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MISSING

The Canadian Engineer

A Weekly Paper for Civil Engineers and Contractors

Hyman Tannery Building, London, Ont.

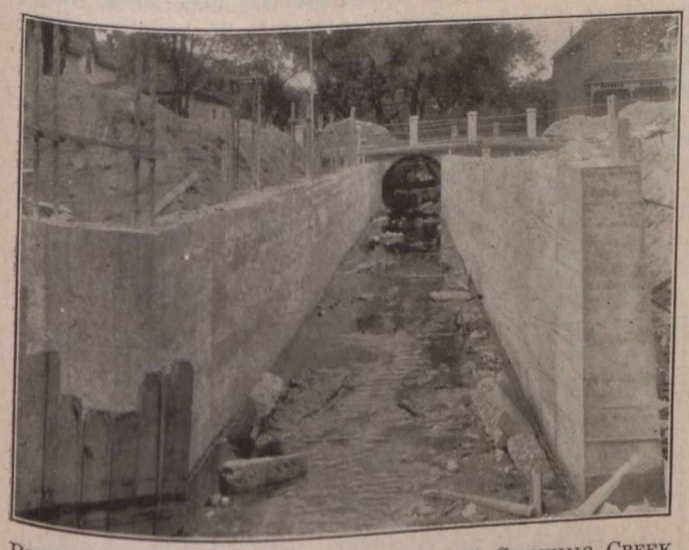
Reinforced Concrete Beam and Slab Construction Found More Economical Than Flat Slab Construction — Difficult Foundation Conditions Met — Cold Weather Concreting Without Tarpaulins — Summary of Essentials for Successful Concreting in Winter

By R. E. W. HAGARTY
Consulting Engineer, Toronto

UNUSUAL methods and results may be claimed for certain features of the design and construction of the Hyman Tannery buildings recently completed at London, Ont. These buildings, which are to be used for light manufacturing purposes, by C. S. Hyman & Co., of London, consist of one large building 75 by 180 ft., five stories high, with foundations and columns designed for two additional stories, and a small building, approximately two stories high, not designed for additional stories.

General Characteristics

The general construction of both buildings consists of reinforced concrete skeleton, with brick curtain walls and steel sash. These beams and columns are exposed on the side and rear elevations, thereby saving a considerable amount of brick wall. The exterior beams are made sufficiently deep to act as lintels,—the steel sash framing directly into the bottom of the beams. The window sills are of concrete, while the jambs are brick. Standard solid steel sash with plain glass was used, also standard horizontally-pivoted ventilators, with chain operators.



PHOTOGRAPH TAKEN SEPTEMBER 4TH. 1919 SHOWING CREEK THROUGH CENTRE OF BUILDING WHICH CAUSED UNUSUAL FOUNDATION DIFFICULTIES

On the ground floor it was necessary to make provision for drainage, and this was accomplished by sloping the reinforced concrete floor construction to the required pitch to carry the water down the pipes located at convenient places in the floor.

The floors are finished with a 1-in. coating of 1:1 concrete, which has given an excellent result, surfaced with "Agatax" floor finish.

Foundations

One of the interesting features of the construction of these buildings from an engineering standpoint has been the foundations which were constructed on very soft, wet sand and quicksand. The footings, accordingly, were carefully designed to spread the load in such a way as to produce as nearly as possible uniform pressure, and, therefore, provide for uniform settlement of the building.

FORMS IN PLACE FOR FIRST FLOOR COLUMNS, OCTOBER 1ST, 1919

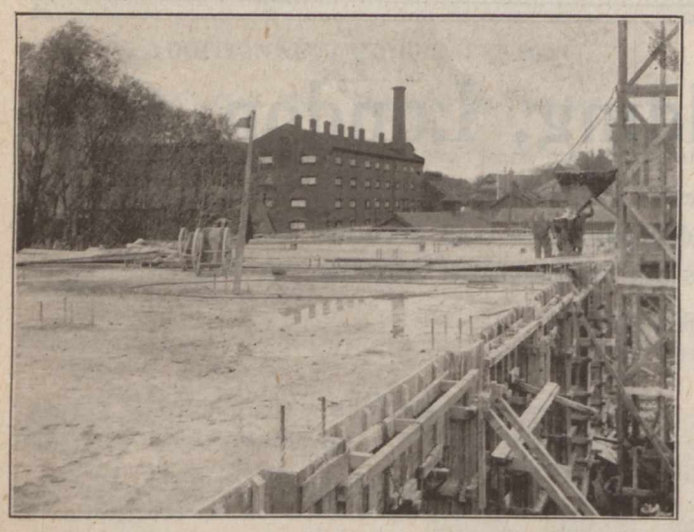
Making the foundation more difficult, a creek ran through the centre of the small building. The contractors experienced considerable difficulty in this section of the work, but succeeded in getting the concrete into place for the footings by damming up the creek with bags of cement to prevent the flow of water from entering the excavation until the concrete could be poured.

A very rich mix of cement was used, in order to provide against certain unavoidable loss of cement, due to "flooding." However, the building has been completed for several months, and there is no evidence of settlement of any kind. No settlement cracks have appeared anywhere in the structure. Considerable care had to be taken to construct all footings to such a depth that the lateral movement of the wet sand between footings of different elevations did not take place. It was noteworthy that these footings matured

under water, which could not be prevented from flooding in immediately after the concrete was placed.

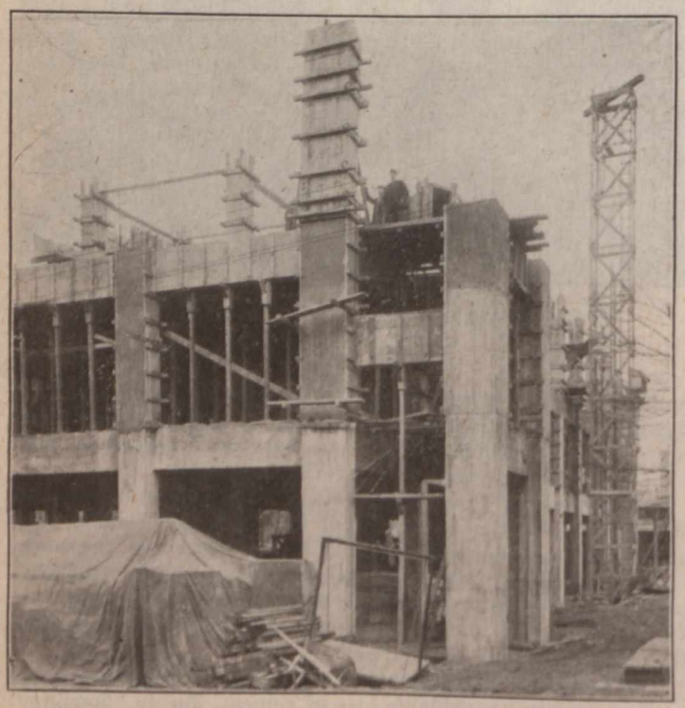
Type of Construction

The general type of construction of the superstructure is reinforced concrete columns, beams, girders and slabs. The buildings were originally designed for the flat slab con-



POURING BEAMS AND SLABS FOR FIRST FLOOR, OCTOBER 21ST, 1919

struction, but the beams and slab floor construction was finally adopted because a very considerable saving, amounting to several thousand dollars, was effected by making this change. Not only was the construction of the floors more economical with beams and slabs designed for the same loads and the same factor of safety in the materials, but also the building was made considerably lighter, and therefore, loads on the foundations were lighter and provision for



FIRST AND SECOND FLOORS NEARING COMPLETION, NOVEMBER 26TH, 1919

them was much easily made. The columns are of the square type throughout the building, reinforced with four bars each, with wire lacing, 8 and 12-in. spacing. The mixture of concrete which was used in the columns was 1: 1: 2, while the mixture in the floors and beams was 1: 2: 4.

The reinforcing for all floors and beams throughout was square twisted steel bars. The beams had bent bars and stirrups, while the slabs had bars bent up over the supports, with square twisted temperature bars at right angles to the main reinforcement.

The stairs were constructed throughout of reinforced concrete with a rise generally of 7 ins., with a 10-in. tread. The stairs and landing slabs were poured after the main construction of the concrete frame. Concrete vats were constructed in the basement, consisting of 8-in. concrete walls, without reinforcement.

Cold Weather Concreting

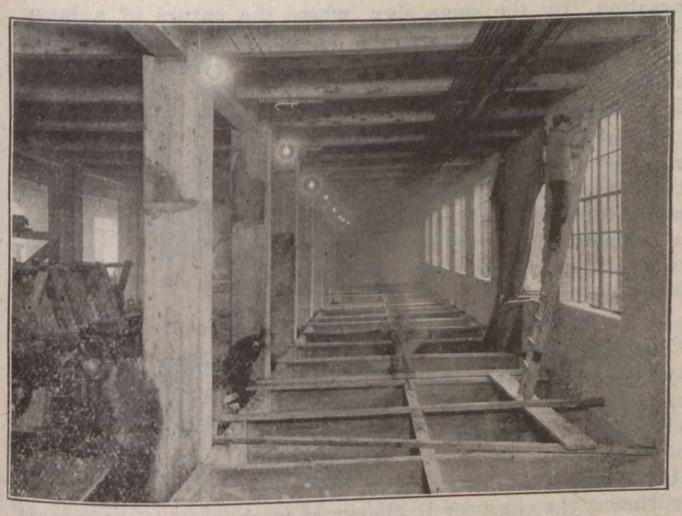
Another extremely interesting feature of the construction of these buildings, from an engineering standpoint, was the fact that they were constructer during the cold

CONCRETING IN VERY COLD WEATHER WITHOUT TARPAULINS, DECEMBER 10TH, 1919

months last winter, and no trouble was experienced from the effects of cold weather. Contrary to the usual practice, tarpaulins were not used. The entire process of pouring the concrete to prevent freezing consisted mainly of taking extreme care in the proportioning and heating of the materials, also in the method in which they were placed. The writer has always maintained that in this lies the secret of cold-weather concrete. The concrete was placed quickly after leaving the mixer and covered as soon as possible. The forms were stripped from the slabs from one to two weeks after the pouring of the concrete, thereby enabling the concrete to cure, which it will invariably do to better

ANOTHER STORY POURED—NOTE THAT FORMS HAVE BEEN REMOVED FROM THIRD STORY, DECEMBER 31ST, 1919

advantage if exposed to the air than if covered up by the forms. There is no danger of collapse, provided concrete has obtained its initial set before freezing takes place; this conclusion the writer has come to after the observation of



INTERIOR CONCRETING PROGRESSED WITHOUT HALT THROUGHOUT COLD WEATHER OF JANUARY WITHOUT USING TARPAULINS, PHOTOGRAPH, JANUARY 7TH, 1920

many structures constructed under cold weather conditions.

The main requirements for cold weather concrete appear to be:—

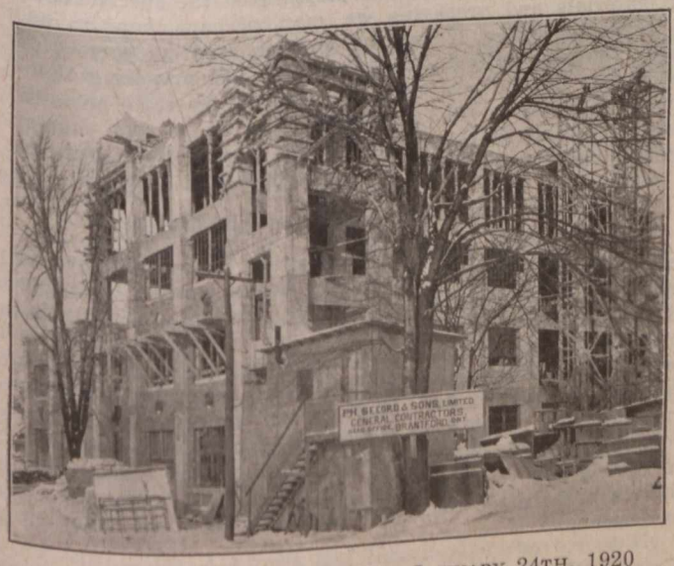
1.—The use of a rich-mix concrete;

2.—The thorough heating of stock piles, sand, stone and gravel by steam jets for some hours before these materials are used;

3.—The use of hot water;

4.—Thorough mixing of the concrete;

5.—Placing of the concrete with special care as to speed, after leaving the mixer;



BUILDING NEARING COMPLETION, JANUARY 24TH, 1920

6.—Covering the concrete in the buggies, while in transit from the mixer to the forms;

7.—Sprinkling the forms with hot water, if possible;

8.—Covering the concrete as soon as possible, after placing.

Outstanding Features

Summing up the general conditions of the construction of these buildings, these outstanding points are noteworthy:—

(a) That concrete can be successfully constructed during the winter months without the use of tarpaulins.

(b) That for the same factors of safety, the beam, slab and girder type of reinforced concrete design is undoubtedly a more economical method of construction for buildings, of this class at least, than the type known as the flat-slab construction.

The reinforced concrete design was prepared for the architects and contractors by the writer. H. C. McBride, of London, Ont., was the architect, and P. H. Secord & Sons, of Brantford, Ont., were the general contractors. The materials were tested at the mills by the Canadian Inspection & Testing Co.

GASOLINE MOTORS ON CONSTRUCTION WORK

BY J. NAPIER
Gasoline Engine Specialist, Montreal, Que.

WHEN a contractor purchases a gasoline-driven outfit for material-hoist, pump, or concrete mixer, he is only concerned with one question: "Will it *go* when I need it *most*?"

Most gasoline motors will, if given fair play, more than repay their cost. They should, with care such as the writer proposes to suggest, prove a most profitable investment to the owner. The gasoline-powered unit has several pronounced advantages over steam under ordinary circumstances. Portability, ease of obtaining fuel, quick starting, economy of operation, compactness and light weight, are powerful factors in favor of the gasoline-driven plant. So far as reliability is concerned, the modern gas-engine of reputable make is just as dependable as any steam-driven machine.

Over 15 years' experience with internal combustion engines has led the writer to the conclusion that the chief trouble in their operation is the man who operates them.

Some time ago the writer received a hurry call to investigate "trouble" in the 6 h.p. engine of a hoist. The superintendent of construction in charge of the job met the writer with the following remark: "Well, you are here, but I don't think you can do anything with this junk-heap; we've tried all day." Here was the trouble:—

1. Valve cage had been removed and replaced without gasket. Result,—no compression. (Man's fault.)

2. Batteries absolutely no good and very carelessly kept in box with assortment of nuts, nails, washers and dirt. (Man's fault again.)

3. More water than oil in crank-case, which any novice should know would not help lubrication. (Encore.)

4. The machine had been sent from the contractor's yard with bearings loose, and "assembled" apparently by throwing the parts together. (Blame anybody.)

The machine is of good make, but had been simply abused. The "mechanic" who overhauled it would no doubt have made a first-class ditch-digger, but his ideas of machine-assembly were certainly very elementary.

Suggestions to Engine Owners

For the guidance of those who have invested in gasoline engines, the writer respectfully offers the following suggestions:—

(a) Every maker of repute supplies definite instructions for operating and caring for his particular make. See that the instructions are kept with the engine or filed with some responsible person on the job. The man who is running the machine may not be able to read, but the superintendent or foreman should know how.

(b) Insist, unless the operator is known to be competent, that he keep his hands off the valve setting, magnets, etc.

(c) Don't try to run an engine "on nothing." Oil is the cheapest extravagance.

(d) Give the operator half an hour each day that the engine is used, to clean up, oil and grease where necessary, and see that he does it.

(e) Where steam is being used on same job or in vicinity, don't let the operator put steam cylinder-oil in a gas

engine. The writer caught our esteemed friend on the 6 h.p. engine, just as he was preparing to empty about a quart of oil used for a steam-driven mixer, into the base chamber of the hoist-engine. That little joke would probably have cost the contractor somewhere around $150, as the time he would have spent getting the mess out of piston-rings, etc., would have meant 20 or 30 men idle.

Give your outfit a show! It represents your good money, and on that money you expect, and are entitled to, a fair return in service. Encourage the operator to use his intelligence, and if at the end of the job his machine shows that it has been well cared for, make the encouragement tangible. Buy machines equipped with some simple system of magneto ignition. There are several excellent magnetos. But if batteries *are* used, don't waste time and money on the old-fashioned "single cell." Use a good multiple battery, of which there are reliable makes; the etra "first cost" will be more than repaid by longer service. Such batteries are usually enclosed in a metal housing, which protects them from dampness and injury, besides greatly reducing chances of short circuits.

The writer is well aware of the difficulties contractors encounter in obtaining efficient help except at wages out of all proportion to the mental effort involved. The only remedy the writer can suggest is for superintendents or foremen to obtain an elementary knowledge of gas engine operation. As before mentioned, instruction books—usually very explicit and non-technical—accompany every engine, and if the care of such machines be put upon a properly organized basis, there should be no call for a specialist, except in rare circumstances, such as *periodical* overhauling.

CLASSIFICATION OF CONTRACTORS BY STANDARD RATINGS*

By Leonard C. Wason
Aberthaw Construction Co., Boston, Mass.

MAKING preparation for things that do not happen, usually implies waste—sometimes waste of energy, sometimes waste of both energy and money. Maintaining an organization to attract business, only a fraction of which is eventually secured, is a necessary process, yet it contains elements of waste. Ordinarily, this waste is not considered serious if it bears a sufficiently low ratio to actual sales. But, as the ratio increases, there must come a time when selling costs will constitute an intolerable burden of overhead expense.

Without carrying this part of the discussion further, it will probably be admitted that, if that part of selling—or business-getting—which consists of barking up empty trees, could be eliminated, or materially reduced, much waste would be avoided.

These considerations hold particularly in the case of construction enterprises. He would be rash who would attempt to guess the amount of fruitless expenditure on the part of contractors in the preparation of estimates and proposals for work—especially public undertakings, that is never awarded them. Their only means of gaining consideration is to go through the formula, knowing all the time that the engineer in charge always may rule out a favorable proposal on the ground that the contractor making it is probably incapable of meeting all the obligations entailed in his offering.

Avoiding Waste Through Classification

Under existing circumstances the right to reject any proposal must, of course, reside with the engineer in charge. Yet waste would be avoided by restricting the competition in advance to contractors who can render satisfactory proof of capability for the type and magnitude of the work to be undertaken. Such capability should be immediately determinable in accordance with a system of marks or ratings which a board of engineers and contractors could, without much difficulty, devise.

Given a task of known magnitude, it is a simple matter to compute the amount of liquid capital which a contractor must eventually command in order safely to assume the operation. By the same sign, when the nature of a large work is clearly understood, it is foolish to consider—even in theory—placing it in the hands of a contractor who is unable to supply adequate proof of special experience on his own part and on that of the supervisors in his employ.

The item of "plant"—equipment— is of constantly increasing moment. What kind of plant, and in what quantity, does the projected development require? Does the competing contractor own this equipment? If so, in what condition has he maintained it? If not, how and where does he propose to get it, and what assurance has he that he will not be disappointed?

Insuring Existence of Essentials

Eliminate any one of the factors, capital, experience, equipment, and the multiple—satisfactory accomplishment—can never be obtained. That is virtually self-evident. The advisability of insuring the existence of the factors before talking of setting them into operation seems equally clear. If the suggested system of marks, or ratings, were in active existence, the engineer in charge of work on which proposals were to be invited would announce at the outset the limits of ratings within which the proposals of competing firms or individuals would receive consideration.

Such a definition of terms would rid the competition of the purely speculative and irresponsible bidder, as well as of the honest but over-optimistic seeker after business. In so doing it would relieve the engineer of the grave responsibility of rejecting certain bids solely on the basis of his judgment, or of general report. It would have the further advantage of bringing the bidding contractors to a clearly understood common denomination of ability and intention that would make comparisons of their proposals a simple one. In a larger proportion of cases than under existing methods, the award would go to the one making the most attractive offer.

If we ever reach the point of specifying the qualifications of contractors instead of stopping at the specifications of materials and processes, we may, perhaps, hope to see adopted the device of making payments to contractors to cover the cost—often extremely heavy—of preparing their estimates. It is a cost that must be met by some one,—in the first instance the contractor. But he, in due course, dilutes it through the profits of the jobs that he obtains, thereby making them pay toll to the jobs that he loses.

Guaranteeing Skill, Integrity, Responsibility

Here, then, is waste, much of which is avoidable by the comparatively easy and completely honest process of rating contractors according to proved qualifications. Nothing invidious is implied in this process, nor is there anything in it to prevent the contractor from securing added recognition as it is due. It would, indeed, stimulate effort by recording growth through various stages, each carrying its virtual guarantee of capability. Hence, in accomplishing an economic good, it would, in addition, achieve the ethical good of raising the whole tone of the contracting business from that of a too often uncertain trade to that of an honorable profession.

*From the Bulletin of the Associated General Contractors of America.

A committee of the U.S. Engineering Council appeared recently before the House Committee on Appropriations at Washington, D.C., in support of the appropriation of $250,000 asked by the U.S. Secretary of the Interior for investigating the possibilities of the Boston-Washington superpower project. The work would be undertaken by the U.S. Geological Survey, and would cover water, steam, electric and oil power production and distribution, in relation to the industries within the territory surveyed. On May 11th, the House passed the Sundry Civil Bill carrying an item of $125,000 for this purpose.

HOUSING AND TOWN PLANNING: A SURVEY*

By H. L. Seymour
Assistant to Dominion Housing and Town Planning Adviser

WE have all learned from bitter experience that when we commence a survey which we hope will occupy but a limited length of time, very frequently we are unable to finish within that time, so I want to say right now that in the event that I might not be able to complete my survey, the principal point I wish to establish is the need for amended town planning legislation in Ontario, and incidentally I hope to make notes of the surveyors' opportunities and duties in connection with housing and town planning.

Elements of Town Planning

It has been stated that town planning as an art has been practised for many centuries, but that as a science it is in its infancy. One of the earliest evidences of town planning being treated as a science, it seems to me, was the passing of legislation to make town planning really effective, thus involving the public control of land development. In most countries land may be taken for public use, or it may be controlled without taking in the interest of public health, safety and general welfare. An example of these two points has been cited and may be found in the case of a city which wishes to control the collection and disposal of garbage. The city may expropriate private land as an incinerator site. It may, without any public expense, issue regulations for the manner in which the private owner is to provide receptacles for garbage, and the points at which these receptacles are to be placed for collection by the city. To extend these principles to all matters that affect the general welfare is the object of town planning.

It may be said in brief that town planning should deal with health, sanitation, and economy in development of land and in amenity and convenience therewith. Any owner may develop private property as he pleases, but only if such development is consistent with the general welfare. On account of this restriction it assures, however, to every owner or user of land suitable access to streets, desirable sanitary conditions, plenty of light and air, and for example, in a residential area a house may be built with assurance that no factor or other undesirable building will be erected in that area.

Early Legislation

Among the early town planning legislation enacted was that in Italy in 1865—the Italian Municipal Town Planning Act, which has since been amended and extended. This Act was largely a development and extension of the law for the public expropriation of land. Since that date, in nearly every European country, town planning acts have been enacted. As a great advance on her previous legislation, in 1919 France made town planning compulsory. Communes along the Seine, cities of 10,000 inhabitants, or growing cities of 5,000 inhabitants must within three years have planning schemes formulated and in force.

In India, Bombay has a Town Planning Act, while the Madras Town Planning Bill was introduced in 1918. Ceylon had a Housing and Town Planning Improvement Ordinance as early as 1915.

South Africa, Australia and New Zealand have recently prepared town planning bills, and even in Japan, the Town Planning Committee of the Imperial Japanese government is at work.

In the United States, city planning acts have existed or are being enacted in several of the States, and there are now hundreds of cities and towns that have their City Planning Commissions for planning and developing schemes of various kinds. Zoning, an important part of town planning, on which I hope to dwell in greater detail later this evening, has attracted the attention of a number of cities, some of which have already zoning ordinances in force. Briefly, zoning deals with the character of buildings and the dividing of a city into areas, in which the use, height and density of buildings are specified. The British Housing and Town Planning Act of 1909 resulted from previous public health and housing legislation. It dealt only with new or partly developed areas and was not a compulsory act. As amended in 1919, cities and other areas of 20,000 population by 1923 must have prepared and submitted town planning schemes, and these schemes may apply to any land, not only to new development.

In Canada, the first provincial town planning acts (for in Canada town planning legislation is a matter for the provinces and not the Dominion) were founded on the British Housing and Town Planning Act of 1909. According to the New Brunswick Act of 1912 and the Alberta Act of 1913, only undeveloped or partly developed areas can be dealt with by town planning schemes. The Nova Scotia Act of 1912 was amended in 1915, and at that time was heralded as the most advanced town planning legislation in the world—it was a compulsory Act. By recent amendment on account of war conditions, the time has been extended, and now by 1921 every city, town or municipality shall have either prepared a town planning scheme or a set of town planning by-laws. The Act, like most of the recent provincial town planning Acts in Canada, applies to any area. For example, in the city of Halifax, under their town planning scheme it was possible to prescribe a building line on an important street in the centre of the city, so that future widening might be carried out without undue expense. A large new building has been erected which had it been built up to the street line, would probably have blocked the widening of the street for years.

Modern Acts

Prince Edward Island, Manitoba and Saskatchewan have modern acts adapted to the needs of the respective provinces, that of Saskatchewan being the only compulsory Act. Under the Saskatchewan Act, regulations regarding new streets and subdivisions have been prepared by the provincial government for those cases in which municipalities have not already made their own regulations as authorized by the act or for new development in an organizad territory. It may be of interest to surveyors to note what information has to be shown on the development plan according to these regulations:—

"The plan accompanying the application shall be drawn to a scale of not less than 200 ft. to one inch, the north point being plainly indicated thereon. It shall contain in its title the word "development" and shall:—

"(a) Describe the location of the area affected and show the location of the boundaries of the quarter sections or registered parcels containing the land to be subdivided;

"(b) Show the location and dimensions of all streets, lanes, roadways, blocks, public reservations and other proposed subdivisions;

"(c) Show the location and dimensions of the streets of adjoining registered subdivisions;

"(d) Show the names of the streets and the number of the blocks, and indicate thereon the number and widths of the lots within each block;

"(e) Show any railway right-of-way, irrigation canal, drain, ditch or easement affecting the land included within the plan;

"(f) Show drainage channels and creek beds, the contours of the normal water level and the high-water level of all bodies of water, any buildings erected on the property and the approximate outlines of copses or other wooded areas;

"(g) Show contour lines in light brown ink of every difference of five feet in elevation of the land to be subdivided, referred to mean sea level, where possible;

"(h) Show the area it is proposed to register outlines;

"(i) Bear the signature of the party or parties for

*Lecture delivered at the last annual meeting of the Association of Ontario Land Surveyors.

whom the survey is being made, the date of the preliminary survey and the signature of a Saskatchewan land surveyor;

"(j) Indicate by dimensions, properly tied to the lot boundaries, the proposed line of frontage of any buildings intended to be erected;

"(k) Show contours, and, if such area is the property of the owner submitting the plan, show by broken black lines a proposed street plan for an area exterior to and within 700 feet of the boundaries of the area it is proposed to register."

No Legislation in Quebec or British Columbia

Two provinces, Quebec and British Columbia have as yet no town planning legislation, although draft bills have been prepared in both instances. In neither of these provinces, it is understood, is town planning to be compulsory, but in one of these provinces the need for proper topographical maps is so keenly felt that the preparation of such maps is to be made compulsory. . A section of the proposed bill in connection with this matter reads as follows:—

"(1) Within two years after the passing of this Act each local authority shall submit a topographical map to the Minister, for approval, on a scale of not less than 400 feet to one inch showing any contour levels of irregular land which it is desirable to plan, and all existing features within any part of its area which is built upon or, is likely to be built upon, including:—

"(a) All registered streets, distinguishing between those which are improved, by the construction of pavements, sidewalks, sewers, water mains, etc., and those which are not improved;

"(b) All registered lots distinguishing between those which are built upon (indicating the character of the building thereon), and those which are free from buildings;

"(c) All railways, street railways, canals, rivers, timber areas, public open spaces, and other physical and artificial features within the area built upon or likely to be built upon."

Ontario Legislation

The Ontario City and Suburbs Plans Act was passed in 1912. In a paper read before the Ontario Land Surveyors' Association in 1915, T. D. LeMay, city surveyor of Toronto, fully described the provisions of this act which sought to give cities of 50,000 or over a voice in the planning of land adjoining city limits which sooner or later by annexation might become part of the city itself.

Mr. LeMay has given a great deal of attention to the question of planning in Toronto and vicinity, and he has arranged with the Geodetic Survey of Canada for the establishment of control for topographical surveys and considered such questions as the monumenting of block corners and has studied Ontario Acts and city By-Laws that relate more or less directly to housing and town planning features.

As to the City and Suburbs Planning Act, now as amended, "The Ontario Planning and Development Act," one member in discussing Mr. LeMay's paper on that Act in 1915, made the following statement:—

"I think that question of town planning is one of the most important questions that is now before the people, but it seems to me it should go more deeply into the matter and not only as to the condition of the streets and roads, but also that of the parks, then the factory districts and other things of that sort should be included."

Within the last year the following appeared in the Toronto "Globe" relative to the Ontario Planning and Development Act:—

"The act is too narrow in its scope, and is concerned primarily with the planning of roads and streets. Ontario should lead the way in progressive legislation, but unless steps are taken to amend this act it will soon be the last province in the Dominion that has not a satisfactory town planning act.

"The act does not deal with such matters as the density, height and character of buildings; the building lines on street frontages and air space surrounding buildings; the relation between width of streets of varied widths and the density and height of buildings fronting thereon; the limitation of the number of dwellings on given areas of land—which is the only cure for overcrowding; the zoning of cities so as to separate the factory, business, residential and agricultural areas in a comprehenive scheme; adequate sanitation, convenience and amenity in the grouping of buildings, the safeguarding of the municipality against claims for compensation in respect of alleged injury to property due to proper and reasonable limitation of the use of land for the sake of health and safety and the necessary power to pull down buildings that contravene the law or are dangerous to health and safety.

"An effective town planning act such as has been passed in six provinces of the Dominion would give these powers and more in one act and would prevent the development of civic evils in the future that are not regarded as incurable."

More recently at a South-western Ontario Town Planning Conference, there was adopted a resolution providing for the representatives of municipalities to interview the provincial government with reference to new legislation.

Housing

You will gather from the foregoing that town planning must concern itself with building development as well as the planning of roads. Housing is a particular form of building, and is associated even in the title in the British Housing and Town Planning Act. It is that part of town planning which deals particularly with the living conditions of people. It is with the health and happiness of people that those of us who are interested in town planning are to a large extent concerned. Desire for human betterment is a desire, no doubt, possessed by us all, and one that should not be lost sight of in whatever line of activity we are engaged.

To provide for the shortage of houses, produced largely by war conditions, the Federal Government by orders-in-council of December 3rd and subsequent dates, made provision for the loan to the various provinces of the Dominion of $25,000,000 at 5% for housing purposes.

There are four conditions under which loans are granted by the Federal Government to the provinces:—

(1) Each province must prepare a general housing scheme meeting with the approval of the Federal Government.

(2) The maximum loans to be advanced on different types of houses are fixed.

(3) The ownership of land on which houses may be erected is stipulated.

(4) The terms of years for repayment of loans are specified.

All the provinces in the Dominion, except Alberta, have passed housing acts, but two of the provinces, i.e., Prince Edward Island and Saskatchewan, have not as yet complied with the conditions above mentioned.

According to the Dominion orders-in-council, one of the objects of the loan is "to put within the reach of all workmen, particularly returned soldiers, an opportunity of acquiring their own homes at actual cost of the building and land acquired at a fair value, thus eliminating the profits of the speculator."

Town Planning Institute

I would now like to draw attention to an extract from the Report of the Committee on Town Planning, read at the last annual meeting of the Association of Dominion Land Surveyors at Ottawa:—

"After considerable deliberation, this committee has decided that this report might be most useful if made in the form of suggestions to surveyors. The first suggestion is that all surveyors should develop or retain an interest in town planning. It is probably not necessary to remind the members that through the efforts of a committee, of this association, the recently formed Town Planning Institute came into being. Many surveyors have joined this institute. To others we urge an interest in at least a local

way. Take some thought of your home town, of its planning problems, and how you can help as a leader in public opinion if not in a strictly professional way."

The membership of the Town Planning Institute of Canada comprises surveyors, architects, engineers, landscape architects and barristers. It is made up largely of the first three classes, and I want to make brief mention of their respective relations to housing and town planning. Their primary functions, as I understand it, are respectively to survey, to design and to construct, and these activities must, of course, be closely correlated for any comprehensive development where or if all three classes are engaged.

Town Planning a Collaboration

The surveyor should make a survey of all conditions and factors that may effect a housing or town planning scheme, the incidental staking of street and lot lines becoming possibly quite a subsidiary part of his work. He should report and investigate matters as they exist, or have existed, and by such activities facilitate the planning. To survey in the fullest sense of the word and to record conditions—this is the "statics" of town planning.

The engineer is essentially the constructor to carry out the plan in the constructing of street utilities and buildings, and in the providing of transportation facilities. He is concerned with the "dynamics" of town planning.

The architect has been till recently the only one of the three professions mentioned who is fitted by his training for imaginative design. Engineers cannot be said to design in the sense in which I am using the term, and we find some of our best engineers recognizing this. For example, as to bridge design I was very pleased to listen to an address in Ottawa recently by Frank Barber, of Toronto. In his address he made it quite clear that aesthetics in bridge design—and he, was speaking particularly of concrete bridges with which he is so familiar—did not consist in the calling in of an architect to add a few decorations at the last at extra expense, but of working in co-operation with the architect from the start and obtaining a design not only more beautiful, but certainly at no greater cost—a bridge that would truthfully proclaim to the eye its functions.

Functions of the Surveyor

A number of our surveyors are qualified municipal engineers. I have heard some surveyors criticised for posing as engineers without the necessary experience or knowledge. My own criticism of surveyors is that they have never really in deed or thought become surveyors in the wide sense of the term at all. This point I wish to emphasize, as I think it the most important point in the relation of the surveyor to town planning. But if the engineer-surveyor becomes sufficiently skilled in imaginative design to fully take advantage of and correlate all the facts he has collected, and all the conditions he has surveyed, I think we have the "makings" of a town planner who can correlate the work of surveyor, architect and engineer in any large work, or who in a small development can successfully carry it through.

It is in these smaller or at least newer developments that I feel there is the best immediate future for the surveyor. He is well accustomed to subdividing lands, now he must think of developing them. City planning, so engaging to the imagination, frequently involves engineering problems of a nature requiring the services of our best engineering experts. But it is particularly towards new or rural development that our town planning legislation in Canada is directed. Nearly every municipality has its own engineer, fewer a surveyor or architect. In any housing or town planning development sewer, water, street improvements will generally be carried out by the engineer of the municipality, leaving the competitors in private practice, the surveyor and the architect—the one legally qualified to layout the development, the other qualified (legally in some provinces) to design houses. Who is to do the planning—the architect or the surveyor, or possibly an engineer in private practice?

The field is open, gentlemen—it's a fair race. Each profession can advance good reasons for winning out. But the surveyor should and can be on the ground first because in nearly all instances a topographical survey is necessary.

(To Be Continued)

G. H. DUGGAN TO RECEIVE HONORARY DEGREE

GEORGE HERRICK DUGGAN, president of the Dominion Bridge Co., Ltd., of Montreal, who graduated with the class of '83 from the University of Toronto is to receive the degree of D.Sc. from his alma mater on June 3rd. Mr. Duggan has not only taken a leading part in engineering development in Canada, as for examples in the design and construction of the Quebes bridge, but he has for some years taken an increasingly prominent part in financial undertakings. He is a director of the Royal Bank and a member of other well-known institutions.

The Canadian Concrete Shipbuilding Company's new steamer "Permanencia," the first ocean-going vessel of concrete built in Canada, was launched at North Sydney on May 19th.

Paul Kircher, resident manager of the Canadian Concrete Products Corporations, Ltd., whose plant is at Chatham, Ont., has changed his headquarters from New York to the People's Gas Building, Chicago.

The brickmaking industry is to be initiated at Matheson by the Matheson Products Co. One hundred and ninety acres of land, with a clay deposit that is said to be 40 ft. deep, will be utilized by the company, which will manufacture brick, tile and terra cotta ware. The plant will have a capacity of 20,000 bricks per day to start with, and this output is expected to increase in a short time to five times this amount. R. S. Potter is president of the company, and R. L. Ollman, manager.

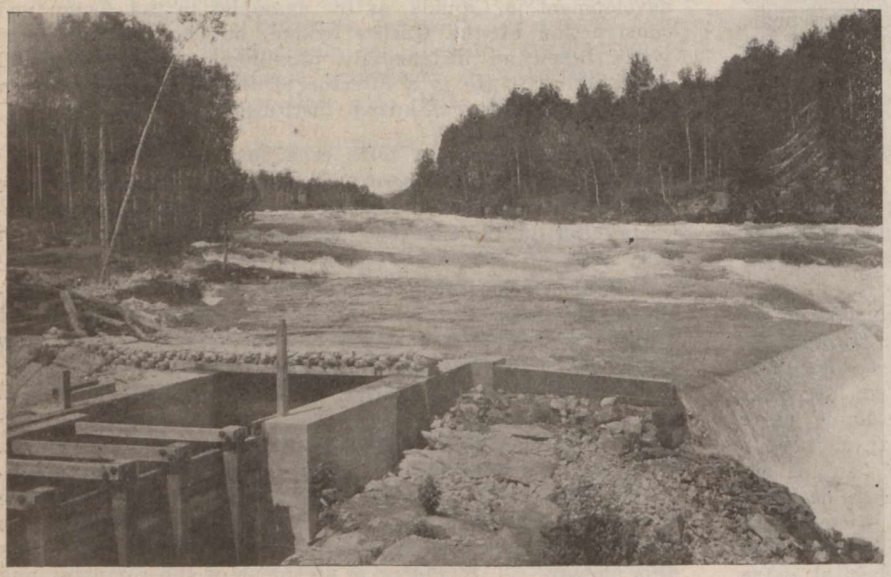
An experiment in irrigation, which, if successful, may lead to the adoption by the federal government of a large irrigation policy for eastern Canada, is being conducted at the Experimental Farm this season. This is practically the first irrigation test being conducted for the benefit of the east, although government irrigation schemes have been worked out in the west. Three acres have been leased near Hartwell's Locks for the experiment, and half of this will be irrigated. A comparative report will be prepared when the crops are harvested, and if the irrigated area shows to advantage it is possible that recommendations for a large irrigation may be made. The water will be taken from the spillway of the locks, and roots and corn will be sown.

Dr. Van. H. Manning, Director of the Bureau of Mines, Washington, D.C., in tendering his resignation to President Wilson recently, said: "In leaving the government service there comes to me, as it has over and over again, the thought that, although this government spends each year many millions of dollars in useful scientific work for the benefit of the whole people, the monetary recognition of its scientific and technical servants is not sufficient to enable them to continue in the service for the people. This has been especially true within the last few years, when it has been impossible for many men to remain in the government service. With the marvellous expansion of the industry in this country and the growing necessity of science to industry, the scientific bureaus have been utterly unable to hold their assistants against the competition of industry, which is taking their highly-trained men at salaries the government does not pay, or even approach. I feel very deeply that there ought to be more adequate compensation for the scientific and technical men in the government service, so that none of them may be compelled to accept positions on the outside. Many of these scientific men are of fine type for government work; care little for the commerical field; take an intense professional interest in their tasks, and are of inestimable value to the government."

NIPIGON RIVER POWER DEVELOPMENT

ALTHOUGH the general characteristics of the Hydro-Electric development on the Nipigon River at Cameron's Falls were described in *The Canadian Engineer* for June 12th 1919, much new matter with respect to the project is contained in a recent issue of the Bulletin issued by the Hydro-Electric Power Commission of Ontario, from which the following is quoted:—

The demand for the use of electrical energy in New Ontario having become such that additional generating capacity was found a necessity, the Hydro-Electric Power Commission of Ontario, at the urgent request of the municipalities in the Thunder Bay district—viz., Port Arthur and Fort William, has undertaken the construction of a large development on the Nipigon River at Cameron's Falls, with provision in the initial installation to take care of the immediate power requirements and with plans so arranged as to permit extensions to be made from time to time as the occasion demands.



INTAKE OF TEMPORARY DEVELOPMENT

The construction of new terminal grain elevators, the demands for power and pulp and paper industries and the possibilities of the mineral resources of the district, as well as the rapidly increasing loads in both cities, were indicative of a demand far in excess of the available capacity of the only existing source of supply—the Kaministiquia Power Co.—and the necessity of making provision for the immediate demands of the future caused considerable anxiety to the local authorities. After careful consideration, a solution of the problem was finally secured by the assistance of the Hydro-Electric Power Commission of Ontario, the ultimate result being a decision to proceed at once with the construction of the Nipigon development.

The city of Port Arthur is being served at the present time with electrical energy through the medium of the Hydro-Electric Power Commission of Ontario, under an agreement between the latter and the Kaministiquia Power Co., bearing date of September 9th, 1909, and an agreement between the municipality and the commission running concurrently with the power company's agreement, both of which expire in December, 1920. These agreements provide for a supply of power up to 10,000 h.p., any excess of this amount necessitating additional development.

During the period of preliminary investigation concerning the future power supply of this district, considerable attention was given to a development at Silver Falls, near Dog Lake, on the Kaministiquia River, located approximately 30 miles west of Port Arthur. This scheme was abandoned, however, due to the ultimate capacity being limited to a maximum of approximately 25,000 h.p.

Lake Nipigon, with an area of 1,500 sq. mi., provides an ideal natural storage basin for this development, whereas the total drainage area of the Nipigon River, including the lake, approximates 9,100 sq. mi.; the maximum stream flow of the river approximates 3,600 sec. ft. without regulation; with regulation on Lake Nipigon, however, 5,800 sec. ft. is obtainable for the operation of the completed development at 75% load factor, thus assuring ideal conditions from a hydraulic operating standpoint.

Neither the Kaministiquia Power Co., nor the abandoned scheme of development at Dog Lake (both of which are located on the Kaministiquia River) is capable of taking care of high load factor loads, such as pulp and paper mills, to the same extent as the various possible developments on the Nipigon River, due to greater variation of stream flow and much smaller drainage area.

As the demand on the Kaministiquia Power Co. was approaching the ultimate capacity of the development, and as the requirements of the Twin Cities could not be adequately provided for from this plant in addition to prospective pulp and paper mill loads, and, furthermore, as the Dog Lake scheme did not permit provision being made for sufficient power for future increase in demand, nor provide for supplying energy to the various high load factor loads which would form future requirements, it was quite obvious that the Nipigon site should be adopted, and arrangements were perfected after due consideration for starting the work immediately.

Although Cameron's Falls is located at a greater distance from the Twin Cities than Silver Falls, thus necessitating a longer transmission line from the former source, yet, it was considered that the available capacity of the various sites on the Nipigon River, including Cameron's Falls, would provide for the needs of the district to better advantage, as the demands of the class of load peculiar to the neighborhood were such that it would be only a question of time when the Silver Falls development would be inadequate to meet all conditions and the ultimate result would involve a further development on the Nipigon River.

CAMERON'S FALLS, NIPIGON RIVER

By-laws were submitted in Fort William and Port Arthur, January 1st, 1917, authorizing the execution of an agreement with the commission covering delivery of power from the Nipigon development, and were carried almost unanimously in both municipalities. Agreements were executed between the commission and the cities of Port Arthur and Fort William on May 17th and October 10th, 1917, respectively, and an order-in-council was passed accordingly, providing the necessary funds and authorizing the commission to proceed with the construction work.

The elevation of Lake Nipigon above the mean tide water level is 852, whereas that of Lake Superior at the mouth of the Nipigon River is 602, making a total difference of 250 ft. between the two lakes.

The various sites at which the development is possible on the Nipigon River are shown on the map reproduced on page 531 of our issue of June 12th, 1919, the total potentiality of the stream varying from approximately 100,000 h.p., based on continuous flow, to 200,000 h.p. at 50% load factor. The site chosen by the commission for the initial development is located at the foot of Lake Jessie, near Cameron's Pool.

Hydraulic Layout

The hydraulic layout involves the construction of a solid concrete dam with rollways and sluice gates in the centre section and wing walls on either side. The total length of the dam is approximately 300 ft., being 60 ft. in height at the maximum section, and involves the use of approximately 17,000 cu. yds. of concrete. Three earth dams will be required in addition to the main dam.

The forebay will occupy an opening in the natural rock walls of the stream and will be approximately 300 ft. in length. The powerhouse will be of concrete construction and is designed for an installation of six units. The forebay, headworks, powerhouse excavation and tailrace will be completed for the full development.

The ultimate capacity of the plant will be 75,000 h.p.; only two units, however, will be installed at the present time.

The turbines are being supplied by the I. P. Morris Co., of Philadelphia, Pa., and are now ready for shipment. They are rated at 12,500 h.p. at 72 ft. head, 120 r.p.m. These turbines will be vertical type, single runner, with concrete spiral cases.

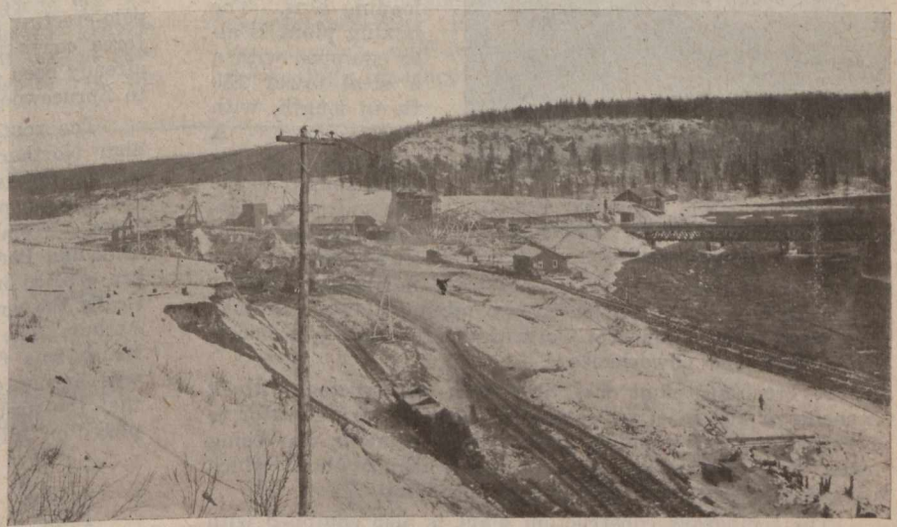
Electrical Layout

The generators are rated at 10,600 kv.-a., at 80% power factor, 12,000 v., 3-phase, 60 cycles, each unit being equipped with a direct-connected 125-kw., 250-v. exciter. A spare motor-generator exciter will be provided, consisting of a 185-h.p., 3-phase, 500-v., squirrel-cage motor, driving a 125-kw., d.c. generator. These generators are being supplied by the Canadian Westinghouse Co.

The electrical energy at the generating station will be transformed from 12,000 to 110,000 volts for the purpose of transmission to Port Arthur and Fort William. The step-up transformers consist of a bank of three 8,000 kv.-a. units with one spare. These transformers are oil insulated, water cooled; the primary voltage is 12,000, secondary voltage 63,500 at full load 80% power factor, and will be Y-connected on the secondary side.

The electrical layout of the powerhouse provides for a double 12,000-volt bus with an oil breaker between each generator and the bus, and an additional oil breaker between the bus and each transformer bank. One 110,000-volt outgoing feeder will comprise the initial installation; the completed plans, however, provide for three such outgoing lines. The electrical equipment at the power-house is so arranged that two generating units, one transformer bank and one outgoing 110,000-volt line, constitute a separate and distinct unit; consequently, the completed development will consist of three such distinct units, making a total of six generators, three banks of transformers and three outgoing lines.

At the main terminal station at the receiving end of the line, which will probably be located at a point central to the two cities, provision will be made for one 110,000-volt bus with two 22,000-volt buses, one being a main bus and the other an emergency bus. This arrangement permits each outgoing 22,000-volt feeder to be equipped with one oil-switch for connection to the main bus and one set of selector disconnecting switches for connection to the emergency bus. The emergency bus will be connected to the main bus through an oil breaker, and should it be necessary under operating conditions to cut out one of these feeders on account of trouble or for the purpose of making repairs, this feeder will be transferred to the emergency bus by the closing of the oil breaker between the emergency and the main bus, the closing of the selector disconnecting switches between the feeder and the emergency bus, and the opening of the oil breaker between the feeder and the main bus.



TAIL-RACE, MAIN DEVELOPMENT, SHOWING RAILWAY BRIDGE IN BACKGROUND

The transformer equipment at the receiving station will consist of banks of three 4,000 kv.-a. units with one bank comprising the initial installation. These transformers will be oil-insulated, water-cooled, 63,500 volts at full load, 80% power factor Y-connected on the primary side and 22,000 volts on the secondary side.

Construction work at the development site was begun by the commission during the month of December, 1918, with a force of about 50 men, this number being gradually increased according to progress made until a maximum of 675 was reached.

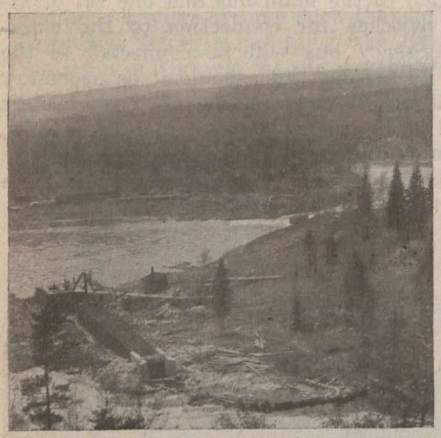
Construction Plant

Due to the location of the development considerable work of a preliminary nature was found necessary before proceeding with the construction of permanent works, such as the construction of a temporary power plant, one mile of railway siding (standard gauge), including a bridge across the river, as well as various camp buildings and cottages for the purpose of providing living quarters for the staff and the workmen. The temporary power plant consists of two turbines obtained from the old Otonabee plant, near Peterborough, which are utilized to drive one 350 kw. generator and three Ingersoll-Rand compressors of 200 h.p. each.

The electric generator provides energy for lighting camp buildings and operating motor driven pumps, whereas the compressors supply air for operating rock drills. The temporary powerhouse building consists of a concrete substructure with frame superstructure. Water is supplied to the turbines through a timber flume 200 ft. in length with the intake end submerged directly in the rapids of the river.

To avoid ice trouble, considerable of which was experienced during the first few months of operation, this flume was covered with tarpaulin, and in addition to this protection, live steam was introduced at the intake end, all of which was found to give satisfactory results.

The additional construction plant consists of two steam shovels, one No. 60 of 2½ yds. capacity, and one No. 50 of 2 yds. capacity, together with one locomotive crane, five locomotives, four dump cars and five derricks.



CAMERON'S POOL, SHOWING FLUME AND POWERHOUSE OF TEMPORARY DEVELOPMENT

A concrete mixing plant has been constructed which consists of two ¾-yd. mixers with bins above for rock and sand, an elevator for carrying cement to the mixers and a derrick for loading bins. The mixing plant is also equipped with a a steel tower 150 ft. in length, with steel chutes. A second mixing plant similar to the one already described is being installed at the northwest corner of the powerhouse site. These two mixing plants will take care of all of the concrete work of the forebay, gate house, wing walls and powerhouse.

A crushing plant has also been constructed with a capacity of 200 tons per day, with the necessary elevator to a screening and washing plant. Arrangements are being made for the erection of a second washing plant, which will be placed at the rock pile in the dump.

The temporary construction plant is also equipped with a machine shop, carpenter shop, car repair shop and grain house.

The camp buildings are very complete, being equipped with electric lights, steam heating and a bath-house including showers. A hospital with a resident doctor also constitutes part of the camp accommodation, and a private telephone system has been installed connecting all portions of the work. A private telephone line has also been constructed connecting the camp buildings with the village of Nipigon.

CONSTRUCTION CAMP BUILDINGS, NIPIGON DEVELOPMENT

Up to March 31st, 1920, 173 acres of land had been cleared, 64,000 cu. yds. of solid rock excavation made, 74,000 cu. yds. of earth excavation completed and 8,000 cu. yds. of rock crushed. These figures do not include any work in connection with the temporary powerhouse or the permanent railway, or the bridge across the river, but constitute excavation which has been made in connection with the powerhouse, forebay and gatehouse.

The approximate cost of the temporary power plant was $46,000, whereas the machinery which has been installed and is being used for construction purposes, represents an outlay of $18,000. The cost of the railway from the main line of the Canadian Northern Railway to the camp site was $31,000, and the cost of the railway bridge across the river approximately $24,000.

Transmission Line

The transmission line will consist of a single three-phase circuit, the conductor being of No. 4/0 steel reinforced aluminum, and will be approximately 67 mi. in length from the generating station at Cameron's Falls to the Port Arthur receiving station. Provision is being made for an additional transmission line, which will be erected after the completion of the first circuit.

The transmission line between the powerhouse and the Twin Cities will consist of wood pole construction utilizing 45-ft. western cedar poles, with suspension type insulators and a cross-arm arrangement. Poles are spaced approximately 325 ft. apart and have been erected on a private right-of-way.

The construction of the transmission line was begun in March, 1919, with five gangs of men, consisting of three pole-erecting gangs and two wire-stringing gangs, the entire force consisting of a maximum of 150 men. Poles have already been erected from the easterly limits of Port Arthur to Sprucewood, a distance of 60 miles.

The route of the transmission lines follows the Canadian Northern Railway for approximately 15 miles after leaving the development, from thence follows a cross-country route to a point near the Canadian Pacific Railway near Loon. From Loon to Sprucewood the route parallels the Canadian Pacific Railway. Approximately 25% of the poles are erected in rock. It was found necessary to clear practically the entire right-of-way from the development to Port Arthur. The width of the clearing varies from 80 to 100 ft. Brush was found in most sections but very heavy timber was encountered from Sprucewood north. It is expected that the first circuit of this transmission line will be completed on July 1st, 1920.

Possible Demand for Power

From a survey which has been made in connection with the existing and future loads in the city of Port Arthur, it is estimated that the possible demand will approximate a connected load of 18,000 h.p. This load will consist of electrical energy supplied to ten terminal grain elevators, two of which are now being operated by steam and one of which is being converted from steam to electric drive. Energy is also being supplied at the present time to the city water works, Port Arthur Drydock and Shipbuilding Co., Port Arthur Pulp and Paper Co., the street railway system and numerous smaller consumers. An additional pulp and paper industry is negotiating with the municipality at the present time for 6,000 h.p. to be used within the limits of the city, while the Hydro-Electric Power Commission has been negotiating with three different pulp and paper industries, the location of which has not yet been definitely determined, each of which will require an initial installation of from 10,000 to 13,000 h.p. The present demand at Port Arthur approximates 6,000 h.p., but on account of additional load coming on, the demand of the municipality on the Nipigon development when power is first delivered will probably approximate 10,000 h.p.

The present power possibilities of Fort William approximate a connected load of 18,000 h.p. Some of this load is now being served by individual steam plants, but the greater portion of the electrical energy being supplied in this municipality is obtained from the Kaministiquia Power Co. The load in this municipality consists of twenty terminal grain elevators, the greatest number of which are being served by the Kaministiquia Power Co. at the present time.

Electrical energy is also being supplied to the Ogilvie Flour Mills, the Canada Iron Corporation, the Canadian Car Co. and various other smaller users.

Due to the fact that the existing agreement between the city of Fort William and the Kaministiquia Power Co.

will remain in force for another four years, Nipigon power will be supplied in Fort William to the expiration of this agreement to individual customers. At the expiration of the Kaministiquia Power Co.'s agreement, however, the power now being supplied to the existing municipally-owned system of the city will be furnished by the Hydro system.

REPORT OF COMMITTEE ON FIREPROOFING OF THE AMERICAN CONCRETE INSTITUTE

SINCE the previous report of the Committee on Fireproofing of the American Concrete Institute a considerable number of fire tests of concrete columns have been made by the Bureau of Standards at Pittsburgh. The report communicating these test results has been made the basis of certain changes in the committee's recommendations. As will be seen from that report and the previous reports of the fire tests of concrete columns made at Pittsburgh, extensive spalling has invariably taken place in the fire tests of hooped columns from highly silicous gravels, made in the usual way. Most of the columns tested have had a thickness of 1½ in. of protective concrete over the steel. Two columns, Nos. 79 and 80, from Pittsburgh gravel with 2½ in. of protective concrete (see Table) gave results that were distinctly better than those with protective concrete only 1½ in. thick, Nos. 73, 74 and others, and yet so poor, in comparison to those shown by columns from more favorable aggregates, with 1½ in. of protective concrete, that the expedient of securing better protection in the case of columns from highly silicious gravel, by providing an unusual thickness of protective concrete, does not seem worthy of recommendation.

On the other hand, the two columns from Pittsburgh gravel, Nos. 77 and 78, with a thickness of 1½ in. of protective concrete, reinforced by a light grade of expanded metal, of large mesh, to prevent the loss of protective concrete by spalling, gave fairly satisfactory results. While the results of the test of these columns were not as good as those from columns from limestone, trap rock and blast furnace slag aggregates, the loss of strength in the four-hour fire test, as determined by loading to failure in the furnace while the column was still hot, was less than 60% in both cases, which presents a strong contrast to the results from columns from the same aggregate, Pittsburgh gravel, without reinforcement in the protective concrete, which failed under the working load before the four-hour fire test was completed.

Columns from Pittsburgh gravel, Nos. 82 and 83, with 2½ in. of protective concrete, with the light, expanded metal reinforcement in the outer concrete, to prevent the loss of protective concrete by spalling, could not be loaded to failure in the furnace, at the end of the four-hour fire test, due to the fact that their strength exceeded the load limit of the furnace equipment, which is equivalent to a stress of approximately 3,480 pounds per square inch on the effective area of these columns. When tested cold, after fire test, in a testing machine of high capacity, these columns showed an ultimate strength only slightly lower than that of a similar column, No. 84, which had not been subjected to fire test.

Value of Mesh Reinforcement

Judging from these results, it would appear that if the protective concrete of columns from highly silicious gravel aggregates were reinforced with expanded metal so as to prevent loss of protective concrete by spalling, they would be sufficiently protected by the thicknesses of protective concrete recommended for different conditions in the last report of this committee. The expedient of providing such reinforcement in the protective concrete of columns made from highly silicious gravels is accordingly included among the recommendations for columns.

Two gravel concrete columns, Nos. 85 and 86, in which the aggregate was low in quartz content, have been fire-tested. Approximately 90% of the gravel was made up of limestone pebbles, and there was a high percentage of limestone in the sand. The columns had 1½ in. of protective concrete with no expanded metal. These columns showed no tendency to spall in the fire test and gave comparatively good results in other respects. Neither of them failed under the maximum furnace load when tested hot at the end of the four-hour fire test. When tested cold, after the fire test, the ultimate strength was found, in both cases, to be more than 75% per cent. of that of a similar column, No. 87, which had not been submitted to fire test.

These results indicate that gravels and sands that are very high in limestone content are suitable for use in fire-resistive concrete. It is probable that all gravels that are low in quartz may prove, on investigation, to be free from the spalling tendency. How high a proportion of quartz can

DATA FROM TESTS OF ROUND HOOPED COLUMNS OF FIFTEEN INCH EFFECTIVE DIAMETER

Aggregate	Column No.	Thickness of protective concrete, in.	Time of failure under working load Hrs.	Time of failure under working load Mins.	Max. Stress tested cold without fire test lbs. per sq. inch	Max. Stress at end of 4 hr. fire test lbs. per sq. in.	Max. Stress tested cold having been loaded to 3480 lbs. per sq. in. at end of 4 hr. fire test
	73	1½	3	50	....	....	....
	74	1½	3	20	....	....	....
	75	1½	..	..	4,880	....	....
Pittsburgh gravel	*77	1½	..	..	....	1,995	....
Pittsburgh sand	*78	1½	..	..	....	2,120	....
	79	2½	..	..	....	1,495	....
	80	2½	..	..	....	1,640	....
	81	2½	..	..	5,590	....	....
	*82	2½	..	..	....	....	5,115
	*83	2½	..	..	....	....	4,950
	*84	2½	..	..	5,155	....	....
High limestone gravel....	85	1½	..	..	....	....	4,440
High limestone sand	86	1½	..	..	....	....	5,240
	87	1½	..	..	5,620	....	....

*Those columns which had expanded metal in the protective concrete are indicated by an asterisk.

be included in gravels without the resulting concretes spalling under fire test conditions cannot be determined from the tests thus far made. The evidence now available appears to be sufficient, however, to justify the recommendation, which is to be found in a later paragraph of this report, that gravels high in limestone content be given a preference, for fire-resistive concrete, over highly silicious gravels.

Amended Recommendations

The recommendations made in the report of this committee, for 1919, amended to conform to the evidence presented in the foregoing discussion, may be stated as follows:—

1. That in concrete columns where four-hour protection is required, protective material not less than 2 in. in thickness shall be provided over the steel. In columns in which a high percentage of steel is used, increasing the importance of affording it ample protection, the thickness of protective material shall be 2½ in. for four-hour protection, and special care shall be given to the accurate placing of the steel in the forms, to avoid inadequate protection on any side.

2. That for fire-resistive construction, limestone, trap rock, blast furnace slag, well-burned clay and gravels, composed largely of limestone pebbles, be given a preference over highly silicious gravels.

3. That where highly silicious gravel aggregate is to be used, in columns without hooping, and with no special safe-

guards, round columns be given a preference over rectangular ones.

4. That where highly silicious gravel aggregate is to be used, all columns, but especially rectangular columns and round columns with spiral reinforcement, be safeguarded by means of one of the following expedients:—

(a) Placing expended metal or other high-weight large-mesh reinforcement in the outer concrete to prevent the loss of protective concrete by spalling.

(b) Giving columns additional protection of approximately 1 in. of cement plaster either on metal lath or reinforced with light expanded metal or other suitable material.

THE CONSTRUCTION PERIOD*

By H. C. Anderson, Ann Arbor, Mich.

In the early days of appraisals, interest during the construction period was frequently ignored. In some of the later appraisals it has been taken at very large figures, large because of the assumption that the construction period extended to the completion of the entire property; that is, no part of it was assumed to go into operation before the completion of the whole. There seems to be very little, if any, disagreement among engineers and commissions as to the annual rate of interest, but in many cases there is a wide variation in the length of the construction period.

If it is assumed the property is to be reproduced "piecemeal," we will have one period of construction. On the other hand, if the property is to be reproduced "wholesale," we will have a different period of construction. If a certain property is to be reproduced "piece-meal," the result would naturally be higher unit cost and lower total interest cost than if reproduced by the "wholesale" method. In some cases the two may balance.

Fixing of Construction Period

The particular part is to fix, as accurately as possible, the construction period. Usually some part of the property, a power plant for instance, will be the best guide. Obviously, a street railway, complete in every other respect, must remain idle without power, also the question of the critical speed of construction must be given consideration. Theoretically, a large property could be constructed in a few months, assuming enough men and material could be procured, but to do this it would be necessary to exceed the speed of economical construction, which would result in very high unit cost, and no doubt would more than offset the decrease in the interest cost. Consideration must be given to the question of obtaining labor and material in large quantities at the time desired, and the fact that no city would consent to the extensive tearing up of its streets that may be necessary with a short period of construction.

One method often used is to assume an interest rate of 6% applied to the entire cost over one-half the construction period. The cost is zero at the beginning and is assumed to increase uniformly to the full amount at the end. The criticism often made of this method is the assumption that money can be borrowed day by day, or month by month, as needed. It is difficult to imagine bankers willing to furnish money in this way.

Illustrative Problems

Another method often used is to assume an interest rate of 6% and 2% allowance on the unexpended balance, assuming the unexpended balance to equal one-half the loan, the loans to be made at equal intervals during the construction period. The following concrete problems will illustrate the two methods:—

Problem No. 1:—Assume a property costing $12,000,000 and a construction period of three years, interest rate 6%. The expenditures proceeding uniformly from zero at the beginning to the full amount at the end.

Solution:—Six per cent. for one-half the construction period will give a total interest charge of 9%, this applied to the $12,000,000 cost will give $1,080,000 as the interest cost.

$$\frac{1,080,000}{12,000,000} = 9\%$$

Problem No. 2:—Assume a property costing $12,000,000 and a construction period of three years, interest rate 6%, allowance on balance at the rate of 2%, balances equal one-half the loan. $2,000,000 borrowed each six months.

Solution:—

First loan .....$2,000,000 @ 6% for 3 yr.	$360,000	
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000	
Net interest first loan		$350,000
Second loan ... 2,000,000 @ 6% for 2½ yr.	300,000	
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000	
Net interest second loan		290,000
Third loan .... 2,000,000 @ 6% for 2 yr.	240,000	
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000	
Net interest third loan		230,000
Fourth loan ... 2,000,000 @ 6% for 1½ yr.	180,000	
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000	
Net interest fourth loan		170,000
Fifth loan .... 2,000,000 @ 6% for 1 yr.	120,000	
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000	
Net interest fifth loan		110,000
Sixth loan .... 2,000,000 @ 6% for ½ yr.	60,000	
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000	
Net interest sixth loan		50,000
Total interest for three years		$1,200,000

$$\frac{1,200,000}{12,000,000} = 10\%$$

If this money is borrowed $4,000,000 each year for three years instead of $2,000,000 each six months the total interest becomes

$$\frac{1,320,000}{12,000,000} = 11\%$$

It will be noted, in this analysis, the assumption is made that no part of the money is spent until the day construction starts. In actual practice this would be very difficult, if not impossible. The land for various purposes, such as right of way, power stations, sub-stations, shops, car houses, gas plants, commercial offices, etc., would necessarily have to be purchased one or more years before construction started. The following concrete problem will illustrate this method.

Problem No. 3:—Assume a property costing $12,000,000. Of this amount the cost of land is $1,200,000 and the structural property $10,800,000. It will require three years to obtain the land, starting one year in advance of construction. Construction period of three years. Interest rate of 6%, allowance on balance at the rate of 2%, balances equal one-half the loan, money borrowed each six months.

Solution:—If the purchase of land starts one year in advance, and money is borrowed every six months there will be eight periods to consider; following are the amounts borrowed each period:—

	Land.	Structural property.	Total.
First period	$ 200,000	.....	$ 200,000
Second period	200,000	.....	200,000
Third period	200,000	$ 1,800,000	2,000,000
Fourth period	200,000	1,800,000	2,000,000
Fifth period	200,000	1,800,000	2,000,000
Sixth period	200,000	1,800,000	2,000,000
Seventh period	.....	1,800,000	1,800,000
Eighth period	.....	1,800,000	1,800,000
Total	$1,200,000	$10,800,000	$12,000,000

*Paper presented at the spring meeting, May, 1920, St. Louis, Mo., of the American Society of Mechanical Engineers.

First loan .....$ 200,000 @ 6% for 4 yr.	$ 48,000		
Credit on balance 100,000 @ 2% for ½ yr.	1,000		
Net interest first loan		$	47,000
Second loan ... 200,000 @ 6% for 3½ yr.	42,000		
Credit on balance 100,000 @ 2% for ½ yr.	1,000		
Net interest second loan			41,000
Third loan ..... 2,000,000 @ 6% for 3 yr.	360,000		
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000		
Net interest third loan			350,000
Fourth loan ... 2,000,000 @ 6% for 2½ yr.	300,000		
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000		
Net interest fourth loan			290,000
Fifth loan .... 2,000,000 @ 6% for 2 yr.	240,000		
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000		
Net interest fifth loan			230,000
Sixth loan ..... 2,000,000 @ 6% for 1½ yr.	180,000		
Credit on balance 1,000,000 @ 2% for ½ yr.	10,000		
Net interest sixth loan			170,000
Seventh loan .. 1,800,000 @ 6% for 1 yr.	108,000		
Credit on balance 900,000 @ 2% for ½ yr.	9,000		
Net interest seventh loan			99,000
Eighth loan ... 1,800,000 @ 6% for ½ yr.	54,000		
Credit on balance 900,000 @ 2% for ½ yr.	9,000		
Net interest eighth loan			45,000
Total interest cost			$1,272,000

$$\frac{1,272,000}{12,000,000} = 10.60\%$$

If this money is borrowed at the beginning of each year instead of every six months the amounts for each period will be as follows:—

	Land.	Structural property.	Total.
First period	$ 400,000	.....	$ 400,000
Second period	400,000	$ 3,600,000	4,000,000
Third period	400,000	3,600,000	4,000,000
Fourth period	.....	3,600,000	3,600,000
Total	$1,200,000	$10,800,000	$12,000,000

The total interest cost will be $1,392,000.

$$\frac{1,392,000}{12,000,000} = 11.60\%$$

Each Property a Special Problem

I do not know of any one formula that can be applied to every type of utility, and which when solved, will give accurately the interest cost during construction. Each property will have its own individual problems, and for this reason a thorough study should be made of the particular property under consideration to determine:—

(1) The magnitude of the property and the difficulties that must be overcome during construction;

(2) The method used in finding the reproduction cost;

(3) The proper construction period, taking into consideration the method used in finding the reproduction cost;

(4) Knowing the construction period, what is the proper method to use in finding the total interest cost?

In the end, after all theories have been considered, it is the judgment of competent engineers that should be the controlling factor.

Taxes During Construction

Like interest, taxes during construction is an item of cost incurred during the construction period and must be paid. The only question being, what is the proper amount to allow. It may be argued that the value of a utility depends on its earnings, and there can be no earnings during the construction period therefore, no taxes should be paid. But it does not work that way. The assessor finds the land and puts it on the rolls. He finds the building materials, machinery and partially erected buildings and they also go on the rolls, perhaps not in full amount, but in some amount at least. The problem, however, is somewhat easier than in the case of interest. It is always possible to go to the company's books and find the amount of taxes the company is actually paying, also the rate, but it is not always possible to find the ratio of assessed to actual value.

It also becomes necessary to estimate just what percentage of the property under construction the assessor will find and put on the rolls. It is also necessary to consider whether the date of starting construction and the date of assessment are the same, or whether the assessment is made in mid-year of each year of the construction period. The final result will not be very different with two methods. The following problem is presented only to illustrate the solution under certain assumed conditions.

Problem No. 4:—Assume a property costing $12,000,000, of this amount the land is $1,200,000 and the structural property $10,800,000. The purchase of land is started one year before construction and continues for three years, the construction period is also three years, the assessment is made in mid-year of each construction period. The assessor will find 70% of the construction cost, the rate is 2%. The amount put into property each year is as follows:—

	Land.	Structural property.	Total.
First year	$ 400,000	.....	$ 400,000
Second year	400,000	$ 3,600,000	4,000,000
Third year	400,000	3,600,000	4,000,000
Fourth year	.....	3,600,000	3,600,000
Total	$1,200,000	$10,800,000	$12,000,000

Solution:—

Total cost end of first year	$ 400,000	
Cost at middle of first year	200,000	
Assessment @ 70%	140,000	
Taxes paid first year 2% of $140,000 ..		$ 2,800
Total cost at end of second year	4,400,000	
Cost at middle of second year	2,400,000	
Assessment @ 70%	1,680,000	
Taxes paid second year 2% of $1,680,000		33,600
Total cost at end of third year	8,400,000	
Cost at middle of third year	6,400,000	
Assessment @ 70%	4,480,000	
Taxes paid third year 2% of $4,480,000		89,600
Total cost at end of fourth year	12,000,000	
Cost at middle of fourth year	10,200,000	
Assessment @ 70%	7,140,000	
Taxes paid fourth year 2% of $7,140,000		142,800
Total taxes paid		$268,800

$$\frac{268,800}{12,000,000} = 2.24\%$$

As in the case of interest, before the final percentage to include for taxes during construction can be determined, it will be necessary to know what method was used in finding the reproduction cost, if "piece-meal" the percentage will be one thing, if "wholesale" it will be another. The proper amount to include for taxes finally depends on first, the length of the construction period; second, what per cent. of the construction cost will the assessor find; third the tax rate.

The second meeting of the National Board for Jurisdictional Awards was held in Washington, April 26-28, 1920. Representatives of the A.G.C., the National Association of Building Trade Employers, the American Institute of Architects, Engineering Council and the Building Trades Department of the American Federation of Labor sat as a court of injury and handed down awards in four cases. The most important of these gave the employers full direction over the erection and removal of scaffolds up to 14 feet in height on building construction work, with the option of having the work done by mechanics or laborers in the lathers, plasterers, bricklayers, and masons' unions. The carpenters and joiners were given jurisdiction in the matter of asbestos shingles, prepared paper roofing, asphalt roofing, shingles and strip shingles, which had been disputed by the slate and tile composition roofers. The asphalt workers as against the plasterers were awarded the work of putting up asbestos ceilings and insulation on jobs for which were put in the ground work.

ROADS FOR MODERN TRANSPORT REQUIREMENTS*

By H. T. Chapman
County Surveyor of Kent, Eng.

ROAD engineers are now confronted with many factors and difficulties that must be taken into consideration, not only in the construction of new roads, but also in the maintenance, repair and improvement of our existing ones to meet present and future requirements.

In the engineering of new roads, there is scope for the provision of proper alignment, gradient, width, strength and suitable surfacing to meet the reasonable requirements of traffic that may be expected. We have also some data to work on, and practical demonstration that our predecessors were not sufficiently bold or prophetic in making provision for "future extensions." It is gratifying to note that the engineers of our larger cities and towns are not perpetuating the smaller view in their town-planning schemes, and it is to be hoped that others responsible for planning roads will follow their example.

Width

It is not suggested that all new roads should be constructed from 60 to 120 ft. in width in the first instance, but it is urged that sufficient land should be retained or kept on option to provide ample width for all future development of local and through traffic that may reasonably be expected.

It is impossible to estimate the value of the time lost by transport of all descriptions being unduly delayed owing to congestion on roads in and leading to cities, towns and even villages throughout the country.

It is almost heart-breaking to contemplate the widening of practically all our existing main roads—especially in urban areas—to meet even present-day requirements, as it would involve the demolition of so much valuable property. Again although by-passes to towns and villages may, in some instances, meet the case, they cannot invariably be planned or effected, and even so the traveller does not always want to by-pass the places in question.

It is impossible to lay down any hard-and-fast standard width, as no one can foresee future alterations in traffic or local circumstances; but the author's advice is not to err in the minimum width, and should it be found that too much land has been acquired or reserved, which is improbable, it would possibly be found that the money expended has not been badly invested.

The question of alignment and gradient, so far as new roads are concerned, is not, generally speaking, such a great difficulty, as it is unnecessary to lay out new roads in dead, straight lines, as did the Romans. The improvement of our existing roads in these directions is, however, a much more difficult problem. It is well known that the majority of our roads were not planned or laid out, but were simply evolved from tracks, and as our forebears avoided low ground, swamps, etc., the consequence is we have so many tortuous devious lengths now in existence. It is remarkable to what extent a winding and twisty road can be improved by effecting short diversions, widening of turns, etc., and this is not a very difficult proposition, if only the requisite ground can be acquired.

The necessary adjuncts to all good roads are—(*a*) Subsoil and surface water drainage; (*b*) adequate foundation; (*c*) lateral support; (*d*) suitable surfacing.

Subsoil and Surface Water Drainage

Whatever type and volume of traffic use the roads, suitable subsoil and surface drainage is essential, as without doubt the action of water deteriorates and diminishes the effective value of all kinds of foundation and surfacing materials. The greatest difficulties are presented in draining stiff subsoils, such as clay, also unstable ones, including bog land or peaty ground. In the case of the former, longitudinal, cross and herringbone drains of permeable rubble, with the trenches filled in with ashes or other permeable material, leading into pipe drains or ditches, are most suitable, and in the latter, open jointed pipe drains laid on and covered with brushwood or fascines will serve the purpose.

It is well known that road surfaces, particularly if not impervious, deteriorate rapidly when not well drained, and that in many cases the action and scour of surface water causes as much, if not more, damage than the actual traffic.

Foundations

Except in the cases of new roads, it is acknowledged that sufficient consideration has not formerly been given to the provision of adequate foundations, which are just as essential for good, strong roads as for safe buildings. Everyone will acknowledge that it is difficult and costly to strengthen foundations of existing buildings, even so it is similarly difficult to strengthen road foundations without entire reconstruction.

It is remarkable the thickness of rubble pitching and road metal that clay, which is one of the most common subsoils, will work through under pressure of traffic unless a bed of clinker, ashes or sand is superimposed to prevent its doing so. This is especially the case should the surface and subsoil be not well drained.

In the author's opinion it is imperative that the road foundations should be stable, impervious and homogeneous, whatever type of surfacing is adopted.

For sett-paved roads, concrete foundations of adequate thickness are recognized as being the most suitable for all conditions of traffic.

Should the subsoil be unstable or yielding, then the concrete foundations will be in the nature of a raft or slab, and subject to tensile strains. Reinforcement is desirable in such cases, but on hard, firm subsoils a greater thickness of plain concrete may be preferable. This is a debatable point. In the case of bituminous surfacings, including tar-macadam, asphalt carpeting, etc., the author is of opinion that bituminously cemented foundations or base coats are preferable to concrete.

Where the surface is resilient there should be some compensating resiliency in the base or foundation, and when the surfacing is non-resilient, the foundation should possess the same characteristics. Except in the case of sett paving, it is desirable that there should be considerable adhesion between the surface and the base coat or foundation.

Lateral Support

It is essential that all our highways should have adequate side support or abutments, and it is surprising the extent to which this is lacking on many roads. This is necessary, not only to bear the weight of the traffic, but also the thrust and spreading action caused by live loads. We all know that in calculating stresses on buildings and bridges, a higher factor of safety is allowed for live loads, but this appears to be frequently overlooked where roads are concerned.

Generally speaking, in the case of urban roads, ample lateral support is provided by curbs and channels, but not so on most rural roads. If bituminous surfacings consist of tar-macadam and carpetings, unless the sides are well supported to hold up the material to the traffic and prevent water penetrating, the results are soon self-evident. It is true that, in the case of macadam, surfacing, the sod edging of the verges and the foot of banks form some lateral support, but not usually sufficient, especially when the carriageways are narrow and the sides much traversed by wheels.

The author has laid many miles of continuous *in situ* concrete curbings, and this stands well, except where wheels abraid and break it. He has tried the concrete-submerged curb, but does not greatly favor this for various reasons.

Although we are all agreed that water-bound granite macadam is inadequate for heavy (either in volume or character) traffic, it has served its purpose, and will of necessity continue to do so on many roads for years to come. It

*Presented at a conference of municipal and county engineers of Great Britain, April 16th, 1920, London, Eng.

is remarkable how well this surfacing stands if constructed in a proper manner and regularly attended to as required in the way of patching, surface tarring, etc. What would our armies abroad have done without broken stone roads?

The author has already referred to the necessity of "imperviosity" and homogeniety, and that is the secret of the success of tar-macadam, which is the next step in the way of improved surfaces after water-bound granite. The three Sidcup sections, Nos. 9, 10 and 11, laid in July, 1911, are still in evidence and in good condition. They have been tarred annually and received some surface repairs. Their cost up to date, including construction and annual repairs, has been under 1s. per yard per annum, and over 10,000,000 tons-weight of traffic has passed over them.

Except for our wealthy municipalities, the initial cost of wood and granite paving on concrete is almost out of the question, but in many instances this is the most economical method of dealing with roads carrying intense traffic.

Having regard to all circumstances, including the difficulty of transporting road materials, the author is of opinion that bituminously coated or carpeted "double coat" road surfacing is the most suitable for all classes and volume of traffic. Except the binders, including pitch and tar and bitumen, all the materials can, generally speaking, be obtained locally, and so-called "inferior" materials, and even waste products, can be used as aggregates.

Machinery and Plant

Special machinery and plant is required, and great care and skill necessitated for the preparation of the materials; but it is to be hoped that both these will be available in the near future.

For the under or base coat the author thinks that, generally speaking, comparatively soft stone, scarified macadam, or selected clinker mixed with pitch and tar and laid hot suffices, but all road engineers and contractors will not agree with this and prefer to use bitumen instead of pitch and tar.

For the carpet, which should be put on as soon as possible after the base coat is completed and not be less than 1¼ ins. in thickness, the necessary grading of the sand or clinker and the proper proportion of bitumen are the essential factors for success. This should be laid at a temperature of about 300 deg. F. and very carefully rolled, after which the traffic may be allowed over it in a few hours.

The author is of opinion that the waviness or corrugations caused by traffic are set up in the youth of the surfacing, and also owing to insufficient adhesion between the carpet and the base coat. He well knows some sections that are now somewhat wavy after being down about three years, but not more so than within three months of their birth.

He has under observation one section of this class of surfacing on the London-Folkestone road that was laid in 1913, and is still in fair condition, notwithstanding the fact that since August last about 13,000 demobolized lorries from France, on their way between Richborough and Slough, have been hauled over it by chassis. Many of these lorries have been tireless or improperly tired, and the towing chassis have, of course, during the same period made double journeys over it. In addition to this, there has been an enormous amount of government traffic over the road during the war as well as ordinary traffic, which is by no means light.

Concrete Surfacings

The last type of surfacing to be referred to is concrete. In the discussion on this subject at the conference held at Olympia in November last, some speakers wandered from the subject and debated on concrete foundations. We are all agreed that, under certain conditions, concrete foundations are the most suitable, but not universally. The author prefers a bituminous foundation or base coat for a bituminous surface, and still adheres to the view that for quick, heavy traffic some resiliency (but not too much) is desirable both in the foundation and surface. We know that some elasticity is necessary in structures carrying heavy loads, and especially live loads, hence the steel in reinforced concrete.

Just as a fine, rich mixture is necessary for good, strong reinforced concrete, so it is essential if the surfacing is to withstand the abraiding and hammering action of quick, heavy traffic.

From observation of the trial sections of concrete surfacing laid on the London-Dover main road in the spring of 1915, the author has come to the conclusion that 6 ins. of 6 to 1 concrete is not adequate to stand the action of quick, heavy traffic, also that expansion joints are unnecessary when surface reinforcement is provided. It is satisfactory to note that the portion of the sections which were surfaced with 3 to 1 concrete show very little sign of wear or deterioration except at the expansion joints, which are admittedly *de trop*. He is of opinion that 8 ins. of concrete, the lower 6 ins. consisting of a 6 to 1 mixture topped with 2 ins. of 3 to 1 concrete, the reinforcement to be placed between the two layers and the upper one laid before the initial set has occurred in the lower one, will meet all the requirements of traffic, and should last with little if no repair for many years.

Important Points

Important points to be observed are the putting in and proper tamping of the concrete to obviate all air or water holes, to keep the surface concrete moist, so that it does not dry out or mature more rapidly than the bulk below, and also to keep all traffic off the newly-laid surface for at least twenty-eight days.

The author would like to resurface the Gravesend sections with 5ins. of reinforced concrete, the lower 2½ ins. to consist of a 6 to 1 mixture and the upper 1½ ins. 3 to 1, without expansion joints and laid during suitable weather, which was not the case when the first edition was constructed, also to close the road and divert all traffic during the execution and for one month after completion, and he is sufficiently optimistic to think that this will provide a good wearing surface for many years. He is not in favor of surface-tarring concrete as, in his opinion, the only benefit arising therefrom is to cause a cushion for horses' shoes and perhaps slightly minimize the jar. Tar is not a good friend to Portland cement.

The author ventures to think that road users and road makers are in closer touch, and are appreciating that their interests are entirely mutual. The road user has no desire in his own interest to cause undue damage to roads, and the latter wishes to encourage and facilitate all classes of transport which it is admitted is in the national interest.

E. I. C. COMMITTEE OF POLICY

At a recent regular meeting of the council of the Engineering Institute of Canada, the following Committee on Policy was appointed: J. B. Challies, Ottawa, chairman; A. R. Decarie, Quebec; Brig.-Gen. C. H. Mitchell, Toronto; Walter J. Francis, Montreal;; K. H. Smith, Halifax; J. G. Sullivan, Winnipeg; and A. E. Foreman, Victoria. This committee was given power to add to its numbers, having regard to geographical location.

A. H. Harkness, consulting engineer, Toronto, was appointed chairman of the Committee on Remuneration. It is intended that the personnel of this committee, when selected, should include some of the junior members of the institute.

The council will submit to the vote of the members an amendment to the constitution, which, if carried, will permit juniors to vote at branch meetings and to be eligible for election as branch officials excepting only in respect to the office of branch chairman.

C. C. Inglis, executive engineer, Special Irrigation District, Poona, India, desires Canadian manufacturers to submit written quotations on 6-in. post-hole augers, and also on smaller sizes, f.o.b. boat.

RELATION OF TRACTORS AND TRAILER TRAFFIC TO HIGHWAY DESIGN*

By H. Eltinge Breed
Consulting Highway Engineer, New York City

TRACTOR and trailer traffic is a sure thing. It is here to stay. There are registered in the United States to-day 35,000 trailers.. That is definite; so is their percentage of increase in the last two years,—over 100%. At this rate of increase we can plan for 500,000 or more tractors and trailers by the year 1930. The only uncertain factor is whether the rate of increase will itself increase, and how much. I personally believe that we should plan for at least double the number of tractors and trailers given above.

Events of the last two years have caused many doubts as to whether the great occasion always does produce the great man, but in this mechanical age of ours, the advent of the tractor and trailer is one indication that the great industrial need always produces the means to fulfill it.

Economic Situation

The crux of the economic situation as I see it is, even more than production, distribution of the products of the soil, of labor, of machines, and fairer distribution of the wealth that accrues from these products. The motor truck and the tractor and trailer have been developed to meet the need of distribution.

The railroads cannot meet this need; industries in the Middle West are being forced daily to shut down because of the shortage of freight cars for the transportation of material. Farmers the country over are frantic with anxiety about the movements of their crops. Congress, the Interstate Commerce Commission, the Car Service Bureau and many others squabble and muddle along with no prospect of adequate solution. Whatever relief we get this year and next will be from motor transportation.

Much as we need distribution, we need even more economy in distribution. It is appalling to realize that we, as consumers, pay from 3 to more than 10 times the actual cost of the finished article, be it manufactured or natural product. Whatever effects a saving in cost to the consumer is a national boon. Motor power for short-haul freight does effect such a saving. That, I believe, is the great reason for its rapid growth. Mr. Banham says: "I find that if we combine all the costs, such as additional crating, labor, etc., to make a less than carload shipment, the rate averages a dollar a hundred from Yonkers to Newark. If you take the same movement by motor trucks or tractor and trailer, with decreased boxing, weight and labor, the rate averages 20 cents. For 12 miles, then, there is a difference of 80 cents per hundred pounds in favor of the motor truck. The saving in time. in space for storage, in materials, are all in favor of transportation by motor."

Saving in Gasoline

There is also the very important saving in gasoline which results from the use of the tractors and trailer over the ordinary truck. The trailers make it possible for one tractor truck, one driver and one motor to do the work of three trucks. With the trucks they have met the industrial need. To-day, in the tie-up in New York harbor, they are coming to the rescue and moving the food-stuffs. More and more they are becoming to the great cities the strongest assurance of a sufficient food supply.

But in the uncertainty of highway design, motor transportation suffers a serious check. I say "uncertainty," because this spring improved roads went to pieces as they never did before. The Lincoln Highway, between Trenton and Philadelphia, completely busted up. Some people say that the damage was due to the hard winter. That I disbelieve. Weather is a natural process that should not hurt a healthy protected organism, either human or highway.

The roads are organically wrong, because they are not designed for the loads they must bear. Unless they can sustain the necessary traffic, they do not fulfill their function. They hinder, instead of help, distribution. The savings effected by motor transportation more than offsets the cost of the roads that are essential to this transportation. The economic value of good roads to the country cannot be expressed wholly in terms of the dollar.

Adequate design of highways for tractor and trailer traffic means an immediate provision for three lines of traffic near all large cities and on all trunk routes, with possibility of an added 10 ft. longitudinally for the fourth line. For each line of traffic at least 9 ft.. should be allowed. The additional width is necessary because tractors and trailers move at a speed of from 6 to 12 miles an hour, and other cars, going from 12 to 40 miles, must have room to pass.

Turns must be widened because of the greater length of the tractor and trailer, and curves must be super-elevated in order that they may keep in their own line of traffic.

Reduction of Grades

With the increasing cost of motor fuel, special attention must be given to reducing grades. To consumption of gasoline increases directly with an increase in grade. On a fairly level road, one can haul a heavier load for less fuel. This saving on main roads heavily travelled often compensates in two or three years for whatever additional cost is involved in reducing grades.

Because of the distribution of load over 6 to 8 wheels, and because of their slower movement, tractors and trailers are less hard in impact upon pavement than heavily loaded trucks. They would not require any greater strength of foundation or better type of surfacing than we would provide for regular heavy traffic, but all heavy traffic requires an adequate foundation and a durable type of pavement. A semi-durable pavement for heavy traffic is sheer waste.

I become more and more convinced, however, that the final success of road building depends upon the intelligence of the public. The public must not only demand good roads but must know enough about what constitutes good roads to act as a spur to the sometimes sluggish consciousness of engineers and contractors. Public knowledge prevents private graft.

Good roads require an alert, intelligent public, engineers with vision, and competent contractors. These factors, and the training in highway engineering that some universities are now giving, and the urgency of the need itself, will gradually produce highways that will be adequate to the demands of tractor and trailer traffic.

*Read at the National Highway Traffic Association's annual meeting, May 13th, 1920.

W. Reese has opened an office at 23 Steven St., Hamilton, Ont., representing "W.R." Patents, Ltd., of Leeds, Eng., manufacturers of CO_2 recorders, and the Hele-Shaw Patent Clutch Co. of Oldham, Eng. During the war Mr. Reese was inspecting engineer for the Imperial Government at the Armstrong-Whitworth plant in England, and previously he was in British Columbia as master mechanic for the Consolidated Mining & Smelting Co.

Education of the public with respect to the value of the highway as a public utility is being conducted in Virginia through the medium of moving pictures. In "Virginia's New Hour" it is proposed to show the modern road in action and to demonstrate its beneficial effects, not only upon the commercial and industrial activities of the state, but upon the whole range of life—social, religious and educational, taking in all walks of high and low degree. One of the fundamental points striven for is to turn the tide of youth back to the farm and to set in motion forces that will in due time result in placing a check upon the disproportion between the progress of the fields and that of the cities, between that of industries and that of agriculture.

British Columbia's "Engineering Profession Act"

Complete Text of Act Passed by Legislature of British Columbia Relating to Practice of Engineering Profession in That Province—Safeguards and Penalties—Provisions of Act to be Enforced April 1st, 1921

IN order that engineers throughout Canada may be in possession of the full text of the British Columbia Act relating to the practice of engineering in that province, the bill as passed by the legislature is presented in full herewith:—

WHEREAS a petition has been presented praying that the qualifications necessary to permit persons to act or practise as Professional Engineers be established by legislation;

AND WHEREAS it is expedient to grant the prayer of the said petition;

THEREFORE His Majesty, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows:

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

Interpretation

2. In this Act, unless the context otherwise requires, the expression:

(a) "Professional Engineer" means any person registered as a Professional Engineer under the provisions of this Act;

(b) The "Practice of Professional Engineering" means the carrying on for hire, gain, or hope of reward of any branch of Civil, Mining, Mechanical, Electrical, Chemical or Structural Engineering, and shall be deemed to include reporting on, designing, or directing the construction of public utilities, industrial works, railways, bridges, highways, canals, harbor works, river improvements, lighthouses, wet docks, dry docks, floating docks, launch ways, marine ways, steam engines, turbines, pumps, internal combustion engines, air ships and aeroplanes, electrical machinery and apparatus, chemical operations, machinery, and works for the development, transmisison or application of power, light and heat, grain elevators, municipal works, irrigation works, water works, water purification plants, sewerage works, sewage disposal works, drainage works, incinerators, hydraulic works, and all other engineering works, and all buildings necessary to the proper housing, installation and operation of the engineering works embraced in this section;

The execution as a Contractor of work designed by a Professional Engineer, the supervision or construction or work as a foreman or superintendent or as an inspector, or as a roadmaster, trackmaster, bridge or building master, or superintendent of maintenance, shall not be deemed to be the practice of Professional Engineering within the meaning of this Act;

(c) "The Association" means the Association of Professional Engineers of the Province of British Columbia;

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

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

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

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

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

(i) Nothing in this Act shall be construed so as to require the registration or license of anyone registered as an architect under any Act of the Province of British Columbia relating to the practice of architecture, where the practice of such person is confined to architecture, and nothing in this Act shall apply to any British Columbia or Dominion Land Surveyor practicing his profession, except that such surveyor shall not style himself nor hold himself out as a Professional Engineer unless he is licensed or registered under the provisions of this Act;

(j) "Registration" means the admission of an Engineer to membership in the Association and the enrollment of his name in the Register, and "Certificate of Registration" means the official certificate under the seal of the Association evidencing the same;

(k) "Licensed" means that permission has been given to a non-resident Engineer to temporarily practise professional engineering without being registered, and "License" means the official certificate under the seal of the Association evidencing such permission.

Association of Professional Engineers

3. (a) All persons registered as Professional Engineers under the provisions of this Act are hereby constituted "The Association of Professional Engineers of the Province of British Columbia," and shall be a body politic and corporate, with perpetual succession and a common seal;

(b) The head office of the Association shall be at Vancouver, British Columbia.

4. The Association shall have power to acquire and hold real property not producing at any time an annual income in excess of ten thousand dollars, and personal property, and to alienate, mortgage, lease or otherwise charge or dispose of the same or any part thereof as occasion may require, and to sue and be sued.

5. The Association may pass by-laws not inconsistent with the provisions of this Act, regarding:

(a) The election of the Executive Council of the Association;

(b) The government, discipline and honor of the Members;

(c) The maintenance of the Association and the management of its property;

(d) The fixing of an annual fee not in excess of fifteen dollars, and other fees;

(e) The levying, remission and collecting of annual and other fees;

(f) The examination and admission of candidates to the study and practice of Professional Engineering;

(g) The calling and conduct of meetings, voting, quorum and general business, banking, borrowing and credits;

(h) All other purposes reasonably necessary for the management of the Association.

6. (a) All by-laws or amendments thereto shall become effective only after ratification by two-thirds majority of the votes received from the Members of the Association in good standing at a meeting duly convened. The Registrar shall file with the Lieutenant-Governor-in- Council a copy of each by-law or any amendment thereto, immediately the same is ratified, certified under the seal of the Association as a true copy;

(b) Notwithstanding anything in this Act contained, any by-law may be disallowed by the Lieutenant-Governor-in-Council.

Who May Practice

7. (a) Only such persons who are Members of the Association and registered as such under the provisions of this Act, or who have received a License from the Council of the Association as hereinafter provided, shall be entitled within the Province of British Columbia to take and use the title of "Professional Engineer," or any abbreviation thereof, or to engage in the Practice of "Professional Engineering."

(b) Any person residing in the Province of British Columbia at the date of the passing of this Act, who is at that date, and has been for five years previously practising Professional Engineering as defined in Sub-section (b) of Section 2, shall be entitled to be duly registered as a Member of the Association without examination; provided that such person shall produce to the Council, on or before the first

day of April, 1921, satisfactory credentials of his qualifications;

(c) Engineers who were practising previous to the late war and who were accepted for services in the forces of the British Empire, or any of its Allies, shall be entitled to all the rights and privileges conferred under Sub-section (b) of this Section;

(d) Any person who may hereafter come to the Province of British Columbia, and who shall produce to the Council a satisfactory certificate, signed by the proper officers, evidencing the fact that he is a duly registered member in good standing of an Association of Engineers in another Province in the Dominion of Canada, having equivalent standards of qualification for membership to this Association, together with an application for registration in this Association endorsed by the Registrar of such other Association, may become a duly Registered Member of the Association without the payment of the annual fee for the year in which he joins, but shall pay a fee of five dollars for such registration;

(e) Any person not otherwise qualified as hereinbefore mentioned, before being admitted as a Registered Member of the Association shall make application to the Council, and shall produce credentials satisfactory to the Council, or in lieu thereof pass the prescribed examination, and shall pay the prescribed fees;

(f) Notwithstanding anything to the contrary in this Act, any person may practise without being licensed in the Province of British Columbia, for the sole purpose of examining, consulting on, advising on or reporting on properties and works in the said Province; and such person may, without being licensed, superintend operations directly connected therewith, provided, however, that such privilege of superintendence shall not be construed as entitling such person to hold himself out as, or to generally practise as a Professional Engineer;

(g) Any person who is employed as an Engineer by a public service corporation, a public utilities or government department, whose business is normally carried on in two or more of the Provinces of Canada, and who is, by reason of his employment, required to practise as an Engineer in other Provinces than that of his residence, may so practise in the Province of British Columbia without being registered or licensed, or payment of fee;

(h) Any person who is a resident of some other Province of Canada in which there is no Association of Engineers similarly constituted to the Association, may obtain a license to practise, subject to the discretion of the Council, upon producing satisfactory evidence of his qualifications, and upon payment of the prescribed fees;

(i) Any person acting as an assistant to a Professional Engineer where such person is directly responsible for the technical quality of work as set forth in Section 2, Subsection (b) hereof, must be a Professional Engineer. Any person may otherwise act as an assistant to a Professional Engineer, and shall not be deemed to be practising Professional Engineering when so engaged;

(j) The provisions of this Act shall not apply to any member of His Majesty's Naval, Military or Aerial Forces while actually employed on duty with such Force.

Partnership

8. In the case of two or more persons carrying on the practice of Professional Engineering in co-partnership, only such members as are registered or licensed under this Act shall individually assume the functions of a Professional Engineer. A firm as such cannot be deemed to be a Member of the Association or be licensed to practise.

Council

9. (a) The powers conferred on the Association shall be exercised by an Executive Council, which shall consist of a President, Vice-President, and nine Councillors, to be chosen from Registered Members of the Association, and who shall hold office as hereinafter provided;

(b) The President shall be elected annually by the Association, and shall hold office until his successor is elected. He shall act as Presiding Officer at the meetings of the Council and of the Association, voting only when votes are evenly divided;

(c) The Vice-President shall be elected annually by the Association, and shall have all the powers of the President during the absence of the latter;

(d) The last past President shall be a member of the Council. Four Councillors shall be elected annually by a ballot vote; the four having the highest number of votes cast shall be declared duly elected, and four Councillors, one of whom must be a Member of the Faculty of Applied Science in the University of British Columbia, shall be appointed annually by the Lieutenant-Governor-in-Council;

(e) The "Registrar" and the "Secretary," the former of whom must be a Professional Engineer, shall be appointed by the Council within one month after its assumption of office;

(f) The same person may be appointed to the office of both Registrar and Secretary;

(g) The Secretary of the Association shall also be the Secretary of the Council;

(h) The Secretary of the Association shall, on his assumption of office, lodge in the hands of the President of the Council a bond for one thousand dollars in some bonding company satisfactory to the Council. All the expenses arising form the furnishing of such bond shall be borne by the Association;

(i) In case of the resignation or death of any member or members of the Council, the other members of the Council shall have power to fill all vacancies so caused until the time of the holding of the next annual meeting; provided the said annual meeting is not to be held within a period of three months after the occurrence of such vacancy or vacancies.

Examinations

10. (a) The Council shall appoint annually a Board of Examiners for each branch of Engineering as set out in Section 2, Sub-section (b), and shall fill the vacancies in the same as they occur;

(b) The duties of the Board shall be to examine all candidates for admission to membership by examination. As soon as possible, and not later than 21 days after the close of each examination, the members of the Board who shall have conducted such examination, shall make and file with the Secretary a certifiacte showing the results of such examination, whereupon the Council shall notify each candidate of the result of the examination and of their decision upon his application. The members of the Board shall also file with the Secretary the examination papers submitted to each and every candidate, together with the answers of the respective candidates thereto, and shall attach thereto a certified copy of their report, with the marks awarded to each candidate in each subject of such examination; and such documents shall remain on file in the office of the Registrar, and shall be open to inspection by any of the said candidates, or by any person duly authorized in writing on their behalf, during regular office hours for a period of at least six months following the examination.

11. (a) Regular examinations of candidates for registration or license shall be held at Vancouver, or such other place or places as the Council may direct, beginning on the last Monday in the months of February and November in every year, unless such Monday be a holiday, in which case they shall begin on the next ensuing day not being a holiday;

(b) Special examinations may be granted, provided the candidate or candidates for such special examination deposit in advance with the Registrar a sum sufficent to defray the expenses of such examination and the prescribed examination fees. Any balance remaining over shall be returned to such candidate or candidates;

(c) The scope of the examinations and the methods of procedure shall be prescribed by the Council, with special reference to the applicant's ability to design and supervise works which shall ensure the safety of life and property;

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

(e) Every candidate for examination shall give at least one month's notice in writing to the Secretary of his intention to present himself for examination, and with such notice shall forward a fee of five dollars, and before undergoing examination shall pay to the Association twenty-five dollars as a fee, and before receiving his certificate of registration shall pay the annual fee set out in the By-laws, and a sum of not more than five dollars for the publication of his name in the British Columbia Gazette;

(f) In case the candidate should fail in his examination, he may present himself at any subsequent regular examination by paying a fee of ten dollars.

Registration Without Examination

12. (a) The Council shall consider an application for registration from any person who submits proof of qualifications possessed by such person by virtue of experience, training or examination by another examining body of recognized standing, and, if found satisfactory, shall grant a certificate of registration;

(b) Any person who, without examination, is registered as a Professional Engineer, shall pay to the Association before being so registered the sum of fifteen dollars for examination of credentials, and the annual fee set out in the By-laws, and a sum of not more than five dollars for the publication of his name in the British Columbia Gazette;

(c) The Board shall examine all degrees, diplomas, certificates and other credentials presented or given in evidence for the purposes of obtaining registration or license to practise, and may require the holder of such credentials to attest by oath or by statutory declaration on any matter involved in his application, and shall report the result of its investigation to the Secretary.

13. The Council shall have power to establish conjointly with any Council of any other Association similarly constituted, in one or more of the Provinces of Canada, a Central Examining Board, and to delegate to such Central Examining Board all or any of the powers possessed by the Board respecting the examinations of candidates for admission to practise; provided that any examination conducted by such Central Examining Board shall be held in one place at least within this Province.

14. The Registrar shall keep a Register of all Professional Engineers, showing the dates of their certificates, and shall cause a list of Professional Engineers in good standing who are authorized to practise, to be published in the first issue of the British Columbia Gazette on or before February 14th of each year. Should a Professional Engineer omit to pay the prescribed fee on or before January 31st in any year, his name shall be erased from the Register, and should he wish to resume practice he may be again placed on the Register by paying the prescribed annual fees and a further sum sufficient to meet the expenses of having his name published in one issue of the British Columbia Gazette.

Conditions and Records

15. (a) Notwithstanding any other provision of this Act, no person shall be registered unless at least twenty-three years of age, and unless he has been engaged for six years in some branch of engineering, except in the case of a graduate from a recognized Engineering College, in which case the period of engagement in engineering work shall include his term of instruction;

(b) Candidates for admission to practise who, for any reason have been unable to take advantage of an academic engineering course, must have served at least six years under a Professional Engineer or Engineers, or an Engineer or Engineers whose standing is recognized by the Council, and must pass an examination satisfactory to the Board.

16. (a) The Registrar shall issue a "Certificate of Registration" to all Professional Engineers registered under this Act, and to any person entitled thereto upon written instructions from the Council, and upon payment in advance of the prescribed fees. All certificates shall be signed by the President and by the Registrar, and bear the seal of the Association, and shall specify the branch or branches of engineering in which the Professional Engineer has been examined or otherwise accepted, and shall operate as a permit to practise for the remainder of the year in which issued, and upon payment of the annual fee in each subsequent year he shall issue an annual certificate, which will operate as a renewal of such permit for that year. The holder of a certificate shall at all times prominently display the same in his office or other place of business;

(b) The Registrar shall issue a license to practise, specifying the period for which it is issued, to any non-resident practioner entitled to such license, upon payment of the prescribed fee.

17. The Registrar shall keep his Register correct, in accordance with the provisions of this Act, and the rules, orders and regulations of the Council.

18. Each person who is registered or licensed to practise shall pay in advance to the Secretary-Treasurer, or any person deputed by the Council to receive it, such annual fee as may be determined by the By-laws of the Association, which fee shall be deemed to be a debt due by the practitioner and to be recoverable with the costs of same in the name of the Council in any court of competent jurisdiction.

Penalties

19. No person entitled to be registered under this Act who shall neglect or omit to be so registered, shall be entitled to any of the rights or privileges conferred by the provisions of this Act so long as such neglect or omission shall continue, and any person not registered or licensed under this Act who practises, acts, or advertises himself as a Professional Engineer, save and except as hereinbefore provided, or assumes verbally or otherwise the title of Professional Engineer, or any abbreviation thereof, shall incur a penalty of not less than fifty dollars and not more than three hundred dollars for every such offence.

20. If the Registrar makes or causes to be made any wilful falsification in any matters relating to the Register, he shall incur a penalty of not less than twenty dollars nor more than five hundred dollars.

21. If any person shall wilfully procure or attempt to procure himself to be registered or licensed under this Act, by making or producing, or causing to be made or produced, any false or fraudulent representation or declaration, either verbally or in writing, every such person so doing and every person knowingly aiding and assisting him therein, shall incur a penalty of not less than twenty dollars nor more than five hundred dollars.

22. Any information for the recovery of any such penalty or forfeiture may be laid by any Member of the Association, or by any person appointed by the Council.

23. No prosecution shall be commenced for any offence against this Act after two years from the date of committing the offence.

Investigation of Irregularities

24. The Council may, and upon application of any three Members shall, cause inquiry to be made into matters respecting any fraudulent or incorrect entry in the Register, or the unprofessional conduct, negligence or misconduct in the execution of the duties of his office, or the conviction on a criminal offence of any Registered Member, and may in its discretion order the erasure or correction of any entry in the Register, or may reprimand, censure, suspend or expel from the Association any Member found guilty as aforesaid; provided that the name of a Member shall not be erased from the Register on account of a conviction for a political offence outside His Majesty's Dominions, nor on account of a conviction for an offence which, though within the provisions of this Act, ought not, in the opinion of the Council, either from the trivial nature of the offence or from the circumstances in which it was committed, to disqualify a person from practising Professional Engineering.

25. The Council may, for the purpose of the execution of the duties of the Council under this Act, employ at the expense of the Association such legal or other assessor or

assistant as the Council may think necessary or proper; and any person whose status or conduct is the subject of inquiry shall also have the right to be represented by counsel.

26. At least one week before the first meeting of the Council to be held for taking evidence or otherwise ascertaining facts, a notice shall be served upon the person whose status or conduct is the subject of inquiry, and such notice shall embody a copy of the charges made against him, or a statement of the subject-matter of the inquiry, and shall also specify the time and place of such meeting. The testimony of witnesses shall be taken under oath, which the Presiding Officer is hereby authorized to administer, and there shall be full right to cross-examine all witnesses called, and to call evidence in defence and reply. In the event of the non-attendance of the person whose status or conduct is the subject of any such inquiry, the Council may, upon proof of the personal service of the notice aforesaid in accordance with the provisions of this Section, which proof of service may be by statutory declaration, proceed with the subject-matter of the inquiry in his absence, and make their report of the facts without further notice to such person.

Evidence

27. The Council, or any person interested in the proceedings on any such inquiry, may make application to the Registrar or any District Registrar of the Supreme Court to seal a writ or writs of subpœna for the attendance of any witness or witnesses, and for the production of books, papers and documents by such witness or witnesses at such inquiry in form similar to that prescribed by the Supreme Court Rules, and such writ or writs of subpœna shall have the same force and effect as though issued out of the Supreme Court, and the fees therefor and the rules governing the same shall be such as are in force in the Supreme Court.

28. Any person who has failed to pass an examination, or whose name has been ordered to be erased from the Register, or who feels himself aggrieved, or is affected by any order of the Council, or any decision of the Board of Examiners, may appeal from such order, finding, action, or decision, to any Judge of the Supreme Court at any time within six months from the date of such order, finding, action or decision, or the publication thereof; the said Judge thereof, upon the hearing of such appeal, which may be analogous to appeal to the County Court under the "Summary Convictions Act," may make such order confirming or reversing in whole or in part, or varying the order, finding, action or decision appealed from, or directing further inquiries by the Council into the facts of the case, and as to costs, as to the said Judge thereof shall seem right in the premises. Such order, when so made, shall be final.

29. In all cases where proof of registration under this Act is required to be made, the production of the last annual list published in the Gazette as herein provided, or of a certificate bearing a date subsequent to the issue of the said Gazette containing said annual list, showing that the person or persons therein named is or are duly registered, certified under the hand of the Registrar for the time being and the seal of the Association, shall be sufficient evidence of such registration in lieu of the production of the original Register; and any such certificate purporting to be signed by any person in the capacity of Registrar shall be *prima facie* evidence that such person is such Registrar, without any proof of his signature or of his being in fact such Registrar; provided, always, that the evidence herein aforesaid may be displaced by any certificate of the Registrar under seal of the Association, showing the fact of erasure of any name or suspension or revocation of any licence to practise.

Recovery of Penalties

30. Any penalty recoverable under this Act may be recovered in the same manner as penalties are recovered under the "Summary Convictions Act," before any Justice of the Peace having jurisdiction in the locality in which the offence was committed, and every such penalty may, together with the cost of conviction, be levied by distress and sale of the goods and chattels of the offender.

31. Within one month after this Act comes into force, the Lieutenant-Governor-in-Council shall appoint a provisional Council consisting of eleven members, who shall elect their own officers.

At least one member shall be chosen from practitioners in each of the branches of Engineering named in Section 2, Sub-section (b) hereof.

Duties of Provisional Council

32. The duties of the Provisional Council shall be to provide the Register called for by this Act, to enter therein the names of those and those only who are entitled to registration under the provisions of Section 7, Sub-section (b), and who apply in writing to be registered and pay the prescribed fees, and to call within six months from the coming into force of this Act the first general meeting of the Association, for the purpose of electing the regular Council and any other organization purposes of the Association; and shall have the powers conferred in this Act on the Council of the Association. Their powers shall cease on the election of the regular Council of the Association.

33. Every person registered under this Act shall have a seal, the impression of which shall contain the name of the Engineering, the branch of Engineering in which he has been accepted, and the words "Professional Engineer, Province of British Columbia," with which he shall stamp all official estimates, specifications, reports, documents and plans.

34. No provision of this Act restricting the practice of the profession or imposing penalties shall take effect until the first day of April, 1921.

35. Nothing in this Act contained shall be construed as altering or affecting any provisions of the Coal-mines Regulation Act, Metalliferous Mines Inspection Act, or the Pharmaceutical Act.

36. Nothing in this Act contained shall be construed as preventing the carrying on by any person on his own property of any work for the sole use of himself and his domestic establishment; nor the designing, construction or installing by any person of appliances, works or plants of a value not exceeding five thousand dollars; provided, however, that such work shall not involve the safety of the general public.

"CEMENT-GUN" FOR PILE PROTECTION

IN a railroad trestle extending beyond shore line, the four-pile wooden bents were considerably deteriorated below the high water line and have recently been reinforced and protected by cement mortar applied by the gunite process. A cement gun and supply of sand and cement were loaded onto a flat car, followed by another flat car equipped with a motor-driven air compressor, pressure tank and fresh water reservoir. The gunite was applied from $\frac{1}{16}$ in. to 8 ins. thick, depending on the condition of the piles, and wherever large holes had been eaten by marine borers they were covered by wire netting and the piling was brought up to normal size, and in all cases was protected to above high water level. Short piles were treated at the rate of almost one pile per minute, and after 7 days it was difficult to break the gunite—even in the thinnest places—with continuous pounding. The work was executed by a gang consisting of one man who handled the sand and operated the motor, another who handled the cement-gun and served as conductor of the train, two men to feed sand and cement to the mixer, one man delivering the mixture to the cement-gun, and one man to operate the cement-gun, besides a machine tender and a helper, and three men to handle the hose and nozzle.—From "Public Works."

The Municipal Committee of the Ontario Legislature has approved of a proposed amendment to the Highway Improvement Act requiring every engineer appointed by a county council to be a graduate in civil engineering of a university, or a member of the Engineering Institute of Canada, or an Ontario land surveyor.

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DO CONSISTENCY AND RICHNESS DETERMINE STRENGTH OF CONCRETE MIXTURES?

FRESH impetus may soon be given to the struggle to find a satisfactory means of measuring the consistency of concrete mixtures. A prominent investigator in the United States has collected data, as the result of a number of original laboratory tests, that appear to indicate that with a given richness of mix and a given consistency, all concretes made from given materials will have the same strength regardless of the cement-water ratio or the gradation of the aggregate. In other words, using aggregate from the same source, and with any given brand of cement, he believes that a 1:2:4 mix and 1:3:3 mix, for example, would have the same strength, provided that sufficient water is used in each case to bring the two mixtures to exactly the same consistency.

Sufficient tests have not yet been made to establish this theory definitely, and the investigator recognizes that more extensive research work is required before he can make any claims for this theory that will be worthy of the attention of the technical world; nevertheless the theory is a most interesting one, and whether substantiated or not, proves once more how important it is to secure some recognized and effective standard for the measurement of the consistency of concrete. Given some dependable apparatus for measuring consistency, the theory above outlined, if further tests prove its accuracy at least within the range of workable mixes, would certainly simplify to a marvellous degree the work of concrete engineers, contractors, inspectors and laboratory men.

Unfortunately the problem of determining consistency seems far from solution. None of the methods applied to other materials are satisfactory or practical when applied to concrete mixtures, and the methods now in use in the various laboratories are very different, and most of them are very unsatisfactory. The slump test has probably been the most popular, and is being adopted officially by some prominent committees, but the objections entered against it are serious. The flow table, tilting chute and other tests have more or less merit, but engineers do not agree in regard to their relative usefulness. They do not agree, to begin with, on the relation between consistency, flowability and slump. The so-called "flow table," devised by G. M. Williams, of the U.S. Bureau of Standards, holds forth cosiderable promise as an improvement on the slump test, and all engineers who are interested in concrete work, will desire to know more about the flow table, and no doubt a number of those who have laboratory facilities under their control will be interested in obtaining detailed information such as would enable them to construct experimental flow tables for their own work. We are very pleased to be able to announce that Mr. Williams has promised us an article on flow-table tests for an early issue.

ARCHITECTS AND ENGINEERS

SHOULD an architect or an engineer have charge of the design and construction of bridges and other important structures.. The question was recently brought to the attention of the U.S. Engineering Council by the American Society of Civil Engineers and by the American Institute of Consulting Engineers. Each of these two organizations had adopted formal resolutions expressing its belief that engineers should have charge of design and construction of bridges and other structures in which engineering elements predominate. Occasion for these resolutions was given by the engagement not many months ago of architects to have charge of the design and construction of certain prominent bridges in Pennsylvania.

This perplexing problem has been considered by a joint committee of Engineering Council and the American Institute of Architects. After a full and frank discussion of the points at issue, the committee composed of three engineers and three architects, all of whom were present, unanimously concluded that the special conditions surrounding each case should determine whether an architect or an engineer should be selected to have charge.

Whether an engineer or an architect has the primary engagement for a project on which the services of both are needed, an important requirement, frequently neglected, is that the collaboration should date *from the beginning.* Each should be given fair credit for his contribution to the completed structure.

Letter to the Editor

FAILURES IN CONCRETE CONSTRUCTION

Sir,—Referring to letters published in the April 22nd and 29th issues of *The Canadian Engineer*, entitled, "Failures in Concrete Construction," that of R. E. W. Hagarty is certainly unfortunate. The opening paragraphs of his letter would indicate that he had no faith at all in concrete, however designed and constructed, but he ends up with the statement that concrete "undoubtedly constitutes one of the most permanent, economical, safe and fireproof methods of building that the world has yet produced."

The ten mistakes recited by Mr. Hagarty are not perpetrated by well-known contractors who have a reputation to sustain. Moreover, specifications cover these points and they constitute nothing more than common sense in concrete construction. They are not being generally violated, as one would be led to believe by Mr. Hagarty.

Instead of constituting "an optical illusion," and being "probably the greatest piece of engineering camouflage which

has ever been 'put over' the innocent public," flat slab construction marks a notable step in the development of permanent, fire-safe, economical concrete buildings. It is true that the design of flat slab construction is based largely on empirical rules founded on the results of tests, but any reasonable analysis of a purely mathematical nature does not reveal anything in conflict with these empirical rules. Moreover, designs executed in accordance with them carry a large factor of safety, as is well-proven by the tests themselves. I hold no brief for any of the systems of arrangement of reinforcing in flat slab construction, but the evidence of the dependability and integrity of the general type of construction has been so completely proven that it is really astonishing to read a sweeping attack on it.

In closing I wish to call attention to references made in both Mr. Hagarty's and Mr. Mylrea's letter to failures of concrete buildings. I would like to ask both of these gentlemen, or anyone else who has read these letters, for definite information which they may have relative to the failure of any concrete structure under the load and conditions for which it was designed. It has been my pleasure to investigate some of these so-called failures with the uniform result that the facts indicated extraordinary conditions, or that the structure which failed could not be classed as a real reinforced concrete structure at all..

A. C. IRWIN,
Engineer, Structural Bureau,
Portland Cement Association.

Chicago, Ill., May 22nd, 1920.

PERSONALS

J. C. GWILLIM, Professor of Mining Engineering at Queen's University for many years, has been forced to resign on account of ill-health.

W. P. NEAR, city engineer of St. Catharines, was recently elected chairman of the Niagara Peninsula branch of the Engineering Institute of Canada.

MAJOR ROUNDELL PALMER, late of the Royal Engineers, who has recently been acting as manager of the public utilities of Brockville, Ont., is leaving to take charge of the installation of the Hydro-Electric Commission at Alexandria.

CHARLES J. DES BAILLETS, for the past three years manager and chief engineer of the Gas and Light Department of the corporation of Sherbrooke, Que., has been appointed by the Montreal Water Board as engineer in charge of aqueduct work.

J. W. DORSEY, assistant professor of electrical engineering at the University of Manitoba, has incorporated a company under the name of the Dorsey Electrical Laboratories, Ltd. Prof. Dorsey announced a few months ago that he had discovered a new and cheaper method of transmitting electrical power, but no details of his invention have yet been made public.

H. L. SEYMOUR, assistant to Thomas Adams, housing and town planning adviser to the Dominion government, will soon sever his connection with the government in order to accept an offer of partnership with Frank Barber and R. O. Wynne-Roberts, consulting engineers, Toronto. In his new connection Mr. Seymour intends to link town planning with the firm's other activities.

OBITUARIES

LEWIS BENNETT, for thirty-seven years a contractor in Hamilton, Ont., passed away on May 17th.

ROBERT MACFARLANE, of MacFarlane & Sons, con tractors, in business for the past seventeen years in Calgary, Alta., died on May 8th.

DONALD PATTERSON, formerly engineer of Huron County, Ont., died recently at his home near Auburn, Ont., at the age of 70. Mr. Patterson retired as engineer of Huron County nearly a year ago, after having held that position for 15 years. He was succeeded by his son, Roy Patterson. The late Mr. Patterson was very interested in municipal affairs, and for some years previous to his appointment was a member of the township council.

SOME SALARY!

EVIDENTLY the salary problem is not confined to this continent. A correspondent draws the attention of the editor of "The Electrician" (London), to a recent advertisement in this wise:—

"Mr. J. W. Hame, city electrical engineer of York, wants a mains superintendent, experienced not only in high-tension, alternating current and low-tension direct current cables, but also in the construction and maintenance of overhead transmission lines, and for this experience he is prepared to pay £90 per annum plus the E.P.E.A. Awards.

"Mr. Hame takes the trouble to point out that at the end of four years of presumably satisfactory service this sum would be increased by a further £42 per annum, and I am sure that what is of more interest to your readers is not what is to happen to the successful candidate in 1924, but whether the Corporation would bury his remains—there would not be much, just the bones and perhaps a little skin attached to it—or if the sorrowing widow would have to do that out of his savings. Further, I should like to know what happened to the previous occupant of that lucrative position, and how many men the job uses up in a twelvemonth. They must have a pretty short life, else Mr. Hame would not make such extravagant promises to those who survive a year (just fancy, another four pence a day extra); its worth is but little stimulant to try to keep alive for that.

"Mr. Hame as well as the Corporation of York are members of the I.M.E.A. Does that body approve of such starvation wages and if they do not approve, have they the courage to protest to their members who are bringing them into discredit, and point out that they are not only a danger to the industry, but a disgrace to their Association?

"What have the Associated Municipal Electrical Engineers to say to this? They are trying to get their own salaries put on a proper basis, as at present they are only being paid from two to three times the salaries of their deputies. Electrical engineers are not a superstitious race, but I would remind them of that legend of Ancient Greece which likens retribution to a bloodhound from which there can be no escape, and which sooner or later inevitably overtakes the culprit and those associated with him."

Water from the Assiniboine River is being sterilized by ultra-violet rays for use in the Brandon Hospital for the Insane.

The bill for the licensing of professional engineers and land surveyors in New York State was passed by the legislature April 24th, and signed by the governor May 4th, 1920.

An effective "safety-first" mechanical device that will instantly disengage a drive when the load exceeds a predetermined point, has been developed by the Link-Belt Co. It is known as the "Lettgo" Mechanical Overload Release. It is especially adaptable for elevating, conveying, and power transmission machinery.. The "Lettgo" will automatically disengage the driving from the driven machinery if the load exceeds the fixed amount, thus allowing the driving motor or other source of power to run free and prevent damage due to the inertia of the motor armature or other high-speed moving parts. The construction of this device is such that it will release whether the load is gradually or suddenly applied, but it can be set so that it will not trip from jars or shocks. The "Lettgo" is symmetrical, and can be assembled to operate in either direction. It can be adjusted for tension, so that it will operate for any desired overload.