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The Canadian Engineer

A weekly paper for Canadian civil engineers and contractors

Canada Protests Against Weir in St. Lawrence

Dominion Government Wants Direct Assurance From the United States Government That It Will Be Removed After the War—To Compensate for Dredging or Merely To Remedy Ice Conditions?—International Joint Commission's Session at Montreal

APPROVAL of the application of the St. Lawrence River Power Company to construct a submerged weir in the South Sault Channel of the St. Lawrence River, near the entrance of the company's power canal leading to the Grass River, was strongly opposed by the Canadian Government at the meeting of the International Joint Commission held last Thursday and Friday at Montreal. The Canadian Government presented its reply to the company's application in printed form, setting forth the following objections:—

"Both the channels at the Long Sault stand in different positions to the others in the St. Lawrence River, in that, by Article VII. of the treaty commonly known as 'The Webster-Ashburton Treaty of 1842,' it is stipulated 'that the channels of the River St. Lawrence on both sides of Long Sault Island and of Barshart Island shall be equally free and open to the ships, vessels and boats of both parties.'

"Any interference with the free and open navigation of the South Sault channel specifically mentioned in, and covered by, said treaty is not within the jurisdiction of the International Joint Commission, but should be dealt with by direct negotiations between the high contracting parties to the said treaty.

"Furthermore, the treaty between the United States and Great Britain, relating to boundary waters, treaty series No. 548, is the foundation of the jurisdiction of your commission.

"In article 10 thereof it was agreed that 'the navigation of all navigable boundary waters shall forever continue free and open for the purpose of commerce to the inhabitants and to the ships, vessels and boats of both countries equally. Subject, however, to any laws or regulations of either country within its own territory not inconsistent with such privilege of free navigation, and applying equally and without discrimination to the inhabitants, ships, vessels and boats of both countries.'

"It is respectfully submitted that all boundary waters of the two countries are to continue free and open, and that your commission has no jurisdiction to alter the treaties subsisting between the high contracting parties relating to same.

Entire Traffic in Canadian Bottoms

"Any attempt to close this channel of the St. Lawrence River, specifically agreed to be kept open for navigation, is of much more importance to the Dominion of Canada than to the United States, in that the St. Lawrence River is the main artery for navigation to the sea by Canada, and almost the entire traffic of this river is carried in Canadian bottoms.

"The South Sault channel of the St. Lawrence River has been used by a number of boats, and freight has been transported down such stream, and if it is alleged by the applicants that it is not now used for navigation, it can only be that the said applicants have diverted about half the natural flow of waters that should go down this channel into their power canal, thereby interfering with navigation to that extent, and now seek to entirely close the navigation thereof.

"That even now it is the only channel that can be used for the carrying of logs in rafts, and previous to the outbreak of the present great European war was so used extensively, and when this class of business revives the proposed weir would compel the passing of rafts through the canal at Cornwall, which would be to the detriment of the rafting, the general freight and passenger business.

Will Alter River Level

"That the closing of this channel, as proposed, will alter the level of the river above, but to what extent the engineers of the Canadian Government have not had an opportunity to definitely satisfy themselves.

"That the closing of this channel will throw the burden of caring for the ice entirely upon the Long Sault Rapids, and possibly create worse conditions than at present in the river above.

"That, whilst the company asks for permission to construct this weir for the alleged purpose of improving ice conditions in the South Sault channel and at their power plant, evidence shows that it is practicable to handle ice in a manner so as to render the proposed weir unnecessary for ice protection purposes.

"That, if the applicants desire more electrical energy during the months of January, February and March, as is represented to your commission, that the blocking of this channel is not the only way by which such additional power may be obtained.

"That whilst the increased output is alleged to be necessary to meet an emergency, the works proposed will close the channel for all time.

"At present there is only developed at this part of the St. Lawrence River about 85,000 horse-power, and that by private interests, whereas there is capable of international development by the two countries some 700,000 horse-power.

"The present applicants, without the concurrence of Canada or without the order of this commission (which it is respectfully submitted should be first obtained), are dredging a channel through Dodger Shoal, and it may be that this proposed dam, instead of being solely for ice protection, is rather a part of the entire scheme to obtain more power at Massena.

"If the Dodger Shoal be dredged, as the applicants seek to do, it will materially affect the level of Canadian waters above the Dodger Shoal and the canal system of Canada at this point on the north shore.

"If the submerged weir be constructed in the South Sault channel, by way of compensation for the dredging at Dodger Shoal, then the control of the high and low-water levels at this part of the St. Lawrence River will pass from international territory and control to the power house at Massena.

"That the proposed works are sought to be erected by and then will remain the property of a private corporation, and are situated in the public domain in a large and important channel of a great highway, and it is contrary to the public interest to permit such to be done by private corporations.

Governments Should Have Control

"That in connection with the deep waterway from the Great Lakes to the Atlantic, to which Canada is practically committed, the governments of both countries should keep control of the bed and full flow of the river so that private corporations may not acquire vested interests therein to be afterwards expropriated or repurchased.

"As has been repeatedly stated to your commission, Canada is opposed to any piecemeal development of the St. Lawrence, particularly by private corporations."

At the recent meeting of the commission held in Atlantic City, when notice of the company's application was first formally presented, the reason given for the application was that the weir was needed to protect the company's plant from ice trouble during the months of January February and March, so that full efficiency could be obtained all the year round, and more aluminum obtained for war purposes.

During the cross-examination of the company's engineers last week at Montreal, it developed that the weir was probably to compensate for the work done in Dodger Shoal, to the west of the site of the proposed weir, and about which Canada had not been consulted.

There were five commissioners at the Montreal hearing; Governor Glenn, one of the United States members, being ill in Atlantic City. Hon Hugh Guthrie, Solicitor-General, and F. H. Keefer, K.C., appeared for the Canadian Government, while G. H. Kilmer, K.C., watched proceedings for the Province of Ontario and the Ontario Hydro-Electric Power Commission; Francis King, of Kingston, appeared on behalf of the Canadian Marine Association; F. E. Meredith, K.C., for the Montreal Harbor Commissioners; James White and Arthur V. White for the Commission of Conservation, Canada; Marshall McLean for the State of New York; Judge Koonce for the United States War Department; George Gordon, Pittsburg, and Leighton McCarthy, Toronto, attorneys for the company; Henry Holgate, Montreal, and B. F. Groat, Pittsburg, engineers for the company.

Judge Koonce Asks Approval

Judge Koonce opened by stating that at Atlantic City he had asked for the hearing of the application. "But now I am asking you to give your approval of the company's application for the sole reason of helping the output of aluminum in order to aid war preparations," said he. "I have here a letter from the Secretary of War, and I do not consider it necessary for me to say any more."

The letter was dated August 23rd, 1918, and pressed for the application to be presented to help out the aluminum supply, and that construction of the work would be of no disadvantage to navigation.

Hon. Hugh Guthrie stated that the government appreciated the attitude of the United States, but "the government of Canada desires to have it thoroughly understood that it in no way seeks to block, hinder or delay any essential work or development which may be necessary or conducive to increase the production of war material by the United States, or by citizens of that country. On the contrary, the government of Canada is anxious to assist in every proper and legitimate way to the end that both the United States and Canada may put forth a maximum of war efforts in the present conflict with the least possible delay," said he. "With such purpose and desire firmly and prominently in view, the government of Canada respectfully submits that the present application of a private corporation to construct a submerged weir across the south branch of the Sault Island channel is directly contrary to both the letter and spirit of existing treaties, and the application raises the question and involves a matter which are subjects of treaty rights and beyond the jurisdiction of the commission to entertain and decide.

"The government of Canada submits that the questions raised have an international scope and bearing and only should be discussed internationally. The Canadian Government, therefore, desires formally to express both its willingness and its readiness to enter upon intimate negotiations and discussions with the United States Government of the whole question of supply and development of power at the Long Sault Island channels in the St. Lawrence River, and the rights and obligations of the respective countries in regard thereto, and to reach a speedy solution of the whole power question at Long Sault Island upon a satisfactory basis to the governments of both countries.

Diversion Not Authorized

"However, the Canadian Government does not in any sense admit the right or title of the St. Lawrence Power Company to divert any of the waters of the river for any purpose. The Canadian Government takes the position that the company has not, and never had, any valid legal right to construct or maintain its canal or divert the water from the river."

Marshall McLean, for the State of New York, claimed that New York was ready and anxious to co-operate to the fullest extent in winning the war, but there were certain fundamental rights between the states and the company.

"The proposed weir is, in fact, to place a dam across a navigable stream," said he. "This will absolutely destroy navigation in the South Sault Channel," He also claimed it meant diverting nearly all the water down the canal.

He pointed out that there is great danger of the company claiming proprietary rights to any structure placed there. The permit for the application was intended to increase the power efficiency and not to increase the rights under the charter. "It would be all right to grant a permit for the duration of the war," said Mr. McLean, "but not for any longer. Title to any structures should remain in the State of New York, the company operating under a charter of the State of New York that provides for certain structures which must not interfere with navigation."

Jurisdiction Undecided

Judge Koonce declared the State of New York had no power over navigable waters, and that the Secretary of War in granting the permits had protected every right of the State of New York.

The commissioners decided to leave the question of jurisdiction for later decision.

A. B. Davis, president of the Aluminum Co. of America, stated that increased production could not be

secured at any other plant. He was reluctant to leave the title to the dam in the possession of any government and did not believe that it could be built expeditiously by the governments. He wanted the dam for war purposes during the war and to prevent interference by ice with ordinary production after the war.

Evidence was produced on Friday to show that the South Sault Channel is navigable.

Mr. Guthrie then appealed to Judge Koonce to get in touch with Washington and have a direct agreement made between the United States and Canadian governments that the weir would be removed after the war, but Judge Koonce did not assent.

Jas. W. Rickey, the company's hydraulic engineer, said that the weir must be in by December 20th and as it would take three months to complete the work, the commission's permission must be secured by September 15th.

The commission met in private session on Saturday to discuss the evidence submitted and will no doubt announce their decision before the end of next week. If the application is granted, the Dominion Government will at once request the United States government to guarantee that the weir will be removed upon request of the Dominion Government at any time after the war. Formal protest will also be made against the present diversion of water through the company's power canal and against any possible future increased diversion.

PLANNING A SYSTEM OF RURAL HIGHWAYS*

By W. M. Stewart
Saskatchewan Land Surveyor

IN all districts which have achieved a system of good roads it is recognized that one of the first essentials is the adoption of a well-considered, carefully worked-out system of roads, classifying the roads according to traffic and placing the system so adopted on a definite, permanent basis by preparing a plan showing the system of roads adopted.

Three Main Divisions

Rural roads are usually classified according to traffic, under three main divisions, as follows:

1. "Main Trunk Highways" or "Provincial Roads," being those which carry a large proportion of through traffic between important cities, towns and other terminal points.

2. "Leading Market Roads," which are those radiating from local market or shipping points and carrying a considerable accumulation of traffic.

3. "Local" or "Neighborhood Roads," being those which carry the traffic, or but little more than the traffic which is created by the farms actually adjoining the road.

An adequate system of provincial and leading market roads will usually comprise about 20 per cent. of the total road mileage in a municipality and will take care of from 80 to 85 per cent. of the total traffic in the municipality. It is evident, therefore, that construction should, so far as possible, be concentrated upon the system of main roads and consequently the system of main roads should be defined at the very inception of a scheme of road development. This necessity is further emphasized when it is remembered that upon the traffic which a road has to carry, that is upon its class, should depend the standard to which it is constructed.

Most municipalities have in a general way determined upon what they consider will be their main roads, but very few of these systems have been actually defined in a definite manner and the various roads considered as main roads by the council one year, are frequently changed by succeeding councils and, further, very few of the systems are based upon a thorough study and analysis of the existing and prospective conditions. This condition must eventually result in a great deal of waste and lack of efficiency in the service given by the roads and it is submitted that the placing of the policy of our municipalities upon a proper basis in this connection is one of the most important steps that the provincial highway officials can take. (And for that reason the Town Planning and Rural Development Act recently passed by the legislature deserves to be welcomed by the rural municipalities and also by highway engineers.)

Main Roads System

The following method of analysis and working out a system of main roads for a rural municipality is doubtless open to much improvement, which will suggest itself as this class of work develops in this province. However, it is outlined in the hope that it may be of use to other members of the profession when they are called upon to deal with work of this nature.

The first step in the planning of a system of provincial highways and leading market roads is the preparation of a plan of the district to be dealt with, showing all railroads, towns, villages, loading platforms at railway sidings, main trunk highways, schools and public gathering places. The Provincial Highways Department should be communicated with for information as to the provincial highways in the district and also as to any information they may possess as to proposed railway lines, etc., in the district. An analysis is then made of the whole district, with the purpose of determining which market towns give the shortest haul for each quarter section and based upon this analysis the whole district is divided into sub-districts, each of which is naturally tributary (from the standpoint of distance alone) to a market town.

Basis for Comparison

An analysis is then made of various alternative locations for the leading market roads, so designed as to:

1. Bring each quarter section as near as possible to a leading market road when following the route of shortest haul.

2. Link up the various leading market roads so as to provide to the best advantage for traffic between sub-districts and between the various cities and towns, also keeping in mind that certain towns, owing to their superior shopping or market facilities will receive much traffic from districts other than those actually tributary to them from the standpoint of distance.

3. Best serve the community when considering the provincial highways, schools, public gathering places, etc.

The system so worked out serves as a basis for purposes of comparison when the changes necessitated by natural topographical conditions, existing settlement, prospective future settlement and development in adjacent or related urban and rural communities or districts are taken into consideration.

The second step is the assembling of information as to: (a) The intensity of settlement and production in the

*Paper read before the Saskatchewan Land Surveyors' Association.

various localities in the district; (b) the class of the unsettled land, for the purpose of serving as a basis for estimating future development; (c) prospective location of new railroad lines, towns, etc.; (d) existing and probable future development in adjacent or related communities; (e) topographical features for the purpose of determining the natural suitability of certain alternative road locations, as upon this factor depends largely the initial cost of the road, the cost of its maintenance and the possible gradients, etc., with the consequent cost of haulage and also the freedom of access to the main roads from the territory to be served; (f) road improvement which has already been done and the condition of the roads so improved.

Final Location

With this information assembled, the final location of the various main roads is made.

In locating these roads it will usually be found necessary to follow existing road allowances (except for minor diversions to avoid serious obstacles) or else along existing land boundaries, such as section and quarter section lines. Diagonal roads for rural districts, while possessing many advantages, are usually out of the question in Saskatchewan (where the system of subdivision is rectangular in form) owing to the waste of land and inconvenience to farmers which they cause. In some cases, owing to existing railroad lines or peculiarly suitable topographical conditions, it may be possible to provide diagonal roads to advantage, but as a general thing they cannot be adopted. The most advantageous location for a leading market road in some cases is a road following the regular road allowances, or section or quarter section lines and zigzagging across the sub-district. However, no general rules can be laid down and each case must be considered as a special problem.

Upon the above basis of consideration the final location of the main roads is made, endeavoring always to keep the final system worked out as near as possible to the basis established when considering distance alone and thus securing the shortest possible haul.

With the system of roads established, a road development plan is then prepared showing the system. This plan should be so prepared that in addition to showing the system of roads adopted, it may also be used as a general road record for the municipality, showing bridges, culverts, drains, improved roads, etc., and being brought up-to-date each year.

Permanence of Policy

In the past, one of the great difficulties in the establishment of a definite system of main roads was the continual changes made by succeeding councils in the policy in this connection. The new Town Planning and Rural Development Act, by its provisions enables the system to be given the permanence which is essential to the success of its development.

The mapping of the final system of main roads adopted should not be considered as completing the work in this connection, for unless development follows along the lines laid down, no better results follow than if the system had never been planned. Therefore, coincident with the adoption of a plan of the road system, an annual program of work, calculated to develop the system in a specified period, should be worked out and its execution provided for as securely as possible. An investigation should be made of the financial ability of the municipality to determine the best method of financing the work, whether upon a cash basis or by bond issues and the whole policy put upon as definite a basis as possible, in order to secure, so far as possible, the continuous development from year to year of the system of roads adopted. It will, of course, not be possible to devote all the road funds available each year to the development of the system of main roads, as there will always be certain isolated pieces of local road upon which it is absolutely necessary that some work be done. It will also probably be impossible to lay down a definite program of work to be carried out through a period of succeeding years. However, a start should be made at the very inception of the scheme by adopting a tentative program of development to be carried on through a definite period to the completion of the system. This initial program will doubtless require amendments as experience develops in succeeding years, but it provides a definite goal to be worked to and permits of interesting and obtaining the support of the public by presenting to them a definite goal towards which development is proceeding, and secures, so far as possible, the continuous development of the system of provincial and leading market roads.

Development By-laws

The new Town Planning and Rural Development Act, by providing for the passing of "development by-laws," enables the adoption of such a program. The "development by-laws" should specify the standards of construction which must be adhered to in the construction of different classes of road, provide for adequate maintenance and also specify the organization to be adopted in carrying on construction and the principles to be followed in financing the work.

The adoption of a well-planned system of roads and adequate accompanying "development by-laws" will insure the construction of those roads which will give the greatest service to the community; will eliminate waste of invested capital through subsequent alterations which would otherwise be necessary eventually; will effect a saving in construction and maintenance costs and reduce haulage costs and generally put the road policy on a proper basis by providing for the proper financing of the work, efficient expenditure of the moneys and protect the investment from deterioration by adequate maintenance.

Community Settlements

In conclusion, it should be noted that no specific reference is made herein to "community settlements," recreation sites, etc., which properly belong in any discussion of a development scheme. These matters, in themselves, constitute a subject of some magnitude and it was decided to confine the discussion more particularly to the actual planning of the highway system. It will also be noted that no reference is made to the necessity for a traffic census. Under the existing circumstances as to the stage of development in Saskatchewan, it was considered that the planning of a system of highways should be based upon where the main roads should be located in order to direct traffic into the most efficient channels, rather than to follow existing traffic. A traffic census in connection with the planning of a system of main roads in Saskatchewan was therefore not considered necessary in the average municipality. As development proceeds and some type of improved road surfacing is necessary a traffic census should, however, be made in order to assist in determining the type of surfacing to be adopted.

Canadian Contractors Form New National Association

General Conference to Be Held October 22nd, 23rd and 24th in Ottawa to Form a Dominion-Wide Organization of Interests Connected With the Various Local Builders' Exchanges—Many Evils to Be Discussed and Corrected

TO improve the status of contractors in Canada, a representative group of men from Montreal, Toronto, Ottawa, London, Galt and other cities have decided to form a national association of general contractors, sub-contractors and supply houses. At a preliminary conference yesterday in Toronto, it was decided to organize a Dominion-wide conference to be held October 22nd, 23rd and 24th, 1918, at Ottawa, Ont. The following temporary executive committee was appointed, with power to add to its numbers especially in regard to western members:—

J. Penrose Anglin, of Anglins Limited, Montreal, chairman; D. K. Trotter, secretary-treasurer of the Montreal Builders' Exchange, secretary; W. Davidson, member of the Winnipeg Builders' Exchange; W. E. Dillon, of W. E. Dillon Co., Limited, Toronto; Herbert Elgie, Toronto; Harry Hayman, London, Ont.; H. Hazleton, president of the Winnipeg Builders' Exchange; J. D. Johnson, Ontario manager of the Canada Cement Co., Limited; W. A. Mattice, of the Dominion Bridge Co., Limited, Ottawa; W. E. Ramsey, of Pedlar People, Limited, Montreal; and E. A. Sanders, secretary of the Mechanical Trades Association, Halifax.

The preliminary conference was called at the suggestion of Mr. Anglin and was held at the rooms of the Builders' Exchange, Toronto. The first session was at 10 a.m. and adjourned at 1 p.m. The second session was called to order about 2.30 p.m. and adjourned two hours later. Among those present, besides most of the abovementioned, were:—

John Quinlan, Montreal; C. F. Smallpiece, eastern manager of the Taylor-Forbes Co.; H. N. Dancy, Toronto; T. Gander, Toronto; R. Jackson, of the Jackson-Lewis Co., Limited, Toronto; Walter Davidson, Toronto; Geo. R. Hyatt, London, Ont.; Edward and George Hayman, of Hayman & Sons, London, Ont.; A. G. Robb, of Galt; T. R. Wright, of London, Ont.; and F. B. McFarren, general manager of the Interprovincial Brick Co.; Geo. E. Stocker, president of Wickett Bros., Toronto.

Minister Will Meet Delegation

Vice-President Davidson, of the Toronto Builders' Exchange, occupied the chair during the morning session and W. E. Dillon, president of the Toronto Builders' Exchange, presided at the afternoon session. Mr. Anglin opened the discussion with an outline of the work that could be accomplished by a live contractors' association, briefly reviewing some of the evils now existing in the business, and stated that the Minister of Public Works has signified his willingness to meet the contractors, or a delegation from their association, to talk over the various matters that relate to Dominion Government work or to Federal legislation.

Mr. Anglin proposed the following tentative list of subjects to be discussed at the proposed Ottawa conference:—

Builders' exchanges (future usefulness of); quantity surveying; method of calling and opening bids; contract and bid bonds vs. cheques; contracts; standard agreements; unit prices; cost-plus-fixed-sum contracts; labor trade parliaments; employers' apprenticeship; technical education; resources, economy, readjustment and standardization of materials; future business; public works; relations with architects, engineers and owners; relations with sub-contractors and supply houses; powers of superintendent or inspector; arbitration; foreign competition; plan making; building by-laws; lien laws; relations with other organizations, such as Boards of Trade and Manufacturers' Associations; code of ethics as between general contractor and trade contractor, covering such subjects as receiving bids and awarding work, payments, bonds, bonuses and penalties; zones of operation; plant; yards; trade papers; and building statistics.

Open Bids Promptly

Mr. Quinlan called special attention to the hardships created through the requirement by the Dominion Government and many other public bodies of marked cheques with tenders. The banks charge high rates of interest, and as these cheques are often retained for long periods, it is a costly practice. Mr. Quinlan thought that in the first place guarantee bonds should be accepted universally and secondly, the bids should be opened at once in the presence of the bidders, and awarded promptly to the lowest bidder if any award is made at all. There should be no delay, no need for wire pulling to find out where one stood in the bidding and no inconvenience through having to refuse other work until announcement is made of the bids for big jobs on which one may have tendered and for which one may desire to reserve funds and staff in the hope of having been the lowest bidder.

Mr. Anglin told how the National Federation of Building Interests had been recently formed in the United States under the auspices of the Chamber of Commerce of that country. Its purpose at present is to discuss building for war work and after-the-war problems. Its proceedings will be of assistance to the newly formed Canadian association, thought Mr. Anglin.

Mr. Elgie referred to foreign competition, but Mr. Anglin thought that unfair home competition is a more serious matter. Too many manufacturers are now doing their own building, thinking that they can buy labor and materials as cheaply as a contractor, and that a capable superintendent is all that is necessary for the construction of works by day labor. It was the concensus of opinion that representations should be made to supply houses and labor unions that an established contractor, who buys in large quantities the year around and who employs labor continuously, should receive a legitimate trade discount upon the prices quoted to the occasional buyer or the temporary employer.

Mr. Wright enquired regarding the fate of the former National Association of Builders' Exchanges. Mr. Anglin and Mr. Gander explained that its demise had been due to a mistake in dividing it into eastern and western sections, having no central executive and no definite dates for meetings.

Mr. Elgie moved that the meeting divide into three separate meetings—supply men, sub-contractors and general contractors—for an hour's discussion of the more selfish viewpoints of each of these three component parts of the field represented, and that each section then make a report to the committee of the whole regarding any

recommendations for the Ottawa conference. This was done, and after lunch reports were heard from Mr. Johnson, representing the supply section; Mr. Gander, of the sub-contractors; and Mr. Anglin, of the general contractors.

Mr. Johnson said that he could not speak for supply firms in general. He had been invited to the meeting by Mr. Anglin and attended to give any assistance he could in bettering the status of contractors, but he could speak only for his company and not for any supply organization. He did not know whether supply firms would wish to join the contractors' association or not, but he thought they had many interests in common. The builders' supply dealers are already well organized locally throughout the country but have no provincial or national association. Did the meeting desire supply men in their association?

Restrict Membership to Exchanges

That question caused a brief discussion, from which it developed that the majority favored a broad association that would take in supply men, sub-contractors and general contractors, but which would have by-laws so drawn that the three would be in separate sections and would meet independently to discuss their own problems, with occasional joint meetings to discuss problems of mutual interest or to hear addresses of value to all three sections. Later, engineering and architectural sections might possibly also be formed should engineers and architects evidence a desire to share the meetings and experiences of the contractors.

Mr. Gander reported that the sub-contractors favor the restriction of membership in the national association to members of local Builders' Exchanges excepting in the case of members who reside in towns where there is no such exchange; that upon the award of a contract to a general contractor, the latter should immediately award the sub-contracts to the men whose bids he had used in making up the general tender; that a standard contract form be prepared which would be binding upon and acceptable to both parties; that supply men and labor unions should give a trade preference to recognized contractors.

Mr. Anglin reported the following resolution for the general contractors:—

Separate Section for General Contractors

"That we, the general contractors' section of the preliminary meeting of the building industries of Canada, recommend that a meeting of the contractors of Canada and allied interests be called to meet this Fall in Ottawa; and as there are at present organized departments of sub-contractors and supply concerns, we recommend to the Ottawa conference that an organization of general contractors be formed either as an affiliated body or as a department of the Builders' Exchanges."

Mr. Anglin reviewed the history of the General Contractors' Association formed in 1912 in Montreal, which was independent of the Montreal Builders' Exchange and which was not a success. He thought that any contractors' association, to be successful, must affiliate with the Builders' Exchanges. Mr. Anglin said that membership in the new association could be limited entirely to members of the local exchanges, as it is the intention to make those exchanges district centres. Contractors in Dundas, Ont., for example, should belong to the Hamilton Builders' Exchange.

Mr. Elgie then moved that the conference be held on the dates above mentioned. His motion was carried unanimously, after which the meeting adjourned.

ENGINEERING INSTITUTE OF CANADA ELECTIONS AND TRANSFERS

AT a meeting of the council of the Engineering Institute of Canada, held August 27th, 1918, in Montreal, the following elections and transfers were announced:—

AYER, KENNETH ROGER, of Ottawa, elected associate member. Mr. Ayer was born at Montreal in 1887. He received B.A. and B.Sc. degrees at McGill University. After serving as engineer with various companies, he became manager and engineer of the Superior Brick Co., Fort William, Ont. Since 1916 Mr. Ayer has been superintendent of the gauge laboratory, Imperial Ministry of Munitions, Ottawa.

CHAMBERS, CHARLES, of Calgary, elected member. Mr. Chambers was born in Richmond, Eng., in 1862. After graduating in an engineering course at the Royal Indian Engineering College, England, he entered the service of the Anglo-American Brush Electric Light Corporation, London. Later he became honorary assistant engineer to the Bombay Port Trust, India, where he was in responsible charge of construction at various times for several companies. He was for nine months director of the government observatory at Bombay, resigning to become first assistant engineer of the Government Central South African Railways. Mr. Chambers is at present inspecting engineer of the Irrigation Branch, Department of Interior, Ottawa.

ELLIS, JOSEPH CHASE, of Halifax, elected junior member. He was born at Selmo, N.S., and received a B.Sc. degree this year at the Nova Scotia Technical College. For two summers Mr. Ellis was with the Geological Survey, and has recently been in charge of a stadia party.

FAULKNER, FREDERICK RICHARDSON, of Halifax, elected member. Mr. Faulkner was born at Truro, N.S., in 1878 and was educated at Acadia University and at the Massachusetts Institute of Technology. After serving for one year as instructor at the Massachusetts Institute, he became assistant engineer of the Bangor & Aroostook R'y; and six months later, resident engineer of the Kettle Valley R'y, in British Columbia. Mr. Faulkner is at present professor of civil engineering at the Nova Scotia Technical College.

GROVE, HUMPHREY SHAKESPEARE, of Lachine, transferred from junior to associate member. Mr. Grove was born at Battersea, Eng., and graduated in science at McGill University in 1909. He was formerly on the drafting staff of the St. Lawrence Bridge and is at present plant manager for the Dominion Bridge Co.

IRELAND, WILLIAM JAMES, of Winnipeg, elected associate member. Mr. Ireland was born at Stratford, Ont., and educated at the Collegiate Institute and by private tuition in advanced mathematics. After serving as apprentice to D. G. Baxter, of Stratford, he became assistant to the city engineer. In 1901 he became chief draughtsman and outside superintendent for Pollmar & Ropes, structural engineers, Detroit, and ten years later was appointed vice-president and manager of the E. B. Reece Engineering Co., Winnipeg. Mr. Ireland is at present assistant chief engineer of the Manitoba Hydrometric Survey, Water Power Branch, Department of the Interior.

MACNAB, IRA PERCY, of Halifax, elected associate member. Mr. Macnab was born at Malogash, N.S., in 1884, and after attending the Nova Scotia Technical College, served four years' apprenticeship in a machine shop. Then he was appointed manager of the Truro

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CONCRETE IN ALKALI SOIL AT SASKATOON*

By H. McI. Weir
Assistant City Engineer, Saskatoon

THE question of the disintegration of concrete in alkali soils has caused a great deal of discussion and considerable uneasiness among engineers throughout the West, especially within the last few years. The Engineering Institute has recently been making extensive inquiries in different localities and it was decided to discuss the subject.

In noting a number of cases of damage to concrete structures in Saskatoon, caused supposedly in part by the action of alkali; it was hoped to be able to present some chemical results, but as there was no information as to the proportions of mix, nor any chemical analyses of the ingredients, the results would not be of much value. After consulting with a chemist on the question, it was decided to only give a description of the physical condition and appearance of a number of cases in alkali ground and compare these with conditions found in ground free from alkali. One case in particular is of interest because concrete blocks of the same manufacture have been used in different classes of soil with vastly different results.

Using Pit-Run Gravel

The greater part of the concrete in Saskatoon is made with pit run gravel, generally clean but containing rather a small percentage of coarse material. There is, however, plenty of good concrete made from it, although it is desirable to add a further amount of broken stone or screened gravel to get best results. The water used in all cases, at least in late years, has been the same. Regarding the cement, the probabilities are that the largest part of it was a good product. In any case it is only fair to assume that even if some of the concrete under consideration was not of the best quality it was not all poorly made.

The main business section of Saskatoon is built on an alkali slough, which is still to be seen in some of the unbuilt portions of the down-town district. Other parts of the city are quite different, there being no appearance of alkali.

The city was probably the first to experience any trouble in sub-surface structures—this is certain of their sewer manholes built in 1906-7 out of locally made cement blocks. As early as 1910 it was noticed that in certain localities the blocks were badly disintegrated; in other places they are still good. An example of this is on the Second Avenue sewer between 19th and 24th Streets where the manholes have had to be renewed, either wholly or in part, and some of them twice. The blocks were entirely disintegrated through their whole thickness. On the other hand, the manholes built of these concrete blocks on this same sewer nearer its mouth, where it is built through ground free of alkali, are still in service and in good condition. Quite recently I examined several manholes on Avenue C, on the west side of the city, another district free of alkali. These manholes were built in 1907 of the same kind of blocks and were all in excellent condition. It would seem more than a coincidence that structures built of concrete blocks, made at the same time by the same workmen, should fail when placed in one kind of soil and give good service in another.

Case A, one of the first cases where foundations in a building were renewed, was a warehouse building erected in 1907 on concrete foundations and pillars laid almost on the surface. No drainage was provided. It was decided to change the building partly to have a basement and partly on account of the very bad condition of the footings.

Case B, which showed very bad disintegration, was erected thirteen years ago. The floor in the basement has very little appearance of concrete now, being little better than loose gravel. Apparently the question of drainage had been given very little or no attention, the cellar being very wet, and no doubt this fact would hasten the destruction of the concrete. In 1917 the owners made some repairs to the west wall, and later in the same year the owners of the property immediately to the south erected a new building, excavating along the outer face of the south wall of this building, exposing it to its full depth. The wall was in a deplorable condition, one being able to dig the concrete out with a stick or the fingers to a depth of from six to nine inches. The wall, made from pit run gravel, had been waterproofed with pitch or tar, which apparently had been no protection. One curious feature noted, and which might be a clue to some cure for alkali action, was that along a portion of the wall from the bottom up several feet, manure had been deposited between the wall and where the side of the excavation had been made. Where the concrete was protected by the manure it was hard and in good condition—everywhere else it was decidedly soft. The owners of the building had to have all the faulty concrete removed and re-poured in conjunction with that of the new building being erected.

In connection with case B, mention was made of the poor condition of the concrete floor, or what had once been concrete. This condition is to be noted in a great many of the buildings in this locality. One case, C, was erected in 1912 almost immediately behind case B. Here although drainage has been attended to, the floor is very poor; where it is cracked, deposits of some white powder accumulated quite noticeably.

Footings and Walls Repoured

In 1912 a building was commenced on Second Avenue a little to the south of what may be styled case D, and in line with the south of that building. After pouring the footings and a portion of the wall and piers operations were stopped and were not recommenced until 1917 when two stores were erected by different parties other than the original owners. On examination of the concrete work it was found that all not exposed to contact with the soil and water was in first-class condition, while the lower portions were as soft as so much mud. The work had all to be removed and entirely new footings and walls poured.

At the same time this last-mentioned building was being erected, an opportunity was given to examine the basement wall of case D, as the building was made larger than originally planned and the excavation was extended to the rear where it abutted on the south face of the south wing of the hotel. The concrete in the hotel wall was easily removed to a depth of about 2½ inches.

Last year a portion of the basement floor in a building (case E) was lowered and some of the footings were exposed. These were found to be soft to a depth of about one inch—not a very serious matter but rather disquieting in a building only a few years old.

This year the interior of a warehouse (case F) erected in 1909 was torn out and entirely rebuilt, including new footings. The new footings were placed in different positions from the old ones and as the new basement was excavated about four feet deeper than the original a good opportunity was given to observe the old concrete.

*Paper read August 9th, 1918, at Saskatoon meeting of the Engineering Institute of Canada.

Broken stone had been used as aggregate and the interior was good, hard concrete. The outer face, however, was soft to a depth of about two or three inches, except in a few places near corners where it was easily broken off to a depth of five inches. This outer portion, like that in case B, was easily removed with the fingers.

Forms Acted as Protection

Another building (case G), a part of the footings of which were exposed this year, was erected in 1911 and destroyed by fire early this year. At the present time reconstruction is under way with an addition on the north side. The old foundations are being used and the excavation for the new portion exposed part of the footings. It is quite apparent that some agency has softened the outer face to a depth of about two inches. The weeping tile in this building was laid on top of the lower course of the footings and it is to be noticed that concrete broken off near this tile is not as soft as that at the very bottom, about eighteen inches lower, where it was quite wet. A white deposit was very noticeable here and there throughout the concrete, wherever there was room for it to lodge. This condition is observed in all these cases. Another point noted was that a portion of the concrete where the forms had been left on was in better condition than where they had been removed at the time of construction.

Seepage Caused Trouble

The city has had other troubles with concrete besides the manholes mentioned before; this at the subways built under the Canadian Northern Railway at 19th Street and 23rd Street. The 19th Street Subway was built in 1911-12 with concrete made from pit run gravel and it might be mentioned that the cement was supplied by the city, or rather by the city and the railway company, as they shared the expense of construction, so there was small possibility, as is so often the case, of the cement being a little shy in the mix, the contractor having nothing to gain thereby. Ample drainage was supplied at the foundations but the surface water did not get away readily as the back-filling was of impervious material. This water seeped through the wall at vertical expansion joints placed at intervals along its length and disintegrated the concrete at the joints very badly. This condition became so bad, and also on account of this water flowing over the sidewalks, the city a few years ago removed the backfilling and replaced it with cinders and gravel. A certain amount of water still gets through but the condition is much improved and no doubt will save the rear of the wall.

In the 23rd Street subway, built in 1912-13 of pit run gravel the same conditions are to be observed in places, although to a lesser extent as a part of the backfilling was done with cinders and the resulting drainage is much better. In this subway, as in the other, the cement was supplied to the contractor and was all tested; also there was an inspector on the work at all times. The face of the two abutments under the railway had to be renewed last year. The damage here was caused partly from the action of water seeping through the joints but there were also several longitudinal streaks of poor concrete which appeared to be caused from deposits of laitance.

This Concrete is Sound

All the cases mentioned above are in the district described as the down-town section and a former slough. That of a cereal building is an example of concrete placed in a different section of the city, in sandy soil apparently quite free from any traces of alkali. At the present time they are erecting new buildings and tanks and have exposed two long faces of concrete from the ground level to the footings. This concrete, which is made with crushed rock, is so hard that a moderate blow from a pick gives no result but a ring and a jar to the arm. The outer face is so hard that no mark is made unless from a heavy blow.

The combined work of chemist and engineer will be required to arrive at any absolute and definite statement that the action of alkaline soils and waters is injurious to concrete structures and provide a preventive for such injury. The cases described, even though they are not backed by any chemical tests or facts, have at least demonstrated certain practical examples that would lead one to believe: (1) That concrete deposited in alkali soils is subject to disintegration whereas in soils free from alkali it stands up well; (2) that dense concrete made of proper proportions, preferably with broken stone and a rich mix, is better than from pit run gravel, care being taken to have voids as few as possible; (3) that proper drainage helps to preserve concrete in alkaline soils; (4) that waterproofing with pitch or tar may not prevent alkaline action on concrete.

Funds Required

It might be well for the Institute to provide funds for the carrying out of tests on large concrete blocks made from tested materials, some to be placed in alkali ground and others in soil free from alkali. As these tests would necessarily extend over a considerable number of years they could be carried out in the vicinity of one of our universities and preferably with some of the university staff on the personnel of the committee appointed to carry out the investigations, as this would assure the work being always under observation.

It is hoped that some way may be found to make the above records of fact more complete, and that an explanation may be reached to account for the condition of the concrete work as above described.

EARNINGS OF CANADIAN RAILWAYS

THE August Letter of the Canadian Bank of Commerce says:—Owing to rate advances the aggregate railway earnings of the three chief systems for the first half of the current year exceed those of any previous corresponding period. The tonnage carried has been practically the same as last year. At present the amount of freight offering is equal to the capacity of the existing facilities. While the additional advance of 20 per cent. which comes into effect on August 12th will for the next half-year ensure earnings sufficient to cover the advanced costs of operation, the volume of tonnage may be less as a result of the decreased cereal production in the west. To some extent this decline in tonnage may be offset by the increased business to be obtained from busy industrial centres where complaints as to lack of facilities are still made, attributable in part to the subjection of ordinary to war requirements.

Since the beginning of 1915, the cost of operating the railroads has steadily advanced and has absorbed a correspondingly larger proportion of the earnings. Not until the winter of last year was an appreciable advance in rates put into effect, and since that time extraordinary advances in wages have been granted, necessitating a further increase in rates. In the record of monthly gross earnings given in the chart enclosed, it is to be remembered that the rates are the same as those prevailing before the war with the exception of those for the closing month of 1917 and for the first half of the current year. It is quite evident that serious as were the difficulties caused by the high price and scarcity of labor, materials and rolling stock, transportation companies have been able to increase the transportation service they give to the country, although they were not permitted until quite recently to increase their charges at all in proportion to the increased cost of operation.

RELINE AND WATERPROOF MINE SHAFT BY USING THE CEMENT-GUN*

TEN mine shafts on the iron range in Minnesota have been relined with precast concrete lumber in the past four years, and in many others monolithic concrete has been placed. Recently the cement-gun has been employed to reline the Penobscot pump shaft of the Oliver Iron Mining Co., at Hibbing. This shaft, built up of steel sets and 2-in. wood lath, was put down in 1911. It was finished in 1912 to a depth of 231 ft. All of the water from the Hull-Rust pit, one of the largest open-pit mines in the world, is pumped out through this shaft. Originally the pumps handled 1,000 gallons per minute, but now the total is only 400 gallons per minute.

The shaft is about 11½ x 6 ft., with two compartments 5½ x 6 ft. Steel sets are made up of 6-in. H-beams while dividers are 6-in. I-beams. Sets are spaced on 4-ft. centres.

Eight Feet a Day

Work was started at the top and proceeded at the rate of two sets per day, making a total of 8 ft. Concrete was placed in two layers, each 2 ins. thick. Sollars or temporary platforms were put in every 15 to 20 ft. in order to catch the rebound which dropped into the shaft, and to prevent accidents from falling materials. Permanent ladders were removed as the work proceeded, in order to give the men space in which to work. Sets were concreted in order, except those in which the sollars were placed. After the concrete had hardened in the sets around the sollar sets, the sollar was dropped and the set concreted.

Reinforcing was put all the way down the shaft, as the first step. This was wire mesh, cut into lengths of 4 ft. so that when placed between the sets it would curve out, forming tension reinforcement near the interior face. To hold the reinforcement in place hook spikes made from ¼-in. rods were driven into the timbers, close to the sets. As the sand and cement mixture left the cement-gun, it dropped down into the shaft through a 1¼-in. hose. Wear on the rubber connections from the gun to the delivery hose necessitated its replacement several times. Otherwise no repairs were needed. Six men were employed besides the foreman, who gave only a part of his time to this job. Three men measured the sand and cement, mixed the materials and carried the mixture to the cement-gun. One man attended to the gun and two men were down in the shaft handling the nozzle. While one was busy with the nozzle the other would be trimming. Sand was obtained from a bed in an open-pit mine, brought to the job in 7-yd. wooden dump cars, screened through ¼-in. mesh and dried with steam coils.

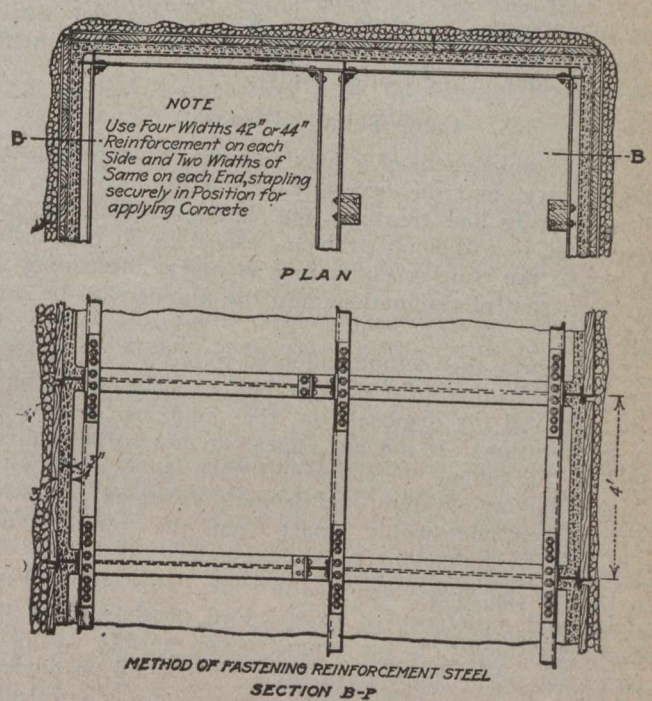
Dry Sand Worked Best

Though the workmen had no experience to begin with, they were of an intelligent laboring class and were able to do the work satisfactorily after a little training. For a 10-hour day the ordinary work of six men was three sets or 12 ft., applying a layer of one coat 2 ins. thick. The best results were obtained when the sand was thoroughly dried and mixed with the cement before being placed in the cement-gun, and batches of 1 to 1½ cu. ft. were handled by the gun much more satisfactorily than larger batches. With these precautions the flow to the hose could easily be regulated, making it possible to place the concrete smoothly on the walls of the shaft.

*From Engineering News-Record, of New York.

Sand was heated in a specially built drier seven coils wide and seven coils high and 12 ft. long, made of 1½-in. pipe. It would sift down through these coils and be perfectly dry when it reached the bottom. A double ¼-in. mesh screen, placed on a slant, was used directly above the coils. Experience with this improvised drier showed that it would have been more efficient if the pipes had been shorter. Steam was obtained from the stationary plant at Penobscot mine, while the air used in operating the gun was furnished by a Westinghouse air pump, furnishing about 220 cu. ft. a minute, carrying 70 lbs. pressure. At the nozzle the air pressure was from 20 to 22 lbs., and water pressure 100 pounds.

In experimenting it was found that if the sand and cement were placed in the gun separately and then mixed,



Cement-Gun Mortar Lines Mine Shaft

there was considerable waste material from the rebound when the concrete was shot on the wall. After the dried sand and cement were mixed before being put into the gun, this waste material decreased decidedly.

Sollars which were put in every three or four sets were cleaned up every day. They were made of 2-in. plank extending 4 ins. on either side of the compartment so as not to slide out. At the end of each day's work the hoses, nozzles and gun were completely cleaned out. Every effort was made to protect the men from injury.

After the shaft was lined no trouble was encountered from water, and the mine officials were so pleased that they decided to use the cement-gun in pointing up joints in the Philbin shaft where precast lumber has been used for the lining. Below the 75-ft. level water was entering, but was stopped by a single coat of cement gun concrete, which prevented any further infiltration.

A beautiful woodland lot of 40 acres, at the confluence of the Grand and Conestogo Rivers at Conestogo, has been handed over by Mr. Walter J. Snider, a miller, to Hon. Finlay Macdiarmid, minister of public works, representing the Ontario government, with the object of furthering the policy of conservation and reforestation throughout Canada. The property has been in possession of the Snider family since about 1850, and is covered with majestic trees.

SEWAGE DISPOSAL*

By Edward Willcox

OWING to the restrictions which have been placed upon the execution of public works that are not -essential for the carrying on of the war, constructional work in connection with schemes of sewerage and sewage disposal has been more or less at a standstill during the past year, except that required for military purposes in connection with camps and munition works.

The greatest progress made in this country recently has been in connection with activated sludge, though experimental and research work has been proceeding in connection with the treatment of trade wastes and utilization of sewage and sewage sludge, but for the principal developments in connection with sewage disposal works during the past year or two we have had to rely chiefly on work done in the United States.

Camp Sewage Disposal

The establishment of a large number of camps all over the country, and the necessity of making provision for the collecting and treating the sewage therefrom, has given rise to a difficult problem, especially in the earlier stages of the war, when there was much uncertainty as to the period of occupation, and the numbers to be provided for.

Frequently the methods adopted were only suitable for temporary camps, the dejecta being collected in pails and removed for disposal on the land, or dealt with by incineration. It did not appear at first to be realized that as the sullage waters would have to be dealt with, a water carriage system, and properly designed works for sewage treatment would, apart from the sanitary advantages, have resulted in much economy.

Of late the War Office has in some cases obtained the advice and assistance of experienced persons, with the result that many of the more recent sewage works in connection with camps have been constructed on modern lines, it being now realized that a large camp is practically a town, and works of a permanent character are therefore necessary.

An attempt at standardization for sewage disposal works was made in connection with certain camps in Ireland, but although systems of drainage for sullage waters were provided, the pail system was adhered to for the dejecta, and instructions were given by the authorities for sewage works to be designed on a basis per head which would be too low if and when a water carriage system were substituted.

Regulation Means Economy

One of the considerations in designing sewage and sewage disposal works for camps where there are large units is the fact that the discharge into the sewers from latrines, baths and lavatories is apt to be in the flushes over comparatively short periods of time, so that without suitable arrangements for equalization, expenditure may be incurred on disposal works which with them would be unnecessary. In order to keep the sizes of the water mains and trunk sewers within reasonable limits, as well as to prevent excessive rates of flow at the disposal works, it was decided that in these divisional camps the men of one infantry brigade only should be the largest number permitted to use the shower baths at one time.

*Abstracted from presidential address to the British Association of Managers of Sewage Disposal Works.

Another feature is the fresh character of the sewage to be treated, so that in cases where the works are near the camps, and with some methods of treatment, it might be advantageous to use mechanical means for breaking it up before it reaches the screens and aëration tanks.

The lack of standardization, either for sewage disposal works or sanitary appliances and arrangements, may lead to much trouble and unnecessary expense, as for instance on the transference of units from a camp where one system has been in use, to a camp where an entirely different one is in operation, with the result that alterations and changes would have to be made to meet the views of those responsible for the sanitation of the incoming unit. The sewage from all camps being of much the same character with no inhibitory trade wastes, there should be little difficulty in adopting a standard system for disposal works for various units, and one would appear to be desirable for the sanitary appliances also.

Fertilizers from Sewage

One lesson of the war has been to emphasize the need for increasing our home production of food. This has led to considerable areas of waste land being put under cultivation, and large numbers of grass lands have been converted into arable land. The problem of obtaining the necessary amount of fertilizers has, therefore, become acute, and has had the effect of drawing attention to the possibilities of the utilization of sewage and sewage sludge.

The difficulties, both financial and engineering, in the way of utilizing sewage for agricultural purposes over large tracts of land are well-known and generally recognized.

As the small percentage of actual manurial value in ordinary sewage sludge renders the cost of its use prohibitive when it has to be transported considerable distances, attention is being directed to the best means of extracting from the sludge those constituents which are most valuable, or by the addition of certain chemicals to increase its manurial value so as to render it both a marketable and profitable proposition.

The war has brought into prominence the fundamental importance of nitrogen compounds, both for munitions and agriculture, and the world's production of food is becoming more dependent upon the utilization of nitrogenous fertilizers.

In addition to the nitrogen contained in sewage, there is much mineral matter, the chief source of which is no doubt the detritus from the surface of the roads. This would also have chemical and physical effects upon plant life. The subject of utilizing mineral matters such as granite dust has recently been dealt with exhaustively in a very interesting paper by Mr. Sampson Morgan, published in the "Fortnightly Review."

Experiments at Croydon

In connection with the question of utilization of sewage to the best advantage, some interesting work has been done at Croydon Sewage Farm during the last two years by Mr. J. E. Farmer, F.C.S. The policy adopted there is based on the principle that the solid matter in sewage deposits more nitrogen than mineral fertilizers. This being so, the soil new to sewage treatment would have a balance of mineral salts, and with the help of nitrogenous manure would produce heavy crops at first.

If, however, owing to the long continued application of sewage, the nitrogen is added at a greater rate than its depletion by cropping, and without a corresponding increase of the mineral matters, which are also depleted by cropping, the soil eventually becomes out of balance

for heavy crop production. The operations at Croydon which consisted of the application of artificial fertilizers, lime, basic slag, etc., in order to restore this balance, resulted in doubling the yield, and has been financially successful. I believe this is the first sewage farm where a systematic and scientific use of artificial fertilizers has been tried to restore the balance of mineral and nitrogenous matters in the soil.

Design of Plants

Such great advances have been made in the disposal of sewage during the past decade, that it may be said a modern sewage works properly designed and constructed can be made capable of effecting any reasonable degree of purification, provided, of course, that there are no excessive quantities of inhibitory trade wastes, but there is still ample scope for research and investigation in connection with the principles involved relating to the correct design of plants for the various stages of the process.

In very few works is there any complete and proper method for measuring the amount of sewage treated. This is a matter of first importance, for otherwise the rates of flow through tanks and on to filters cannot be determined, and there are no means of ascertaining whether unsatisfactory results are due to the overloading of parts of the works or to improper methods of operating.

Many plants are designed with ample capacity, but without a sufficient number of both detritus and sedimentation tank units, with the result that they have not the elasticity which is necessary to deal to the best advantage with varying sewage flows. Detritus chambers should be in duplicate with proper means for emptying, and so constructed as to retain only heavy mineral matters, permitting the lighter organic matter to pass through. This again brings into consideration the question of velocity of flow through these tanks, and the desirability of providing them of sufficient capacity and in suitable units.

The question of the best means of drawing off sewage sludge from tanks with a minimum of supernatant water is also one of great importance.

As a result of the Milwaukee experiments, Mr. Chalkley Hatton states that removing the sludge by hydrostatic head has the advantage of producing a thicker sludge, and he points out that this method of draw-off can be satisfactorily regulated.

Wolverhampton Experiments

I should like to take this opportunity of referring to the experiments recently carried out by Mr. Wm. Clifford, M.Inst.C.E., of Wolverhampton, in order to determine the type of tank best adapted for sedimentation of sewage, and to prevent the short circulating and eddies which all who have tried by means of a color test to time the passing of a liquid through a tank have no doubt observed.

The underlying principle of Mr. Clifford's experiment is to dissipate the energy of the incoming sewage, and bring it to rest in the shortest possible time, to prevent eddies, and to ensure that all the sewage received into it should remain for an equal period of time in the tank.

The large number of exhaustive experiments carried out were of remarkable interest, and resulted in the design and construction of the sedimentation tank used in connection with the activated sludge system at Withington, Manchester, which so admirably fulfils these functions, notwithstanding the fact that activated sludge contains much flocculent matter. and is particularly sensitive to any variation of rate of flow, or increased velocity due thereto.

Briefly described, this tank is of the Dortmund type, its essential feature being in the method of feeding adopted. The sewage passing down a central pipe is discharged into a circular vessel of somewhat larger diameter. Outside this a guard chamber is constructed, the dimensions of the tank, the vessel and the guard chamber are so proportioned that eddies are prevented, and the energy of the incoming sewage is effectually dissipated.

Passing on to the consideration of percolating filters, there are many points which need to be further investigated in connection with these with a view of ascertaining how far and in what way it is possible to reduce their cost and increase their efficiency.

American Research Work

H. W. Clark, Director of the Massachusetts State Board of Health, has recently carried out at the Lawrence experimental station some notable research work with filters of varying depths, and the results he obtained showed that trickling filters of a considerable depth were more efficient than shallow ones, the efficiency being due to the fact that the sewage is relatively a much longer time passing through the deeper filters, and the deeper the filter the greater the tendency of the applied water to mix with the held water, instead of pushing by it, this tendency increasing with the depth.

With equal rates of application the sewage was five or six times as long passing through a 10-ft. filter as through a 5-ft. filter. The higher rates at which these deeper filters could be operated were directly proportional to this increase in time, so that it was possible to increase the dose on the deep filters to that of five or six times the shallow filter, and obtain equally good purification.

If it could be established by experiments on a large scale that a filter 10 ft. deep was capable of dealing permanently with a volume three or four times that which can be treated on a 5-ft. filter, the saving in initial outlay on works might in many cases be considerable, but would of course depend upon the local conditions, such as whether sufficient fall were available, or pumping necessary, also the character of the subsoil, as these conditions may so increase the cost of construction and working expenses as to render it more economical to put down a larger area of shallow filters.

Given a properly designed and constructed filter bed, whatever the depth, with suitable media, its efficiency will largely depend upon the method of distribution which is adopted.

Distribution of Sewage

In 1904 I read at a meeting of the Sanitary Institute at Glasgow a paper on "The Importance of the Uniform Distribution of Sewage on Filters," and I see nothing to alter the views I then expressed, *viz.*, that in order to ensure efficient distribution it is necessary that the liquid should be discharged over every portion of the filters in uniform quantities, and at regular intervals of time, and that the distribution should be arranged so that these conditions may be under complete control.

Distribution can best be effected by a power-driven distributor travelling along a rectangular filter bed fitted with arrangements for regulating the discharge of sewage on to the filter, and which delivers the sewage in an unbroken film by means of large nozzles and fan deflectors.

The Board of Control of Toronto have decided to discuss with the city treasurer and the works commissioner the claim of the Hydro-Electric Power Commission of Toronto for supplying power to the waterworks. The works commissioner disputes the amount of the bill.

OPPORTUNITIES FOR SAFETY ENGINEERING IN CONSTRUCTION WORK*

By David Van Schaack
President National Safety Council

WHAT has been accomplished so widely in manufacturing plants can be done in construction work—in fact has been done. Perhaps even more can be done in construction work, because a greater need exists. Construction work as a class is one of the most hazardous. Each year it exacts a heavy toll of killed and maimed. The underlying principles of safety work apply to construction the same as to other branches of industry, and there is no doubt about the results of their application being equally satisfactory. Stated as two aphorisms, these principles are as follows:—

> A condition of safety should surround all the operations of construction work in so far as the location or the nature of the operation will permit.

And—

> Each person should strive to keep from injuring himself or others.

As is plainly seen, the first places responsibility on the owners, the contractors, the engineers, the superintendents and foremen, or others who share as parts of the "directing minds" of the operations. The "Hand of God" causes very few accidents. They are generally the result of somebody "taking a chance" who knew better.

The second, that "each person engaged in construction work should strive to keep from injuring himself or others," is something to be instilled into the minds of the workers. It is useless, of course, to provide good equipment if it will not be used, or give instructions for safe methods if they will not be carried out. The desire for safety must be in the minds of the foremen and workers, themselves. At first thought, it might appear as an almost hopeless task to instill into the minds of some workmen a sense of carefulness about themselves or others. But I want to say right here that such is not the case. The old copy book adage of "Self-preservation is the first law of nature," is still a moving impulse, and most workmen can be brought to note the advantages to themselves of safe equipment and safe methods. The greatest difficulty, perhaps, is with the quick, heedless type of worker who delights in scorning danger in order to "show off." This kind needs to be disciplined as well as educated. Some rules are necessary at times, but I believe the fewer the rules the better.

Methods, Equipment and Education

Safety work in construction is, therefore, as in other industrial fields, dependent on safe methods and equipment and on education. The importance of the first two has been recognized, while that of education has only within recent years come to be appreciated as it should. Each is dependent on the others for anything like complete fulfilment of its purpose. All are dependent upon that cordial co-operation between employer and employees which is obtainable only through organization, and this co-operation cannot well be expected from the workmen unless they have reason to believe that their employer is willing to do his full share in the joint effort which will inure to their common benefit. What and how the employer does in taking care of his part are the best tangible evidence of his good faith.

Engineers readily appreciate that accident prevention is an economic necessity. The strenuous business competition of to-day calls for the highest degree of efficiency if success is to be attained, and industrial accidents are such an actual and potential cause of impairment of efficiency that they cannot be ignored.

Without belittling its humanitarian side, the day has gone by when safety work was considered an humanitarian fad; the experience of employers who have undertaken it proves too plainly that it is good business. Gone by, too, is the day when its economic value was measured solely in terms of damages or compensation saved, or lessened insurance cost. Considerable as the direct cost of accidents may be, they are much more expensive to an employer through the lost time of injured men, through interruption of the work of others caused by accidents, through the waste of material and the spoiling of product by new men, through their lessened production, through the time of foremen or others diverted for their training.

Not only does safety work cut down the loss in efficiency due to accidents, but it tends to increase output. The less time a workman has to devote to avoiding injury, the more he has to give to production. And the spirit of co-operation among workmen developed by organized safety efforts is also plainly reflected in a greater interest in their work.

Labor Turnover and Safety Work

Every employer knows how costly labor turnover is, how important it is to the general efficiency of his plant to keep his labor force as intact as possible. Especially is this appreciated now, when the turnover is so phenomenally large. Safety work reduces labor turnover, both directly through lessening the number of employees killed and injured and indirectly through promoting better relations between employer and employed.

The thinking employer, who takes carefully into account every single item of cost entering into the turning out of his product and who endeavors in every way to conserve his capital investment, must view with favor anything which tends to stabilize his working force. With the necessary money available, it is possible to purchase his equipment in a short time, but the creation of an efficient working force often requires years. No matter how carefully the original material is selected, it has to be readjusted, sifted out, replenished, sifted and replenished again and again, before the desired efficiency is reached. All this takes both time and real money, plenty of it. Once created, an efficient working force is not only a most valuable asset, but it represents a capital investment which is well worth all the protection that can be given it.

One of the pioneers in safety work struck the key-note when he said that the best safety device was a safe man. Another has put it that the greatest factor operating toward the prevention of accidents is not the prevention device, but the "prevention spirit." The safety slogan which has the strongest appeal to me is "get the safety habit." There is a lot of meaning in that phrase. Safety habit is but another way of spelling caution, which is the one and only preventive of so large a number of industrial accidents. The safety habit may, perhaps, not be so easy to acquire as some other habits of which we know, but it is certainly much more worth while.

I do not think I exaggerate in making the statement that promoting the safety habit, getting the men to think safety and to think it unconsciously, is the biggest thing that safety engineers have to do, and the most difficult.

(Concluded on page 228)

*Abstract of a paper read before the Connecticut Society of Civil Engineers.

The Engineer's Library

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer, 62 Church Street, Toronto

THE FUNDAMENTALS OF MECHANICAL DRAWING

Reviewed by James Ewing
Of Ewing, Lovelace & Tremblay, Montreal

By *Richard Shelton Kirby*, C.E. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London; Canadian selling agents, Renouf Publishing Co., Montreal. 89 pages, 10 x 6¾ ins., profusely illustrated with full-page plates, cloth. Price, $1.50 net.

This, the first edition of a new publication, is certainly a very clear, concise and well-arranged exposition of the primary essentials of mechanical drawing according to prevailing American practice.

The introductory chapter on the selection and use of instruments and materials is replete with good practical ideas and advice to the beginner. It is followed by a number of short yet lucid treatises on geometric construction, curves and conic sections, orthographic and isometric projections and working and perspective drawings.

Twenty-four well-selected plates are given, illustrating the most approved practice and indicating a number of the commonest faults. The examples of conventional signs and the thicknesses and character of lines shown should help to simplify and standardize the usual existing disparity of methods. On the question of lettering, the book follows the lines of most others in dealing with the same subject by attempting to reduce to a science with set rules what is really more of an art requiring the training and cultivation of the eye to appreciate optical effects. An experienced draughtsman might also be inclined to see some possible improvement in the examples of drawings shown by a judicious selection of lines of more varying thickness to indicate relative importance, also by subduing the thickness of dimension lines, and improving the shape of the arrow heads.

It must be borne in mind, however, that the book is mainly designed to fit the beginner for the everyday work of the ordinary mechanical draughting room, and as such it fulfils its purport in a marked degree, is a considerable step in advance of anything hitherto published in a concise form, and is worthy of the widest sale.

MODERN CIVIC ART*

By *Charles Mulford Robinson*, author of "Improvement of Towns and Cities." Fourth edition. New York and London: G. P. Putnam's Sons. Cloth; 7 x 10 ins.; 375 pages; illustrated. Price, $3.50.

Prophet, apostle and practitioner of city planning in America, Professor Robinson made preparations shortly before his death for a fourth edition of this volume. The nature of the book was such that few changes were demanded for successive printings. Accordingly, the present edition differs little from the earlier ones. In fact, the changes appear to be confined to (1) slight cuttings of the plates here and there to correct an old or make a new statement of fact and (2) a preface for the present edition.

Since to many readers the volume offers itself as a new work, a general summary of its contents may be given. After the introduction, the four main divisions of the book, each containing a number of chapters, deal with local points, the business district, the residential sections, and the city at large.

Although it would be unfair to say that the book is inspirational rather than practical, emphasis may well be laid on its inspirational and esthetic appeal, and attention may be directed to the same author's more practical books, entitled "City Planning" and "Improvement of Towns and Cities."

*From Engineering News-Record, of New York.

PUBLICATIONS RECEIVED

Saskatchewan Land Surveyors' Association.—Report of the eighth annual meeting of the Association held in Regina, March 4th and 5th, 1918.

Building Construction.—By R. I. Webber. Bulletin No. 25, issued by the Engineering Experiment Station, Pennsylvania State College, Harrisburg, Pa.

Chemical and Biological Survey of the Waters of Illinois.—Report for year ending December 31st, 1916, issued by the University of Illinois, Urbana, Ill.

The Thermal Testing Plant.—Report for 1916-17 by R. B. Fehr, being Bulletin No. 24 issued by the Engineering Experiment Station, Pennsylvania State College.

Association of Dominion Land Surveyors.—Report of the eleventh annual meeting of the association held at Ottawa on January 30th and 31st and February 1st, 1918.

The Potentiometer System of Pyrometry and Temperature Control.—Illustrated catalogue No. 87 issued by the Leeds & Northrup Co., 4901 Stenton Avenue, Philadelphia, Pa.

Analyses of Canadian Fuels, Part IV., Alberta and Northwest Territories.—Compiled by Edgar Stansfield, M.Sc., and J. H. H. Nicolls, M.Sc. Issued by the Department of Mines, Canada.

Typical Specifications for Bituminous Road Materials. By Prevost Hubbard, chemical engineer, and Charles S. Reeve, chemist. Bulletin No. 691 issued by the United States Department of Agriculture.

A Sanitary Survey of Charleston, West Virginia.—By Mayo Tolman, Director and Chief Engineer, Division of Sanitary Engineering, West Virginia State Department of Health, and issued by that department.

Standard Specifications for Hydrants and Valves adopted by the American Water Works Association June 24th, 1913, and revised June 9th, 1916. Issued by The A. P. Smith Mfg. Co., East Orange, N.J.

Centrifugal Boiler-Feed Pumps.—Eight-page illustrated pamphlet issued by the De Laval Steam Turbine

Co., Trenton, N.J., describing the De Laval combined steam turbine and centrifugal boiler-feed pump.

Analyses of Canadian Fuels—Part V., British Columbia and Yukon Territory.—Bulletin No. 26, compiled by Edgar Stansfield, M.Sc., and J. H. H. Nicholls, M.Sc., and issued by the Department of Mines, Canada.

From the Falls to the Factory.—A treatise on electric power transmission, issued by The British Aluminum Co., Limited, 60 Front Street W., Toronto. This pamphlet is well illustrated and contains nine tables.

Westinghouse Instruments and Relays.—Catalogue 3-B issued by the Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa. This catalogue was issued in June, 1918, and supersedes Catalogue 3-B dated July, 1916.

Stock List.—Issued by Baines & Peckover, Toronto; stock list of iron and steel at their Esplanade warehouse, Toronto. It is 4″ x 8″, 64 pages and cover, well illustrated and with the information neatly tabulated and handy for reference.

Gauges at a Glance.—By the late Thomas Taylor Liverpool. Published by E. & F. N. Spon, Limited, 57 Haymarket, S.W.1, London, and Spon & Chamberlain, 120 Liberty Street, New York City. Fourth edition, 81 pages, 5 x 7½ ins., cloth. Price, $1.50 net. Contains all the principal gauges of the different metals, tinplate substances, etc., collated and compared; foreign moneys, weights and measures, metric weights and measures into English equivalents and vice versâ; weights of bar iron, tinplates, galvanized sheets, steel, etc.

Dixon's Graphite Brushes for Motors.—This booklet, issued by the Joseph Dixon Crucible Company, Jersey City, N.J., tells the story of how graphite brushes came into being and describes the several advantages of graphite brushes over carbon. The various conditions of service are also described and recommendations made as to where graphite brushes may be used to the best advantage. The two centre pages are devoted to an arrangement of prices and sizes so that the cost of any size brush may be easily found. There are also rules telling how to order graphite brushes. Other graphite electrical specialties, such as resistance rods and lubricating rods, are shown and described.

Suggested Standards for Sewer Construction.—Published by the Provincial Board of Health of Ontario as Bulletin No. 6 of the Experimental Station, Engineering Service. This is a reprint from the annual report of the Provincial Board of Health, 1917, and includes Mr. Duff's report on the manufacture of vitrified clay sewer pipe. Six pages have been added to those in the annual report, giving the regulations approved in October, 1914, governing the preparation and submission to the Board of Health of plans and specifications relating to sewerage and sewage disposal systems. These six pages include illustrations showing the shoring of trenches, standard manholes and gulleys in brick and concrete, contour plan for sewer study and suggested plan and profile drawings.

By foregoing their fixed assessments this year, thirteen factories have considerably augmented the city of Brantford's revenue. They have agreed to do so until the end of the war, on the understanding that the exemptions will run their full term after the war.

Sir William Mackenzie was in Ottawa recently to discuss the payment for $60,000,000 of Canadian Northern Railway stock to be acquired by the government. The arbitration board, it will be remembered, made an award of $10,800,000, but a price of $10,000,000 has, it is understood, been agreed upon as sufficient.

HALIFAX PROFESSIONAL MEETING

THE final program has been prepared for the third general professional meeting of the Engineering Institute of Canada. This meeting will be held September 11th to 13th at Halifax. The headquarters will be the rooms of the Halifax Board of Trade, where all sessions will be held. The program follows:—

First session, Wednesday morning.—Addresses of welcome by the lieutenant-governor of Nova Scotia and the mayor of Halifax; "Some Notes on Preservation of Timber for Use in Salt Water," by C. E. W. Dodwell, district engineer, Public Works Department, Halifax; "Economic Aspects of Halifax Ocean Terminals," by A. E. Macleod, accountant, Halifax Ocean Terminals; "Town Planning, Halifax and Vicinity," by H. L. Seymour, town planning assistant, Commission of Conservation; luncheon at the "Green Lantern."

Inspection trips by automobiles through the devastated area and by train over the Terminal Railway to the Ocean

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OPPORTUNITIES FOR SAFETY ENGINEERING

(Continued from page 226)

It is the leading feature of the general educational work which is the keynote of all successful accident-prevention campaigns. Workmen do not intentionally get hurt, but ignorance and thoughtlessness are the most prolific causes of accidents, and these causes can be eliminated only through a comprehensive plan of education.

Foremen Should Be in Full Sympathy

The one thing to do is to create an atmosphere of safety, if I may so describe it, and the more the foremen and workers participate in creating it, the better the results will be. The size of the job in no way governs the degree of safety that can or should be attained. The underlying principles are just as much needed and are as effective on small work as on large work. Suggestion, education and persuasion will obviate much of the need for coercive measures.

Especially should the foreman be in full sympathy. Not only is his the closest authority, but he is the natural teacher of the men and the example whom they emulate. The foreman often makes the best rule book and danger signal. If you can interest him, help him to see clearly the causes and remedies of accidents. If you can make him feel that accident prevention is worth while, I venture to say that three-quarters of the work is accomplished. He is in the best position to note the real hazards of the work and determine the true causes of accidents. He is closest to the men and his influence to induce them to acquire safety habits can be enormous.

Square Pegs in Round Holes

There is another feature of accident prevention, and a very important one, to which I should like to call your attention. This concerns itself with the selection of men for work and their instruction in it. Too little attention, from the safety standpoint, is often given to these matters. To put a heavy, slow-thinking man on a job requiring both bodily agility and mental alertness, or vice versâ, is simply inviting accident. So, too, is assigning a man to work without carefully instructing him how to perform his duties safely as well as otherwise efficiently. Every new man on a job should be carefully instructed in general safety as well as in the safe way of doing his particular work.

LEGISLATION FOR ENGINEERS*

By Frederick H. Peters
Commissioner of Irrigation and Chief Engineer, Department of Interior, Calgary

IF the idea of legislation is a good one, it is the biggest thing that engineers could possibly have to think about and work at, until it is either put into effect or killed. This paper is prepared for discussion by engineers and as it affects the conditions of their whole life's work, every engineer owes it to himself, his family and to the country itself to give his best thought and action towards the satisfactory settlement of this matter.

Ever since this idea was first brought up, some men have continually said, "What is the use of all this talk, we cannot do anything anyway." This is not my opinion and I firmly believe that if we can only get together and form a decided opinion as to what we want, and then direct all our efforts towards getting it, that we can surely change the conditions and cure the evils that exist by a few years of consistent work.

Developments in Calgary

I will try and put the case before you by tracing this development in Calgary, and introducing some other comments suggested by outside ideas that have been expressed by writers in the various engineering publications.

The original Calgary resolution stated the opinion of that branch, that Dominion legislation should be sought to establish the status of engineers throughout the Dominion, and in order to start some effective movement, asked the secretary of the Institute to canvas the opinion of the whole membership of the question. This resolution developed out of a general feeling of dissatisfaction and unrest among members of the profession, which existed at the time, and exists still, at least in the territory between the Great Lakes and the Rocky Mountains.

The first feeling was that the whole profession, and everything connected with it concerning the material welfare of those practicing it was most unsatisfactory. The first step was to try and analyze this feeling and see what was at the bottom of it. The result was an expression of the two definite facts, that we get neither the remuneration, nor the respect that is due to us, as members of the profession which has done more than any other to develop the natural resources and create the industries of the Dominion. The second step was to try to determine why this was, and what we were going to do about it, and then the ball was opened and the question was discussed from time to time from every possible angle.

Discussion Extends to Edmonton

The engineers in Alberta—for by this time the discussion had extended to the Edmonton branch—naturally turned to their own organization, the Engineering Institute, to look for a cure for their troubles; and here there were some very strong opinions expressed, that there was no use bothering with the Engineering Institute (then the Canadian Society) because it had never done anything in a material way for its members, and it was no use expecting that it would do anything in the future. If you consult the constitution of the Institute it is very easy to see why it has never done anything for the material interest of the members, because the Institute as it exists provides only for the advancement of scientific learning, or, in other words, it may be classed as a purely educational body. The Institution has done this. It has fulfilled its aims and so we need not criticize it. But we want to extend its aims and efforts to include a consideration also of the material welfare of the members.

At this stage in the development, while we were not entirely clear as to why the troubles existed, and what to do, the opinion had become very firmly fixed that decided troubles did exist, and that the question which had been brought up was a real issue. And it was decided that we would do something and that the first thing to do was to decide on some line of action and then keep hammering away at the same place until some results were gained.

"Let Us Advertise"

As a result of a great deal of discussion and interchange of ideas, the opinion was developed that we do not get the respect which is due us, because we are not understood and people do not know our worth. The first answer to this statement was, let us advertise, and tell the people of our worth, and give them an opportunity to understand us. The counter-argument to this was, that while such a step might go a considerable length in bettering the conditions being complained of, we could never purge our ranks to uplift the profession and protect the public, unless we were able to control our organization and keep out incompetents and undesirables. It was pointed out that to-day anybody could call himself, and practice as, an engineer, and therefore advertising alone would advertise the incompetents as well as the others.

It was finally stated and accepted by the Calgary branch that legislation was the best cure for this feature. Legislation seemed to be the only possible thing that would define the name, establish some legal standard, and make it possible to control the organization.

Will It Increase Remuneration?

The idea of legislation is not a new one. Because some prior legislation had not worked out as a practical success there were still some doubts expressed as to its practicability. The idea, however, as stated above, was generally accepted. But a considerable number of members who were very sincere in their desire for a betterment of conditions, and were frank enough to state their opinions, asked the question, "Will this increase our remuneration, because that is the sum and substance of what we want?"

The answer to this question was, that nothing could do this specifically and directly except a trade union, and that any idea of forming a trade union was rejected without argument. But it was endeavored to get these members to take a reasonable view of the matter, and it was pointed out that if we could get a law to define our status and bring us together so that we could speak with one voice, then, if we were active, reasonable in our demands and consistent in our efforts, it seemed that we should certainly be able to gain the recognition and remuneration that was desired.

It was pointed out in discussing this feature that our profession was working under peculiar conditions, in that the members were nearly all employed by the governments, the large corporations, or other big enterprises. In this respect our profession is very different from that of the doctors and lawyers, who are for the most part carrying on private practice. It is admitted that this is a very difficult feature and it is hard to say just what effect it will have on making legislation a practical success in bringing about the results desired, but if nothing in the affirmative can be guaranteed, it can at least be stated with

*Paper read August 10th, 1918, at Saskatoon meeting of the Engineering Institute of Canada.

assurance that legislation cannot possibly do any harm, because conditions could not be worse in connection with the points being discussed, than they are at present.

Then some other members said, admitting all your statements, and although you veil it very nicely, what you are really seeking by the proposed legislation is a close corporation, and they said the close corporation idea has many bad features, as it has been worked out with other professional men, notably the doctors and lawyers. The answer was, perhaps so, but perhaps this has been the cause, because their corporations are too close. And, again, we have a great advantage starting in at this time, because we know of these faults that have tended to develop in other profesions, and we can profit by them and guard against them in our own case.

Unprofessional, Claimed Some

Then, again, some said it is unprofessional and undignified to seek legal protection, and it is not done by the American Society of Civil Engineers, or by the British Institute. As to this first contention, it was considered a quaint conceit that these same men were largely the same ones who had wanted to advertise. As to the second contention, a search for precedent is always a wise course, and a safe course, but if one goes too far in looking for precedent it becomes the greatest millstone around the neck of advancement, and it was suggested that we really have precedent in the Manitoba and Quebec acts dealing with engineers; in the Alberta and Saskatchewan Land Surveyors' Acts, and also the passing of an act covering the profession of architects and engineers in the State of Illinois.

So, taking it bye and large, the matter has been pretty well threshed out at Calgary, and we have decided on legislation as the only logical and legitimate means of gaining a permanent cure. Really, it seems that legislation is the only way to achieve anything of permanence, because if you follow the matter out to the end, you might argue and talk and advertise, or fight, if you will; but in the end, if you have not the law of the land to back you up, to use a slang expression, "where do you get off at?"

It was considered most desirable to go straight for Dominion legislation so that there would be one law in effect from coast to coast, and in this way all the possible difficulties on account of variation in provincial laws would be done away with. Sketching the desired legislation in a very broad way, it was to fix a standard by defining the term "engineer." To provide adequate and practical means of control of the profession by requiring compulsory registration as a necessary antecedent to practice. To provide adequate penalties for infraction of the law, and finally, in order to avoid the criticisms which might be directed against, and the faults which might come from a close corporation, to have stipulated by the legislation a certain measure of outside control.

Outside Control Desirable

This last point is really the only idea that contains anything very new and different from the legislation which is already in force in some other places. It was the idea at Calgary that the most desirable method of gaining some outside control was to arrange this through the recognized universities. The universities in the Dominion are maintained at public expense, or by private subscription, for the purpose of educating young men and fitting them to follow the practice of engineering, and it seemed most consistent that after these authorities had trained the young men in the profession that they should later on have some voice in controlling them during the period that they were practicing the profession.

The next advancement in the matter came through a meeting of the Ottawa branch, which was held during the winter of 1917, when the writer of this paper explained the development of the movement up to that date. The resolutions which were passed by this meeting gave a very decided impetus to the advancement of the matter, because it was the first definite expression of opinion from any eastern branch, and the opinion of this meeting was very definitely expressed as being favorable to the idea of legislation.

Another very important point which was discussed at this meeting was the practicability of gaining legislation, and as the result of considerable discussion it was pretty definitely understood that it would not be possible to gain Dominion legislation. Following this, the idea was expressed that the next best way of going about the gaining of legislation was to get, as nearly as possible, standard acts passed in the various provinces, and then finally gain Dominion legislation, bringing them together in a similar way to the Dominion act passed recently covering the medical profession.

Alberta Division Favorable

Another step in advance was made in the spring of 1918, when this matter was very fully discussed at a meeting in Edmonton, of the Alberta division. This meeting finally welded the Calgary and Edmonton branches together as being strongly in favor of legislation, and we were, further, very fortunate in having with us the secretary of the Vancouver branch, who was able to state that, in his opinion, there was no question but that the engineers in British Columbia would, after the matter was lined up a little more, certainly approve of the idea of provincial legislation.

With a view to gaining some action in the near future, it is proposed at the Saskatoon meeting of the Institute to present proposed provincial acts by the provinces of Manitoba and Alberta. In both of these provinces, as also in British Columbia and Saskatchewan, we have great facility for introducing the proposed measure of outside control through the universities, because in the several provinces noted there is one provincial university, so that there are no difficult questions introduced by having several recognized universities to deal with, with the possibility of friction between them, as might be the case, for instance, in Ontario.

During the last few months there has been a good deal of talk and writing in the engineering publications along the lines of this paper, and it would appear that, in general, everybody has this matter in mind. This is a most excellent sign and may be taken almost as a practical assurance that the time has come when something is going to be done. The ideas which have been expressed are generally all along the same line, with the exception of some engineers who still advocate that a close corporation, and nothing but a close corporation, will meet our requirements.

One Letter to the Editor is Condemned

Unfortunately, it seems necessary to note some exceptions amongst the engineers who have been writing on this matter, and who have suggested ways and means of gaining our ends, that certainly would not be approved by the people of the Dominion of Canada. For example, one writer in *The Canadian Engineer* suggested that the engineers advertise the fact amongst the young men at

the universities that the profession of engineering is the worst one they could possibly go in for, and by this means discourage engineering undergraduates; cut off the supply of young men, which would in turn create a scarcity of engineers and obviously leave room for an unnatural boosting of salaries. It is necessary to point out most strongly that any suggestions along these lines are very bad, and should be frowned on by all members of the profession. We must play this game straight with all our cards on the table, and avoid all these foolish and unreasonable ideas, always remembering the basic idea, which is to uplift the profession and place it in a better position to serve. If we once lose sight of this basic idea we must lose public confidence and the whole movement would undoubtedly be wrecked before anything very concrete had been achieved.

Friction With the Miners?

There is one special point which has come up in connection with this matter which is worthy of the greatest consideration and attention by the members of the Institute. That is the matter of some difficulties and friction which has already arisen between the engineering Institute and the Mining Institute. It is quite apparent to anybody who looks into the case that there are some old sores of long standing between the civil and mining engineers. The writer of this paper is one of the younger men of the profession, who was not in the game when these old sores were opened up, and undoubtedly a very large number of the civil and mining engineers of today are the younger men who do not have any of the old feelings of jealousy or resentment which no doubt used to exist.

It is particularly unfortunate that any feeling of this kind should exist, and certainly there seems no reason why any friction or difference should continue to exist between the civil and mining engineers. It is most sincerely hoped, starting with the head office organization in Montreal, that every civil engineer in Canada will be prepared to go more than half-way in meeting the mining men in any difference of opinion, or old bad feelings which might exist. It would seem that if a movement of the kind being discussed is going to start off by first having a row with the members of a closely allied profession, it would augur very ill for the future.

ENGINEERING INSTITUTE OF CANADA

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Engineering Works. At present he is mechanical superintendent of the Nova Scotia Tramways & Power Co.

McArthur, James Joseph, of Ottawa, elected member. Mr. McArthur was born in 1856 at Aylmer, P.Q. He developed and carried on the photo-topographical method of survey of the Rocky Mountains, and assisted in the settlement of the Alaska Boundary question. In 1906 Mr. McArthur was appointed assistant to the International Boundary Commissioner. He had charge of the final demarcation of the International Boundary from the Pacific Coast to Lake Superior. He was appointed assistant superintendent of the Geodetic Survey of Canada in 1914 and in 1916 received appointment as His Majesty's International Boundary Commissioner.

McKean, Harold Stewart, of Halifax, elected associate member. Mr. McKean was born in 1890 at Pictou, N.S., and was educated at the Nova Scotia Technical College. In 1914 he enlisted and is at present lieutenant of Royal Canadian Engineers.

CHEMISTRY OF CONCRETE*

By Arch. Blackie
City Chemist, Winnipeg, Man.

THE disintegration of concrete is due to the presence of the so-called alkali salts in the soil and to the presence of ground water which dissolves these salts and carries them into the concrete. The so-called alkali salts that occur in the soil in this district are sulphate of sodium, magnesium and calcium; these salts are also found in the ground waters. The salts are found in deposits and, I think, are generally found only near the surface.

Chemical analyses of disintegrated concrete shows that the disintegrated portion contains a much higher percentage of sulphate than the original materials used in the concrete, and also that the disintegrated mass is impregnated with minute crystals of calcium sulphate, these crystals are found in great quantities in the disintegrated material, and gradually become fewer as the portion of the concrete unacted upon is approached.

The solubilities of the above sulphates in cold water are in the following proportions:—

$Mg\,SO_4$ 30 parts in 100 parts cold water;
Na_2SO_4 4.3 parts in 100 parts cold water;
$CaSO_4$ 0.18 parts in 100 parts cold water.

As might be expected from their solubilities, the deposits usually contain more calcium sulphate than Mg or Na sulphates.

With regard to the solubilities another point that has to be remembered is that whilst the solubility of $Ca\,So_4$ is low in distilled water, the solubility is about doubled in a solution of salt or Na Cl and also that all our ground waters in this district contain more or less salt, in some instances being so brackish as to be unpalatable. Research into the chemical action of alkali in cement has been carried out for some years by different experiment stations in the United States, and all are agreed that the sulphates are the principal causes of the trouble. Just how they react with the concrete is disputed.

Theory Advanced in 1911

Bulletin 81 of the Montana Experiment Station, published in February, 1911, advances the theory that disintegration is due to the formation of compounds which have a greater molecular volume than that of the compounds in cement which are acted upon by the solutions. These cause expansion and subsequent cracking.

Another theory put forward is the formation of tricalcium sulpho-aluminate, this compound causing cracking and subsequent disintegration. Technologic Paper No. 95, issued by the Bureau of Standards in 1917, proves that this compound cannot be formed, but the authors of this bulletin do not commit themselves to any definite theory and summarize their work so far as it has gone with the following conclusion:—

"No definite conclusion can yet be drawn as to the ultimate resistance of concrete to the action of alkali in the soils and waters of the projects. However, the complete failures found at the Belle Fourche project where local materials were used, together with the action which has commenced on the surfaces of many of the blocks on other projects, indicates that materials of good quality and proper workmanship are of greatest importance.

*Paper read at Saskatoon meeting of the Engineering Institute of Canada.

"Concrete which is to be placed in alkali soils should be made of selected and tested materials, so proportioned as to produce a dense concrete. As small an amount of mixing water should be used as will allow the mass to be properly placed. Unless these precautions are taken the resistance of the concrete to alkali will be reduced."

Draintile

On page 93 of Technologic Paper No. 95, Bureau of Standards, the following conclusions are drawn regarding the use of cement draintile exposed to soils and water containing alkali salts in quantities of 0.1% or more:—

1. The use of cement tile in soils containing alkali salts in large quantities is experimental.

2. Porous tile due to the use of lean mixtures or relatively dry consistence are subject to disintegration.

3. Some dense tile are under certain conditions subject to surface disintegration.

4. Disintegration is manifest by physical disruption, caused by the expansion resulting from the crystallization of salts in the pores and by softening, resulting from chemical action of the solutions with the constituents of cement.

5. While results obtained will not permit of a definite statement as to the relative effect of the various constituents of the salts indications are that the greater the quantity of sulphate and magnesium present and the greater the total concentration of salts, the greater will be the disintegrating effect.

6. Tile made by the process commonly used, which allows the removal of forms immediately after casting, are subject to disintegration where exposed to soils or waters containing one-tenth per cent. or more alkali salts similar in composition to those encountered in this investigation.

7. The hand-tamped tile of plastic consistency as made in this investigation are not equal in quality to machine-made tile of the same mixture, and they do not resist alkali action as well.

8. Steam-cured tile show no greater resistance to alkali action than tile which are cured by systematic sprinkling with water.

9. Tile made of sand cement have less resistance to alkali action than tile made of Portland cement of the same proportions.

10. The tar coating as used is not effective in preventing the absorption of alkali salts from the soil.

11 The cement-grout coating is not effective in preventing the absorption of alkali salts from the soil.

12. No advantage is found in introducing ferrous sulphate into the cement mixture.

Rules for Making Tile

If cement draintile are to be used in alkali soils or waters obtaining 0.1 per cent. or more of salts similar in composition to those encountered in this investigation, they should be made of good quality aggregate in proportions of not less than 1 part Portland cement to 3 parts aggregate. The consistency should preferably be quaking, which has proved the most resistent of all mixtures used. This is wetter than that generally used in commercial tile plants and will probably require the retention of the tile in the molds for several hours, unless some means are found to hasten the hardening of the cement.

In contrast to this, we have secured as a sample a piece of draintile taken from the ground beside the Grain Exchange footings, where it has been exposed to the ground waters for thirty years. The concrete is perfectly sound and shows no sign of disintegration. Unfortunately, details of the mixture used in the manufacture of this pipe are not available.

The University of Wyoming Agricultural Experiment Station, Bulletin No. 113, published in March, 1917, summarizes the results of their work with the following conclusions:—

1. Cement put into solutions of alkali sets as well as in water.

2. In solutions of sodium sulphate Ca So_4 2 H_2O is formed.

3. In solution of magnesium sulphate Ca SO_4 2 H_2O and Mg $(OH)_2$ are formed.

4. In solution of sodium chloride a silicate is formed. The high percentage of sodium in this silicate is likely the reason for the increase of insoluble sodium in the cement.

5. Sodium chloride in solution or its presence in solution with other alkali salts has its effect chiefly through a solvent action.

Sodium Sulphate the Worst

6. Of the solutions tested the 5% sodium sulphate had the greatest disintegrating effect.

7. Solutions containing (mixed) chloride, sulphates, and carbonates had the least effect.

8. Mortars disintegrate faster than neat cement.

9. The formation of compounds of greater molecular volume than the volume of calcium hydroxide is not the cause of the disintegration of cement.

10. The ultimate cause of the disintegration of cement is due to the alkalis forming compounds with the elements of cement, which are subsequently removed from the cement by solution.

The conclusions drawn in all these summaries are more or less supported by experimental work, and yet they are to some extent contradictory. This shows the necessity of further work and research on the question. However, the final paragraph of Bulletin 113 from the University of Wyoming summarizes the whole situation, that is, that ground water must be taken care of. The writer's first experience of the disintegration of concrete occurred when some years ago in Winnipeg it was reported that one of the large concrete sewers of the city was being destroyed by sewage. With the city engineer a careful investigation was made of the sewer, and it was found that all of the disintegration occurred high up in the sewer, and that there was no evidence of disintegration at or near the water level. The disintegrated concrete was soft and of putty-like consistency.

Disintegrated Sewers

An analysis of a sample of disintegrated concrete from this sewer showed the sulphate content to be 2.54%. The concrete from which the sewer was made consisted of limestone, sand and cement. Although we have no analyses of these materials it may be assumed that with the exception of the cement the concrete materials would not contain any sulphate. If we assume that the cement used contained 2% SO_3 (the standard specifications require that Portland cement shall not contain more than 1.75% SO_3) and that the concrete was mixed in proportions 1 part cement to 7 parts of aggregate, then the SO_3 in the concrete would be 0.25%, yet the analysis shows SO_3 content 2.54%.

Sample of concrete from four other sewers where disintegrated concrete was found showed SO_3 content 5.02%, 5.03%, 2.35% and 5.90%. These percentages are

all very much higher than could be reasonably expected and confirm the results of laboratory experiments which show that solutions containing magnesium and sodium sulphate react with the cement and also the limestone.

Alkali Action on Sands

From various minor laboratory experiments carried out by the writer at different times, a conclusion was reached that some interesting information might be obtained and some light thrown upon the disintegration of the concrete by determining the action of the various alkali solutions upon the sands used locally in the composition of concrete. Accordingly, some tests were made using a sand known locally as Bird's Hill sand, and having the following composition:

Silica (SO_2) - - - - -	47·54%
Iron and alumina (Fe_2O_3 and Al_2O_3)	28.32%
Loss on ignition - - -	19.32%
Calcium (Ca) - - - -	3·71%
Magnesium (Mg) - - -	0·57%
	99·46%

It was found that .009% was soluble in water and of this .0012% existed as water soluble sulphates stated as SO_3. The sand was then extracted with the following solutions:—

1. 10% magnesium sulphate.
2. 5% calcium sulphate plus 10% sodium chloride.

These experiments showed that to some extent these alkaline solutions had a solvent effect upon the lime in the sand. These tests were not brought to a definite conclusion and further investigation is necessary along this line.

Some further tests were then made on briquettes made with cement and limestone in proportions of 1 to 3 by weight. The limestone was graded so that its grains would be the same size as those of standard Ottawa sand. These briquettes were placed in the following solutions:— 5% magnesium sulphate, 10% sodium sulphate, 5% calcium sulphate plus 5% sodium chloride; and also in a solution made from white soil deposit having the composition: Calcium sulphate, 62.5; magnesium sulphate, 37·5. These briquettes showed rapid deterioration by softening of the edges, reduction in tensile strength and also by the solution becoming turbid.

Winnipeg Water District Tests

In previous experiments some indication had been given that mortar coming into contact with the alkali ground water before it had thoroughly hardened, would disintegrate rapidly. With this in mind, a series of tests were made in conjunction with the officials of the Greater Winnipeg Water District.

Four sands were selected for these tests differing both in grading and chemical composition. A large number of briquettes were made from these sands for 1 to 2 and 1 to 3 mortars. A set of neat cement briquettes were also made for comparison.

For each mortar 40 briquettes were made and cured 24 hours in a moist closet, 20 of these were then placed in the following solutions: (1) Distilled water; (2) tap water; (3) 10% magnesium sulphate; (4) 10% sodium sulphate.

The remaining 20 briquettes were steamed by being placed on a rack over water in a copper boiler such as is is used for testing cement pats. The temperature was maintained as nearly as possible at 150° F. After 48 hours' steaming the briquettes were placed in solutions corresponding to those used for the unsteamed sets. From the five briquettes in each of the sulphate solutions two were removed and kept in air for 24 hours and then replaced in solution 24 hours. This treatment was continued throughout the test which was for a period of 3½ months. Some of the briquettes disintegrated and some remained firm. In general, 1 to 2 mortars withstood the action of the sulphates better than the 1 to 3 mortars, and the unsteamed briquettes better than the steamed. Some of the latter were so badly swollen and disintegrated that it was thought advisable not to break them but to keep them for exhibition. In order to throw some light on the cause of the failure of some of the mortars to resist the action of the sulphates some density tests were made on the various mortars used in these briquettes.

On comparing the figures obtained for density with the resistance of the mortars to the alkali solutions it was observed that in general for a given cement content the mortar with the lowest density disintegrated first.

In the case of standard Ottawa sand 1 to 3 mortar there is insufficient cement paste present to fill the voids in the sand. These briquettes disintegrated very badly. The neat cement specimens were practically unacted upon. One of the mortars, on removal from the sulphate solutions, showed a strength after 3½ months of 600 lbs., whereas the strength of same mortar in distilled water for same time was 360 lbs. The writer advances the explanation that the calcium sulphate formed in the briquette is itself very strong and has added to the strength of the briquette but that in presence of plenty of water the sulphates would gradually be dissolved out and the briquettes would disintegrate.

To summarize the results of these experiments. So far as they have gone they seem to indicate that the action of the sulphates on mortar is proportional to the porosity of the mortar. In view of the fact that comparatively little time has been available to go into this matter thoroughly the results of these tests should only be taken as pointing to a line of further investigation which should yield most interesting results.

CALGARY COMMITTEE CONDUCTING EXPERIMENTS WITH CONCRETE IN ALKALI SOIL

TO study the cause of the trouble which some of the western cities have had with underground concrete structures in alkali soils, the Calgary Branch of the Engineering Institute of Canada some time ago appointed the following committee: George W. Craig, city engineer; F. C. Field, city chemist; F. W. Alexander, division engineer, C.P.R.; H. Sidenius, assistant engineer, Department of Natural Resources, C.P.R.; and A. S. Dawson, chief engineer, Department of Natural Resources, C.P.R.; all of Calgary. This committee presented the following report to the professional meeting of the Institute, held August 8th to 10th 1918, at Saskatoon::—

The most usual causes of the disintegration of concrete may be summarized as follows:—

1. Bad workmanship.
2. Poor and unsuitable materials and badly-graded and proportioned mixtures, including amount of water used.
3. Alternate wetting and drying out and alternate freezing and thawing out.
4. Destruction and removal of the protecting outer skin from various causes.

5. The presence of an excess of alkali salts.

It is unnecessary to mention the effects of frost before setting, erosion of the skin by excessive velocities, and other mechanical agencies, which to a great extent can be provided against during construction, and subsequently by various well-known methods.

The following remarks apply to various structures in the city of Calgary and in the country extending east between Calgary and Medicine Hat, all of which have come under the observation of the writers.

Bank-Run or River Gravel

The aggregates were mostly bank-run gravel or river gravel. The cement was all western brands which had passed standard tests and the water was from rivers and local wells. The workmanship was good and all done under close supervision. The worst conditions have been found on types of structures whose design has necessitated their being backfilled on one side, and subjected to heads of ground water from the same direction and at or below the orginal ground surface. These conditions seem to be aggravated where the structures are subjected to dry and wet surroundings, exposed to sun and shade in the winter months or to excessive velocity, and where alkali salts are most in evidence and the ground wet.

The fact that the deterioration starts on the surface, extending inwards, and that the water being carried by the structures has analytically been shown not to be responsible for the trouble would indicate that the deterioration was primarily caused by the ground water and its effects on the concrete. These effects vary in degree from the spalling off of the surface in what results in a pile of loose gravel below to a condition where the mass becomes of a slimy consistency, like so much lime mortar or mud. As a rule, samples in what might be termed an intermediate stage get harder if permitted to dry out in the air, when they become coated with white powdery salts.

Majority of Work O.K.

These observations have come from a committee who, as individuals, have had direct charge of over 250,000 cubic yards of concrete. The majority of the work is in first-class condition, and the disintegration of a very small portion of the whole must be due to some extreme local conditions which exist at certain points where failure is taking place. The verdict has been pronounced that the disintegration is caused by alkali salts, and that the sulphates are the most active. This is the opinion of most of the men of the United States who have been working on the same problem for several years, although there is a difference of opinion as to just what change takes place. Either the disintegration is due to the formation of soluble compounds, which are leached out of the concrete, leaving it inert, or it is due to the disruption caused by the crystallization of the salts in the pores, or by chemical action of the substances in solution with the constituents of the concrete.

Samples of soil were taken for analysis where concrete was failing, also concrete both sound and showing different degrees of disintegration, for the purpose of determining whether the soil adjacent to the structures contained sufficient alkali salts to account for the injury, and also to determine whether these salts had actually reacted with the concrete. The sulphates would seem to be by far the most active salt found. It is generally admitted that magnesium sulphate is the most active salt found in alkali soils. The samples of soil were, therefore, analyzed for sulphates, which were subsequently calculated to sulphuric anhydrate, and a composite sample for magnesia which was calculated to magnesium oxide.

Inspection of the results shows that there are sufficient alkali salts in all samples analyzed to have a destructive effect on concrete of excellent quality. The samples of concrete were analyzed for lime, sulphates and magnesia. The purpose of these determinations was to ascertain if the percentages of sulphates and magnesium were greater in disintegrated concrete than in sound portions of the same structure.

It was noted that there were smaller percentages of lime in the samples of disintegrated concrete than in the samples of sound concrete; and there was probably a slight leaching of lime from the disintegrated concrete, which decreases its per cent. A still further and more pronounced decrease in the per cent. is brought out in the accumulation of sulphates in the disintegrated concrete.

Ordinary Foremen Unsatisfactory

In view of our observations, the conclusion has been reached that we must get away from the idea that any ordinary foreman can handle concrete the way it must be handled. We have already revised our specifications demanding better workmanship, better materials where possible, richer mixtures with less water, and closer supervision by men who know the concrete business as a specialty.

We have already adopted the practice of using water-gas tar and coal-gas tar on the surface of walls which will be subjected to conditions which are known to cause trouble; but in this connection it should be noted that any asphaltic preparation becomes inert when subjected to alkali salts, and that practically pure tars must be used. The best possible drainage facilities are also being provided for all structures built.

We have also started in on an elaborate series of experiments on concrete blocks, 10 in. x 10 in. x 2 ft. 6 in., using both western and eastern cements, with the following aggregates: Standard, e.g., screened, washed and graded; bank run, washed; bank run, natural; each in a 1:2:4 and 1:1½:3 mixture. The cement and water will be chemically analyzed and put under standard tests. Sand and gravel will be analyzed, chemically and physically.

Blocks Will Be Tested

The blocks will be: (1) Plain; (2) treated with soap and alum; (3) treated with water-gas tar and coal-gas tar. They will be placed in the best and worst localities that can be found, and will be systematically examined and tested over a period of three years or longer. It is anticipated that these investigations will help us as well as others who may work along the same lines, and be of value to the community at large. They may result not only in getting at the root of the trouble, but enable us to determine on a mixture and a class of work that will stand up, and that also will be most economical.

The Etobicoke Township (Ontario) Council struck its tax rate at a special meeting held recently. The rate for 1918 will be 21 mills, an increase of over 4 mills on last year. The council claim that the increase was largely due to the increased cost of labor entailed in repairing roads worn out while the Toronto-Hamilton highway was closed.

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Principal Contents of this Issue

CONCRETE IN ALKALINE SOILS

FOR the past eight years it has been generally known that alkaline soils have a disintegrating effect upon porous concrete. The Reclamation Service of the United States issued a pamphlet nearly a decade ago which called attention to the action of such soils, and when the matter was reviewed editorially in the January 14th, 1910, issue of *The Canadian Engineer*, it was stated that it would be of great interest to engineers doing work in Western Canada.

For some years, however, but little complaint has been heard from Western Canada regarding underground concrete structures in alkaline districts, but the accumulation of evidence has gradually alarmed many engineers until now it appears to be a very live subject in the Prairie Provinces. When proper drainage is not provided, the action of alkaline waters on concrete is similar to frost action if the concrete be sufficiently porous. Properly made, dense concrete apparently offers much greater resistance. Most of the western concrete that has failed after being placed in alkaline soil, was made with pit-run gravel; and nature has rarely been sufficiently obliging in regard to the proper grading of aggregates.

There are too many examples of excellent service afforded by concrete structures over long periods of years, even when placed in contact with alkaline waters, to condemn the material in any wholesale manner because of failures of concrete of which the precise history is unknown. On the other hand, there are certainly serious failures in Western Canada. Even one wing wall of the Bassano Dam is affected, although it is not known to what extent this and other failures may be due to frost instead of alkali action. The extent of the problem is sufficient, however, to warrant earnest study, and the Calgary Branch of the Engineering Institute of Canada is to be congratulated upon its initiative in appointing a committee to investigate whether density—better workmanship—be truly the proper and only solution. The outstanding feature of the Calgary investigation to date appears to be that good concrete requires good materials correctly used and not abused, and that the most important ingredient of successful concrete is the brain of a trained engineer.

THE FUTURE OF PRICES

IN discussions as to the course of industry after the war, it is generally assumed that prices will fall again to "normal." This assumption is, however, not entirely justified. There is really no such thing as "normal" prices. What is meant is, of course, the price levels existing in 1914. These represent a considerable change as compared with prices of preceding years, and it would be an extraordinary thing if prices should again decline to anything which could be referred to as "normal" as compared with the prices existing at the beginning of the war.

From one point of view the whole future, not only of manufactures, but also of other phases of economic life, such as the wage scale and the value of real estate, resolves itself into a question of prices. The phenomenal rise which has taken place during the war years has been due to a number of causes, including scarcity of labor, unusual requirements on the part of governments and of industries working for the government, and disturbances to industry directly resulting from the war, such as shipping losses. Some of these, it will be seen, will disappear upon the return of peace while others will remain more or less permanently. Generally speaking, the factors on the demand side which have been influential in the rise in prices will cease. On the side of supply, it may reasonably be expected that an ample labor force will again be available. The large volume of shipping now being created will probably replace all the damage by a large margin, but some of the inroads upon industry will not be repaired for many years to come. For instance, the conversion of industrial plants into the munitions business and their reconversion into peace activity will add an element of capital expense.

Rising prices did not commence with 1914. As a matter of fact, a period of rising prices was almost concluding at the time and probably would have done so had not extraordinary conditions not only extended the period but also accentuated the movement. During the past hundred years and more there has been an alternate rise and fall of prices during every period of about 21 years. The year 1896 was the end of a period of falling prices and from that time up to the present, the movement has been consistently upwards. The year 1914 was the eighteenth of this period and if previous experience had been repeated a decline would have set in at this time. War conditions, however, were sufficiently abnormal to disturb entirely the ordinary course of economic events. These fluctuations in price levels are usually attributed to a large extent to the relation of the supply of gold to the demand. This is represented by a valuation of gold, expressed in terms of other commodities, and when the supply is not equal to the requirements, prices naturally fall. A large production of gold, on the other hand, brings about a rise in prices which tends to restrict the production of gold by increasing its cost. It is significant, therefore, that gold production has declined rapidly of late and there is every evidence of it continuing to do so, as profits have been greatly reduced.

There is no indication as yet of general declining prices. In the cases of some commodities, however, the upward movement has been slower during the past few months. The "Economist" gives figures showing an actual decline in the price of cereals and meats in 1918 as compared with 1917. General price levels show an advance over last year but not as great as the advances represented by 1915, 1916 and 1917. It is not likely that prices will commence to decline until the end of the war, although as soon as peace is in sight they may fall in the case of some commodities, as a result of a decline in demand being anticipated. If, on the other hand, the war be followed by a period of fairly normal activity, there is no reason whatever to look for prices to fall to their level of 1914, and although they probably will decline to some extent, they may stop at a level much above the level of that year.

PERSONALS

J. G. SULLIVAN, C.E., until recently chief engineer of the Canadian Pacific Railway Company, has announced the opening of a consulting engineer's office at 703 McIntyre Block, Winnipeg, Man. Mr. Sullivan will make a specialty of all kinds of railway work, mining, foundations, tunnelling, elevators, etc.

H. R. SAFFORD, chief engineer of the Grand Trunk Railway System, has been appointed to a very important office in connection with the Federal Administration of Railways in the United States. He will be engineering assistant to H. Holden, Regional Director of the central western district, who has jurisdiction over the operation and maintenance of about 50,000 miles of railroads, embracing many important systems such as Santa Fe, Rock Island, Chicago & Alton, Union Pacific, etc. Mr. Safford is a graduate of Purdue University and a charter member of the American Railway Engineering Association, of which he is now vice-president. He is also a member of the American Society of Civil Engineers and a councillor of the Engineering Institute of Canada.

L. H. GOEBEL has resigned as superintendent of filtration and chief water chemist of the Union Stock Yard and Transit Co., Chicago, to join the engineering staff of Wallace & Tiernan Co., Inc., manufacturers of chlorine control apparatus and sanitary engineering specialties. After graduation in sanitary engineering at Purdue University, Mr. Goebel was attached for a time to the Union Stock Yards filtration plant and subsequently was sanitary engineer, city chemist and bacteriologist of Cedar Rapids, Iowa, returning to the Union Stock Yards Co. early this year. Mr. Goebel will be attached to the Chicago office of the Wallace & Tiernan Co.

T. AIRD MURRAY, a well-known consulting engineer of Toronto, is very ill at Rochester, Minn., having undergone a serious operation at the Mayo Institute. Mr. Murray spent all of last winter in Bermuda, and when he returned home this summer, it was thought that he had entirely recovered his health; but during a trip to Saskatchewan, for which province he is consulting sanitary engineer, Mr. Murray was again taken ill and his physician advised him to go to Rochester for treatment.

OBITUARIES

Lieut. J. A. GARVIE, M.C., formerly of Toronto, has fallen in battle. Lieut. Garvie was a graduate of the School of Practical Science, Toronto, and joined the Officers' Training Corps in Toronto in 1915. A few weeks before his death he won the Military Cross.

MORLEY DONALDSON, formerly vice-president and general manager of the Grand Trunk Pacific Railway, with headquarters at Winnipeg, died recently after an extended illness. He was born in Edinburgh, Scotland, in 1851, and was educated by private tuition in France and Canada. Mr. Donaldson spent some time in the engine works of E. Gilbert & Co., Montreal, and later assisted in the construction of Hoosac Tunnel, Mass. He entered the Canadian Atlantic Railway service as chief draughtsman in 1881, becoming successively mechanical superintendent, superintendent of traffic and mechanical departments, and general superintendent until the road merged with the Grand Trunk Railway System in 1905. In 1912 he was appointed vice-president and manager of the G.T.P. R'y.

HALIFAX PROFESSIONAL MEETING

(Concluded from page 228)

Terminals, followed by tea at "Waegwoltic," comprise the program for Wednesday afternoon.

Second session, Wednesday evening—"Diving Bell in Use at Halifax Ocean Terminals," by J. J. MacDonald, assistant engineer, Halifax Ocean Terminals.

Third session, Thursday morning—"St. John Harbor Works," by Alex. Gray, harbor engineer, Public Works Department St. John; "St. John Railway Terminals," by C. C. Kirby, divisional engineer, C.P.R.; luncheon as guests of the Commercial Club.

Fourth session, Thursday afternoon—"Use of Reinforced Concrete in Harbor Work," by A. F. Dyer, engineer, Furness Withy Co., Halifax; excursion on harbor as guests of the Board of Trade.

Fifth session, Thursday evening — "The Quebec Bridge," by G. F. Porter (public lecture at the Hall of the School for the Blind).

Sixth session, Friday morning—"Halifax Ocean Terminal Railway," by R. H. Smith, resident engineer, Ocean Terminal Railway; address by a representative of the Halifax Board of Trade.

The meeting will close on Friday afternoon with excursions which may be arranged to suit individuals or groups to any points of interest, such as the new telephone exchange, Imperial Oil Co. plant, Woodside Sugar Refinery, Halifax shipyards, parks and public gardens, Nova Scotia Tramway & Power Co.'s power house, etc.