular layout and I found that for a northern Canadian climate such a layout makes possible a direct saving of about 40 per cent. in providing the ordinary family with shelter, light, water, heat and the commonest sanitary appliances. I had no idea at all of depriving any one of his legitimate share of filth and disease or the right to chastise his family.

I realize there are certain legislative formalities to be gone through with before such houses could become the property of individual owners. But the number of apartment houses in our Canadian cities, especially the northerly ones, shows that the individual ownership difficulties need not stand in the way of the success of the scheme. Individual ownership in itself is not a supreme object of all families.

Summary of Chief Advantages

The fact that the proposed plan would seem to encourage better living conditions, should not be seized on by hard-headed people, and branded as impractically altruistic. The chief point is that it is a money-saver and a fuel-saver. It also offers more sunlight and the possibility for various kinds of healthy enjoyment for children and adults close to their home. But it may not impose these. Externals may or may not be of value, but here is an opportunity to give externals a fighting chance.

Another critic sees a difficulty in the administration and care of the park property. Personally I cannot see why these triangular pieces of land could not be treated by the local parks commissioner exactly as is done at present. If this is too difficult, the trouble may be overcome by not allotting them to parks. They would make ideal apartment house sites. Where the block is retained intact by the original builder, these corners, as any other land in the block not desired by tenants, could be administered and cared for by him.

The housing problem, as I see it, is fast becoming a national one and as such it must be solved in the light of national aims and necessity. As a nation, thrown for the first time on its own resources and into trade competition with other nations more favorably situated with regard to living conditions, it is hard to see how we can afford to overlook any possible economy. Simply stated, we depend for development resources upon the difference between what we make and the cost-of-living necessities. To increase this surplus is a most vital problem. We are entering an era vastly different from the one which ended in a national real estate boom with its accompanying evaporation of working capital. We still retain the conditions and rules which made that extravagance possible. Before we can make any very great saving in our way of living, these conditions and rules must undergo certain modifications, and that in defiance of some very powerful interests. It would seem that the first steps in making such changes should be to show how such actual saving can be made and to point out its true national significance.

WOODSTOCK FILTRATION PLANT

CITY ENGINEER A. K. GRIMMER, of Woodstock, N.B., reports that the filtration plant under construction there will probably be in operation about October 1st. The filter building, which is of reinforced concrete, was constructed by Mooney & Co. The portion of the building containing the filter equipment is 27 ft. long x 36 ft. wide x 16 ft. deep, while the part containing the sedimentation basins is 52 ft. long x 17 ft. wide x 16 ft. deep. The stone from the excavation for the building was used in the construction of a breakwater which protects the property from ice.

All the filter equipment was supplied and installed by the New York Continental Jewell Filtration Co., under the direction of H. G. Hunter, of Montreal, resident engineer for the company.

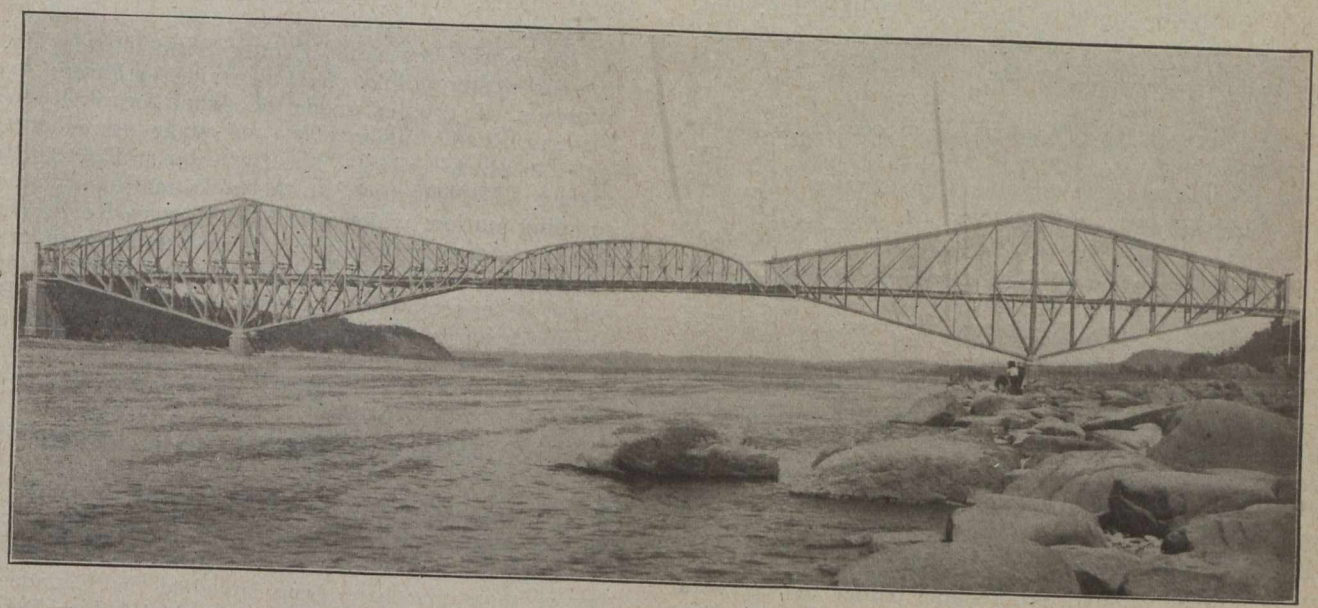
The capacity of the plant will be 1,000,000 gallons per day. In the power house, which was remodelled from the old pumping station, the following new units have been installed:—

One low-lift steam turbine pump, 1,000,000 Imperial gallons per day capacity; one high-lift steam turbine pump, 900,000 Imperial gallons per day capacity; one gasoline-motor driven turbine pump, 800,000 Imperial gallons per day capacity; one electric-motor driven low-lift centrifugal pump, 1,000,000 Imperial gallons per day capacity; also an electric-motor driven pump connected so as to supply water directly from the river in case of emergency. Besides this equipment there is a previously installed high-lift electrically driven centrifugal pump, 800,000 Imperial gallons per day capacity.

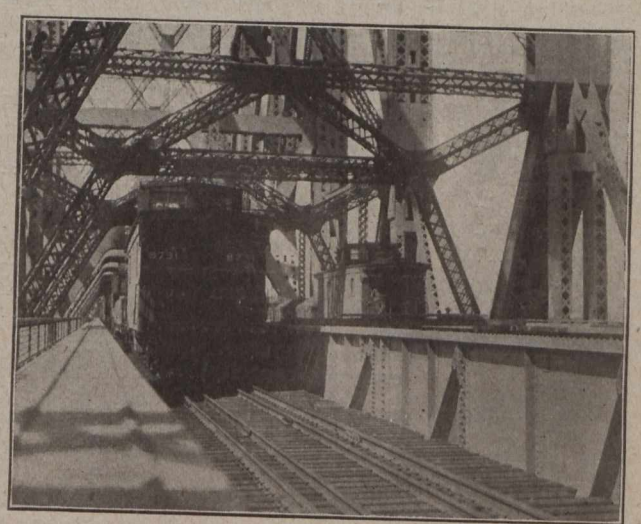
The enlargement of Guelph's water reservoir to accommodate 5,000,000 gallons, and the installation of an additional pump at the waterworks capable of pumping 6,000,000 gallons a day, are the chief items referred to in the report submitted to the city of Guelph by the Provincial Fire Underwriters of Ontario.

THE FINAL TESTS OF THE QUEBEC BRIDGE

These three photographs were taken last week while the tests were being made



"IN the annals of engineering, the construction of the Quebec Bridge—for immensity, uniqueness of design, excellence of detail, boldness of organization—has rarely been equalled and never excelled," says a large poster in the Canadian Government Railway's exhibit at the Canadian National Exhibition, now being held in Toronto. The poster is displayed alongside a very fine painting of the Quebec Bridge produced this year by Richard W. Rummell. The above photograph, probably the latest taken of the bridge, shows the structure absolutely completed in every way. It has now been formally taken over by the Dominion Government.



The Two Heavy Trains on the Central Span

There Is 17½ ft. Space Between the Two Track Systems

See page 200 of this issue for description of tests.

"The award of the board of arbitrators to the Canadian Northern Railway will be paid on the 24th of the present month. The award was for $10,800,000, but, under an agreement entered into between the government on the one hand and Mackenzie and Mann and the Canadian Bank of Commerce on the other, the amount to be paid will not exceed $10,000,000. There are a few minority stockholders, however, who were not bound by the agreement which the government made with Mackenzie and Mann and the Bank of Commerce, and these are asking that their stock be paid for upon the basis of the full award. It is likely that this will be done."—Monetary Times, August 23rd, 1918.

The new fourth lock of the American ship canal, near St. Mary's Falls, at Sault Ste. Marie, is practically completed and the construction plant is being removed. The structure has cost about $3,500,000. The lock is 1,700 ft. long, with 1,350 ft. clear between gates as compared with 1,000 ft. chambers in the Panama canal locks. This new lock is said to be the longest canal lock in the world. The width of the chamber is 80 ft. The walls, which are of reinforced concrete, are 75 ft. high, and at the bottom are 26 ft. thick, tapering to 8 ft. at the top. Six culverts, 6 ft. x 9 ft., fill and empty the chamber. The lock required 180,000 cubic yards of concrete, and 725 tons of rod reinforcing was used.

ESSEX BORDER INTERCEPTING SEWER

At a meeting of the Essex Border Utilities Commission held last Friday afternoon at Windsor, Ont., the contract for the East Intercepting Sewer was awarded to Merlo, Merlo & Ray, of Walkerville, Ont. The tender was awarded at cost plus a sliding scale fee. The cost prices tendered by the various bidders were as follows:—

Merlo, Merlo & Ray, Walkerville, $108,642.80; Standard Construction Co., Toronto, $118,224.90; F. F. Fry, Toronto, $119,220.40; Dominion Construction Co., Toronto, $119,835.90; McKendrick & Black, Detroit, $131,192.55; Wells & Gray, Ford City, $135,067.40; McLaughlin Bros., Ottawa, $136,862.80; Donnelly & Stevens, Cleveland, $155,293.00; Bate, McMahon & Co., Ottawa, $161,847.40; Nicholson & Gerou, Toronto, $169,228.75.

The sliding scale fee system used in this award follows the plan recently adopted by the United States War Department with some of its contracts, and it is also said to be similar to the plan proposed for adoption by the Halifax Relief Commission and by the United States Shipping Board.

The specifications calling for tenders read as follows:

"The lowest capable and reliable bidder to receive a fee of $12,000, which fee will be increased by twenty-five per cent. of any amount by which the actual cost is less than the agreed upon estimate of cost, and which will be decreased by ten per cent. of any amount by which the actual cost exceeds the agreed estimate.

"Under this plan, the contractor will be allowed rentals for machinery and equipment between limits to be announced, the rental to be determined by the engineer from a consideration of the capacity and usefulness.

"In general, all expenses incurred on the site of the work would be paid the contractor, but no salary or allowance to a president, general manager or general superintendent who devoted only part time to the work."

The East Sewage Interceptor will be 12,340 ft. in length, the work including manholes, measuring chambers, regulating chambers, force main and other structures. It will be constructed in the municipalities of Ford City, Walkerville and Windsor. The Essex Border Utilities Commission will finance the work and will pay the $12,000 fee in instalments. The agreed estimate of $108,642.80 submitted by Merlo, Merlo & Ray, is supposed to be the actual cost of the work as calculated by that firm. A certified cheque of $1,000 was required with each tender The successful bidder must file a surety of $10,000.

The work includes 33,860 cubic yards of excavation (estimated), of which 21,300 cubic yards is in trenches between 18 ft. and 24 feet deep, 12,000 cubic yards between 12 ft. and 18 ft., 540 cubic yards between 8 ft. and 12 ft., 10 cubic yards less than 8 ft., and 10 cubic yards over 24 ft.

The contract includes furnishing materials for and laying 1,060 ft. 15-inch vitrified sewer pipe; 1,310 ft., 18-inch; 1,530 ft., 20-inch; 2,540 ft., 24-inch; 1,960 ft., 27-inch; and 3,640 ft., 33-inch pipe. The contract also includes the supply of 48 sets of manhole castings and 229 ft. of 20-inch reinforced concrete force main, measuring chamber at Ford City, measuring chamber at Walkerville, three regulating chambers and various house connections.

It is estimated that 720 square yards of asphalt block pavement will have to be cut and replaced, 170 square yards of concrete pavement and 2,850 square yards of sidewalk.

The Commission is not committed to vitrified pipe for the 27-inch and 33-inch portions of the sewer. It is also considering brick, reinforced concrete pipe, vitrified segment block, concrete segment block and monolithic concrete.

The sewer begins at Palette Road, Ford City, and extends westerly through Walkerville to Parent Avenue, Windsor. It crosses under the Grand Trunk Railway at Victoria Road, Walkerville, and makes three crossings under existing sewers. The elevation at Palette Road is 575.57. The elevation at the west main regulator and pumping station, which will be at Victoria Road, Walkerville, is approximately 564. A 20-inch force main there connects the interceptor to the Windsor sewer at an elevation of approximately 577.39, the elevation at Parent Avenue being about 574.46; these elevations referring to sewer inverts.

CANADA'S SHIPBUILDING EFFORT

In a pamphlet entitled "Canada's War Effort, 1914-18," issued by the Director of Public Information, Ottawa, the following table appears showing the number of ships that have been launched in Canada since January 1st, 1918, or will be launched before December 31st, 1918:—

	Steel Vessels					Wood Vessels				
	Atlantic Coast shipyards	Great Lakes shipyards	Pacific Coast shipyards	Total	Dead weight carrying capacity (approx.)	Atlantic Coast shipyards	Great Lakes shipyards	Pacific Coast shipyards	Total	Dead weight carrying capacity (approx.)
Built to order of Imperial Munitions Board	5	18	11	34	179,800	14	4	27	45	138,600
Built to order of Dept. of Marine ...	4	4	3	11	48,000	..	.	..	..	.....
Built under private contract	8	5	1	14	62,400	..	.	8	8	17,800
Total	..	..	..	59	290,200	..	.	..	53	156,400
Grand total: Ships										112
Tonnage (approx. deadweight carrying capacity)										446,600

N.B.—The above figures do not include a large number of small craft of less than 1,000 tons, at present building, such as trawlers, drifters, small schooners, etc.

In connection with a government shipbuilding program, 20 ships with a gross tonnage of 55,000 are at present under construction. These are being built under contracts entered into by the Department of Marine. Seven will be delivered during 1918, the remainder in the following year.

The Department of the Naval Service, since the outbreak of the war, has placed contracts in Canada on behalf of various governments for the following vessels: A number of submarines for the Imperial Government, as well as several submarines for the Italian and Russian Governments; about 550 motor submarine-chasers for the Imperial Government; about 36 motor submarine-chasers for the French Government; a number of steel lighters, shipped in "knock-down" form, for the use of the Imperial Government in Mesopotamia; and a large number of trawlers and drifters for the Imperial Government.

FINANCING ROAD WORK IN SASKATCHEWAN*

By H. S. Carpenter
Superintendent of Highways, Province of Saskatchewan

ALL moneys used for the construction and maintenance of rural highways in the province of Saskatchewan are provided and administered either by the Department of Highways of the provincial government, or by the councils of the rural municipalities.

The moneys spent by the Department of Highways are provided for in the annual estimates under two main heads: (a) money provided from income account, and (b) money provided from capital account.

To income account is charged all expenditures for the construction, maintenance and operation of provincial ferries, construction and repair of timber bridges, maintenance and repair of roads, and maintenance and repair of permanent bridges.

To capital account is charged the construction of roads, and the construction of permanent steel and concrete bridges.

From the time of the formation of the province in 1905 to 1912 highway expenditures were controlled by the Department of Public Works. During this period all road construction was charged to income account, and permanent bridges only were charged to capital account.

In 1912 the government decided that the time had arrived when a more extensive program of highway improvement should be entered upon, and to this end adopted a policy of borrowing money to carry on road construction work as a capital expenditure. A Board of Highway Commissioners was formed to take charge of the administration of this enlarged program.

For the years 1906 to 1911 inclusive the annual expenditure of the Department of Public Works on roads, bridges and ferries averaged about $784,000. The Board of Highway Commissioners spent in each of the years 1912, 1913 and 1914 on the same services about $2,000,000.

Since the outbreak of the war it was thought advisable to curtail expenditures on highway improvement and the annual expenditures for 1915, 1916, 1917 and the current year average only about $700,000.

Main Road System

The Board of Highway Commissioners formulated a policy of, so far as possible, concentrating the expenditures under its control on the improvement of the main market roads of the province.

There are in the settled portions of the province about 175,000 miles of road allowances. The improvement of this large mileage would be a tremendous task for the people of this province. Very much of this mileage is, however, on roads which are purely local roads which will carry only very light traffic, and fortunately in the open prairie portions of the province many of the roads will in their natural state serve for many years to come to accommodate the small amount of traffic which will pass over them.

It may be roughly estimated that 20 per cent. of the above mileage will be included in a main road system or about 35,000 miles, and probably these 35,000 miles will carry about 80 per cent. of the traffic. The improvement of this 35,000 miles of road represents a big program of road improvement work, but one which the rural municipalities, with liberal assistance from the government, may hope to accomplish within a reasonable time. When we have succeeded in providing well-graded earth roads, together with necessary culverts and bridges of a permanent nature to accommodate 80 per cent. of the traffic, we will have advanced a long way towards solving the problem of good roads for the province.

The policy of limiting government expenditures to the improvement of main roads embodied in a main road system makes possible a well-defined program of work, a steady adherence to which will insure that every dollar spent will bring us nearer our goal.

The Board of Highway Commissioners, in accordance with its main road policy, established on paper a system of main roads for the province. This was drawn up after consultation with the councils of each rural municipality, from information on the files of the Department of Public Works and from information gathered in the field by officials of the board.

Thus a start was made towards the development of a main-road system, and while this scheme was drawn up with the idea of, so far as possible, establishing this permanently, conditions in a new and growing province such as Saskatchewan, where the opening up of new lines of railways is followed by the growing up of new market centres, are such that modifications have to be permitted to meet changed conditions, so the original main-road scheme has been modified and extended from time to time as circumstances required.

Administration of Highway Expenditures

In 1917 the Department of Highways was established to carry on the administration of all highway work which had previously been carried on by the Board of Highway Commissioners.

The selection of the locations upon which improvements shall be made each year rests with the department and is arrived at after consultation with the councils of the rural municipalities, and on the recommendations of the divisional superintendents. These latter are officers of the department who have charge of the immediate supervision of the work in each of the eight divisions into which the province is divided.

During the years 1912 to 1914, when under the Board of Highway Commissioners the government was spending a large sum each year on road and bridge construction, the work was carried on either by government road and bridge crews or by means of grants to rural municipalities. The government crews were organized, controlled and paid by the board. There was sufficient work at that time to keep these crews employed for the whole summer season. These crews, under the same foremen, with very much the same personnel, and even the same horses, were employed year after year and generally became very efficient in their work.

Grants were given to rural municipalities for road construction work on what was called the dollar-for-dollar basis. The board entered into an agreement with the rural municipalities to make a grant for the improvement of certain main roads selected by the municipality and approved by the board, the municipality agreeing to contribute an equal amount from its own funds. The work was carried on by crews in the employ of the municipality, and the board paid over to the municipality one-half the cost of the work, on the certificate of an inspector of the board that the work had been done in accordance with the specifications and agreement.

Since the outbreak of the war the expenditures made by the government have been on such a reduced scale that it was impossible to give the government road crews sufficient work to maintain the organization. It was necessary also to discontinue the system of grants to

*Paper read August 8th, 1918, at Saskatoon meeting of the Engineering Institute of Canada.

municipalities. The Department of Highways now carries on the greater part of its road construction work by authorizing an expenditure on certain main roads approved by the department. The department, being satisfied the rural municipality has the organization and equipment to satisfactorily carry on the work, enters into a contract with the municipality whereby the municipality performs the work with its own crew and the department pays the amount authorized to the municipality on the work being completed and on the certificate of the department's inspector that the work has been carried on in accordance with the specifications.

The arrangement referred to above applies only to road construction. In the case of bridge construction, very few of our municipalities have the equipment or the desire to handle the construction of the larger bridges. Practically all bridges of a span of 20 feet or over required throughout the province are built and paid for by the government. The bridges constructed by the government are, broadly, of two kinds—timber bridges on pile abutments and pile bents, and steel bridges on concrete or pile abutments. The timber bridges are built by bridge crews employed by the Department of Highways, and, as stated before, are paid for out of income account. The steel bridges on concrete abutments, also the reinforced concrete arch bridges (several of which have recently been built), are all let by contract and paid for out of capital account. All the timber for the timber bridges, and the steel and cement for the larger bridges, are purchased by the department direct from the manufacturers.

Saskatchewan is an earth-road province and it will no doubt be many years before, outside of the cities and towns, any very considerable mileage of metalled road surfaces will be constructed. For this reason the question of maintenance has become one of the most important problems we have to deal with. To induce rural municipalities to give more attention to this very important matter, the government is now distributing to municipalities in the way of direct grants a large part of the money collected as fees for auto licenses. This is given to the municipalities on condition that it shall be used for the maintenance only of main roads leading to market towns. The amounts given to each municipality in this way are not large, but it is hoped that with the expenditure of this money on maintenance work, the municipal officials will be brought to see the wisdom of devoting more money for this purpose than has been done in the past, and that the amounts contributed by the government for this purpose will be supplemented to a considerable extent by the municipalities.

Rural Municipalities

The rural municipalities in the province up to and including the year 1914 were spending in the aggregate on road improvement work an amount about equal to that spent by the government, and since the outbreak of the war have not reduced their expenditures to the same extent as has the government.

In rural municipalities the money for road and bridge construction is obtained generally from current taxes, though many municipalities have raised money for this purpose by the sale of debentures. This latter method was resorted to to a considerable extent in the years 1912 and 1913 to provide the money contributed by the municipalities as their share under the dollar-for-dollar agreement with the Board of Highway Commissioners.

No special tax is imposed in rural municipalities for road improvement work or other public works. The council sets aside from the revenues of the municipality as much as it determines can be allocated for this purpose. The money is authorized for the improvement of such roads as the council selects. The Rural Municipality Act, however, provides that one-half the total amount estimated to be expended for general municipal purposes within the year (exclusive of the proceeds of debentures) shall be distributed among the divisions in proportion to the assessed value of the taxable property in each division, unless the council by unanimous vote decide that this amount may be reduced to any amount not less than one-quarter of the total estimate. Moneys raised for road or bridge construction by the sale of debentures must, of course, be spent to carry on the work specified in the by-law.

The Department of Highways exercises no authority or control over the expenditures made by rural councils, or the selection of roads upon which the councils will spend their money. Both the department and the rural councils are, or should be, working towards the same end. It is the policy of the department to plan its improvements, so far as possible, in harmony with the plans of the municipality and many of the authorizations for expenditures by the department in a municipality are made pursuant to an arrangement covering expenditures of municipal funds by the council.

TEST OF QUEBEC BRIDGE

LAST week the final official test of the Quebec Bridge took place when the maximum load which the structure will likely ever be called upon to carry was placed upon the central span. A big locomotive, pulling 55 loaded freight cars, started across the bridge from the north shore, while at the same time a similar train started across the structure from the south end. The two trains, weighing about 14,000,000 pounds, were halted on the central span and rested there for several minutes before continuing across the bridge. Other tests included the running of several trains at high speed past each other on the bridge, the trains passing at the central span.

Although no special trains were run to the site of the bridge, thousands of people from Quebec motored to witness the trial, and when the enormous weight of the two trains had no visible effect on the huge structure, there was cheering from both sides of the river which almost drowned out the piercing whistles of the locomotives on the bridge.

Among the engineers who witnessed the test were C. N. Monsarrat, formerly chief engineer of the Quebec Bridge Commission and now consulting engineer to the Department of Railways and Canals, Ottawa; H. P. Borden, of the Quebec Bridge Commission; Judge E. H. Gary, president of the United States Steel Corporation; Gordon Grant, chief engineer of the Transcontinental Railway; G. F. Porter, engineer of construction for the St. Lawrence Bridge Co., Limited, who were the contractors for the bridge, and other officials of the company; and Messrs. Colclough, Morazain, Atkinson and other officials of the Canadian Government Railways.

The municipality of Swindon, England, has joined in the increased food production campaign, having purchased thirty-six pigs for breeding purposes. A waste paper collection scheme has also been inaugurated.

ENGINEERING COMMISSION TO STUDY NEW MISSISSIPPI RIVER CROSSING

TO investigate the physical and financial feasibility of a new bridge or tunnel crossing of the Mississippi River at or in the vicinity of New Orleans, and the possibilities of united terminal development (both passenger and freight) through the agency of the Public Belt Railroad, the city of New Orleans, La., recently authorized the appointment of a Board of Advisory Engineers.

New Orleans has full control of its available water front, and has already developed to a high state of efficiency its water-front terminal facilities, together with a marginal railroad system connecting these various facilities and the other railroads by the municipal undertaking known as the Public Belt Railroad.

Owing to the geographical position of the city, with its principal rail and water terminals, a direct rail connection across the Mississippi River has long been considered desirable, and this finally resulted in the creation of the Board of Advisory Engineers. The board consists of four members: Lt.-Col. Bion J. Arnold, transportation engineer, Chicago, chairman; Dr. J. A. L. Waddell, bridge engineer, Kansas City; J. Vipond Davies, tunnel engineer, New York; and A. F. Barclay, engineer of the Public Belt Railroad Commission, secretary.

The possibilities of bridge and tunnel construction will be investigated by Dr. Waddell and Mr. Davies, respectively, and the problem of terminal development and general co-ordination of facilities will be studied by Col. Arnold. The board as a whole is instructed to submit a report by January 1st, 1919, covering the following essential matters:—

Feasibility of new river crossing.
Whether bridge or tunnel.
Preferable approximate location or locations.
Connection with:—
1.—Present belt and other railroads.
2.—Provisions for future roads.
Lands required for yards and terminals to 1950.
General type, grades, clearances, approaches, etc.
Development of Union Station facilities out of present passenger and freight terminal areas as an extension of public belt.
Probable revenue from new river crossing project.
Approximate cost of complete crossing project.
Time required for completing specifications and awarding contracts.
Estimated time required for construction of crossing and terminals.
Justification of project from viewpoint of:—
1.—Public policy.
2.—Railroad operating policy.
3.—Return on investment.
Estimated present and future gross and net revenue, operating expenses and maintenance and return on investment.

The field work required for these determinations has already commenced, and is in charge of J. R. Bibbins, of Chicago; Charles K. Allen, of Kansas City; and A. R. Archer, of New York.

The problem presented is complex, not only by reason of the physical dimensions of the crossing project and foundation difficulties encountered in the Mississippi bottoms around New Orleans, but also due to the disposition of present railroad operations, traffic and rates in the Mississippi Valley and the possible effect in the future of railroad reorganization brought about by war conditions.

WATER SUPPLY FOR SASKATCHEWAN*

By George Douglas Mackie
Engineer-Commissioner, City of Moose Jaw

THE water supply problem of the province of Saskatchewan, more particularly that section of the province lying to the south of the South Saskatchewan River, and bounded roughly on the west by Thunder Creek and the Canadian Northern line from Moose Jaw to Forward, on the south by the Shaunavon-Weyburn line, and on the east by the Regina-Weyburn line and the Qu'Appelle River and Buffalo Lake, with an area of approximately 5,000 square miles, is a serious one, is still unsolved, and touches vitally the interests of every inhabitant in that district.

In this large area of country, which, from an agricultural point of view, possesses land which yields the most productive wheat crops in the world, there are no rivers of any size, and the lakes which dot the country here and there over its area are mostly of an alkaline nature and entirely unsuited for drinking purposes. The geological formation of the country is such that the supply of water from wells, even those which have been drilled to a great depth, is very poor, and none of the large centres of population, notwithstanding the fact that they have spent huge sums of money in endeavoring to acquire abundant supplies of water for their citizens, have been able so far to secure such supplies. The whole population is thus seriously handicapped by the one vital element which goes hand-in-hand with the progress and prosperity of any country, viz., an abundant supply of pure water.

Period of Reconstruction

At the present time the whole of our Dominion has its attention concentrated, and rightly so, on the one aim and object which is material to its further progress, and that is the waging to a successful conclusion the great war, which is now in progress, for the peace and safety of civilization; but at the same time the governments of our country are wisely looking ahead to the period of reconstruction which must necessarily follow in all countries on the conclusion of the war, and to the settlement in civil occupations of the large number of soldiers who will return here on the victorious completion of the war, and the works which are to be carried out in this reconstruction period are of vital importance to the engineering profession, as upon them will devolve to a very great extent the designing and execution of any large enterprise on which our governments may embark.

In our Western country the source of all wealth springs from the cultivation of the enormous tracts of fertile land which have yet only been developed to a small degree, and in order that this section of land of which I speak, to the south of the Saskatchewan River, may be properly developed and furnish subsistence for the large population which must ultimately dwell on it, as well as supplying its surplus to the needs of the Empire, an abundant supply of water is the first essential to that development.

No New Problem

The question of providing an adequate water supply for the plains of Regina and Moose Jaw is no new one, and has been taken up from time to time by that very enterprising body of engineers who constitute the backbone of the Department of the Interior, and as far back

*Paper read August 8th, 1918, at Saskatoon meeting of the Engineering Institute of Canada.

as 1894, Mr. Dennis, the then Chief Inspector of Irrigation, in his annual report, dwelt on the necessity for some scheme to provide an abundant water supply for those areas. In his report of 1895 he speaks of the necessity of diverting the water of the South Saskatchewan River to these plains for the purposes of irrigating what he termed as "the arid regions of Regina and Moose Jaw," as well as for the purpose of furnishing an adequate supply of drinking water to the settlers who were then coming in in large numbers to settle on this territory. Since this report was penned it has been demonstrated that this land can be, and is, successfully farmed without the necessity of irrigation, but the problem of diverting the waters of the South Saskatchewan River for the purpose of supplying water for stock and drinking purposes still remains.

The question was brought up by another engineer, Mr. T. Aird Murray, who, in 1911, made a report to the Commissioner of Public Health of the province, in which he pointed out the inadequacy of the water supplies for domestic purposes in the territory between Regina, Moose Jaw and Weyburn, as well as the Qu'Appelle Valley, and suggested that a supply of water be obtained for this country by diverting the waters of the South Saskatchewan River at Elbow by means of a dam across the Saskatchewan River, a tunnel through the height of land, allowing the water to flow by gravity down the Qu'Appelle to Buffalo Lake, from whence the water could be pumped to the various towns and cities as required.

Mr. Francis' Report

Mr. Walter J. Francis, C.E., of Montreal, in a report in 1911 on the water supply problem of the city of Moose Jaw, also made reference to this project, and stated: "When the south half of the province of Saskatchewan will have become densely settled it is our opinion that the South Saskatchewan River will be found the only source of supply for domestic purposes. We cannot find any evidences at present of any other water suitable for cities of fifty thousand population and a densely settled surrounding district. We believe the Saskatchewan to be the proper source, primarily, because its supply is obtained from glacial districts, and, therefore, not dependent upon precipitation in the prairie country. It is, moreover, the only continuously flowing supply of any magnitude in the country. The most feasible route is doubtless that following the valley of Thunder Creek to its source and then crossing over the divide about five miles to the Saskatchewan. From the engineering point of view there are no serious obstacles. The location of the dam on the river, the details of the pumping station, the arrangement and size of the pipe line, and all such features can only be determined by careful study after surveys of the locality will have been made. The only real obstacle to this project is its cost, which will probably run into five million dollars or more."

An Enquiry

The Saskatchewan government at this time appointed a commission to enquire into the whole question of the water supply of this district, and their first action was to apply for a license from the Department of the Interior diverting 200 sec. feet from the South Saskatchewan River for water supply purposes for the southern part of the province. The Department of the Interior, however, are the real pioneers in this matter, and carried out extensive surveys with the object of locating the best line for a gravity supply from the height of land at the Saskatchewan River to supply the territory already described, and very full reports of these surveys, together with plans, will be found in the irrigation reports for the years 1912-13 and 14. It is impossible for me in the short space of time at my disposal to present the problem to you in any detail, but the matter is of such importance to this section of the country that, in my opinion, the engineering profession would be derelict in its duty did it not take up this matter and point the way to a complete solution of the problem.

Water Used

In a report recently issued by the Department of the Interior at Calgary, a statement was given of the quantity of water used in various urban communities in the provinces of Alberta and Saskatchewan, and I find that in twenty of these places the average quantity of water used per day in 1917 amounted to 74.5 gallons per head. Eleven places in Saskatchewan are recorded, and the average quantity of water used in these communities, with populations ranging from 350 to 35,000, amounts to 47.9 gallons per head per day. These are figures which, to my mind, demonstrate clearly the inadequacy of our community supplies in the province of Saskatchewan, more especially when considered alongside the figures for the whole of Canada, which average 111 gallons per head per day. The population of the district to be served, by a rough computation which I have made, based on the 1916 census, figures out at approximately 50,000, to which should be added another 25,000 for the purely rural areas, making a total population to be supplied of 75,000, and if this population is doubled to allow for future growth, the problem is to supply a population of 150,000 scattered over 5,000 square miles with 150,000,000 gallons of water per day.

Two Schemes Outlined

From the Hydrometric Records of the Department of the Interior the mean minimum flow of the Saskatchewan River at Saskatoon is given at 1,247 sec. feet in the period from 1911 to 1917, and this occurred in January, 1913. The maximum flow recorded in the same period is 60,566 sec. feet in July, 1916. If we take the figure of 20,000,000 gallons, of 37 sec. feet per day, which, in my opinion, would serve this community for the next twenty years, it is found that this amount equals slightly less than three per cent. of the minimum flow of the river, so that there can be no question or doubt as to the adequacy of the South Saskatchewan River to supply now and at all times in the future the needs of the province in regard to water supply.

Two schemes have been surveyed by the Irrigation Department, one to secure a supply of water from the river at Elbow, which necessitates the carrying of the water over the height of land, which at this point is 88 feet; the construction of a small reservoir on the height of land, and the flow of gravity from the reservoir along the Qu'Appelle River to Buffalo Lake, where it is proposed to construct a dam and impound the waters. From this dam it would be necessary to pump the water over a height of land approximately 300 feet high before it could be delivered to either Regina or Moose Jaw. The objections to this scheme, in my opinion, are many, the first and most important being that the river bed of the Qu'Appelle River north of Buffalo Lake is of black, swampy earth, and of such a character that any water turned into it for domestic purposes would be badly polluted; and again, the area draining into Buffalo Lake yields a flow of approximately 30,000,000 gallons per day, and the loss by evaporation and other causes amounts to practically the same figure, so that, until the consumption of water under this scheme reached the figure of 30,000,000 gallons per day, the communities

would be supplied, not with South Saskatchewan River water, but really with a mixture of Buffalo Lake and South Saskatchewan River water, in which the waters of Buffalo Lake would predominate. The other scheme presented, and for which many surveys have been carried out by the Department, necessitates the pumping of water from the Saskatchewan River near Shellstone Creek over the height of land, which is over 300 feet, with a gravity pipe line following to some extent the valley of Thunder Creek. The objection to this scheme is the height of land which it is necessary to overcome, and to the fact that the gravity pipe line would touch none of the larger centres of population which it is necessary to supply.

The estimates for these schemes run all the way from five to twenty million dollars, figuring on a supply varying from 30,000,000 to 100,000,000 gallons per day. When these schemes were propounded, of course, they did not appear visionary, but since 1912 we have come down to earth, and it is now felt that a scheme of very much less magnitude will be sufficient for the district for many years to come, and, in my opinion, any scheme which provides for a maximum of 15,000,000 gallons per day will be absolutely adequate for the next fifteen to twenty years.

Essential Points

Granted that it is proven that this district will require a supply of water from the South Saskatchewan River in the very near future, there are a number of essential points which any such proposed scheme must embrace: (1) The scheme must be reasonable in cost. (2) The pipe line must follow a route from the river which would easily be accessible to the larger centres of population to be supplied. (3) The water should be delivered at sufficient pressure to supply the urban centres without the necessity of further pumping. (4) The manufacture of material necessary for the works should be carried out as far as possible on the route of the proposed works.

Mr. H. E. M. Kensit, M.I.E.E., prepared a report to the Department of the Interior in 1913 on the question of the sources of power available for pumping water from the South Saskatchewan River, and at the conclusion of his report he says that all the proposals have been based on a gravity supply, delivering the water with little or no pressure at the level of the Canadian Pacific Railway rails in each city, and points out that the basic idea of an undertaking of this kind should be to make the supply readily available not only for the larger cities, but for a large number of the intermediate smaller towns, and that by a gravity supply this idea is not carried out. On the other hand, he points out that with a pressure system a smaller diameter pipe could be laid, and the pipes could be made to follow the route of a railroad and near the centres of population.

In this opinion I entirely concur, and in any scheme which is adopted the water supply main should certainly parallel as nearly as possible some one of the lines of railways running from the river to the centre of the district between Regina and Moose Jaw.

I have endeavored to outline the problem which faces the community to the south of the Saskatchewan River, and I think that some action should be taken by way of focusing the many schemes which have been proposed for a solution of the problem, and the Dominion and Provincial Governments should be impressed with the fact that the assistance of the engineering profession is at the disposal of these governments, so that a perfect scheme may be placed before them and carried out immediately after the completion of the great war.

STADIA SURVEYS IN THE WEST*

By G. C. Cowper, D.L.S.

THE system of deducting the areas of small lakes and ponds from the quarter-sections was copied from Ontario and Quebec at the inception of surveys in the West. However, an essential difference in the nature of the lakes in the West was overlooked.

In Ontario and Quebec the forest, in its natural state, comes right up to the bank of the lake. Generally, a beach, more or less uncovered, according to the stage of the water, slopes from the bank towards the water. These lakes are permanent bodies of water, deep in the centre, fed by creeks, and with a constant flow of water discharging into streams or other lakes. Their area is little affected by the level of the water. The owners of properties bordering on these lakes have riparian rights, which are proper and necessary for the full enjoyment of their properties.

Few Real Lakes

In the West there are very few lakes of this nature. The majority of the water areas formerly shown on the township plans are merely depressions on the ground, which fill with the melting snow in the spring, and have no outlet. The water disappears by percolation and evaporation, and at the end of the summer has either entirely disappeared, or else is concentrated in the lowest part of the depression.

These water areas vary greatly during the different seasons, and also during the wet and dry cycles which are common in the West. In dry years they practically all disappear, and in wet years may remain at high water mark during the whole summer.

Surface water has been defined as water on the surface of the ground, the source of which is so temporary or limited as not to be able to maintain for any considerable time a stream or body of water having a well-defined and substantial existence.

The majority of the water areas in the West fulfil this condition, and to these it is unlikely that riparian rights can be attached.

Previous to 1883 the survey contractors were permitted to traverse all water areas without any regard to their shallowness or permanency. So it is safe to assume from this that all surface water was traversed where it could be done so at a profit.

From 1883 to 1912 surveyors were instructed to traverse all water areas which did not dry up, the permanency of the water areas being determined as to whether or not they could be forded.

The line to be traversed was the bank, and this was held to be the line where vegetation ceased, or where the character of the vegetation and soil changed.

Areas Calculated to Banks

The areas of the fractional quarter-sections were calculated to the banks, and these areas were the ones granted in the patents.

It is apparent, then, that with the areas of the lakes continually changing, a traverse made in the spring would show a much larger area of water than one made in the fall.

In addition to this seasonal change a marked decrease in the total amount of water is apparent from year to year.

*Paper read before the eleventh annual meeting of the Association of Dominion Land Surveyors.

This drying up of the water areas has been going on for the past thirty years, and is partly due to settlement and the cultivation of the soil, and to the deepening and clearing of the stream channels and the gradual increase in farm drains.

It is most marked on traverses of larger lakes made at periods of twenty to thirty years apart. Invariably the late traverse will show more land.

This condition has naturally led to the settlers applying for additional patents as the lakes have dried up. The question arose as to whether the government or the settler, due to riparian rights, owned the dried-up beds of lakes. Opinions differ as to this, the Department of Justice holding that the settler owned the bed, and that the government could not issue a patent for what it did not own. The Registrars in the West will not issue certificates of titles for dried-up beds of lakes without a deed from the government. To overcome this the government issues "Quit Claim Deeds" for these dried-up beds.

Irrigation Act

It was decided in 1912 to patent all fractional quarter-sections bordering on bodies of water which did not have a permanent, well-defined bank by those legal subdivisions and quarters of legal subdivisions which most nearly covered the land not rendered worthless by water.

This has put an end to a settler purchasing a fractional quarter-section shown on the township plan as containing only a few acres, and acquiring by riparian rights lands which were not paid for and to which they have no equitable rights. These lands in many cases are among the most valuable in the country.

By the provisions of the Irrigation Act, passed in 1898, no grant shall be made by the Crown of any exclusive property or right in the land forming the bed or shore of any lake, river, stream or other body of water.

This Act applies to Alberta, Saskatchewan, that portion of Manitoba incorporated within the province in 1912, and the North-West Territories, with the exception of the provisional districts of McKenzie, Franklin and Ungava.

It would appear from this Act that all water areas should be deducted from the quarter-sections, but I can find no record where the Irrigation Branch has claimed the right to the beds of water areas which periodically dry up, although the case may arise where they might claim the use of a dried-up bed of a lake to use as a reservoir.

Stadia Surveys Inaugurated

On account of the continual drying up of the lakes and the changes in the banks of the rivers, frequent requests were made to the government for the resurvey of water areas. These became so numerous that it was decided in 1913 to revise all the water areas in the West. For this purpose stadia surveys were inaugurated. The water areas to be traversed are given in the manual of surveys as follows:—

1. Rivers averaging one chain or more in width.
2. All islands and all bodies of water which do not dry up and which are over five acres in area. In case of doubt as to whether a lake dries up or whether the extent is over five acres, the traverse is made.
3. Alkaline mud flats which do not bear the weight of a man walking on them are treated as water areas.
4. Lakes and ponds under five acres are reported in the field notes.
5. A marsh producing hay is not traversed and no deduction is made for its area.

The water areas most commonly encountered on the prairie, with the exception of rivers, belong to one of the following classes:—

Classes of Water Areas

(*a*) Permanent lakes which have sandy bottom, gravelly beaches and shore lines well defined. These lakes may be either spring-fed or have creeks running into them. The banks are usually quite steep so that a variation of a few feet in depth has practically no effect on the area.

Unfortunately, both for the settler and the surveyor, there are very few lakes of this class on the prairie, although they are quite common farther north. A surveyor encountering lakes of this kind is not in doubt as to whether they should be traversed or not, and if numerous enough his mileage for the season will be good.

(*b*) Shallow sloughs with well-defined banks from 5 feet to 20 feet high, with beds of soft alkaline mud. These water areas usually dry up every dry year, but the beds very seldom get hard enough to walk on and very rarely produce any vegetation. These sloughs are very common in southern Saskatchewan and Alberta. The surveyor is instructed to traverse them.

(*c*) Permanent water areas fairly deep in the centre, but with an indefinite shore line, which vary with the amount of water in depressions. A difference of a foot or two in elevation of water may cause a variation of ten chains in shore line. Along the shore it is usually marshy.

These lakes are traversed and the legal subdivisions and quarters of legal subdivisions which are rendered worthless by water are selected.

This class of lake causes the surveyor much trouble in making a satisfactory traverse, as it has no definite shore line and the edge of the water is the only line which can be readily followed. This is especially true in a wet season, as it is only by taking careful soundings and obtaining reliable information from the settlers that the legal subdivisions can be wisely selected.

(*d*) Shallow sloughs whose bottoms are either gumbo, hard alkaline mud or sand. They have usually fairly well-defined banks. They fill from surface water, and usually dry up in the fall, but always hold water in the spring and after heavy rains. In the case of a heavy snowfall in a season they will hold water the year round. The beds of these sloughs when dry produce no vegetation of any value, and if gumbo, become very hard and full of cracks.

As water areas, these do not qualify as lakes, but for agricultural purposes they are practically worthless. Whether these should or should not be traversed depends, in my opinion, on whether they usually hold water or are dry for the greater part of the year. Each separate lake has to be considered on its own merits.

(*e*) The final class of water areas met with are shallow depressions, depending wholly upon surface water for their existence. They have no shore lines, the area covered by water depending altogether on the amount of surface water. In dry years they produce hay, and after several wet years may have from eight to ten feet of water. These sloughs in a dry year would not be noticed as a water area. In wet years, however, they have every appearance of being fairly permanent, and it is only from information received from the settlers that their true nature can be determined.

There are a large number of these areas which, previous to 1915, were valuable hay meadows; that fall they

filled with water and have had water in them ever since. These sloughs will undoubtedly dry again, and many of them could easily be drained so that they would always be available as hay meadows. The traverse of these sloughs might be of value for topographical purposes. It would, however, be a mistake to deduct areas for them, as the first time they became dry the owners would apply for titles to them.

Eighty Per Cent. Would Shrink

I would estimate that at least 80% of the water areas in the West belong to one of the last three classes. Or, in other words, if all the water areas on the prairie were traversed after a series of wet years and again traversed after a series of dry years, 80% of these water areas would either show a much smaller area or would disappear altogether.

The area of a quarter section made fractional by one of these water areas, if calculated to the water line, which is the only line that can be readily traversed, would only be correct for the date of the traverse. It is very unlikely that the area of the quarter section when patented would be the same as shown on the township plan.

The nature of the water areas in the West was fully understood by the Surveyor-General and his staff. When it was decided in 1913 to revise the water areas, the following classification for the disposal of the lakes was decided on as being most likely to cover all cases met with.

Lake Classification

Class 1.—Lakes that have entirely dried up. The shore line of the lake according to last traverse is shown on the township plan by broken line and called "Former bed of Lake No. — now dry land."

Class 2.—Shallow lakes likely to dry up. The shore lines of lakes are shown on township plan by broken lines, and are called "Low land liable to flooding." No area is deducted for these lakes.

Class 3.—Lakes which do not dry up but which have shore lines subject to large variations, say, 10 to 20 chains. These lakes are usually fairly deep in the centre and surrounded by shallow water which is likely to dry up. They are shown on the township plans by aliquot parts of sections for the centre, the shallow water being called "Low land liable to flooding." Careful soundings are taken to determine what aliquot parts are worthless.

Class 4.—Lakes which do not dry up but whose shore lines are subject to moderate variations, say, five to ten chains. These lakes are shown by aliquot parts on the township plans.

A lake classified as Class 4 in a dry year might be Class 3 in a wet year.

Class 5.—Lakes whose shore lines do not change. Their shores are shown in full lines on township plans and the areas are taken to the banks.

The surveyor classifies the water areas at time of survey. If the classification does not agree with the report on lakes, it is changed in the office.

Two Extremes in Five Years

The surveys for the revision of water areas have now been carried on for the last five years. During this period we have had two extremes in the amount of surface water. The year 1914 was the climax of a series of dry years, and in that year there was hardly a drop of surface water left on the prairie. The following year the sloughs began to fill again, and owing to abnormally heavy falls of snow during the past two winters, there was more surface water in the spring of 1917 than at any other time during the past twenty years.

We have here, then, an opportunity to see if the above classifications will cover the water areas in a township investigated in both a dry and wet year, and yet give practically the same results.

The permanent lakes whose shores do not vary, and also the alkaline beds with well-defined banks, will cover practically the same area in both a wet and dry year.

The gumbo flats with fairly well-defined banks will likely be a little larger in a wet year than in a dry year. If one of these was shown on the township plan of the original survey as a lake and investigated in 1914, it would be reported as dry land; if investigated in 1917, more significance would likely be placed on the worthlessness of the bed when dry, and it would still be called a lake. If not shown on the township plan, no note would be made of it in 1914, but it is most likely a traverse would be made in 1917, and the water area classified as low land liable to flooding.

Dry and Wet Conditions

A traverse of a permanent lake with a variable shore line made in 1914, would contain only those aliquot parts which are worthless. The same lake would be much larger in 1917, and a traverse made then would contain a number of aliquot parts which should not be deducted from the area. However, if careful soundings are taken and reliable information obtained from the settlers, the worthless aliquot parts may be selected, the remainder of the lake being called low land liable to flooding. If both traverses have been carefully made, the aliquot parts considered worthless should closely agree.

The hay sloughs depending on surface water, would not be considered as water areas in 1914, and if traversed in 1917 would, if their nature could be ascertained, undoubtedly be shown as low land liable to flooding.

So that if the same township was investigated during a dry cycle and again investigated during a wet cycle, the area shown on the township plans as being worthless, with the exception of shallow lakes previously traversed, should be practically the same. There would, however, be a number of low-land-liable-to-flooding areas shown on the plan of the township compiled from the investigation made in the wet years.

Reliable Information Needed

This close agreement can only be obtained if reliable information can be had from the settlers, and I regret to say that I know of no other subject on which the western settlers disagree so much, as on the true character of these water areas.

As pointed out, the condition of the water areas in the West depends almost wholly on the winter snowfall and the amount of evaporation the next season. As these move in cycles there are a large number of water areas which are alternately flooded land and dry land. Some of these beds produce hay when dry, while others are worthless. It would appear that if the water in the hay sloughs were drained into the worthless beds, considerable land of value would be reclaimed and a number of permanent lakes formed. Much valuable information as to the feasibility of these schemes could be very cheaply obtained by having a leveller attached to a stadia party.

I might add that frequent requests are made to stadia parties for information as to the drainage of these lakes.

The nature and extent of the water areas is continually changing as are also the banks of the rivers, so that it is unlikely that the township plans made now will show the

true area of the fractional quarter sections five, ten, or twenty years after the survey.

The settler receiving a patent for a fractional quarter section from the government should receive patent for all the land in the quarter section at that date.

The only positive way of doing this would be to have the water areas surveyed at the time of granting the patent. This could very easily be done if Dominion land surveyors were appointed as homestead inspectors at each land office. The survey of the quarter section could then be made at the time of inspecting the improvements at no additional cost.

During a succession of wet years the settlers want deductions made from the areas of their quarters on account of water. During a succession of dry years they want additions made to the areas. The one for reduction of taxes and amount due on their pre-emptions and the other so as to have more land to sell. As these cycles occur periodically, it is quite possible that a lake might be shown on the township plan at the time of original traverse, to disappear with the second investigation, only to appear again during the third or wet cycle. If investigated during the next dry year, it would again appear as dry land.

To guard against this seeming discrepancy in our surveys, no body of water not previously traversed should be shown as water unless it has been continuously flooded for at least five years, or unless it is apparent that the bed is worthless.

No lake should be shown as dry land unless it has been dry for at least five years. A case might arise of a boundary lake investigated in one township during a dry year and called Class 1, and investigated in the adjacent township in a wet year and called water. The township plans would then show the same feature as dry land in one township and as water in another township.

Following is a partial list of Canadian patents recently issued through the agency of Ridout & Maybee, Toronto: Alfred Matthews, suction blower; Eduardo Murphy and Americo Anzulovich, earth boring machine; Abel Nordstrom and Carlos A. Oberg, drying apparatus; Henry F. Brown, apparatus for cooling, humidifying and filtering air; John W. George, rotary engine; Sidney C. Vinen and Chas. Johnston, centrifugal concrete pole machine; Acme Stamping & Tool Works, cable clamps.

Advocates of the deformed reinforcing bar have ample field for publicity efforts among the members of the firm who recently addressed to the Truscon Steel Co. the following letter:—"Gentlemen—We received order of steel reinforcing bars. We find you sent 70 pieces ½-in. x 32-ft. round rib straight bars. We wanted these to be smooth round bars so they would, after being coated, slip in concrete as it expanded or contracted. Please ship 70 pieces of ½-in. x 32-ft. of smooth round bars and advise us where to return the above rib bars. We hope you will arrange to exchange as we do not wish to blacksmith out the ribs to smooth out bars."—Engineering News Record, of New York.

Colonel Yate, in the British House of Commons, last month, asked the Secretary of State for India what steps the Government of India proposes to take to inaugurate an early investigation into all possible sources of water power in India, with a view to a thorough hydrographic survey of the whole of that country with regard to electric power. The Secretary replied as follows:—"The Government of India propose to constitute a small committee of electrical, mechanical and irrigation experts to visit the different provinces and, after conference with the local officers, to examine promising sites and to report whether a detailed survey is worth undertaking. The local governments are being asked to collect information, both physical and commercial, in advance, in order to facilitate the committee's investigations."

TRANSPORTATION DURING THE WAR

"TRANSPORTATION burdens due to the war rendered it necessary to depart from the usual practice by which railways in Canada were operated as single and independent units," says a pamphlet entitled "Canada's War Effort, 1914-18," issued by the Director of Public Information, Ottawa. "The first step taken in that direction was an amendment to the Railway Act during the session of 1915-16, when, on the request of the Board of Railway Commissioners, the board was empowered to take traffic in a congested grain area from the line to which it was tributary, and hand it over to other lines at any intermediate points at which a transfer could or should be made.

"The power thus conferred on the board has been used to a large extent. It has enabled the large grain production of the West to be marketed practically without loss, through the diversion of traffic to the route, irrespective of its ownership, which at the time was least congested; and it has enabled the transportation of grain and flour to Great Britain and the continent to be maintained at the greatest possible speed. Thousands of cars of grain grown in Canadian Northern prairie territory have been thus diverted from congested Canadian Northern areas over the lines of the Canadian Pacific and Grand Trunk Railways. This practice, commencing with wheat, was extended to coal and then to the movement of other bulk commodities. In general, wherever it would afford quicker transportation, re-routing has been carried out. The result is that the Canadian lines, insofar as actual transportation is concerned, have been treated as a single unit and worked for the purpose of obtaining the best results.

"During the past winter a specially heavy burden was laid on Canadian transportation. The entry of the United States into the war created great industrial and agricultural activity, which, together with the movement of troops, caused the American railway lines and terminals to become blocked. In the meantime, the shipment of foodstuffs could not be interrupted. A special programme was, therefore, put into effect to co-ordinate, to the fullest extent possible, the whole wheat movement from the North-West, and as a result wheat and flour were carried for overseas transportation by the Canadian lines in such a way that the whole of the transportation desired was effected without delay to the ocean carriers.

"In order to provide a freer and more perfect co-ordination of the systems, the Canadian Railway Association for National Defence, now termed the Canadian Railway War Board, was formed. The activities of the War Board have materially assisted the railways to cope with the problems created by the war.

"The government has helped to bring about these results, particularly by the purchase of 260 locomotive engines of various types and about 17,000 freight cars, a number of which are leased by the government to the systems that have not been in position to obtain satisfactory deliveries for their requirements."

Under the title of "Some Excavating!", a contemporary tells the following Munchausen tale, showing the quality of the mud in Flanders: "A soldier walking along a road noticed a hat, which he attempted to kick out of the mud. What was his surprise to find a head under it, and to hear a voice calling for help. When the man was extricated, he said: 'I was on horseback.' So together they proceeded to dig out the horse. The horse's mouth was found to be full of hay taken from a wagon which had sunk still farther down!"

LETTER TO THE EDITOR

Open-Spandrel Arch Bridges

Sir,—I am appending a list of Canadian open-spandrel arches, which is the type now used for arches of the longer span of considerable rise. I am anxious to get this list as complete as possible and am writing to a number of engineers in order to make sure, so far as possible, that none escape me. I believe it is complete except for a foot bridge in Guelph. However, I should be much obliged if any of your readers could tell me of any other bridges that should go on this list.

OPEN-SPANDREL ARCH BRIDGES OF CANADA, 1918.

	Clear span of main arch.	Number of spans.	Engineer.
Saskatoon Bridge ..	150 ft.	7 spans.	Prov. Gov't., Regina,—D. Luten, Consulting Engineer.
King George Arch, Oakville, Halton County, 1912	135 ft.	Length of floor, 476'—9 spans..	Jas. Hutcheon County Engineer; Frank Barber, Consulting Engineer.
Port Arthur, 1913..	130 ft.	1 span..	L. M. Jones.
Wadsworth Arch, Weston, 1910	118'6"	1 span..	Frank Barber.
Crawford Street Bridge, Toronto..	81'4"	3 spans.	Chas. Power, Chief of Dept. Rys. and Bridges; J. S. Burgoyne, Chief Asst. on Design; L. N. Edwards, Chief Asst. on Construction.
Fergus Bridge, Wellington County, 1912	80 ft.	1 span..	Bowman & Connor.
Kleinburg Arch, 1913, York County Highway Commission .	65 ft.	1 span..	E. A. James, Engineer to Comm'n.; Frank Barber, Consulting Engineer.
Victoria Bridge, Brantford, 1911, Market St. South.	60 ft.	5 spans, total length 250 ft., width 64 ft.....	T. Harry Jones.

I might call your attention to the list of bridges, purporting to be complete for spans of over 75 feet, given on page 60 of the "Proceedings of the Twelfth Annual Meeting of the Ontario Good Roads Association, 1914."

FRANK BARBER,
Consulting Engineer.

Toronto, Ont., August 23rd, 1918.

The Province of New Brunswick has sold to the public at par $300,000 of six per cent. twenty-year debentures. The sum of $200,000 was first offered, but the demand proved so great that an additional $100,000 was issued. The money will be used to improve the roads, and the principal and interest is payable from motor vehicle fees.

HAMILTON CITY ENGINEER'S REPORT

E. R. GRAY, city engineer of Hamilton, Ont., has submitted to the Board of Control of that city combined annual reports of the engineering and waterworks departments for the two years ended December 31st, 1917. These reports have been published in one volume of about 160 pages and cover, 6½" x 10", coated paper, illustrated by diagrams and photographs.

Among the features to which the report calls attention is the systematic inspection of bridges at regular periods, which has been inaugurated during the past two years with excellent results.

To Design Storm Sewers

The sewer division is proceeding with the collection of information upon which to base the design of a system of storm sewers. The study is now well advanced. During the past two years this division has constructed a number of local improvement sewers, tendering in competition with contractors.

A detailed pole survey was made by the engineer in charge of the city lighting division over that section of the city where the overhead wiring will be eliminated.

A systematic card index of all plans has been installed by the office engineer, resulting in a considerable saving of time, as there are approximately 3,500 plans on file.

A waterworks appraisal is being prepared and when complete will enable the department to calculate more readily the cost of water.

It is expected that the 10,000,000 Imperial gallon, steam-turbine-driven, centrifugal pumping unit being made for the city by the Turbine Equipment Co., Toronto, will be delivered in December, 1918. The 10,000,000-Imperial-gallon, motor-driven, centrifugal pumping unit has been awarded to the same company, who are agents for the De Laval Steam Turbine Co., of Trenton, N.J., and will be installed at a later date.

Water Consumption Increasing

The water consumption of Hamilton is still increasing. The average pumpage, 127 Imperial gallons of water per 24 hours per capita, is considerably higher than the average consumption by American cities and almost twice the consumption by cities where the services are metered.

Monthly inspections and reports are made by the mechanical and electrical engineer in regard to all pumping equipment in the various stations.

Mr. Gray recommends the construction of a duplicate supply main from the Ferguson Avenue high-level pumping station to the Jolley Cut, at an estimated cost of $3,000.

He also urges that some action be taken to determine the cost of power supplied for pumping purposes at the Beach pumping station, the last definite statement received having been dated February, 1916.

The department is preparing a complete and accurate record of all waterworks valves in the city, so that anyone will be able to locate a desired valve.

May Buy Thawing Apparatus

Due to the unusual severity of the weather, great difficulty was experienced during the past winter with frozen water services, over 350 services having been thawed out, chiefly by electricity. The expense in connection with this work amounted to about $2,000. The apparatus used belongs to the Dominion Power and Transmission Co. Mr. Gray recommends the purchase of such apparatus by the city at an estimated cost of $1,600.

In his report to Mr. Gray under date of March 21st, 1917, the roadway engineer, E. M. Whitby, says:—

"It is interesting to note that from 70 to 75% of our asphalt repairs are being made on five streets constructed in 1910-11. These pavements were all laid two inches thick without a binder. They represent approximately 8½% of the total asphalt area."

The report shows that there are 992,905 ft. of water mains of all sizes in Hamilton, 1,835 hydrants and 1,634 valves.

The population of Hamilton on December 31st, 1917, was 107,832; the acreage, 6,450; the assessed value, $82,704,840.

The engineering staff is as follows:—

E. R. Gray, city engineer; E. M. Whitby, roadway engineer; J. Stodart, sewer engineer; H. J. Clarke, engineering assistant; C. E. Venator, sidewalk and lighting engineer; J. C. Wardrop, architectural engineer; J. R. Heddle, office engineer; A. P. Kapelle, secretary of the works department; C. Pearson and W. Cust, draughtsmen; Thomas Towers, superintendent of waterworks; James Weeden, street commissioner; James Bain, electrical and mechanical engineer; James Boyd, chief engineer of high level pumping station; Campbell Leckie, chief engineer, Ferguson Avenue sewage disposal station; Charles H. Pilgrim, chief engineer, Gage Avenue sewage disposal pumping station; George Dennison, chief engineer Westmount Street sewage disposal station; Edward Baker, chief engineer West End sewage disposal station.

Diagram Showing Increase in Population and Water Consumption, 1870 to 1917

Some statistics regarding the consumption of water are as follows: Average daily consumption, 13,689,012 gallons; gallons per day to each consumer, 127.8.

During the year extensions to the water mains totalled 5,388 feet. The cost of repairs per mile during 1917 was $33.06.

The average head pumped against during the year 1917 was 260.01 feet, as against 258.52 feet for 1916. The maximum total head for 24 hours was 283.77 feet, on April 18th. The maximum pumpage for 24 hours was 19,112,440 gallons, on July 30th. The minimum pumpage for 24 hours was 9,921,340 gallons, on November 9th. Average pressure on mains was 106.83 lbs. as against 103.29 lbs. in 1916. The total pumpage for 1917 was 4,996,489,493 gallons as compared with 4,474,711,870 for 1916, a daily increase of 1,429,527 gallons.

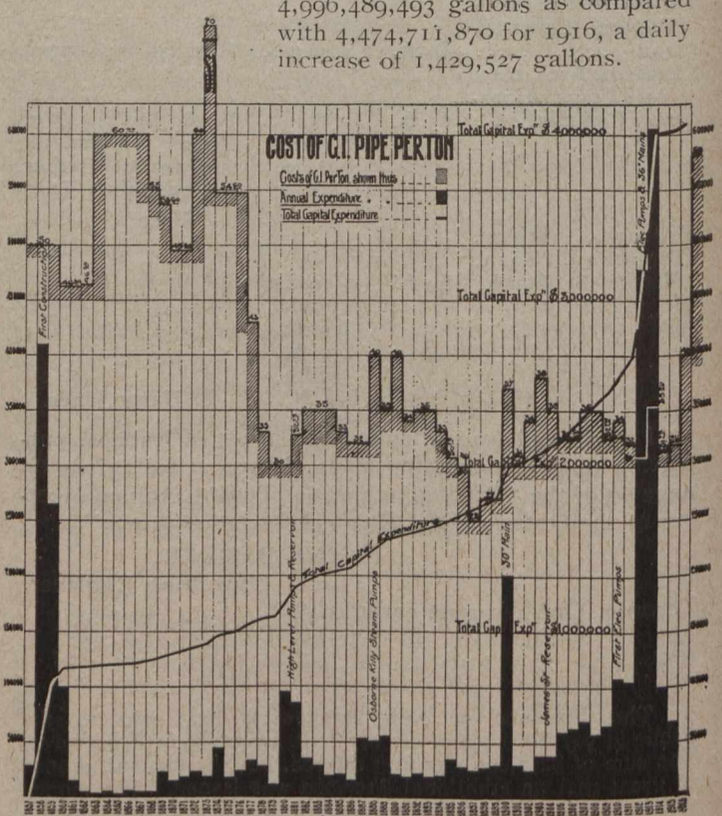
HAMILTON WATERWORKS STATISTICS

THE accompanying charts are reproduced from the recently issued annual report of E. R. Gray, city engineer of Hamilton, Ont. They show the annual waterworks costs and cost of pipe per ton for each year from 1857 to 1917, and the increase in population and water consumption since 1870.

The source of water supply for Hamilton is Lake Ontario, the water being pumped to reservoirs or directly into the mains. Some water is repumped to high-level reservoirs and mountain water towers.

Leaks and Cost of Repairs

Size	Total Mileage	No. Leaks	Leaks per Mile	Cost of Rep air per Mile
48-inch ...	0.0240	..	.....	0
36-inch ...	2.4613	1	1 in 2.4613	$ 17.37
30-inch ...	6.5064	13	1 in 0.5	126.84
24-inch ...	1.5041	1	1 in 1.504	9.34
20-inch ...	9.7174	9	1 in 1.08	28.99
18-inch ...	6.6979	6	1 in 1.116	88.49
16-inch ...	0.8003	..	.....	0.0
12-inch ...	12.7117	4	1 in 3.18	30.32
10-inch ...	2.5452	1	1 in 2.54	2.19
8-inch ...	3.5456	2	1 in 1.772	164.40
6-inch ...	134.3710	38	1 in 3.53	24.82
4-inch ...	2.0808	1	1 in 2.08	42.98
2-inch ...	1.3623	3	1 in 0.454	33.4
1-inch ...	3.7215	3	1 in 2.4	5.02
	188.0495	82	1 in 2.29	$ 33.06



Annual Waterworks Costs, 1857 to 1917

FINANCING ROAD IMPROVEMENTS*

By Archibald McGillivray
Highway Commissioner, Province of Manitoba

FINANCING road improvements is a problem in which the municipal engineer should be much interested and which he should be somewhat familiar. While the actual cost of building a road, or the method of acquiring the funds, do not enter into its theoretical design or practical construction, still they have a direct bearing on the type and standard that should be adopted for any particular locality.

An Economic Question

Generally speaking, roads are established and maintained in a country for the purpose of developing its commercial and industrial life. Doubtless the development of a country's social life is much affected by the roads existing within its borders. In fact the benefits ensuing from good roads taken from the latter viewpoints are almost immeasurable. Nevertheless, the commercial aspect of the question is the one generally viewed by municipal authorities and engineers when planning the construction of a road or system of roads, and the problem of determining the standard to be constructed in a given case resolves itself into a question that is largely economic. Therefore, before such road is built in that community, the question should be asked and established: Will the benefit secured from the construction of a certain high standard of road justify the financial expenditure involved?

Some people have a tendency to adopt the principal that the best, meaning the most expensive, is the cheapest in the end. This is only true to a very limited extent in road construction and where actual traffic conditions demand (or where it may be reasonably presumed that in the near future they will demand) the highest standard of construction. The type of road that should be built is one that will produce the necessary convenience with the least annual overhead cost for maintenance, in addition to interest on initial expenditure.

Roads being a public utility, the cost of producing them should be shared by all on as fair and equitable a basis as can be devised, and to this end the principal of government assistance is justifiable, especially on main trunk roads and main roads to markets.

Manitoba's Policy

In Manitoba, the provincial government assumes certain proportions of the cost of building the aforementioned class of roads under the provincial Good Roads Act, 1914. On main trunk roads radiating from the larger centres of population and connecting enroute the towns and villages, the proportion borne by the province as a whole is 66⅔ per cent. of the cost, the balance being paid by the municipality or municipalities through which the road passes, each municipality affected bearing 33⅓ per cent. of the cost of the section within its boundaries. The larger portion of the cost of these roads is borne by the government on the assumption that they are used to a greater extent by non-residents of the municipalities through which they pass than by the local residents, a condition which with the increased use of the automobile as a popular mode of long distance travelling, will be largely augmented in the future.

*Paper read August 8th, 1917, at Saskatoon meeting of the Engineering Institute of Canada.

On main market roads, the province pays 33⅓ per cent. of the cost of constructing earth roads, and 50 per cent. of the cost of gravel, macadam or other types of a higher standard than the common earth grade. The extra assistance is given on the superior type of road on account of the heavy cost of obtaining the materials suitable for road surfacing in many of the municipalities of Manitoba, and also an incentive to the municipalities to undertake the building of gravel and stone roads on their main lines to markets.

The cost of bridge construction on the two systems above mentioned is shared by the province in the same proportion as on road construction. On bridges which are not situated on a good roads system under the meaning of the act, the government also contributes to the cost of their construction to the extent of 50 per cent. of the cost of permanent structures entailing an expenditure of $200 or over, and 33⅓ per cent. on structures of a temporary nature such as timber and costing $500 or over.

The funds to provide for government assistance to municipalities under the Good Roads Act, 1914, are borrowed as a capital charge on the province, being raised by the issuance of provincial bonds or debentures. The present act provides for the issuance of $2,500,000, of which up to the present time about $1,250,000 has been used.

Municipalities May Issue Debentures

The act also gives the municipalities power to issue municipal debentures to defray their share of the cost of works being performed in the improvement of roads, limiting the amount that can thus be raised by a municipality to 6 per cent. of the total assessed valuation of all its taxable property, and as shown on the last revised assessment roll of the municipality. The rate of interest that may be paid on such debentures is limited to 6 per cent., and the currency of the debentures must not exceed 30 years. They are retired within the stated time by equal annual payments of principal and interest, thus eliminating the necessity of a sinking fund or of making other provisions for the repayment of principal at the expiration of the debenture period.

The retiring of rural municipal debentures by the serial or fixed annual amount method, has much to commend it over other methods, as in many rural districts the establishing of a sinking fund for this purpose imposes an undue responsibility on a rural council, the members of which in many cases are inexperienced in handling this class of business, and unless the trust funds were deposited with the banking institutions of the province at a considerable loss of interest, their reinvestment would be more or less precarious.

Government Guarantees the Debentures

The policy of the government of the province in this respect is to relieve the municipal authorities of this responsibility by insisting on the issuance of serial debentures, which, with the guarantee of the government of the province endorsed thereon, makes them a more acceptable investment to the purchaser, and a safer business transaction for the municipality. No indebtedness by which the security of the municipality is mortgaged, should be incurred without the consent of the ratepayers affected. The Manitoba Good Roads Act requires the assent of a majority of the ratepayers actually voting to a by-law authorizing the council to issue the stipulated amount of debentures before such authority is legal and binding.

The financing of road construction by the issuance of long-term debentures, say, up to 25 to 30 years, is, in the opinion of the writer, a most legitimate method. Certainly the large amount of this work that is so urgently required in this country at the present time could not be done on the "pay-as-you-go" plan. It is not, however, a question of the end justifying the means. Such works as drainage, earth grades, concrete and steel bridges and culverts—essential features in road construction—may well be considered permanent works with resultant benefit extending far into the future, and it is unfair indeed to ask the present-day ratepayers to pay at once for works of this nature.

Advantages of Sufficient Funds

Moreover, the securing of sufficient funds to undertake the construction of a system of roads permits the work being completed in shorter periods of time under more efficient organization and management, thus ensuring better work, more continuity of plans and immediate enjoyment of the resultant benefits.

The cost to the ratepayer in pursuing such a method does not necessarily entail a larger annual outlay than that at present being levied in many municipalities in endeavoring to construct roads in such length of sections as their respective yearly appropriations will permit. Many municipal councils in Manitoba are spending annually on road work as much as from $10,000 to $15,000 without getting very far in a connected system of highways. Now, from the capitalization of such an amount, or even a portion thereof, a very considerable fund could be secured with which to complete a substantial system of roads.

For instance, for several years previous to 1912, the municipality of Wallace, Man., was spending $15,000 annually in endeavoring to improve road conditions there with very poor results, the bulk of the money being spent in grading sloughs without any attention to drainage or other permanent work.

Planned 198 Miles

In 1912, the council decided to take advantage of the Good Roads Act then in existence, and with the assistance of the engineers' department, laid out a plan of work comprising the building of 198 miles of roads.

Debentures to the amount of $198,000 have been issued by the municipality, which amount, with the assistance of the province of a like amount, will carry the scheme to a satisfactory completion, giving the municipality 198 miles of well-built gravel roads, properly drained and bridged throughout with permanent concrete structures.

The annual levy on the ratepayers of the municipality to meet the indebtedness thus incurred is $12,205.53, or about $3,000 less than when the scheme was undertaken, which latter amount will more than maintain the mileage constructed for a number of years until the renewal of gravel surface is needed. Provisions for proper maintenance is a most essential feature in highway improvement work, especially should provision be made therefor where construction has been effected by debenture proceeds.

The Manitoba Act places the responsibility and expense of maintaining roads built under government assistance on the municipality; but reserves the right to the government of performing such work as may be necessary in this conection, and levying on the municipality for the money so expended, should the council neglect or fail to maintain those roads.

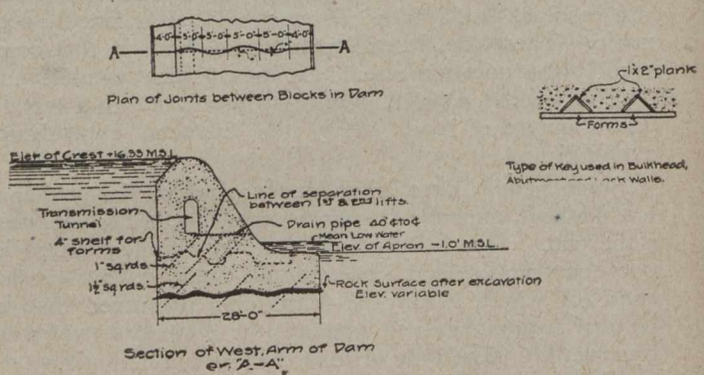
METHOD OF KEYING SECTIONS OF CONCRETE DAM*

By Frank P. Fifer

In Charge of Design Dept., Troy Lock and Dam, U.S. Engineering Dept.

THE following novel method of keying and joining sections of a concrete dam was employed in the construction of the lock and dam on the Hudson River at Troy, N.Y.:—

The type of vertical keys used between sections in the bulkhead and abutments of the dam at Troy consisted of V-shaped grooves. This V type of key was also used in the monoliths of the dam proper for that part of the structure below the elevation of the apron, in addition to which the up and down-stream halves of each section were set at an angle to each other, thus making a V-shaped joint of the whole face. For that part of the dam from the elevation of the apron to the crest, a key consisting of a series of waves or curves was adopted. A plan view of this type of joint, together with a typical section of the west arm of the dam, is shown herewith. The east arm section is similar in outline, the crest being 2 ft. lower in elevation, and similar joints were used in it.



Plan View of Troy Dam, Showing Method of Keying the Sections

The curve type of joint secures a maximum effectiveness with a minimum cost in construction. Any other joint employing projections of the V-type or otherwise, would require for the same effectiveness a very large number of pieces, requiring much handling in placing and removing them at each joint, besides entailing some breakage. The bonding shown being integral with the form itself avoids the extra work, and is ready for use as soon as the form is secured.

The sections of the dam were placed in two lifts. The first lift extended from the prepared rock surface to the top of the apron. This foundation course was anchored to the rock surface by 1½-in. square rods, 10 ft. long, slanting downstream at an angle of 45°, spaced 10 ft. on centres, and are grouted about 5 ft. into solid rock. The second lift extends from the top of the apron to the crest of the dam. The bond between the two lifts is secured by making the line of separation between them a series of knobs and depressions. In addition to the bonding, 1-in. square rods were placed on a 45° downstream slant, the ends of the rods being embedded to an equal depth in each lift. These rods are spaced about 8 ft. centre, and are about 8 ft. long. They were simply stuck into the green concrete of the foundation.

*From "Professional Memoirs."

PEACE RIVER DISTRICT: ITS RESOURCES AND OPPORTUNITIES

UNDER the above title, an interesting little booklet has been published by the Department of the Interior, Ottawa. The author is Franklin H. Kitto, D.L.S., and the booklet was prepared under the direction of the superintendent of the Natural Resources Intelligence Branch of the Interior Department.

Assistance by various other government officials is acknowledged. Charles Camsell, of the Geological Survey, and C. H. Attwood, of the Dominion Water Power Branch, prepared the chapters dealing with mineral deposits and water powers, respectively. The Director of Forestry and the Commissioner of Dominion Parks revised those portions of the booklet relating to their work.

The booklet contains 46 pages and cover and a map of the Peace River drainage basin, in the provinces of Alberta and British Columbia. There are eleven reproductions of photographs secured in various parts of the district. The booklet includes paragraphs on the Peace River, Climate, Soil, Timber, Mineral Deposits, Fur, Fish and Game, Waterpowers, Transportation, Communication, Education and Social Life, British Columbia Section, Great Agricultural Sections, High Prairie, McLennan, Dunvegan, Spirit River, Grande Prairie, Pouce Coupé, Fort St. John, Hudson Hope, Fort Vermilion, and other publications and information available.

Transportation

The Peace River District may now be reached in comfort and despatch by modern means of travel, being connected by rail with Edmonton, the capital of Alberta. Peace River, Spirit River and Grande Prairie are served by the railway and further construction is in progress. In addition, those districts adjacent to the river have the benefit of a steamboat service during the months of navigation.

The Edmonton, Dunvegan and British Columbia Railway runs northerly from Edmonton to Smith, the first divisional point, where the Athabaska River is crossed. Swinging westerly, it follows the Lesser Slave River and skirts the southern shore of Lesser Slave Lake, famous for its yields of whitefish.

High Prairie is on the line of steel at the westerly end of this lake, and marks the approximate divide between the Athabaska and Peace watersheds. The railway then runs more northerly to the next divisional point, McLennan. From McLennan the Central Canada Railway runs northerly to Peace River, reaching the edge of the valley at a point overlooking the junction of the Peace and Smoky Rivers and affording the traveller an excellent bird's-eye view of the town nestling in the valley several hundred feet below. A long descent on a side-hill grade brings one into the valley and to the edge of the waters of the Peace itself.

From McLennan the main line of the Edmonton, Dunvegan and British Columbia extends westerly, crossing the Smoky River and continuing to Spirit River settlement. Location has been carried still west as far as Pouce Coupé, and it is only a matter of time until the steel will be laid across this prairie and thence through the mountain passes to give an outlet to the Pacific Coast.

From Spirit River a branch runs southerly to Grande Prairie, a new town which has sprung up in the heart of the great prairie whose name it bears, and which has been settled so rapidly in recent years.

At present a train service is maintained on all these lines, from Edmonton and return, twice a week. Traffic is already becoming so heavy that a daily train service is probably not far distant. Stockyards and elevators are in evidence, and an efficient freight service is maintained.

Following is the chapter on water powers, prepared by Mr. Attwood, who is chief engineer in charge of the Alberta and Saskatchewan power surveys, under the Dominion Water Power Branch:—

Water Powers

Many misleading statements have been published relating to the vast amount of power available on the Peace River. This river, from the canyon in British Columbia to Vermilion Chutes in Alberta, a distance of approximately 500 miles, is a wide, swift river flowing over a sand or gravel bed, generally shallow, and through a deep valley, with gently sloping sides. The river is a mountain stream, as are many of its tributaries, and as a result the flow is very irregular, varying as much as 50 to 1 between high and low water, with the floods occurring during the summer months and the low flow during the winter.

On the Peace River there are two possible power sites: one in the headwaters at the canyon, and the other at Vermilion Chutes.

The canyon site has not yet been investigated by the department's power engineers, and while the total fall through the canyon, which is about 18 miles in length, is reported to be between 225 and 275 feet, it is not known how much of the total head can be developed. In any event, a power development at this site will be an expensive undertaking, and can only be accomplished when a market for the power is available close at hand.

The Vermilion Chutes site has been surveyed and investigated by the department's power engineers. The river at this site averages one mile in width, and takes a drop of 30 feet in a distance of two miles. The fall is concentrated chiefly at two points; the first or upper fall being in the form of a rapid, half a mile in length, with a total drop of 11 feet. The second drop is situated one and a half miles below the rapid, and is an abrupt drop of 13 feet over a limestone ledge, and is commonly called the "chutes."

At the "chutes" both river banks are low, and an effective head of 30 feet is about all that can be obtained. The continuous 24-hour power available, based on one season's discharge records, amounts to 19,100 horsepower. For nine months of the year possibly 27,300 horse-power can be developed.

The possibility of developing small blocks of power on the tributaries of the Peace has not been definitely investigated by the department's engineers. Of these tributaries, the Pine, North Pine, and Smoky Rivers have their sources in the mountains and foothills and are fed by the melting snows in the mountains during the summer months and have only a small run-off during the winter. The Moberly, Pouce Coupé, and Bear Creek, together with the tributaries below Peace River Crossing, depend upon the precipitation, are subject to floods during the spring and summer months, and have a very small flow during the winter. Further investigations may, however, reveal the possibility of storing and conserving the flood waters on many of these streams. In such an event, these streams will be capable of producing sufficient power to operate small mills, and in some cases supply the power demands of a small municipality.

The inherent disadvantages of the Peace River and its tributaries as a source of power at the present time are the irregularity of flow, the high cost of development and the absence of market.

These disadvantages may, however, be overcome by the creation of storage reservoirs to regulate the flow and by settlement in the district. As the district becomes thickly populated and towns spring up transportation facilities will be greatly improved and a market created for the power.

CONSTRUCTION OF CONCRETE SHIPS FOR EMERGENCY FLEET CORPORATION*

By R. J. Wig
Chief Engineer, Dept. of Concrete-Ship Construction, Emergency Fleet Corporation.

THE reinforced concrete ship can be built structurally equal to any steel ship.

The available information indicates with all the certainty possible, short of actual experience under service conditions, that the concrete ship will be durable for several years, ensuring satisfactory service throughout the probable duration of the present war.

The cost of the reinforced concrete ship complete will vary between $100 and $125 per dead-weight ton, depending upon the number of ships built and the conditions of construction. The cost of the hull alone will be between $30 and $40 per dead-weight ton.

The construction of concrete hulls will not interfere with the present program for the construction of steel and wood hulls, insofar as labor or materials are concerned.

The concrete-ship department has completed the detailed plans for a 3,500-ton concrete ship, so that construction can start immediately. The vessel proposed is of the same size, dimensions, and form as the 3,500-ton standard wood ship, except that the sheer-line amidships has been altered slightly and no outer keel is fitted. The general arrangement follows closely that of the above wood ship, including the number and position of bulkheads. The propelling machinery designed for the wood ship has been provided for without essential change in this vessel. The principal characteristics follow:

Length, 268 ft.; beam over shell, 46 ft.; depth amidship (at side), 28 ft. 3 ins.; draft, 23 ft. 6 ins.; full-load displacement, 6,175 tons.

Comparative Weights in Tons, Concrete, Wood and Steel Vessels

	Concrete.	Wood.	Steel.
Hull	2,500	2,300	1,160
Fittings, outfit and equipment	191	191	180
Propelling machinery	206	206	200
Margin	75	80	60
Ship (light)	2,972	2,777	1,600
Reserve feed	80	80	80
Ordnance	23	23	23
Fuel	300	300	300
Stores	40	40	40
Cargo	2,760	2,180	3,057
Total dead-weight	3,203	3,123	3,500
Full-load displacement	6,175	5,900	5,100
Proportion dead-weight to full-load displacement, per cent.	52	53	68.6

*Abstracted from special report made to United States Shipping Board.

Metacentric Height

The metacentric heights in the light (ship without cargo) and full-load conditions are, respectively, 2.15 and 2.2 ft. The best practice at the present time places these values between the limits of 1 and 3 ft. for vessels of this type and size.

Range of Stability and Righting Arm

The maximum righting-arm occurs at 51.5° and 46.5° for the vessel light and fully loaded, respectively, the extreme ranges being 89° and 81.5°, respectively.

Freeboard

The freeboard amidships at side is 4 ft. 9 ins. This is satisfactory to the representatives of Lloyd's Register of Shipping.

Period of Roll

An attempt to investigate this theoretically is a laborious operation and of doubtful value. It is seldom attempted in the design of steel vessels. It is considered safe to say, however, that the concentration of relatively great weight in the decks and shell in the concrete vessel should aid materially in increasing the period of roll.

Girder Strength or Strength of Vessel as a Whole

The strength of the ship as a girder supported on the crest of a wave amidship, hogging, and also on the crests of two waves, one at each end, sagging, was calculated for five conditions. The same basic assumption as to length, depth, and form of wave and the same method of procedure that is standard practice in calculating the strength of steel ships was followed throughout.

Condition	Maximum bending-moment, foot-tons	Maximum tons per square inch fibre-stress in Deck-reinforcement	Maximum tons per square inch fibre-stress in Keel-reinforcement	Lbs. per sq. in. fibre-stress in concrete
Ship without cargo, hogging	25 175	5.53	*2.80	728
Ship fully loaded, hogging	37 000	5.63	*2.95	766
Ship without cargo, sagging	14,400	1.28	†2.63	270
Ship light with enough cargo in forward hold to trim, sagging	11,960	1.07	†2.19	210
Ship fully loaded, sagging	9,400	0.84	†1.72	70

*Keel. †Deck.

Good practice in steel merchant-ships for a boat of this type gives a maximum stress in the outer fibre of from 5 to 8 tons per square inch, figured on the same basis as given above for the concrete ship. In addition to the stress due to the ship acting as a girder, there is local stress between frames where the plating must act as a beam over that space. This stress is seldom considered in steel ships, but has been computed in the design of the 268-ft. concrete ship.

Transverse Strength

Only for naval vessels is it the practice to compute the transverse strength with accuracy. Either the sizes of frames are taken from the books of the classification societies, or the frames are figured as beams supported or fixed at keel, bilge, or deck, as the case may be. The complete ring in the concrete boat is figured with numerous cases of loading and heeling for every frame. The strength of the transverse frames for the vessel was investigated for a large number of conditions of loading and for various immersions of the vessel. The transverse frames are designed to stand the outside water-pressure with water to the gunwales and with minimum cargo-load, for maximum cargo-load and a sagging draft of 16 ft. 6 ins., and for listed positions with loading slight and heavy.

The bulkheads have been designed to carry a head of water on either side to the deck. The collision-bulkheads,

(Concluded on page 214)

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 E. JENNINGS, Assistant General Manager

HEAD OFFICE: 62 CHURCH STREET, TORONTO, ONT.
Telephone, Main 7404. Cable Address, "Engineer, Toronto."
Western Canada Office: 1208 McArthur Bldg., Winnipeg. G. W. GOODALL, Mgr.

Principal Contents of this Issue

PEAT COMMITTEE REPORTS PROGRESS

PROGRESS is being made by the Peat Committee of Canada,—but no peat. Unfortunately this committee was appointed too late to be a factor in the coming winter's fuel supply for Ontario. Moreover, if the present limited plans are followed, this committee will not be a factor in the fuel supply for the winter of 1919-20. It will be the winter of 1920-21 before any considerable quantity of peat is on the market, and by that time public interest in the enterprise may be thoroughly chilled.

The Dominion government owns a large peat bog at Alfred, Ont., where exhaustive experiments were conducted some years ago and about 3,000 tons of standard peat fuel were manufactured and sold to householders in Ottawa and neighboring municipalities. The bog was then turned over to a private company for further development, but the company spent all of its money in getting ready to operate and had no capital left to carry on the enterprise; its plant was junked.

"The results of the manufacturing operations conducted at Alfred indicate that with strict business management, peat could be manufactured for $1.70 per ton in the field. This figure includes all charges such as interest on investment, amortization, etc.," writes B. F. Haanel, who is one of the four members of the Peat Committee of Canada. In view of this fact, should not either the Dominion government or the Ontario government have adopted more vigorous measures to manufacture peat fuel during the present summer?

The Peat Committee is doing very good work, as good work as can be done under the limited program laid down by the two governments, but the question arises as to whether or not that program is inadequate to meet the needs of the situation.

Not more than 120 sun-drying days per annum can be depended upon in Ontario in the manufacture of peat, and the last of those days of this calendar year are slipping by with no prospect of any peat being laid out to dry.

When the committee was appointed last spring, their first task was to design a modern machine. Ernest V. Moore, of Montreal, was engaged as consulting engineer to design two plants. One of these will be very similar to the one he built at Alfred, but re-designed in the light of the experience there obtained. The other is an entirely new design, which, if successful, will no doubt prove a distinct step forward in the manufacture of machine peat fuel. It is a device that will excavate the peat, lay it out to dry, do the necessary marking into cubes and, when the peat is dry, harvest it into a pile. "The one piece of apparatus will do all this work," says Mr. Moore, "and it will be more simple and less costly per ton of output than any peat plant known to date."

After these plants were designed, manufacturing arrangements were made by the Committee. The factory of the William Hamilton Co., at Peterborough, Ont., is being largely devoted at present to the requirements of the Committee. The two plants will cost about $45,000, but neither of them is likely to be ready for extensive operation this year. It is expected that the two plants will produce a minimum of 20,000 tons next year, and the present program does not call for any additional plants to be put into operation.

As the fuel value of peat, compared with the average available anthracite, is as 1:1 8/10, 20,000 tons of peat will replace less than 12,000 tons of anthracite coal during the winter of 1919-20. The governments' present idea is to see whether this 20,000 tons of peat, manufactured at Alfred under commercial conditions, can be sold through ordinary dealer channels, or by some other entirely commercial means, so as to compete satisfactorily with other fuels. If the new peat plant is demonstrated to be a commercial success (the government experts have no doubt about its success from a manufacturing standpoint), the governments do not intend to go into the peat business. They intend to leave it to private individuals who own peat bogs throughout Ontario, and who, aided by the official balance sheet in regard to those 20,000 experimental tons, may be able to secure capital to develop their bogs as private enterprises.

Assuming that the experimental sales made in the winter of 1919-20 are commercially successful, it is quite doubtful whether private financial arrangements, and the manufacture of additional plants for private companies, can be carried out with sufficient rapidity to enable those private companies to make any considerable amount of peat fuel even for the winter of 1920-21.

Peat appears to be a most desirable fuel from every standpoint excepting its bulk, and with the present fuel scarcity, no one is likely to complain about that. Its calorific value is about 7,000 B.t.u's as compared with 12,500 for anthracite (or probably 10,000 for the average anthracite received in Canada last year). There is no clinker from peat, it ignites very readily, and its ash is very fine.

Raw peat contains 88% water, and as the material is of a colloidal nature, not one-sixth of the water can be pressed out; yet in some way the moisture content must

be reduced to about 25%. Peat may be dried by heat, but to do this more fuel is required than would be supplied by the manufactured peat. Solar energy is the only known form of energy that is cheap enough to be economical in the manufacture of peat, therefore the material has to be laid out in the sun to dry after it has been excavated from the bog, and it requires about thirty drying days.

The new plant which the Peat Committee is manufacturing is apparently a model one, including bucket excavators, a very efficient macerator, conveyers for laying the material on the field, spreaders, markers and mechanical harvesters. An industrial railroad system will grid-iron the bog and little cars will carry the material to the railroad. The whole plant has been admirably arranged and the able chairman of the committee, Arthur A. Cole, of Cobalt, Ont., is to be congratulated upon his work.

Mr. Cole has been well assisted by the other members of the committee: B. F. Haanel, of Ottawa; R. A. Ross, of Montreal; and R. C. Harris, of Toronto. Mr. Cole and Mr. Harris represent the Province of Ontario, and Mr. Ross and Mr. Haanel represent the Dominion Government. Mr. Haanel is secretary of the committee.

The powers and duties of the committee should be much extended. The government might be able to expropriate other peat bogs, if necessary, or to make some arrangement for their use upon a royalty basis, and if enough additional plants could be manufactured in time, peat could be made a real factor in the fuel situation during the winter of 1919-20 at least.

It is understood that the Peat Committee of Canada has prepared a statement reporting progress and relating its plans for next year. Undoubtedly this statement has been submitted to Hon. G. Howard Ferguson, Ontario Minister of Lands, Forests and Mines, and to Hon. Martin Burrell, Dominion Minister of Mines. The statement should be issued to the press. If the people were to realize that a huge quantity of most desirable fuel exists within the borders of Ontario, popular opinion might support the government in taking any steps necessary to develop that fuel in the wholesale manner required by present and prospective exigencies.

CONSTRUCTION OF CONCRETE SHIPS

(Continued from page 212)

fore and aft, were designed for 1,500 lbs. per square inch in the concrete, and 1,600 lbs. per square inch in the steel. The steel stress in the engine-room bulkheads was advanced to 20,000 lbs. per square inch. In the design of bulkheads for steel ships it is common practice to allow a unit stress in the steel of 22,000 to 23,000 lbs. per square inch, so that these assumptions are conservative.

The deck is designed to carry 5 ft. of water or equivalent, which is in excess of the loading on the decks of standard steel ships being built by this corporation.

S. J. McQueen and Co., of Fort William, have made good progress on the addition to the Northwestern elevator at Fort William, and expect to complete the work about October 1st. The present capacity of the elevator is 500,000 bushels, but this will be doubled when the addition is completed. The addition is of reinforced concrete and a reinforced concrete sub-station is also under construction to handle power for the elevator. This sub-station is being equipped by the Canadian Westinghouse Co., of Hamilton. S. J. McQueen and Co. were the designing engineers of the work as well as the contractors.

PERSONALS

THOMAS P. HOWARD, managing director of the Phœnix Bridge and Iron Works, Montreal, has been appointed deputy-director of war supplies for Great Britain.

A. R. DUFRESNE, assistant chief engineer of the Department of Public Works since 1909, has resigned his position and accepted that of manager of the St. John Dry Dock & Shipbuilding Co., of St. John, N.B.

R. A. ROSS, of Montreal, has been appointed chairman of the Lignite Utilization Board. Mr. Ross is a prominent member of Montreal's governing commission. He is also an active member of the Council for Scientific and Industrial Research.

E. L. TAIT, formerly assistant engineer of maintenance of way of the British Columbia Electric Railway, of Vancouver, B.C., has been appointed engineer of maintenance of way, succeeding A. C. Eddy, who has been granted an indefinite leave of absence for military duty, having joined the U.S. Army.

W. S. FALLIS, formerly western manager of the Sherwin-Williams Company of Canada, Limited, Montreal, has been appointed managing director of the company and will remove from Winnipeg to Montreal to take up his new duties on September 1st. Mr. Fallis has been with the company since 1899.

Lieut. K. W. MORTON, of New Westminster, B.C., formerly on the staff of C. C. Worsfield, resident engineer for the Dominion Department of Public Works, has recently been transferred to the Canadian Engineers, after a two months' course in military engineering under the Royal Engineers. Lieut. Morton went overseas with a draft of the 1st Depot Battalion.

A. U. SANDERSON has been appointed as chief engineer of the Toronto, Ont., filtration plant to succeed the late F. S. Hemming. Mr. Sanderson's salary has been fixed at $2,500 per annum by R. C. Harris, commissioner of works, of Toronto, subject to the approval of the Board of Control. WILLIAM SCOTT has been appointed as assistant to Mr. Sanderson at a salary of $2,000 a year.

Col. GEORGE H. EMERSON, former general manager of the Great Northern Railway, with his party, is now co-operating with the Czecho-Slovak troops near Irkutsk. The party is engaged in repairing bridges destroyed by the Bolsheviki forces. Col. Emerson went to Siberia in November, 1917, to superintend the work of double-tracking and re-equipping the Trans-Siberian Railway.

A. E. PHILP, chief engineer of the Canadian Pacific Ocean Service's S.S. "Empress of Britain," and senior chief engineer of the service, has recently been awarded the Order of the British Empire. Mr. Philp served the customary apprenticeship of seven years in a locomotive works in Glasgow, Scotland, and later entered marine service with Elder, Dempster & Co., with whom he served in all engineering grades to that of chief. He has had considerable experience in transport work, having taken part in the Benin and Ashanti expeditions of 1895-96 in that connection. He also aided in transport work during the South African War.

OBITUARY

JOHN JONES, a former street commissioner of Toronto, died last Sunday following a long illness. Deceased was 76 years of age.