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ENGINEERING PRESTIGE

Relation of Engineering Societies to the Community and to Their Members—Survey of What Is Being and Can Be Done to Improve the Welfare and National Status of Engineers

By R. O. WYNNE-ROBERTS
Consulting Engineer, Toronto

IT IS EVIDENT by the action taken by the Engineering Institute of Canada to adopt its present name and to revise its constitution and by-laws, and also by the unrest, not only in Canada but also in other countries, that the question which we have to consider is one which is occupying the attention of engineers generally.

In one form or another, this subject is discussed in addresses, debates and technical journals, for it vitally concerns the profession and is of importance to the public. For reasons which are more or less obvious, engineers do not occupy the status in public estimation to which they are entitled. The Engineering News-Record, of New York, recently referred to an advertisement which appeared in a Dallas, Texas, daily paper, which read: "Wanted at once, forty civil engineers, handymen, cooks, dishwashers and other high-class positions open." We may, of course, dismiss this as a humorous or ludicrous announcement, but it indicates in an ironical manner the estimation in which engineers are held by some people. We, of course, know that the profession is held in esteem by the thoughtful public, but the appreciation generally is not what it should be.

Clemens Herschel, the ex-president of the American Society of Civil Engineers, expressed the opinion that a large part of the lack of recognition was due to the fact that some of the expenditures on public works are made footballs of politics.

The subject of how to increase the prestige and influence of the branch may be considered from two main viewpoints; namely, the relation of the branch to the community, and the relation of the branch to the members. These again may be subdivided under different heads, because the subject covers such a wide field of consideration.

Relation of the Branch to the Community

W. L. Hichens, one of the foremost authorities in Britain in connection with the ship-building and engineering industries, stated in his Watts Anniversary Lecture for 1918, delivered at Greenock on January 18th, 1918, that "no man can serve two masters. He cannot serve himself and the community. He can only serve himself by serving the community."

Dr. J. A. L. Waddell, speaking before the Engineers' Society of Western Pennsylvania on February 29th, 1916, said, "It may be stated, without fear of contradiction, that the status of engineering can be improved mainly in one way; namely, by increasing its usefulness to humanity."

The war has produced a great change in the opinions of men and in their conception of citizenship, and possibly changes revolutionary in character and international in magnitude may take place in the early future. This may be postulated by the steps taken to consider questions involving national schemes of reconstruction of social and commercial organizations in Europe and in North America. Statesmen appear to be imbued with the great importance of this subject, and Royal Commissions have already reported in terms which are deemed to be so drastic and unusual that former conceptions of the relations between capital and labor and between the employer and employed have received a severe jolt.

Furthermore, the usefulness of engineers in these matters is being more fully apprehended, inasmuch as it is contended that as it was through their agency that social, commercial and political conditions of almost every country were transformed during the last century. They must play an important part in the affairs of the country to reconstruct the fabric which has been shaken to its very foundation by the war, and to assume their share of the responsibility of adjusting personal, commercial and national affairs. It is manifest that individual engineers can do much in this direction, but their representative organizations can do more, and the more comprehensive the membership and the more united the forces, the greater will be the possibility of promoting the prestige and influence of the branch.

These qualities, however, are not developed in the community without an earnest effort to serve and guide the people and to cultivate a healthy, vigorous and pronounced public opinion.

The shock and stress of the war have introduced many new problems; they have polarized into action many

NOTE.—Last summer the executive committee of the Toronto Branch of the Engineering Institute of Canada, appointed a sub-committee "to study means of increasing the prestige and influence of the branch." The sub-committee consisted of R. O. Wynne-Roberts, chairman and secretary, E. L. Cousins, H. E. T. Haultain, J. G. G. Kerry and W. Storrie. After considerable study by these engineers, and much correspondence, the chairman has prepared a very detailed and comprehensive report of the committee's research work. This report was written with the Toronto Branch troubles more particularly in mind, but most of its statements are applicable to all branches throughout Canada and to all engineering societies, so the report is of general interest. Instead of abstracting it, we are printing it herewith in full at the special request of the Toronto Branch executive. The executive request each member to read this report carefully so as to be able to discuss it fully at a meeting which will be called at an early date. The committee's shorter official report will be determined largely by the discussion thus aroused.—EDITOR.

schemes which were previously of more or less academic interest to us; they are compelling us to consider our ways and means and how to rehabilitate the social, commercial and political affairs, and they undoubtedly are driving forces to which we have to yield. The war is a war of engineers, and reconstruction must in a large part be the work of the engineer. Premier Asquith in August, 1917, said in the House of Commons that "no one who has any imagination can possibly be blind to the fact that the war, with all the enormous upheaval of political, social and industrial conditions which it involves, must in many ways—and ought to if we are a rational and practical people—suggest to us new problems or possibly modifications in the solution of the old ones."

It is somewhat remarkable that engineers as a profession have in recent years gradually come to acknowledge that their organizations have a great deal more to do beyond facilitating the acquirement and interchange of professional knowledge. The new by-laws of the parent Institute define that one of its objects is to enhance the usefulness of the profession to the public.

A committee appointed by the American Society of Civil engineers, when reporting on April 17th, 1917, stated that "engineers should realize and accept their duties as citizens of the community in which they live"; and further, they should exert "influence in the legislation of the State and the administration of its affairs wherever engineering principles or practices are involved." Local sections (branches) should volunteer judicious and carefully considered advice on public matters involving "engineering questions."

Dr. G. F. Swain, in his presidential address to the American Society of Civil Engineers' meeting at Ottawa in 1913, made the following observations: "The engineer is primarily a member of the social body. Its problems are his problems; he cannot avoid the responsibility of taking a share in their solution. Social problems are the outcome of the work of the engineer, who, as the advance agent of civilization, has been the main factor in creating the condition which gave birth to the problem."

"Problems of citizenship," said Morris Knowles, "are largely engineering in character"; and yet, when Sir Robert Borden issued his message on the fiftieth anniversary of Confederation, and proudly referred to the marvellous material development in Canada, as Fraser S. Keith mentioned in his address delivered at Ottawa on November 15th last, Sir Robert forgot to state that "each and every one of the indications of advancement owes its present state directly to engineering skill and to engineering progress."

Enough has been stated to show the opinion of various authorities on the desirable relation between the branch and the community. It will be well now to refer to what is being done in this direction, so that we may have some indication of the activities in which the branch may engage.

The Providence Engineering Society succeeded in 1917 in inducing the authorities to appoint an engineering committee to consider the preparedness of Rhode Island, especially with reference to the protection of plants and provision for the restoration of interrupted public service and other work which the engineers could probably do in the event of a serious conflagration or the like.

The Nashville Engineering Society in 1907, at the request of city officials, gave the city council assistance in connection with the method to preserve and secure a pure water supply. It afterwards co-operated with the fire commissioners and building superintendent to frame new building regulations. It assisted in the preparation of a uniform boiler code and in drafting national water power laws. It joined with the county authorities in connection with the question of highway bonds.

The Cleveland Engineering Society has been very active. It worked with the Chamber of Commerce to co-ordinate the industries of the city to effect a maximum of war production. It joined with the Builders' exchange and the Institute of architects to revise the building code. It assisted the Civil Service Commission in connection with examinations for engineering positions. It co-operated with the Y.M.C.A. and the Chamber of Commerce on the problem of vocational guidance for boys. It assisted with the City Planning Committee to preserve and beautify certain properties.

The Engineers' Society of Pennsylvania conducted Industrial Welfare and Efficiency Conferences. The Model Charter for Boulder, Col., was drafted by engineers. The Municipal Engineers in Britain, at their various meetings, not only offer criticism of the various civic enterprises which they visit and study, but also frequently submit valuable information to the authorities.

The Engineering Institute of Canada is by no means remiss in its service to the public. Its committee on transportation prepared a comprehensive report on the railway problem. It urged the government to make an investigation how the natural resources of Canada could best be developed.

The Toronto branch has also done some work on behalf of the community. The Saskatchewan branch offered to place the services of the members at the disposal of the provincial government to co-operate to the fullest extent when called upon and to give any information at their disposal, either as a consultory body or in an advisory capacity, concerning the qualifications of members of our profession. The British Columbia division made a similar movement.

It will be acknowledged that although we have done something in behalf of the public, the relationship is not extensive or intimate. In this respect we have maintained an attitude of partial isolation. The public knows very little of what we have done in this behalf. Prestige and influence in the community must more or less correspond to the extent to which we cultivate its confidence, goodwill and appreciation. A negative virtue meets with a negative esteem; or in other words, if we do not as a body serve the public, we cannot legitimately expect its high esteem. It has doubtless been observed by us all how few engineers represent the people in Parliament or on other public bodies. We seem to shrink from publicity and must suffer thereby, whilst public service is that much the poorer. The appointments of C. A. Magrath as fuel controller of Canada, and of R. A. Ross and A. Surveyer as members of the Honorary Advisory Council for Scientific and Industrial Research, suggest a satisfactory change in the attitude of the governments in their attitude towards the profession. The United States Government has utilized the services of engineers and engineering organizations in a larger measure.

The question will arise, What then can we do as a branch to enhance its prestige and influence?

We might co-operate with the Board of Trade and the Canadian Manufacturers' Association to study what industrial developments are desirable and possible, and how to promote them.

It would be desirable to join the Civic League and the Bureau of Municipal Research in the investigation of various problems associated with city affairs.

The employment of partially disabled soldiers is a very important subject. The branch might afford assistance in some direction to the governmental commissions.

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METHODS AND COST OF SNOW REMOVAL*

By H. F. Richards
Superintendent of Maintenance and Repairs,
South Park Commissioners, Chicago

THE areas covered by the South Park Commissioners in their snow-cleaning work include about 67 miles of drives and 175 miles of walks and 90 to 95 acres of skating ice.

The South Park snow-handling equipment at the present time includes five 3-wheeled tractors fitted with detachable V-shaped plows having wing extensions and with detachable revolving street brooms, one 4-wheeled tractor equipped with both V-shaped and straight moldboard attachments, some very large snow-hauling wagons, twenty large 4-wheeled iron plows of the road grader type, seventeen large wooden 4-wheeled tractors fitted with detachable revolving street brooms, one 4-wheeled tractor equipped with both V-shaped and straight moldboard attachments, seventeen large wooden 4-wheeled plows similar to the road graders, six small iron-wheeled plows, used mainly for cleaning snow off sidewalks around the smaller parks, several straight moldboard attachments for auto trucks, and a considerable number of large ajax scrapers, triangle plows, ice shaving machines, etc., for cleaning the fields of skating ice.

About three winters ago a snow-slushing machine was constructed for the purpose of disposing of snow in the downtown district through the sewers instead of loading it on wagons and trucks and hauling it to a dump. This was a small machine, consisting of a water turbine with a supply line to a fire-plug, so patterned that it would hang in a sewer manhole in a wire mesh basket, three free blades connected with the turbine chopping the snow and with the aid of the water from the turbine exhaust forcing or washing it through the wire basket into the sewer where the current of water and sewerage took it away. The basket served to keep pieces of wood, bricks and other rubbish from passing along into the sewer and possibly clogging it.

In January of this year the abnormal snowfall plainly showed the necessity of a powerful and efficient machine to handle snow rapidly and in large quantities. After a little experimental work a 2-disk rotary snowplow was constructed and given some preliminary tests, but the lateness of the season did not permit perfecting it. With more power, however, it gives promise of being developed into a practical affair.

The following statement shows the cost of cleaning snow from the park driveways, the time required for carrying out the work being three days:

First Day (a.m.)—Plowing snow to the gutters from Washington Park stables to 12th Street and Michigan Avenue, over the following driveways:

	Width, ft.	Area, sq. yd.	Length, miles.
Washington Park (part)	40-50	30,000	1.20
Grand Blvd. (centre drive)	55	64,416	2.00
South Park Ave. (35th to 33rd)	42	6,122	0.25
33rd St. (South Park to Michigan)	42	8,282	0.31
Michigan Ave. (33rd to 12th)	50	67,320	2.25
	....	176,140	6.01

Cubic yards of snow on drive, at 4 in.	19,571
Cubic yards of snow on drive, at 6 in.	29,357

For a 4-in. snowfall it is estimated that 40 horses (5 right 4-horse hitches and 5 left 4-horse hitches) will be required to plow these drives in five hours before noon. At the rate of $6 per 8-hour day for team and driver, the cost will be $75.

For a 6-in. snowfall it is estimated that 48 horses (6 right 4-horse hitches and 6 left 4-horse hitches) will be required. At the rate of $6 per 8-hour day for team and driver, the cost for five hours' work will be $90.

Cost of Plowing Snow Off Above Driveways

	Per mile of drive.	Per 1,000 sq. yd. of pavement.	Per cu. yd. of snow.
For 4-in. snowfall	$12.49	$0.427	$0.00384
For 6-in. snowfall	14.98	.512	.00307
Total cost (without overhead) for 4-in. snowfall			$75.00
Total cost (without overhead) for 6-in. snowfall			90.00

First Day (p.m.)—In the afternoon half of the teams which plow from the park stables to 12th Street and Michigan Avenue in the morning will plow snow to the sides of the drives on—

	Width, ft.	Area, sq. yd.	Length, miles.
Drexel Blvd. (both drives)	*40	70,224	3.00
Oakwood Blvd.	50	17,060	0.50
Washington Park (part of drives)	40-50	20,000	0.80
The other half of the teams will plow—			
Garfield Blvd. (South Park to State)	40	11,733	0.50
Michigan Ave. (55th to 33rd)	50	82,228	2.75
*Each.	..	201,245	7.55

Cubic yards of snow on drive at 4 inches	22,360
Cubic yards of snow on drive at 6 inches	33,541

The cost of the afternoon's work (5 hours) will be the same as for the morning's plowing—$75 for a 4-in. snowfall and $90 for a 6-in. snowfall. These drives will not be gone over twice, but it is intended to go over the drives between the Washington Park stables and 12th Street on Michigan Avenue twice in order to get them as clean as possible, as the first trip over the drives usually does not remove all of the snow.

Cost of Plowing Snow Off Drives Cleaned in the Afternoon of the First Day

	Per mile of drive.	Per 1,000 sq. yd. of pavement.	Per cu. yd. of snow.
For 4-in. snowfall	$ 9.94	$0.373	$0.00336
For 6-in. snowfall	11.93	.448	.00268
Total cost (without overhead)			$75.00
Total cost (without overhead)			90.00

Second Day (Nine Hours' Work).—Half of the teams will plow to the gutters on—

	Width, ft.	Area, sq. yd.	Length, miles.
Garfield Blvd. (south drive—State to Western)	40-25	56,691	3.00
Garfield Blvd. (north drive—South Park to Western)	40-25	68,424	3.50
Other half of the teams will plow snow on—			
A.M.—(From park stables to 79th St. and Bond Ave.)—			
Washington Park (part of drives)	40-50	10,000	0.40
Midway (south drive)	40	21,910	1.00
Jackson Park (part of drives)	40	44,000	2.00
Yates Ave. (71st St. and Bond Ave. to 79th St.)	32-38	36,500	1.75
P.M.—In the afternoon over the following drives:			
Fifty-first St. (including Drexel Sq.)	40	31,976	0.94
East End Ave.	50	18,700	0.65
Jackson Park (rest of drives in "outer" circle)	40	70,000	3.00
		358,201	16.24

Cu. yd. of snow on drive: At 4 in., 39,800; at 6 in., 59,700.

As this is a 9-hour day, the cost of plowing the snow after a 4-in. snowfall, using 40 horses, will be $135, at the

*Abstracted from paper read before the Western Society of Engineers.

rate of $6 per 8-hour day for team and driver; in case of a 6-in. snow the cost will be $162, 48 horses being used.

Cost of Plowing Snow Off Drives Cleaned on the Second Day

	Per mile.	Per 1,000 sq. yd.	Per cu. yd.
For 4-in. snowfall	$ 8.31	$0.378	$0.00340
For 6-in. snowfall	9.98	.453	.00272
Total cost (without overhead) for 4-in. snowfall			$135.00
Total cost (without overhead) for 6-in. snowfall			162.00

Third Day (Nine Hours' Work).—One-half of the teams will plow snow to the sides on the following drives:

	Width, ft.	Area, sq. yd.	Length, miles.
66th and 67th Sts. (Jackson Park to Ashland)	28	67,518	4.10
*Normal Ave.	32	63,580	2.10
Other half of the teams will plow—			
Grand Blvd. (side drives)	†25	58,432	‡4.00
Washington Park (rest of "outer" circle of drives)	40-50	45,000	1.60
		234,530	11.80

*Cu. yd. of snow on drive: At 4 in., 26,060; at 6 in., 39,090. †Each. ‡Together.

At the rate of $6 per 8-hour day for a team and driver, the cost of plowing a 4-in. snowfall, using 40 horses, will be $135; for a 6-in. snowfall the cost will be $162, 48 horses being in use.

Cost of Plowing Snow Off Drives Cleaned on Third Day

	Per mile of drive.	Per 1,000 sq. yd. of pavement.	Per cu. yd. of snow.
For 4-in. snowfall	$11.44	$0.576	$0.00518
For 6-in. snowfall	13.74	.692	.00415
Total cost (without overhead) for 4-in. snowfall			$135.00
Total cost (without overhead) for 6-in. snowfall			162.00

The above costs are based on a rate of 75 cents per hour—$6 per 8-hour day—for a team and driver. They do not provide for finished cleaning over the various driveways of the South Park system, but cover primarily the clearing away of the "roughage" after snowstorms, such as can be accomplished by a single trip of the battery of plows over the different drives. Where two teams are used on a grader plow, the second driver operates the plow adjustments, so no laborers are necessary in such cases. As will be seen, the cost per mile for cleaning, outside of the downtown district, ranges from $8.331 per mile as the minimum for a 4-in. snowfall to $14.98 per mile as the maximum cost for a 6-in. snow, two teams being used on each grader.

In some instances but one team is used on a grader and then a laborer is required to man the plow. It has been found that this reduces the cost of a single trip, cleaning of a certain driveway, making it from $5.40 per mile for a snow of 4 to 5 ins. to $7.20 per mile for a fall of from 5 ins. to 1 ft., when the team hire is $6 per 8-hour day and the rate for labor is 30 cents per hour.

Carefully kept records show that the work of cleaning snow off drives with tractors after ordinary snowfalls can be done at a cost somewhat less than with horse-drawn machines and with them the work progresses much more rapidly, too. In breaking up packed snow and ice the tractor outfits have proved themselves particularly adapted, while they are able to pile the snow over the curbing better than horse-plows, leaving the gutters open.

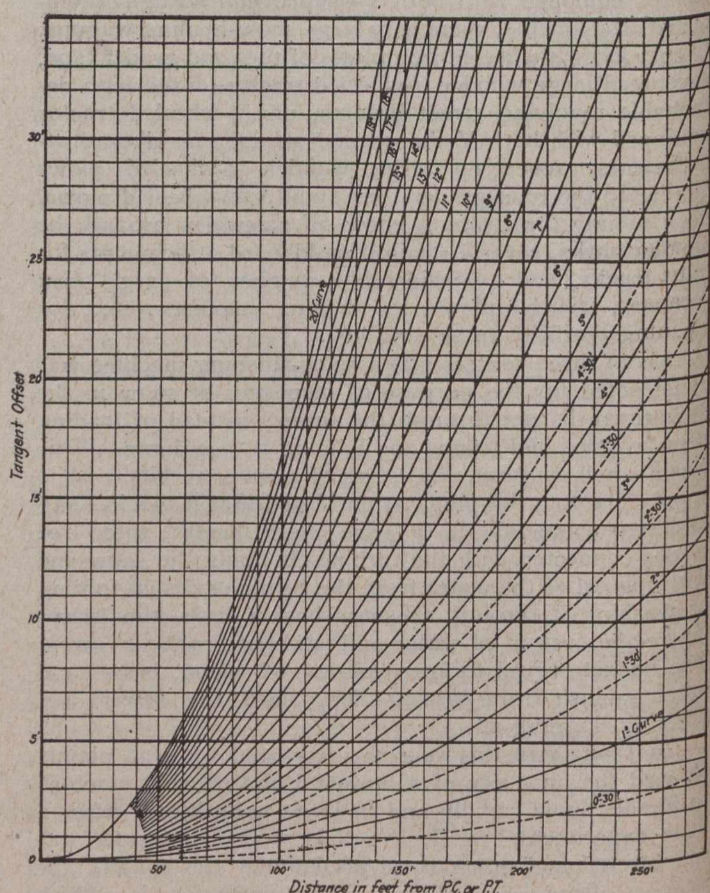
In a paper read before the Ottawa Branch of the Canadian Society of Civil Engineers on Thursday last, April 12th, Lieut. Edgar A. Jamieson brought out many interesting points in gun manufacture.

LAYING OUT CURVES BY TANGENT OFFSET*

THIS chart is for the use of highway engineers, and is made a convenient size for pasting in the field book. When plotted to a larger scale, interpolation can more readily be made.

By use of the cross-section paper on which the chart is made and the scale that is adopted, each 10 ft. in distance and each 0.2 ft. in offset is readily taken from the chart and other distances can be interpolated.

It is not intended to discourage any accurate method of laying out curves, but in highway work the tangent offset method is sufficiently accurate in the majority of cases, and this chart is designed to save field calculations.



If used in connection with a well-arranged set of tables of the one degree curve, such as Table 30 in "Harger and Bonney's" handbook, it will practically eliminate figuring in the field and speed up the survey considerably.

The following instructions accompany the chart:

In measuring up to the P.I., leave temporary markers at stations and plus stations where the curve is to be located. From the newly located P. I. turn off the desired deflection angle. Determine the degree of curve necessary to fit the conditions from the external and tangent length and take from table the tangent and length of curve, and record the station of the P. C. and P. T. Make the curve correction for difference in length of the sum of the tangents and distance on the curve at the P. I., and start measurements along next tangent, leaving temporary markers up to the P. T. of the curve. To lay out curve, start at the station or plus station near the P. C. and measure along the curve, using standard chord lengths, and using the offsets from tangent as read from chart, which increases as the distance from the P. C. or P. T. increases.

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*"Engineering and Contracting," New York.

SOME PRACTICAL POINTS IN THE DESIGN AND CONSTRUCTION OF PARTITIONS*

By H. L. Barraclough

HAVING been asked to write something on the use of partitions, I had almost thought their common use and infinite variety would scarcely have required anyone to ask further information on the question, a matter of some difficulty, owing to the simplicity of construction.

Like many other things, the war has brought partitions into an almost endless number of uses, one of which has been for the building of huts and houses. Though this may be new to some, the writer has been concerned in the building of schools and sanitoria, some years ago, with plaster slabs, cement rendered outside, and those places stand to-day as good as when erected.

When partition slabs were first used they had to meet some stern opposition from those always present in a community who oppose anything new. Even to-day one meets with people who are opposed to innovations. However, we may thank the evils of war for dispelling some objections concerning partitions.

Simple as it may seem, the erection of partition slabs, as experience has proved, should only be entrusted to the hands of men used to this particular class of work. A badly built-up job is sure to develop cracks in unthought-of places, the blame very often being fixed on the manufacturer of the particular partition slabs. This long-suffering individual very often has little means of replying to the criticisms, where the slabs alone are supplied by him.

There are several kinds of partition slabs manufactured and on the markets: Breeze, pumice, plaster and clay, each of which has its special claims.

Plaster, until recently, has been the most common in use, and has many advantages over breeze slabs. Solid plaster slabs are light, easily fixed, with little or no waste in erection. When up, they form a solid wall, hygienic in all ways, as every possible lodgment for dirt and vermin is effectually closed after the walls has been plastered out, and are fire and sound-resisting, provided the work has been executed by skilled labor, which goes largely to ease the question of after-cracks.

My opinion is, that hollow plaster slabs, although lighter, have some objectionable features, the compressional strength of the slab having been somewhat destroyed through the apertures; and further, if spiking is resorted to for fixing, very often the spikes crack the slabs when being driven in, and generally weaken the whole wall.

In fixing plaster partition slabs, it is essential that the suction should should be destroyed by applying a thin cement wash, and that they should be well bedded in plaster in preference to spiking.

It is preferable that all slabs, used for partition work, should be tongued and grooved horizontally and vertically, and in fixing, the grooves should be placed upwards and the joints broken, as in brickwork, and the vertical joints carefully grouted in with plaster, both where they join up to the door frames or brick walls and where they butt against each other. Where a slab has to be cut it is advisable to form a groove by scooping a piece out.

Plaster slabs have been successfully used for external works fixed on wood framings and faced with tiles, but this is an expensive form of work, and if not carried out by experienced labor, the tiles are liable to come off.

Seven years ago two-inch plaster slabs were used for internal and external walls of a school in Northumberland. The slabs were fixed to wood framing on outside, rendered over surface with cement, mortar floated to an even surface and rough cast with a mixture of slag and pea gravel, one-inch internal slabs nailed to framing floated and skimmed with washed haired lime and putty, and finished with putty and plaster throughout, a dado of 3 ft. 6 in. being formed with Portland cement back, and finished with Keene's cement, face trowelled smooth. It has proved a very satisfactory construction, as well as cheap.

A well-known firm has recently introduced a plaster slab with a special face to receive cement rendering for external work, and they claim that it will withstand the weather for twenty years without being re-rendered. These have been used for external works on several jobs in the Midlands, and would appear to be eminently suitable for a cheap-system cottage or bungalow building. This system could be used in conjunction with light, reinforced concrete piers and beams or wood framing, and has the advantage of being a very rapid construction. Doors and windows can practically be fixed in any position, as the openings can easily be cut, after the wall is up, without much danger of damaging other parts.

The foundation need only be 9 in. depth of good concrete under the wall, weathered on the outside, doing away with the necessity of any damp course.

Breeze partition slabs are manufactured by several firms, in various sizes and shapes. They are light, and one on the market, to my knowledge, affords a first-class key for fixing, and is cast with an indentation with horizontal edges. There is always a danger that the breeze used in manufacturing slabs may contain sulphur, which will in time discolor the plaster and cause it to scale off; and where the partition is faced with tiles, the latter will crack and often fall off from the action of the sulphur, which seems to go on for a long time, thus causing much annoyance and anxiety, and where used it is advisable that the slabs should be obtained only from a firm of sound repute.

The pumice slab is a very light form of construction, convenient to handle, and is manufactured from pumice and volcanic sand (imported into this country from Italy), mixed with Portland cement. These slabs form a rigid construction when up. Nails can readily be driven into them and take a good hold, doing away with the necessity of plugging for fixing skirtings or picture-rails.

The hollow terra-cotta partition tile is well known to many, and can be obtained in different sizes from several firms, and has the advantage of being easily handled. It can be obtained with a keyed or smooth face, and is being used just now extensively for exterior work. It is easily built up, the horizontal joints being bedded with cement, and the vertical joints grouted up, and seems to be quite effective in withstanding the weather, but it has only come into prominent use for this purpose recently, owing to the present shortage of other materials, and it remains to be proved what effect time will have on it. I am, however, strongly of the opinion that there are several points in its favor for this purpose, being cheaper than a brick wall of the same thickness, resists the damp better and ensures a more even temperature, but does not lend itself to nailing. Where it is necessary to fix skirtings and rails, provision should be made for same

*Paper read before the Concrete Institute, March 21, 1918.

at the time of erection by carefully inserting plugs in the joints. Should this not be done at the time of erection, and it is found necessary to fix electric fittings or hook-rails, the joints should be cut out and a plug built in, as any attempt to drive a nail into the tile is generally a failure, besides being liable to break the face of the whole tile.

Those of us who have had to do with partitions know only too well that they mostly have the annoying habit of showing cracks, which, more often than not, go right through. These cracks may develop from either of the following causes:—

The cracks generally occur just under the ceiling or near walls and door frames, or at top corners of door frames. The cracks at the tops or by the walls may be caused by variation of temperature, causing expansion or contraction, or through the supports deflecting or settling. Cracks also are generally to be found on top stories of buildings with large flat roofs, owing to the expansion of the flat as well as the partition, and up to the present I have not seen any successful method of stopping this occurring with a built-up partition, for even when cut and carefully filled in, the cracks will readily appear again.

The cracks on doors are particularly noticeable when the jambs project a few inches above the frame, and this is caused by the wood frame swelling, through absorbing the moisture from the partition whilst it is being erected. These can generally be stopped up successfully if cut out and filled in, after the partition has had time to dry out, and will not appear again, provided the door frames are fixed rigidly enough to prevent the partition from being shaken when the door is shut quickly. The best remedy, however, is to prevent this by stopping the door jambs off flush and carrying the partition over in one slab. This method is now recognized by most practical fixers as the best, and, with few exceptions, is carried out wherever possible.

The position of a partition is too often left to be settled after the floor and beams are all in, and then it is placed anywhere, whether the weight is supported by a main beam or only by the floor, and more often than not is placed on the floor, away from the main beam, which may only be calculated to carry a load of 100 lbs. per foot super; whereas many 3-in. partitions, when plastered both sides, weigh 18 lbs. per foot super, and 10 ft. is quite an ordinary height for such a partition; therefore, one foot run would weigh 180 lbs. The heaviest articles of furniture in domestic buildings are generally placed against the partition, and in an office it is quite an ordinary occurrence to find a heavy safe one side and a tier of shelves filled with books and papers on the other. Taking the total weight of the safe at 15 cwts., placed in the centre of the bearing, and the bookcase at 2 cwts. per foot run, we find, if a 3-in. partition, 12 ft. wide × 10 ft. high, happens to be placed on the floor, as per diagram, we get the following load per foot super in that particular place:—

	Pounds.
3-in. partition—18 lbs. per ft. sup. × 12 ft. wide × 10 ft. high = a distributed load of......	2,160
One safe = a distributed load of 30 cwt. = ...	3,360
One tier of shelves, 10 ft. wide, at 2 cwt. per ft. run = 20 cwt.	2,240
Giving a total load of........................	7,760

Taking the width of floor occupied as 3 ft. × 12 ft. = 36 ft. sup.

Therefore, 7,760 lbs. ÷ 36 = 215.5 lbs. per ft. sup. on this particular portion of the floor, which is more than double what the floor weight and main beams were calculated to carry, and, except for the large safety factor required by the authorities, there would be more than mere cracks appearing. The writer is strongly of the opinion that the position of all partitions wherever possible should be settled at the time of planning, and proper beams arranged to carry them, and when this cannot be done, it is advisable wherever possible to have partitions cast in situ and reinforced with small, steel rods, forming a beam from wall to wall. This method has been carried out by me, and has always proved most satisfactory, and helps very considerably to tie the wall and distribute its load more evenly, and costs very little more than a built-up partition; being quite solid in construction, it is thoroughly hygienic.

There is yet another means by which a partition can be constructed without slabs, and where a very thin partition is required, it has many advantages, as when finished and the whole thoroughly set, it forms a very strong and rigid structure, being light, occupying little space, and being practically sound, fire and vermin-resisting. There is no temporary sheeting or strutting required, and the work can be done with little labor.

The foundation work usually consists of vertical rods, securely and tautly fastened at top and bottom by screws, nails or clamps at about 12-in. centres. To these supports expanded metal lathing is firmly secured by soft wire or some other convenient means, and both sides covered by any quick and hard-setting plasters, which can be finished to a smooth face without loss of time.

The solid partitions are sometimes built only 1½ in. thick, but generally made to finish 2 in. thick, and can be used in combination with any class of concrete floors and ceilings, or ordinary wooden floors. Doors and other openings that may be required for lifts or ventilation can easily be formed and frames securely fixed in position at the time of construction, or after the partition is up. The whole forms a partition possessing all the desired advantages of a divisional wall not required to carry any weight, and occupies the least possible space for such purposes. This class of partition is very suitable for internal lift wells, where good anchorage can be obtained for the vertical tie-rods, as it takes up little room and stands vibration.

These are only a few of the many classes of fire-resisting partitions, but I have endeavored to include those most generally used. I have evaded mentioning the names of any particular manufacturers, as many are known to all of you, and I trust that you have not been bored by my effort to explain a few practical details in connection with my experience of the past.

As mentioned previously, one of the most troublesome things in connection with partitions is their habit of cracking. I hope, however, that some useful information regarding a cure for the complaint may be brought out in discussion, as no doubt partitions will play an even larger part in future constructions of small property than they have done in the past.

TORONTO BRANCH, AM. INST. OF E. E.

The Toronto section of the American Institute of Electrical Engineers held a meeting last Friday, when W. P. Dobson read a paper on "High Voltage Phenomena." One hundred and ten members of the section were present.

KETTLE RAPIDS BRIDGE*

By W. Chase Thomson, M.Can.Soc.C.E.

THE Hudson Bay Railway extends from The Pas, the northern terminus of the Canadian Northern Railway in Manitoba, to Port Nelson, on Hudson's Bay, a distance of 424 miles. The grading has been completed throughout, and the rails have been laid to mile 332.

There are three important bridges on the line: The first crosses the Saskatchewan River at The Pas, and comprises four fixed spans of about 150 feet each, together with a swing-span of about 250 feet; the second crosses the Nelson River at Manitou Rapids (mile 242), and is a handsome structure of conventional deck cantilever type, with a channel-span of 304 feet 6 inches and anchor-spans of 108 feet 9 inches, supplemented by an 85-foot plate-girder span at the north end; the third, which is the subject of this paper, is at the second crossing of the Nelson River, or Kettle Rapids, (mile 332), the present end of steel.

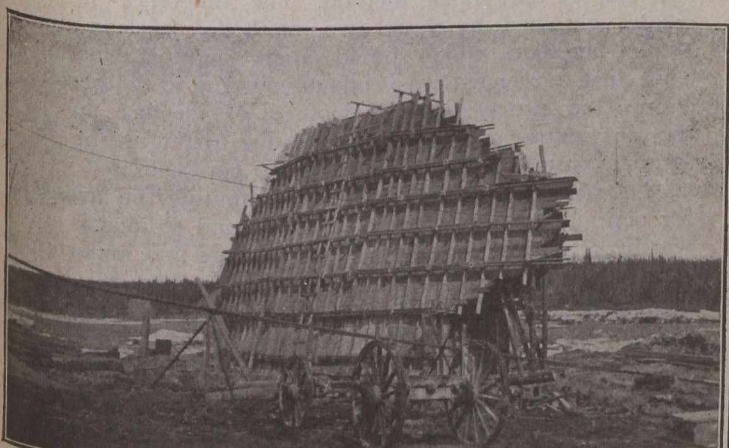

Fig. 1—Abutment 1 Under Construction

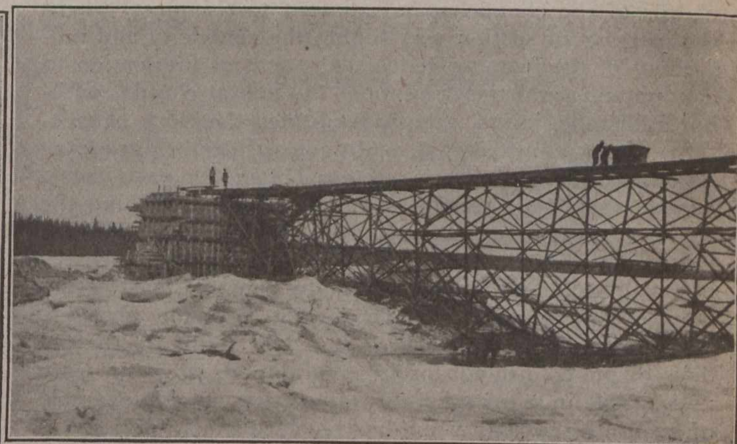

Fig. 2—Pier 2 Under Construction

The Nelson is one of the great rivers of Canada, its drainage including the prairies of Alberta, Saskatchewan and Manitoba on the west, the Red River Valley on the south and part of Ontario on the east; but, owing to the intervention of Lake Winnipeg, which serves as a huge reservoir, the flow of water in this river throughout the year is remarkably uniform.

The main channel at the bridge-site is only 350 feet wide, and estimated to be about 200 feet deep at the centre; the current is very swift, and there is always a certain amount of open water. Directly above and below the bridge-site, however, the river freezes all the way across, but only after the jamming of the ice and the consequent rising of the water. There can never be any danger from ice, either to the superstructure or to the piers, for the steelwork is 15 feet clear of the highest fixed ice-peaks, and there is running-ice only when the water-level is much below its maximum elevation.

In locating the line, advantage was taken of two very conveniently-placed islands, allowing a central span of 400 feet, with piers and abutments on the solid rock. This rock is of pre-cambrian origin, and is a tough granitoid gneiss.

The bridge is a continuous structure, 1,000 feet long, having a channel-span of 400 feet and two side-spans of 300 feet each. The trusses, or main girders, are of the sub-divided Warren type, 50 feet deep throughout, 24 feet apart, centre to centre, having 25-foot panels. There are two lines of stringers, 8 feet apart, centre to centre; and the base-of-rail is 17 feet 6 inches above the centre-line of the bottom-chords. The structure is riveted throughout, and all bracing is rigid; it is fixed at Pier 3, and provided with expansion-rollers at all other bearings. The ties are 8 x 12 inches, 14 feet long, spaced 12 inches, centre to centre; they are notched ½ inch on the stringers, and every fourth tile is fastened thereto by a ¾-inch hook-bolt. The outer guard-timbers are 8 x 9 inches, spaced 10 feet 10 inches in the clear; they are notched one inch and secured to every fourth tie by a ¾-inch bolt. Steel guard-rails, weighing 60 lbs. per yard, are provided inside of the running rails, with 8 inches clearance between heads. They are brought together in a frog beyond the ends of the bridge. The main (or running) rails are of the American Society of Civil Engineers' standard section, weighing 80 lbs. per yard. At Abutment 1, where the total expansion and contraction of the bridge will be about 8 inches, they are provided with specially-designed expansion-joints of the split-switch form, with points of manganese steel. Refuge-bays, for pedestrians, are provided at intervals of 200 feet.

Three types of bridges were practicable for this location: First, simple spans, with temporary members over the piers for cantilever-erection of the channel-span; second, the conventional cantilever bridge, with a central freely-suspended span; third, a true continuous-girder bridge. The first would have been satisfactory, but uneconomical, owing to the great weight of extra metal required for erection stresses only. The second was rejected partly on account of the objectionable articulated joints at the end of the suspended span, but principally because of the expensive shop and erection work in connection therewith; for an economically-designed cantilever structure would have required a much greater depth over the piers, with considerably less depth at the abutments and for the suspended span, resulting in sloping chords and irregular webbing; besides, in order to obtain such economical proportions, it would have been necessary to locate the bottom-chords as close to the base-of-rail as possible, thus largely increasing the quantity of concrete in the structure.

The third type, as designed and built, is the most rigid of all, and the most economical; for it required no extra metal for erection-stresses, except in the bottom-

*Abstracted from paper read before the Montreal Branch of the Canadian Society of Civil Engineers, April 11th, 1918.

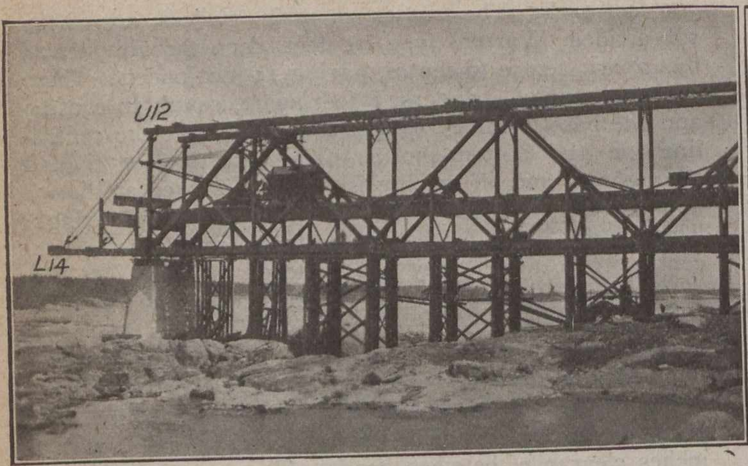

Fig. 3—Southern Anchor-span Erected; and Beginning of Cantilever Erection, Showing Temporary Supports for Panel-points L14

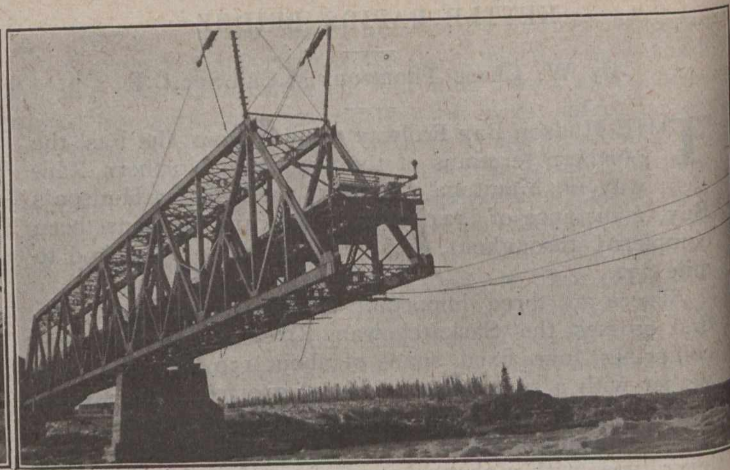

Fig. 4—Southern Half of Bridge Erected

chords of the channel-span adjacent to the piers, where the increase of section was slight; the simplicity and uniformity of the framing reduced the cost of fabrication to a minimum; and the continuous horizontal chords, without adjustable joints, greatly facilitated the work of erection. It is admitted that continuous-girder bridges have been regarded somewhat unfavorably in the past, for it has been claimed that the usual theory for computing the stresses therein, which assumes a constant moment of inertia, is inexact; that the computation of the stresses is too difficult and tedious. Finally, that the least settlement of any support would radically alter the stresses, and thus endanger the structure. No doubt, in the old days of pin-connected bridges, continuous girders were undesirable in many respects; although a notable example of such a structure, which has received much praise and which gave excellent service for many years, was the old Canadian Pacific Railway bridge at Lachine. Now that pin-connections have been almost entirely superseded by riveted joints, continuous girders are growing in favor; and the most remarkable example of such construction is to be found in the recently-constructed Sciotoville Bridge over the Ohio River, comprising two continuous spans of 775 feet each.

Regarding the objection that the computed stresses are inexact, it may be stated that, in the present instance, the reactions were first computed for panel-concentrations by formulæ as given in Merriman and Jacoby's "Roofs and Bridges," Part IV., pp. 12 and 13, and afterwards checked by the elastic method. The difference in the results obtained by these two methods was less than ½ of 1 per cent., which should satisfy the most exacting. This close agreement was undoubtedly due to the parallel chords and nearly constant moment of inertia; but, in the most extreme case, the error due to the use of the formulæ would probably not exceed 6 per cent.

The objection that the labor of computing the stresses for continuous girders is too difficult and tedious is unworthy of notice, especially where a large and important structure is concerned.

Finally the claim with reference to results that would be produced by a possible settlement of one or more of the supports is more rational, but much exaggerated; for continuous girders are very elastic structures, and can accommodate themselves to small settlements of supports without developing serious alterations of stress in their members. In this case, the ends of the trusses, if unsupported, would deflect 25 inches below the horizontal line from dead-load; and the alteration in the dead-load reactions at the abutments, due to raising or lowering the end supports a whole inch, would only be 9,500 lbs., or 4 per cent., whilst the reactions and stresses for the live-load would not be affected at all. Moreover, it is inconceivable that any settlement of the foundations can take place, as they are all on the solid rock; otherwise, this design would not have been adopted. Furthermore, in order to provide for possible small inaccuracies in fabrication or erection, the ends were made adjustable by

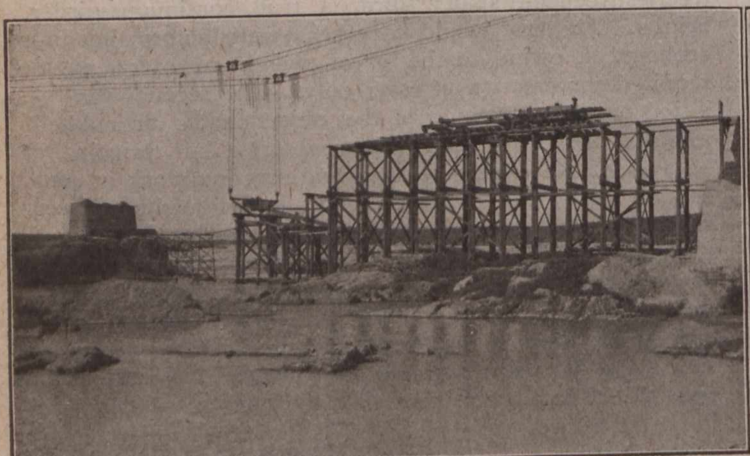

Fig. 5—Falsework Under Construction for Northern Anchor-span

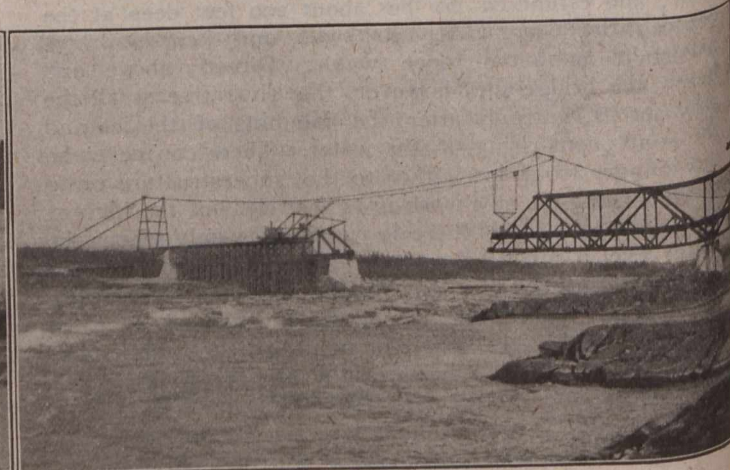

Fig. 6—View of Cableway; and Beginning of Erection of Northern Anchor-span, with Traveller at Floor-level

Fig. 7—View from Top of Cableway-tower

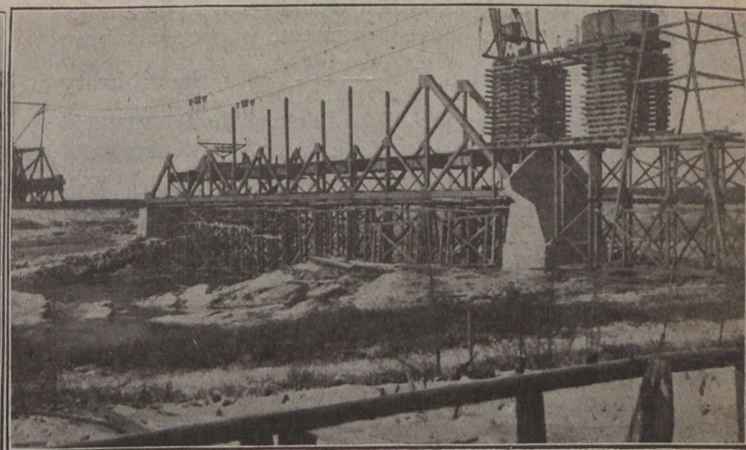

Fig. 8—Lower Steelwork for Northern Anchor-span Erected; Traveller Raised on Blocking, for Working on Top-chords

allowing 1⅝ inches for shims between the shoe-castings and the bottom-chords; and hydraulic jacks, with gauges attached, were used to set the ends at the height necessary to obtain the computed dead-load reaction. In this connection, and referring again to the Sciotoville Bridge, the following quotation from an article by Clyde B. Pyle, published in "Engineering News-Record," January 31st, 1918, will be of interest:—

"One of the most striking features of the entire erection was the curve for the last few inches of the jacking, after the steel towers were both free. The computed increment for each inch of lift was 7.5 tons; and the actual increase in load was too small to be read on the gauges.

"It is quite evident from this condition that, for long-span continuous trusses, it is not as vital a point as was formerly thought to be the case to have the supports at exactly correct elevations. In this case an error in setting one of the end supports, say, as much as 3 inches, would have changed the end reaction 22.5 tons, or the stress in the end-post 32 tons, which would be less than the probable error in computing the actual stress in that member. The worst condition of shop-work, erection and setting of shoes could not possibly total more than one inch; so that the certainty of stresses and therefore the safety of such a bridge is left without question.

"The fact that complications enter into the design and erection cannot bar the use of such bridges as long as they are economical. The reasons usually given, that the stresses are not statically determinate and that uncertainties of stresses result from slight errors in elevation of the supports, are no longer valid."

Details of Design

The structure has been designed in accordance with the General Specification for Steel Bridges, issued by the Department of Railways and Canals in 1908, except for a slight modification in the impact formula, affecting alternating stresses only, and a change in the allowable unit-stresses for compression members.

In the matter of impact, when dealing with alternate live-load stresses, the Department's specification requires the impact to be computed by squaring the arithmetical sum of the tension and compression stresses due to the live-load (or the range of stress), and dividing by the maximum algebraic sum of co-existing dead-load and live-load stresses, or $I = \frac{range^2}{max.}$. Now, taking an extreme case in which a member is subject to alternating live-load stresses of equal amounts, but no dead-load stress, the impact would be $\frac{(L + L)^2}{L} = 4L$, or four times the live-load stress of either kind, which is certainly excessive. If, however, we take for the *range* the live-load stress of one kind and add to it 4/10 of that of the other kind, we have $\frac{(L + 0.4L)^2}{L} = 2L$, approximately, or an impact equal to twice the live-

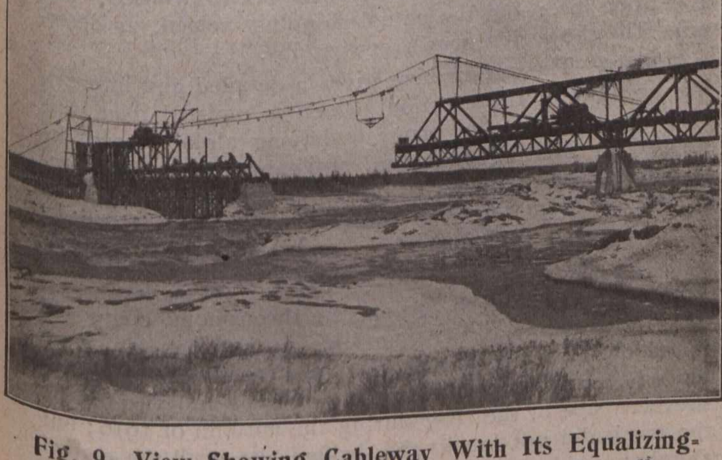

Fig. 9—View Showing Cableway With Its Equalizing-Girder; Derrick-car on Southern Cantilever; Traveller on Top-chords of Northern Anchor-span

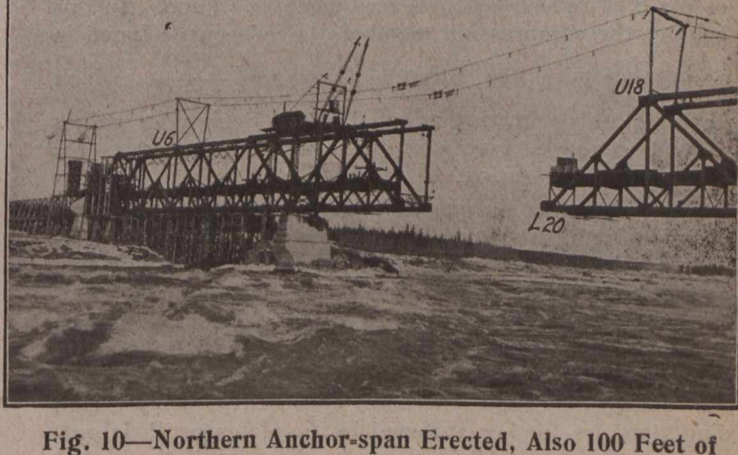

Fig. 10—Northern Anchor-span Erected, Also 100 Feet of Adjacent Cantilever. Note Additional Rocker-bent at U6 for Supporting Cables

load stress of either kind, which would seem to be ample. In conformity to the above argument, impact has been computed by the formula, $I = \frac{range^2}{max.}$, with the arbitrary stipulation that the *range* shall be taken as the arithmetical sum of the live-load stress of the greater kind and 4/10 of that of the lesser. When the live-load stress is of one kind only, the formula reduces to $I = \frac{L^2}{L + D}$, in which L = live-load stress and D = dead-load stress.

Concerning the unit-stresses for compression-members, the Department's specification calls for 16,000 lbs. per square inch reduced by Gordon's formula, using in the denominator the factor 18,000 for square ends, 12,000 for one square and one pin-end, and 9,000 for pin-ends. It is now quite generally recognized, however, that 16,000 lbs. per square inch is entirely too high for short columns; and the Joint Committee on Columns and Struts in the United States, which has recently submitted its final report, recommends a maximum working unit-stress of 12,000 lbs. per square inch, which is therein shown to provide a factor of safety of 2, or the same as for tension members when designed for a unit stress of 16,000 lbs. per square inch on the net section. In the General Specification for Steel Highway Bridges, recently adopted by the Society, the formula for compression members is 12,000 — $0.3\,(l/r)^2$, which becomes zero when $l/r = 200$. In this bridge, the compression members have been designed in accordance with the formula $12{,}000/1 + \frac{(lr)^2}{36{,}000}$, which agrees closely with that adopted by the Society for values of lr up to 70, but gives somewhat higher unit stresses for greater working ratios.

Latticing of main members has been avoided as far as practicable; but the open sides of compression chord members are double latticed with 5 x ⅝-inch flats, having two rivets at ends and at intersections. Tension chord members are similarly latticed with 5 x ½-inch flats. All of the principal web members are provided with substantial longitudinal diaphragms, which are considered as part of the effective section thereof; and heavy compression diagonals are further stiffened by tie-plates on their outstanding flanges. All joints and splices are fully riveted throughout.

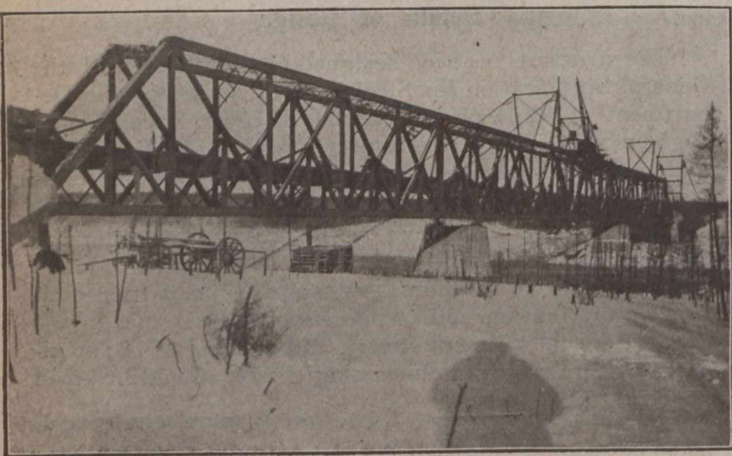

Fig. 11—View of Bridge from South Shore Before Cableway and Traveller Had Been Dismounted. Note that the Lower Members of the Portal-struts and Sway-Bracing are Missing; They Were Omitted Temporarily for the Accommodation of the Derrick-car

Rocker-bearings are provided throughout, having 8-inch bearing-pins at the piers and 6-inch bearing-pins at the abutments; and the shoes are steel castings. The bridge is fixed at pier 3 and movable at pier 2 as well as at the abutments. At pier 2, the expansion rollers are 8 inches in diameter; and each set is provided with four 12-tooth cut pinions to prevent skewing. Substantial curtain-plates are supplied for the protection of the gears and to keep out the dust; but they are removable for inspection and cleaning of the bearings. At the abutments, the expansion rollers are 6 inches in diameter and similarly provided with alignment gears and curtain plates. The fixed bearings at pier 3 are similar to the expansion bearings at pier 2, except for rollers and bed-plates. The bridge-seats are tool-dressed perfectly level and to the exact elevations called for on the drawings; and sheet-lead, ⅛ inch thick, is provided to equalize any minor irregularities of the surfaces.

Owing to the small deflection of this bridge, which is only 3 inches at the centre of the channel span, for dead-load combined with the maximum effect of the live-load, it was considered unnecessary to provide for a perfectly straight bottom-chord under any particular condition of loading; so the trusses have been cambered, in accordance with the more usual method employed for simple spans of moderate length, by increasing the length of the top-chord panels.

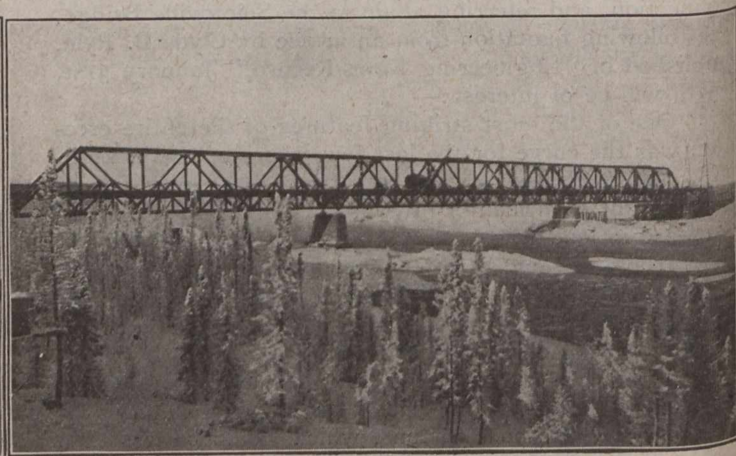

Fig. 12—General View of Bridge, Taken from the South Shore and Looking Up-stream

The total estimated weight of steel in the structure (including floor-bolts), computed from the writer's detail drawings before the contract had been awarded, was 4,424,000 lbs.; and the actual shipping weight, as determined by the scales, was 4,415,000 lbs.

(NOTE—The author here gives a detailed and interesting account of the erection, which is omitted from this abstract, the erection program having already been described by Sterling Johnston, assistant manager of construction, The Canadian Bridge Co., Limited, in an article in *The Canadian Engineer* for March 7th, 1918.—EDITOR.)

Substructure

The substructure is of concrete throughout, composed of pit-gravel and cement, in such proportions as were found by trial to give the best results. It had been intended to construct at least the abutment and pier on the southern side of the river during the autumn of 1916; but the track did not reach the bridge site until the end of October; cold weather set in shortly after, and there was barely time to construct the foundation for abutment 1, Excavation for this foundation was carried to a depth of over 10 feet, through frozen clay and silt, to the solid rock. The concrete was placed during the second week in December, and in very cold weather; but the materials had been heated, the mass was large and the result was entirely satisfactory, as found from a careful inspection the following spring. The abutment was completed during the month of April, 1917.

Operations at pier 2 were begun on April 10th, and under very adverse circumstances; for the river was then at elevation 328.0, or 10 feet above the average rock-surface at this point; and the rock was covered with a solid mass of ice, 25 feet thick. However, it was necessary to get ahead with the work as rapidly as possible; so the ice was excavated, and the rock was bared by May 5th, at which date the water had fallen to elevation 325.0. Although the ice-walls of the excavated shaft appeared to be perfectly solid throughout, the water percolated through and stood at the same elevation as that in the open river-channel; but it was perfectly still, without current or surge. A timber caisson, conforming on the bottom to the irregularities of the rock-surface, was then constructed; and all small openings therein were sealed by sheet-piling, carefully scribed and driven so as to broom the ends thereof. Every inch of the rock-surface inside of the caisson was then picked with needle-bars, to insure that it was entirely clear of ice; and heated concrete was deposited by deep-sea buckets. The rock-surface at this pier had previously been carefully examined during low water, and found to be absolutely sound; thus every confidence may be placed in the foundation. The footing for this pier was completed on May 9th; the construction of the main shaft thereof offered no difficulties, and was effected without incident.

At pier 3, no difficulties incident to water or ice were encountered; for work at this point was not started until June 29th; but there was a horizontal fissure in the rock at about elevation 322.0, which necessitated blowing up by dynamite the overlying mass. This resulted in giving an entirely satisfactory though very irregular foundation, to which the footing for the pier was made to conform.

Excavation for abutment 4 was commenced on June 14th, and was carried through about 10 feet of frozen clay, silt and boulders to the solid rock. The footing, up to elevation 341.5, was completed July 21st.

The pit-gravel, used throughout on this work, was invariably frozen and required to be thawed by steam; thus all of the concrete was placed warm, and with most gratifying results; for, on removal of the forms, not a single bad spot was discovered.

The butterfly wing-walls of the abutments were reinforced by twisted steel rods, one inch square, placed 3 inches from the rear surface. There were horizontals, 6 inches apart, wired to verticals, 3 feet apart. In addition, two such rods were placed along the upper edge of the wings. The total quantity of concrete in the work is about 3,000 cubic yards; and of reinforcing steel in the wing-walls, 2,300 lbs.

Surveys Were Accurate

The laying out of the work was difficult and tedious, owing to the irregularity of the ground and to the necessity of locating pier 3 by triangulation; but the instrument work was done with such care and precision that all important dimensions and distances were afterwards found to be practically exact. In locating the centre-line of bed-plates on pier 2, and that of the shoe-castings on pier 3, where great accuracy was desired, the piano-wire method of measurement was used, taking into account the pull on the ends of the wire and the corresponding sag, as determined on a level surface, and making the proper correction for temperature. The distance between centres of bearings on piers 2 and 3 was afterwards found to agree with the steel structure, as built, within 5/16 inch. It had been specified that the centre-line of the expansion-shoes should coincide with that of the corresponding bed plates at a temperature of 30 degrees, Fahrenheit; and, on inspection, with the thermometer at zero, the centre-line of the roller-shoes at pier 2 was found to be exactly 1 1/4 inches northerly of the centre-line of the bed-plates, instead of 15/16 inch, the amount of contraction in the steelwork in 400 feet for a fall in temperature of 30 degrees. Thus the distance between the bearings was too great by 5/16 inch. If there had been any appreciable error in the setting of the bearings on these piers, it could have been rectified, as provision had been made for jacking-up the structure, if necessary; but, as the dead-load reactions here are about 500 tons each, and the shoes very awkward to move, any such adjustment after erection would have been difficult and expensive.

The entire work has been under the general supervision of W. A. Bowden, chief engineer, Department of Railways and Canals, Ottawa; and of J. W. Porter, chief engineer, Hudson Bay Railway, The Pas. It was designed in full detail by the writer, who has been retained throughout for consultation in connection therewith. The substructure was fabricated and erected by the Canadian Bridge Company, Limited, Walkerville, Ont. T. B. Campbell, bridge engineer, Hudson Bay Railway, was in charge at the bridge-site, under whose immediate supervision the concrete work was constructed, and by whom all lines and elevations for the erection of the steelwork were given; I. E. Mahon was the superintendent of erection for the bridge company; and James Carr, representative of the Canadian Inspection and Testing Laboratories, Limited, attended to the field inspection. The entire work has been carried out without loss of life and without a serious accident.

Great credit is due to Messrs. McDonald Brothers for the excellence of the concrete work; to Mr. Campbell for the accuracy of his lines and elevations and for his efficient supervision; to the engineers of the bridge company for their splendidly conceived and carefully prepared scheme of erection; to the shops for the neatness and accuracy of workmanship; and finally to Mr. Mahon for his skill and care in handling under difficulties this important and somewhat unusual erection.

ASBESTOS OUTPUT INCREASED

The production of asbestos continues to increase under the stimulation of war demand. The product has been marketed at much higher prices and the total sales show a substantial increase. Stocks on hand at the end of 1917 were slightly in excess of those reported at the end of 1916.

In addition to the production in the province of Quebec, which is derived from the asbestos areas at Black Lake, Thetford, Robertsonville, East Broughton and Danville, there is a small output of crude asbestos amounting to 10 tons, valued at $2,150, produced and shipped from the Porcupine district in the province of Ontario. These Ontario operations have been discontinued for the present, but indicate the possibilities of sources of supply other than the well-known areas in Quebec.

Exports of asbestos during the calendar year 1917 were 93,932 tons, valued at $4,903,326, or an average of $52.20 per ton and asbestos and waste 52,088 tons, valued at $430,956, or an average of $8.27 per ton. There was also an export of manufactures of asbestos, valued at $55,666.

CONCRETE IN WESTERN CANADA*

By J. F. Greene
Construction Engineer, Carter-Halls-Aldinger Co., Winnipeg, Man.

At the very beginning, the writer wishes to apologize to any who may have the conviction that he is prepared to offer conclusions, based upon exhaustive evidence, covering the durability of concrete in Western Canada. When asked for a paper upon the subject, he begged to be excused upon the ground that his experience in Western Canada has been confined to two isolated communities, Calgary and Winnipeg, and that it had been of short duration. In reply it was urged that the society, realizing the importance of the issues involved, had determined to make a complete investigation, and that a paper at this time would serve as an entering wedge in this investigation. Inasmuch as the writer's firm had been engaged on the underpinning of the Grain Exchange, and as it was well known that an instance of serious deterioration of concrete had been found there, he was asked to assume the obligation of opening the investigation. The writer's part was to be that of the actor who appeared at the opening of a Greek drama, whose function it was to disclose to the audience the narrative of previous events, a knowledge of which was necessary for the proper understanding of the action of the play which was to follow. If in the course of this narrative, he should bring out many things which are not new, you will bear with him on the ground that he is treating a subject with which most of you are familiar, and because the presentation of these facts is necessary for a proper statement of the case.

* * * * * * * *

While a complete treatment of the durability of concrete would embrace within its scope all of the agencies and conditions which add to or take away from the permanence of concrete, we shall confine ourselves to one aspect of the subject, the deterioration of concrete under the action of alkali waters. Although we have limited the location to Western Canada, we consider that it lies within the province of this paper in its preliminary capacity to travel far afield; to ascertain what has been done by those who have been confronted with the same problem, and to profit by their investigations.

The subject is not new; we find mention of a paper upon the action of alkali on cement written for the Engineering News, of New York, in 1891. In 1910, instances of serious deterioration of concrete in the sewers at Great Falls, Montana, came to light. The Montana Agricultural College made a series of experiments to determine the results of the action of alkali salts upon cement, and the U.S. Bureau of Standards at the same time began an investigation of the action of salt in alkali waters on cements.

That the phenomenon of the deterioration of concrete in Western Canada is widespread and of sufficient magnitude to warrant the expense of a thorough investigation is evident from the following brief review of failures reported up to date:—

In the province of Manitoba, in and around Winnipeg, there are serious failures to report. In the foundations of the Grain Exchange the deterioration had gone so far as to have involved the replacing of all of the concrete footings at no inconsiderable expense. In the foundations of the Union Bank, where alkali ground water was present, there was deterioration. Further evidence of serious deterioration has been found in the sewers of Winnipeg and St. Boniface. While we have referred to these cases as alkali failures, we are not prepared to offer them in evidence as examples of the action of alkali salts upon well-made concrete. While on the Grain Exchange there was conclusive evidence of lack of care in the grading and handling of the materials, in the cases of the sewers referred to we are not justified in offering an opinion from the evidence at hand.

Although we have received reports of but two failures in Saskatchewan, we feel that a further investigation may bring to light more evidence regarding this evil. Ordinarily, the deterioration is found at or below the ground line; in the rear of retaining walls or basement walls or in sewers; in all cases it is not apparent to the casual observer, and it requires either an actual failure or a careful investigation to disclose the evil.

In Regina, an instance of deterioration at the haunch of a concrete arch bridge has been reported. In Saskatoon, a basement wall was uncovered, bringing to light serious disintegration. While the ultimate cause of failure was the action of the alkali salts, we have no evidence to offer regarding the primary cause.

In Alberta, the evil has assumed proportions of sufficient magnitude to have warranted the appropriation of $4,000 to begin an investigation to ascertain the most efficacious method of combatting the evil. In many parts of the irrigation belt the concrete in wing walls and foundations which has been in place but a few years has completely disintegrated. From Calgary we have reports of deterioration of sewers with evidences of alkali as a contributory cause. Here again we must offer the facts of the failure with no evidence of the primary cause. I might note in passing that engineers in Alberta who strive to obtain a well-prepared concrete, labor under the great disadvantage of being unable to obtain a well-graded, clean sand. The different kinds of sand available, whether bank run or screened, will run uniformly fine with a high percentage of silt. How serious is this handicap may be inferred from the fact that the aggregate for concrete used in the eastern edge of the irrigation belt was hauled eighty miles from a pit near Calgary. Because a large part of the concrete which has been placed in Alberta without engineering supervision has been made from a bank run aggregate, poorly graded and not washed, we may anticipate deterioration where this concrete shall chance to come within the sphere of activity of alkali salts.

Summing up the above, we find ourselves conclusive evidence of deterioration of concrete in the presence of alkali salts in Manitoba and Alberta and an outline of a case in Saskatchewan.

The phenomena accompanying the action of the salts of alkali water upon concrete are the withdrawal of the lime content from the cement with a complete loss of the binding power which the cement had possessed. The lime combines with the SO_4 content of the alkali salt to form a new substance which, instead of binding the aggregate together, requires more space than the lime in its original form, thereby tending to force the aggregate apart. In the case of the deterioration on the Grain Exchange, all cohesion had been lost and one might easily have removed the stones of the aggregate by hand.

Because of the fact that concrete is a building material upon which the engineers of this region have placed the stamp of approval, and because a disease of concrete of serious proportions has developed, it is incumbent upon the engineering fraternity to know the characteristics

*Paper read before the Manitoba Branch of the Canadian Society of Civil Engineers.

peculiar to this disease, and the conditions under which it flourishes; to ascertain what means may be employed to prevent the disease, and not only to make use of these means, but to spread the knowledge acquired throughout the entire field of concrete activity.

While entering upon this investigation with open minds, we are aware of a widespread conviction among engineers that a well-proportioned, properly placed concrete will resist the action of the salts of alkali water, and that acting under this conviction engineers have designed and installed concrete structures involving large expenditures of money, having created in the minds of their employers the presumption that concrete was a permanent building material. It is, then, the object of this investigation to determine whether it is possible and economical, with the materials at our disposal and with the exercise of due care in the handling of these materials, to produce a concrete which will resist the action of the alkali waters or whether it is either necessary or even conservative in the light of present knowledge to recommend the use of a waterproofing coat for concrete in places where alkaline salts are present.

Alkali is a term used to designate the soluble salts that accumulate in regions of little rainfall. They are formed by the disintegration of rocks and are found in the soils as well as in the drainage water which leaches them from the soils. The sulphates of magnesium, sodium and calcium are the best-known of these, which together with the chlorides are the most active agents for the disintegration of concrete.

Investigations have been confined for the most part to the action of either individual salts or several of the salts combined in solution upon cement or upon cement mortar. Having determined that the disintegration of the concrete under the action of alkali waters was due to the action of the salts upon the cement content of the concrete, investigators have observed the action of concentrated solutions of alkali waters upon cement and cement mortars, with a view to concluding from the results of the tests the probable action of the alkali upon porous concrete. Series of tests based upon this assumption have been conducted at the University of Montana, the University of Wyoming, and the University of Colorado. A most comprehensive series of tests was made by the U.S. Bureau of Standards, the results of which are embodied in a complete report issued in 1912. We are not concerned at this time with the details of these reports only insofar as we may conclude that they have established certain definite hypotheses which need no further proof, and from which we may proceed as a starting point for future investigation.

We have concluded, after a careful perusal of the information offered in the various reports of the tests showing the action of alkali water upon cements, that we are in agreement with the authors of all of the reports in the conviction, *viz.*, that alkali waters, if allowed to permeate through masses of concrete, will cause ultimately complete deterioration of the concrete. The instances of failure already adduced in the different provinces of Western Canada offer further convincing evidence in support of this conclusion.

We may then logically confine our activities to an investigation of the action of alkali waters upon a well-made and well-proportioned concrete with a dense, non-porous surface. The only experimental evidence which we have obtained upon this aspect of the subject was found in a report of the U.S. Bureau of Standards, dated November, 1917.

A series of concrete blocks of a selected aggregate in the proportions of 1 : 1½ : 3 and 1 : 2½ : 5 were made at a central laboratory, and after curing were placed on eight different projects in the alkali region of the United States, extending from the northern boundary to the Rio Grande. These blocks were placed in the soil at locations where the ground waters were known to contain alkali salts, and where the concrete would be freely exposed to the action of the alkali waters. Other concrete blocks of the same proportions, 1 : 1½ : 3 and 1 : 2½ : 5, were made from the aggregates obtainable at the various projects, and in common use in the various localities as ingredients for concrete. While these blocks were carefully moulded, no mechanical grading for maximum density was attempted. These blocks were exposed at the same locations with those containing the selected aggregate.

In this way an opportunity was afforded not only of comparing the action of the salts upon well-proportioned and well-made concretes, with varying mortar contents, *i.e.*, 1 : 1½ : 3 against 1 : 2½ : 5, but also of comparing the scientifically prepared concrete, with that brand which would be held in each locality, in the common acceptation of the term, as "good concrete."

The report contains observations made after one year's exposure. There has been no evidence of disintegration in those blocks made from the selected aggregate in the proportion of 1 : 1½ : 3. Of the blocks made from the selected aggregate in the proportion of 1 : 2½ : 5, four out of a total of thirty blocks have shown indications of disintegration. While the comparison based upon the above evidence is in favor of the 1 : 1½ : 3 as against the 1 : 2½ : 5, we do not feel that the evidence is complete enough to warrant us in drawing a conclusion.

Reverting now to the blocks made from the local aggregates—on two of the projects, all of the blocks of both proportions have shown indications of alkali deterioration. Of the blocks prepared in the proportion of 1 : 1½ : 3, ten out of thirty-two blocks (about one-third of the total number) have given evidence of deterioration, while eighteen out of thirty-two of the 1 : 2½ : 5 blocks (almost two-thirds of the total number) have shown signs of failure.

From these tests we may reasonably conclude that it is conservative to assume that concrete made from local aggregates without mechanical grading, may be porous and liable to disintegration in the presence of alkali waters. While not warranted in drawing a conclusion regarding the comparative resistance to deterioration offered by concretes with varying proportions of mortar, we feel justified in calling attention to the preponderance of evidence in favor of the concrete with the higher cement content.

From the evidence presented in this report, we can offer no conclusion regarding the ultimate effect of the action of the salts on the concrete made from the selected aggregate, because the time allowed for possible deterioration covered a period of only one year. We have no further experimental evidence to report upon this phase of the subject.

In the absence of direct and definite evidence upon the subject it may be profitable to consider indirect evidence which, though not of itself able to produce conviction, yet may be of sufficient value to confirm a conclusion already suggested. Under this category there may be adduced an argument drawn from the fact that there has been an opinion held in common by the engineering world that well-proportioned, properly made concrete will resist the action of alkali waters. Such an opinion widely held throws the burden of proof upon an objector, and establishes a presumption that the opinion has some basis in fact.

In support of this presumption, we may offer the following contentions: First, the fact that, although in alkali regions, there are many evidences of the failure of concrete, yet there are many concrete structures in the same regions exposed under similar conditions which have given no signs of deterioration. Many have drawn the conclusion that if some concretes have survived the assaults of the alkali waters, then the failures of other concretes must have been due either to improper grading of the aggregate or to a careless mixing and molding of the concrete.

Further confirmation of the widely held opinion that good concrete will resist the action of alkali waters has been based upon the known facts regarding the action of the salts of sea-water upon concrete. The active salts in sea-water are the same as those in alkali waters, namely, the sulphates and chlorides of magnesium and sodium. While innumerable instances of failures of concrete in sea-water can be adduced, there are many piers and walls in salt water which have been in service for many years, and which are intact, showing no evidence of deterioration.

The scientific basis for the assumption rests upon the contention that in a well-proportioned, properly made concrete, the calcium content of the cement at the surface exposed to the air, combines with the CO_2 of the atmosphere to form calcium carbonate, a salt which is practically insoluble in the presence of alkali salts. While it may be contended that calcium carbonate is soluble in sodium chloride, the fact remains that the carbonate surface of concrete in salt water, when not removed by mechanical abrasion, will withstand the action of the sodium chloride of the sea-water. According to this theory, then, a dense non-porous skin of calcium carbonate is formed on the surface of good concrete; and upon the integrity of this surface depends the life of the concrete.

This is a brief statement of the indirect evidence bearing upon this phase of the subject. Inasmuch as the direct and indirect evidence combined lead to no definite conclusions, further investigations are needed.

The details of the plan to be adopted in an investigation are a matter for individual opinion, and I will take this opportunity of outlining a *modus operandi*. Locations in the western provinces in which it is evident that alkali salts are present in the ground water, should be designated. At these locations concrete blocks should be placed in the soil exposed to the action of the alkali waters. At each location the blocks should be of three kinds:—

First, blocks molded under the supervision of an engineer in the proportion of one part of cement to five or six parts of the combined aggregate obtainable in the district, the parts of the sand and gravel to be so proportioned as to give a concrete of a maximum density for the given cement content and the concrete to be placed with as small an amount of mixing water as will allow of being properly worked.

Secondly, a set of blocks should be made by a local contractor from the same aggregate in the proportion of 1:2:4 and of the consistency which is the common practice in the locality. These blocks should be fair samples of the concrete used in that district.

Thirdly, a set of blocks of a leaner mix and with the various blocks protected with different waterproofing coats should be exposed under the same conditions. Observations made at intervals of a year should be recorded, passed upon by a committee, and published.

The objects aimed at in this plan are to ascertain, first, whether a well-made concrete, proportioned from local aggregates in a manner which is commercially practicable for both large and small jobs, will resist the action of the alkali ground waters which are present; and second, whether the ordinary commercial concrete obtainable without engineering supervision, will withstand alkali salts.

Should these experiments show that one or both classes of concrete will deteriorate, then it may be necessary to recommend the use of a waterproofing coating, and the experiments with the third class of blocks will offer evidence upon which to base recommendations, as to the kind of waterproofing to be employed.

It may be pertinent at this time to revert to the fact that while the information from an investigation may not be available for several years, we are confronted with our immediate problem of the position which engineers should assume in the light of our present knowledge or lack of knowledge.

We have been forced to the conclusion that a porous concrete will disintegrate under the action of alkali salts. Engineers are familiar with the methods to be adopted in the attainment of a dense, non-porous concrete, and they know, too, that care in every operation of the making of the concrete is the price of success. Yet it is common knowledge that a large proportion of the concrete in the western provinces has been placed either with inadequate engineering supervision or with no supervision at all. The natural results of such a policy has been the widespread opinion held among contractors, foremen and laborers that concrete is a fool-proof material and that special care in the making of the concrete is not necessary. Reliable knowledge of the effect upon the density and compressive strength of concrete, of varying the proportions of cement, sand, gravel, the amount of water, the method and time of mixing, and the method of placing,—such knowledge is rare among foremen, workmen and even among subordinates employed by architects and engineers to supervise the work.

Under these conditions it is reasonable to suppose that much of the concrete placed in foundation work has been of a porous quality, and we may anticipate reports of failures when such concrete comes within the sphere of action of alkali waters.

The conservative position, then, for the engineer who is responsible for the placing of concrete in foundation and sub-soil work, should entail the examination of the soil and ground water for alkali salts; careful supervision of the proportioning and handling of the material to give a dense concrete, with a non-porous surface; and an adequate provision for the removal or drainage of the ground water.

In conclusion, we wish to apologize again for having been unable in the time and with the means at our disposal, to obtain more convincing evidence on this subject. We are painfully aware that we have offered in evidence only one series of facts which should have a place in a paper upon the durability of concrete in Western Canada, namely, the announcement of failures of concrete in the various provinces; and that the body of this paper has been built up from evidence dealing with conditions prevailing outside of the Dominion, which we have assumed as on a par with those which prevail in Western Canada. May we not offer this confession of our inability to obtain necessary information upon this important subject, as an argument in favor of an early beginning of a complete investigation into the action of the salts of alkali waters upon concrete?

The 14th convention of the American Concrete Institute will be held at the Hotel Traymore, Atlantic City, N.J., June 27th, 28th and 29th, 1918. This convention had been arranged for February, but owing to the unusual traffic conditions at that time, was deferred until the later date.

ENGINEERING PRESTIGE

(Continued from page 332)

The question of public ownership of various utilities is one of importance. The branch could doubtless do much to clarify the situation and to show the public the merits and demerits of public ownership.

There are, doubtless, opportunities in connection with the food and fuel problems which we might help to solve.

We could study the subject of producing denatured alcohol for industrial and power purposes.

The question of how to prepare for post-bellum days is of paramount importance from the social, commercial and national points of view.

Problems of transportation, town planning, natural resources, engineering projects, industries and developments, taxation, and many other matters are capable of exhaustive treatment by the branch, and these intimately concern the community.

It might be possible to arrange a bursary for a poor lad to pass through the university, by the assistance of the branch.

Publicity

One important feature in the relation between the branch and the community is concerned with the matter of publicity. Our meetings generally are held privately, attended by members only, and not much information is given to the daily press with respect to what is being done. There are, of course, exceptions, but they are recent and rare.

Cleveland, Providence, Rochester, Philadelphia, Ottawa and other societies have recognized methods of gaining publicity in the daily papers. Some also arrange for public lantern lectures on engineering works for schools, libraries, churches, societies, etc., with a view to instructing and educating the people in matters which are of importance to them. Some societies have done a great amount of work in this direction, Cleveland being a prominent example.

The American Association of Engineers, which was established in June, 1915, and has nearly 3,000 members, "goes into publicity because it believes that engineers as a whole will be benefitted to the extend that the public knows about their work already performed or of the position largely achieved which can be realized when the public really understands what can be gained in greater health, comfort and prosperity."

Dr. J. A. L. Waddell says: "To secure greater recognition (which is tantamount to increased prestige and influence) requires that a more extended publicity be given to the work of engineers and to the results and effects thereof upon the community in which those works exist. It is not sufficient merely to describe the technical details of a structure or other piece of construction work; but it should be shown how such a structure or construction affects the community, by drawing a sharp contrast between the conditions preceding the improvements and those subsequent thereto. It is thus that the public can best understand and appreciate."

This is now partially done by the newspapers, and it is appreciated by the public and the engineering profession, but it requires a persistent, consistent and organized publicity to "establish our profession in its rightful position of leadership by educating public opinion."

Certain daily newspapers make engineering a special feature of certain issues, and publish articles of undoubted merit and originality. Others, again, have occasional items, prepared for popular consumption, but these are often inaccurate and misleading. The description of the expansion and contraction of the Quebec Bridge is a recent example. The profession welcomes the services rendered by the press, and we feel sure it would give every assistance to newspaper representatives if the opportunity was afforded. Engineers are not always absorbed in the technicalities of their work; they are often able to give ideas. In fact, they have always to organize in advance, and are compelled to be visionary in a practical sense of the word. They have to see ahead and prepare. Who, then, can furnish more abundantly ideas for the communities to aspire to realize?

Gardner S. Williams, a prominent engineer in the United States, recently stated that "the man who conceives, who dreams the dream, is of vastly more importance and value to the world than he who merely makes it a reality. It is ideas that are needed—there are plenty who are ready to execute them. So the greatest in engineering are the designers, those who conceive and produce that which has not been conceived or produced before. The time has come when recognition must be given both to the dreamer and to the builder. Those who have made possible the present condition of human existence, upon whom the world depends for its morning meal and its evening light, for its daily news and its weekly bath, are entitled to the acknowledgment of the debt their fellows owe, and they must get it."

Engineers can become less prosaic and more imaginative and they can succeed in gripping the imagination and appreciation of the public by means of judicious publicity.

W. F. Tye said, "One of the attributes of a great people is to have a thorough belief in themselves." He might have said that the other is to impress this fact on the public mind.

Relation of the Branch to Its Members

The other phase of the question which we are asked to consider is the relation of the branch to the members. The estimation of the prestige and influence of the Branch in the minds of the members is one of great importance, because, while the branch may survive in the absence of a general public recognition, it cannot live long if the members are not satisfied. At any rate, its existence would be that of languor and emasculation if its prestige and influence were inappreciable.

It will be observed that four out of the five objects of the Engineering Institute of Canada, and therefore of the branch, are primarily personal in their significance. We have already dealt with the fifth object, namely, the relation of the profession to the public.

Prestige and influence of the branch are ultimately associated with each of the objects and we will endeavor to present our ideas in connection with each of them.

To facilitate the acquirement and interchange of professional knowledge among its members is a very important function of the Institute, and when fully developed, affords the members an excellent scope for service.

The brotherhood or masonic sentiment of placing the knowledge and experience gained at the disposal of others, should be cultivated, and furthermore, it is even more important that the members should take a greater part in the discussions and papers than has hitherto been the case; it offers an excellent opportunity of enforced study to correct deficiencies. Those who are seeking information should not be reluctant to make enquiries, and those who are in the fortunate position of being able to impart information should be generous in giving it. Free discussions and candid criticisms have made other engineering organizations of greater value to their members. It may be affirmed generally that the value of a paper and its discussion may be measured by the information imparted. Discussions may be made to be more valuable than the paper; indeed, one of the functions of reading a paper may be asserted to be to induce the members to openly discuss and criticize and to add to the information given. If members will invest their knowledge and experience for the promotion of the prestige and influence of the branch, they will eventually earn a dividend in the form of mutual esteem, and this is worthy of a considerable effort and sacrifice.

A succession of papers, however excellent in quality, by few members will not bear fruit unless the many are prepared to contribute to the fund of knowledge. Problems are seldom solved by different engineers in an identical manner; each member has some individuality in his solution; varied conditions require different treatment or engineering becomes stereotyped; new and valuable developments are the product of circumstances as necessity is the mother of invention, and the discussion of papers affords the engineer abundant and excellent opportunities to present information of this character. The branch can develop this feature, and when it attains this object to the full, its prestige and influence will be advanced to an extent which will doubtless exceed our sanguine expectations.

The presentation of medals, premiums or other awards to members for papers is appreciated, and the subject should be considered by the branch.

The number of subjects which we could discuss with advantage is great, and we invite members to consider the following as possible ones for papers:—

The essentials of specifications; economics of bridges; rainfall and engineering; city acquisition of Toronto street railway; Toronto harbor works; Toronto's new union depot; high or low railway approaches in Toronto; activated sludge process of sewage treatment; city transportation problems; city planning; aesthetic treatment of structures; problems in local improvement assessments; research in its relation to engineering; engineering and food production; valuations; engineers and conservation of life; indexing and filing of records; statutory registration of engineers; local government board for Ontario.

The prestige and influence of the branch in the minds of its members can, of course, be materially promoted by holding meetings which are both instructive, attractive and fraternal. Our meetings cannot be said to be well attended. One member, in reply to the question, stated that "if each member would consider it his duty as well as his privilege to attend all meetings of the branch, a healthy interest would soon be developed." Another replied suggesting "more meetings. We do not see fellow-members often enough to really know them or become interested in meeting them."

The following are the other remarks as to the work of the branch:—

"That papers, studies, etc., of the Institute deal with the commercial and economic features of engineering work."

"A better and printed programme, with regular meetings."

"Development of social side."

"Greater usefulness to younger members."

"Papers given before the Institute should have particularly technical parts eliminated so that members in other branches of the profession could still follow and appreciate the paper."

"Would like to see the Institute the place of open and instructive discussion of engineering problems."

"It would be well to affiliate with the American Society of Civil Engineers, if possible."

"There is need of vim and action."

"Regular dates for meetings, programmes of meetings planned further ahead, and more attention paid to securing local talent."

"Strongly advise close co-operation between American and Canadian Societies."

"All should join the Engineers' Club."

Sixteen replies offered suggestions as to the work of the branch.

The branch may be considered as the primary and vitalizing institution where members are given equal opportunities to serve and to be served and receive training for larger fields. The provincial division may be made the secondary institution where the experience and inspiration obtained at the branch would be given scope for increased development. The federal council should be the ultimate forum where those who have rendered signal service would find a vaster field for their energy, experience and knowledge. This is the vision which every member should have. This might be the policy of the Institute to foster. This might be made the dynamic influence to draw out the best we all possess. Reward or honor in proportion to service may not be in the minds of those who do their best, but all are human and like to know that what they do is appreciated.

"The duty of technical societies," said one engineer, "is to emphasize the qualities of sympathy, integrity and nobility in an engineer, entirely apart from any recognition of technical abilities."

The fraternal element might be mentioned in connection with visitors from other branches. It is highly desirable "to cultivate friendly relations with all engineers," and it would be an advantage if engineers visiting different cities where branches are located, would carry with them a card of introduction from their own branch, so that we might know them and extend to them our welcome. One of the chilling effects of attending meetings is to be unknown and isolated where we might be given a cordial fraternal reception if the members but know who we are. As Gardner S. Williams stated, the branches should be the very "embodiment of democracy." We are mutually concerned in the success of individual members, as is evidenced by the satisfaction felt by us in the distinction conferred upon men in various parts of the battle fronts.

To Promote Professional Interests

The Engineering Institute of Canada admits engineers engaged in any branch of engineering, and consequently it is anticipated that some day it will be in a position to speak for the whole profession. The attainment of this anticipation depends in a large measure upon the success of the branches, and sufficient power should be invested in them to make them the active and energizing unit of the Institute.

Professional interests comprise the status of engineers in the community, employment, compensation and brotherhood. We submit that each of these matters should be carefully considered by the branch. W. F. Tye, in an address before the Ottawa Branch in 1917, very ably discussed the subject of the present status of the engineer in Canada. He referred to the fact that we are seldom put in government commissions or consulted on technical matters by the government, even when the questions involve engineering problems.

Charles C. Garrard, in an article contributed January 25th, 1918, to "The Times Engineering Supplement," on the place of the profession, remarked that "on studying the function of the engineer, the first differentiation one can make is that he is a worker with his brain. It is a trite distinction to classify all workers into the two classes of manual and brain workers. Nevertheless, it is a true distinction, and one which must, by the nature of things continue. Both classes of labor are necessary, and both should be organized so that not only may the interests of the individual members be safeguarded, but that the whole may use its corporate power to the best advantage. The tendency at the present day is for the manual workers to become better and better organized. On the other hand, with few exceptions, such as the medical and legal professions, the organization of brain workers is either totally lacking or wretchedly ineffective. In no profession is this more apparent than in engineering. Strong, and in many ways active, engineering professional institutions are in existence, but they do not take upon themselves responsibility in this matter, and the question arises whether they can be adapted to the desired end or whether new institutions or engineering associations are required. The latter course appears very undesirable, and the existing societies, if properly used, should be sufficient.

"In the past, engineering institutions in Britain have devoted themselves almost entirely to the academic side of the profession. In setting this high value upon their position as the repositories of engineering knowledge and tradition, the members of these societies have shown that they have been animated by high ideals. In suggesting, therefore, that new functions should be added to the existing ones, it is necessary to say that the high ideals hitherto obtaining need be in no degree abated. It is really only a question of making the ideals effective and making the institutions themselves such a power in the country, that in all engineering matters, scientific, industrial and financial, it will be just as much a matter of course for them to be consulted, as it is nowadays for the government to take into counsel the Engineering Employers' Federation, or the Amalgamated Society of Engineers."

The name "engineer" is doubtless productive of confusion in the public mind, because it means so much and yet so little. It connotes, for example, the person who plans and builds a railroad across a continent, or the person who operates the locomotive on that road. The name "engineer" may imply the person who designs and constructs any of the great water supply schemes, and also the person who puts in the plumbing in our houses. It may refer to the chief engineer of an immense hydro-electric undertaking and also the one who installs the wiring in a cottage. Men who design, operate and make pumps, dredges or heating plants, and they who designed and built the Quebec Bridge, as well as the men who turn swing bridges, are called engineers.

We have civil and military engineers and engineers of all the numerous branches of modern engineering, including agricultural, forest, efficiency and others. The divisions are so legionary and often so meaningless to the public that it is small wonder it frequently fails to appreciate what we are, or what we are doing, and in this manner our status is affected.

We each endeavor to specialize in some branch of our profession or work, and desire to be publicly known by a title which distinguishes us from others. And, moreover, we have separate, distinct and an increasing number of organizations to represent the several interests. There have been reasons for this, but the time has come for blending together to constitute one united and irresistible power. Engineers up to the present seem to be obsessed with the idea that individualistic attitude or condition of the sections of the profession is of advantage. The medical, legal and other professions do not have this idea. Each has its sections and yet recognizes and loyally support one great organization which is virile, powerful and respected.

The architects are able to command public recognition by virtue of their democratic and representative institution. The Chambers of Commerce represent every kind of competitive business, yet through the federated chambers they possess great influence. The Canadian Manufacturers' Association includes a great variety of competitive industries, and by setting aside individualistic idiosyncrasies are able by union to do great things. The Federations of Labor comprise members of all kinds, and by their united stand are able to sway national elections and to insist upon recognition.

But the engineer so far possesses no such compelling power. We observe traditional ideas and customs established decades ago, when conditions were very different from the present. It is to be hoped, nevertheless, that the new name, "Engineering Institute of Canada," with a new spirit and aspirations among its members, will create a forceful and inspiring *esprit de corps* that will weld all classes of engineers who are qualified into a body that shall be representative and in a position to speak in an unmistakable and authoritative manner in our behalf. If and when this occurs, the anomalies, confusions and weaknesses of the past will be forgotten, and by the creation of a homogeneous entity we shall be able to impress on the public that we are worthy of its highest esteem and of a status that shall be mutually beneficial.

"Let us, therefore, organize," writes L. G. Legrand, of Winnipeg, "for in organization is the secret of strength, the basis of influence and the opportunity for power." This is a consummation towards which the branch might devote its thoughts and energies in the immediate future, and thereby promote its own prestige and influence.

We observe by the technical press that the engineers in the United States are seeking to solve this identical problem through the Engineering Council, the American Association of Engineers and the Committee of Co-operation. Each of these is endeavoring to attain the same result in different ways. We would desire the Engineering Institute of Canada to be the one great dominating and influential engineering institution in Canada, representing all engineers, and by making the branches and divisions the real and effective bases of the organization, all matters which affect our interests can be attended to in their incipient stages, and also be prevented from becoming a source of menace to the profession generally.

Status of Engineers

There is, of course, another side to the question of the present status of engineers, and that is whether legislative powers should be secured to restrict the practice and the title of engineer to those who are qualified. The questionaire which was issued to the members, asked for expression of opinion on this matter. The result has virtually left no decided impressions as to what is the representative opinion with reference to the registration or licensing of engineers. About two hundred questionaires were issued and forty-eight replies were received. Of these, twenty-one members stated that they were in favor of licensing, nine were against, eight were undecided or conditionally favorable, and ten expressed no opinion.

We are somewhat disappointed with these results, because the members who responded relatively constitute but a small proportion, and may not be representative of the branch members.

There can be no doubt, however, that legislative restrictions are desired by a large section of the members of the Institute in Canada. Quebec and Manitoba have these powers at present; Alberta appears to be anxious to obtain similar powers; British Columbia endeavored to have the legislature define the term, "engineer." This question has for some time been discussed in the United States. Indeed, some States have granted statutory authority to limit certain engineering practices, and engineering societies in others are committed to this policy.

The Calgary Branch suggests that legislation would follow out the spirit and intent of the Manitoba and Quebec Acts concerning engineers, and that it should be Dominion-wide and not provincial in its scope. If the British North America Act, however, does not make this feasible, then the acts passed by the various provinces should be made reciprocal. The experiences of the medical, legal and educational professions in this regard should afford us an excellent lesson as to the absurdity of making each province a water-tight compartment in these matters.

The Calgary Branch further suggests that the "gaining and maintaining of the necessary legal status to allow of practice, would necessitate the gaining and maintaining of registration as a member of the Engineering Institute of Canada. And in this connection there is suggested the one radical and new idea, that registration with the Institute could be gained only on the issuance of a certificate granted by a Board of Engineers which would be controlled by the science faculties of all the recognized universities in Canada, and not by the council of the Institute. And similarly, the grading of the registered members would be controlled by the Board of Engineers."

It must be presumed that engineers equipped with satisfactory credentials coming to Canada would be granted the necessary certificate by the Board of Engineers.

Some prominent engineers believe that licensing of engineers would be retrograde; others again believe that "proper standard requirements fixed by law which the engineer must attain to practice independently, must produce beneficial effects." (Engineering News Record, of New York, January 10th, 1918.)

"As far as the exclusion of undesirables from the practice of engineering is concerned, licensing would be a good move, but no state has any moral right to prevent non-resident engineers of ability from doing work within its boundaries without first passing an examination and paying a fee for a license." This is the view held by Dr. Waddell.

"Any land surveyor, locomotive driver or chauffeur, even," says Prof. William H. Burr, may call himself an engineer and the public as a whole will award him what he claims, while the members of the profession either do nothing or mildly criticize the procedure. There seems to be insufficient professional spirit to assert a proper dignity and secure such discriminating legislation as shall convey to the title its honest meaning or defend its use. Various attempts have been made to secure legislation which through a proper procedure of licensing would give to engineering the professional standing due to it, but the the members of the profession have not yet attained to a sufficiently broad and intelligent view of the matter to extend their vision beyond certain personal considerations and demand such measures as may protect and dignify the profession as a whole. The public is generally ready to accept at their own valuation any body of intelligent and honorable men, but if a body of even such men lack sufficient self-respect to assume and occupy worthily a professional plane and conduct their work in a suitable and professional manner, the public may hold them, even, cheap; and certainly will fail to accord the recognition properly desired and claimed by prominent and true members of the profession."

Under the present conditions it is difficult to discern how the Engineering Institute of Canada can obtain legislative limitations or to persuade parliament that the practice and title of engineers should be limited to those who are qualified, when the Institute only represents a portion of the engineers in Canada. The situation would change materially if the other sections of engineers were to join forces or, better still, to become members of the branches.

It is known to all that there are many engineers engaged in two or more branches of business. In fact, the different phases of engineering are so intertwined that it is difficult to demarcate their respective limits. The chemist and metallurgical engineer, the electrical engineer and the chemist, the analyst, biologist and sewage engineer are all closely associated. The mining engineer designs and constructs a variety of work, such as drainage, roads, railways, structures, bridges, water supply, heat, light and power, and so on; in short, as Dr. Raymond remarked, the mining engineer "has all the problems that torment the civil, mechanical and electrical engineers, together with a torturing lot of his own that they don't have."

These multitudes of inter-relations of the profession and the variety of functions which the engineers have to fulfil, afford the best arguments for union and for legal standing. The public is not adequately safeguarded; the absence of statutory definition and limitations place the public under a grevious disability. It knows that doctors and lawyers cannot practice without due qualifications, and yet when it requires an engineer to carry out works of vital importance, which in the aggregate involve vast expenditures and also involve the health, comfort, prosperity and life of the community concerned, the public has no statutory assurance that the person to be employed is duly qualified.

It must be remembered, however, that in some respects engineers are not situated similarly to doctors and lawyers. Comparatively few doctors and lawyers are officials or employes of others, but the majority of engineers are. The questionaire revealed this situation very emphatically. Out of the forty-eight replies, twelve are from private practitioners and thirty-six are from those who are employed by the governments, public bodies, railways and private firms.

Licensing of engineers, under these conditions, may be of importance to those who are practitioners, but only to a lesser degree to those who are otherwise employed. If licensing is to be enforced in a comprehensive manner, then it may be deemed by the public to resolve itself into a professional union, as trade unions are to craftsmen. Trade unions are vitally concerned with the question of the status, rights and responsibilities of its members and jealously watch that no infringement of its non-statutory rules take place, not only by these men but also by the employers. Should serious infringements occur and the union fails to have it rectified, it declares a strike. In this way many who are not concerned in the conflict are often seriously affected and sometimes the guilty parties suffer the least. Statutory limitation of engineers, however, would be safeguarded by penalties to be imposed by the court, and to obtain decisions, it would be necessary for the Institute to undertake legal proceedings, because the complainant may not be able, for obvious reasons, to assume the responsibility. This matter would necessarily have to be taken up by the branch, division or federal council, as obtains with the medical, legal and other professions, for its own protection.

If a powerful corporation or municipality should employ an engineer who has not fulfilled the statutory requirements, it might lead to a strenuous and costly litigation. We would be prosecuting the action in the interest of the profession, whilst the corporation or municipality would have equal reasons for their shareholders or ratepayers, but not the same conception of ideals to assuage the antipathy to the restriction. Aside from this possibility, the corporation or municipality might perhaps employ the engineer under another title. To circumvent this eventuality, it would be necessary to have a clear definition of what is an engineer. F. H. Peters, Calgary, in his article in *The Canadian Engineer*, February 14th, 1918, expressed the same thing when he stated that if the profession is to have a proper standing it must be one that is defined by the law of the land.

The opinion of a committee of the San Francisco Society of Civil Engineers is that "the licensing question is sure to face us sooner or later, and if we have no satisfactory definition (of engineer) and a classification of our own, we shall have one thrust upon us by those who frame the new statutes."

The State of Florida in May, 1917, passed an act for the examination and registration of "professional engineers" which defines the title "professional engineering" to mean any branch of the profession other than that of military engineer, and a comprehensive list of works is given. So far as we understand, it does not apply to subordinate engineers. This act was based to some extent upon a draft which was prepared by an American society of engineers.

Employment

Employment is, of course, an ever-present question for us all. But our national engineering societies have taken no active part in helping engineers in this direction. The payment of annual dues, and receiving in return the proceedings of the organization and attending the meetings when possible, is no doubt the prevailing idea among many, of the functions and value of the Institute.

Employment has been considered "a matter with which the Institution of Civil Engineers is not officially identified," although assistance is given when possible. A committee was appointed in July, 1916, by the American Society of Civil Engineers, which reported in 1917 that "there is in existence a general feeling that our society should in the future give systematic study to the practical matter of employment."

It would be desirable that this question of organizing some form of co-operative employment clearance and of exchanging reports between the branches should be carefully investigated.

"The future of the profession," according to Fraser S. Keith, "lies largely in how far it is willing to assist the individual member." This is one method.

Compensation

The question of compensation is one which is of importance to all members, especially under the prevailing and prospective conditions.

It is instructive to note that according to a petition sent to the U.S. Railway Wages Commission by the Engineering Council for increased pay for assistant engineers, it was stated that assistant railway engineers are paid less than twelve classes of non-technical men. The Engineering News-Record, of New York, in its March 7th, 1918, issue published the following schedule of monthly pay:—

Road passenger engineers and motormen	$176
Road freight enginemen and motormen	153
Road passenger conductors	152
Train despatchers and directors	$131
Road freight conductors	131
Yard enginemen and motormen	128
Yard conductors	113
Road passenger firemen and helpers	106
Gang and other foremen	97
Yard brakemen	95
Road freight firemen and helpers	94
Assistant engineers and draftsmen	93
M. W. and S. foremen	92

The American Association of Engineers also reported to the U.S. Railway Wages Commission on the question of salaries of technical men employed on railroads. The association stated that the average monthly rates were: Draughtsmen, $90; inspectors, $90; instrumentmen, $100; assistant and resident engineers, $125; division engineers, $150. In the circular it is mentioned that the chief engineer of the L.C. & C. Railway in 1839 stated that "two assistants of division to be selected by the resident engineer, their salaries $1,500 per annum each." The pay consequently has been stationary, whereas all else have mounted up seriously.

It is anticipated by some that if legislative powers were obtained to license or register engineers, compensation would be automatically improved. This may be realized, although it is not clear how the laws of supply and demand will be changed materially. We have services to sell and their value depends to a large extent upon the prevailing demand for them and the available supply. Services, like commodities, are valued according to circumstances.

We believe that if engineers must be licensed before they can be employed in any capacity, the number of men available would probably for a time be less, and their general abilities would be greater. In other words, the inefficient ones would be weeded out. Still, laws cannot be passed without some regard being paid to those already employed as engineers and to newcomers from other countries who are qualified to act. Consequently if licensing would tend to create a dearth of engineers, and as a consequence cause the pay to increase, the conditions would soon become known and the field would be attractive to others. We cannot help expressing the opinion that the principal way of improving the compensation of engineers is to unite as a body to raise the status and to promote the prestige and influence of the branch.

Compensation can usually be demanded by capable men notwithstanding competition, but it is necessary to make ourselves known by our capacity and attainments. This can be done by reading papers before the Institute, by contributing to the discussions, by participating in public affairs, by forcing ourselves to the attention of the public and by showing character and judgment. "A proper recognition is essential so that adequate compensation may follow," says Dr. Waddell.

Dr. C. R. Mann was appointed by five United States national engineering societies and the Carnegie Foundation to investigate the question of the education of engineers, and after seven years' study and exhaustive interchange of views, he found that out of 1,500 answers to inquiries, 87% of the engineers placed more value on character, judgment, efficiency and understanding of men, than on knowledge and fundamentals and technique of practice. This verifies the old and self-evident thesis, that man is greater than his knowledge. In this connection Dr. Mann maintains that "the engineering profession can render no greater service to education than by constantly reminding the schools that the development of character, judgment and human sympathy is the ultimate end and aim of education."

Sir Maurice Fitzmaurice, in his presidential address, remarked that "the capacity of getting on with people and still holding one's own has a distinct money value and a very high one."

Defence

It is important for the prestige and influence of the branch that it should as far as possible support its members when it considers they are unjustly assailed. The reputation of the profession is vitally concerned in that of its members; the two are inseparable. The by-laws of the Institute provide for the disciplining of members who have broken any code of ethics, but it contains no provision for the defence of members who are unjustifiably attacked. The first implies the second, or one object of the Institute has been overlooked.

This function of an organization involves very careful consideration and a rigorous investigation, otherwise what at first may appear unwarranted, on full study may be found to be the result of indiscretion or lack of judgment on the part of the members involved. But notwithstanding this element of uncertainty, it is desirable that the member may know that when the facts are proved to the satisfaction of the branch, he can rely on its support in time of trial. These cases usually occur in municipal engineering where the personnel of the council changes and influences are brought to bear to carry out certain schemes which the engineer sometimes cannot approve. As an official he should carry out the instructions of his council, but as its technical adviser he should justify his actions; therefore, the dual duties may occasionally place him in a predicament and open to attack. The fact that there is a branch which is prepared to support him may have no weight with the council, but it will afford him some assistance in doing what he deems to be right and proper.

The Calgary Branch stood behind the city engineer who was severely criticized in connection with the construction of the Centre Street bridge, and proved to the public that his critics were unjust. Both the engineer and the branch gained respect and prestige by this action.

Research

One of the objects of the Institute is to encourage research, and especially as the Institute is to represent every branch of the engineering profession there should be some scope. Alfred Saxon stated in Manchester (1917) that "inasmuch as mechanical engineering was the key industry to all the industries, the need of scientific research to assist in the creation of new ideas and new methods and to reduce manufacturing cost and prevent waste of material, was overwhelming."

Albert H. Hooke remarked, in 1916, that when the tunnel was being driven in 1891 in connection with the Niagara Water Power Works, aluminum, carborundum, alundum, silicon, artificial graphite, calcium carbide, cyanamide, etc., were unknown to commerce.

Engineers have not been absent from the field of research, for circumstances have often compelled them to make scientific investigations with the view to carrying out various projects with increased success and profit.

The use of coal and waste gases for different purposes, the generation and use of steam, the extraordinary development of the internal combustion engines, the uses of electricity, the development of water power, the application of reinforced concrete, transportation, electric communications, steel production, etc., are the products of creative engineering geniuses that have vibrated the world. Notwithstanding the enormous strides made in the recent past, the future holds out an invitation for greater conquests of natural forces and for their conservation for the use of mankind. The encouragement of research by the branch would help to increase its usefulness, and if it should lead to the discovery of a Bessemer, Ericson, Faraday or Edison, prestige and influence would be gained.

Benevolence

We might refer to the matter of benevolence in connection with branch activities. Misfortune comes to some when they are least prepared. The war has upset the careers of many, and although unemployment may not at present be a pressing matter, still some experience difficulty in finding it. Unemployment, sickness, accidents and other misfortunes are depressing events, especially when friends are few and funds are scarce. The prestige and influence of the branch would be exalted in such circumstances, if it were able to render assistance when needed. It is a difficult problem and a delicate one, especially in the cases of those whose temperament is such that they would spurn charity. Still, if we could render aid in a quiet and private manner, it would tend to alleviate anxiety, reduce the load and brighten the prospects of some fellow engineer in distress. The fact that we know of no such case may be due to the silence of the members and the absence of branch funds, but that they will occur is as certain as anything human can be. The raising of a fund for this purpose is relatively a small matter, as it can be done in various ways.

Conclusion

In presenting the foregoing report on "how to increase the prestige and influence of the branch," we have to state that the subject is opportune and important. The branch should be the cultivated sense of the body politic. It is the principal means by which we can assert our rights, enjoy our privileges and increase our professional standing. Neglect the functions and atrophy sets in; cultivate them and they develop in usefulness, strength and vitality.

We believe that the profession is destined to occupy a position of greater importance in the future life of the nation than it has ever done in the past, and that the era which is now unfolding its doors will call for loyal and efficient public service. Many of the troubles of the past have been prescribed for without making a scientific diagnosis of their causes, but in future the engineering profession will be invited,—nay, compelled,—to accept its duties and responsibilities in this work. The branch should constitute the strongest living organism of the Institute, otherwise our professional obligations and privileges will not be realized.

Engineers will be able to do a great amount of work as they are now represented, but when our forces are combined, the possibilities of doing greater work will be enormously enhanced. We would cherish the hope that engineers of all branches of the profession will see the force and influence of one great Canadian engineering organization. That does not mean the submerging of various categories of engineers, but the encouragement of the progress of each, under one common flag, one common aspiration and for one common achievement, namely, the promotion of the best in every branch of engineering for the advancement of our national prosperity; and this will assuredly redound to our personal and professional advantage, prestige and influence.

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Principal Contents of this Issue

DOUBLE-TRACK THE INTERCOLONIAL!

FROM Moncton to Halifax the Intercolonial Railway should be double-tracked as a war measure and as a measure of lasting importance to the prosperity of Canada. Halifax is a world port with wonderful possibilities, but it is being strangled by inadequate railway approach facilities. The Intercolonial, the Canadian Pacific (via St. John) and the National Transcontinental all pour Halifax freight into Moncton. From Moncton this freight must be hauled for 186 miles into Halifax over a single-track railway. The port of Halifax is now a big bottle with a very small neck.

On this continent the nearest port to England and France is Halifax. This is a factor of prime importance when bottoms are at such a premium and when the fight for world civilization may depend upon the ability of American and British shipping to survive the staying power of the Hun. The average freighter can save upwards of eight days in a return trip across the Atlantic if she sails from Halifax instead of from Portland, Boston or New York; and upwards of four days if instead of from St. John. That means that a boat on the Halifax route can carry from one-quarter to one-third more men, food, ammunition and supplies than can a boat of similar size which loads at American ports.

Railway transportation and port facilities govern the degree to which this geographical advantage can be utilized. The magnificent harbor at Halifax is rivaled by few in the shipping world. As the government's terminal plans mature at Halifax, that port will no doubt be equipped with facilities of first class, but railway congestion will still drive traffic into other channels unless the Intercolonial from Moncton to Halifax be double-tracked.

Operating officials state that a single-track railway can operate little more than 400 freight cars per day in each direction from any terminal, allowing for efficient passenger operation at the same time. About that many cars go into and leave Halifax daily, and probably more than that number are handled at St. John, but thousands of cars from the Canadian West and Western United States, now routed to American ports, would go to Halifax if the Canadian Government Railways could handle them.

The railways to the American ports are heavily congested. The whole shipping problem on the Atlantic coast would be materially relieved by widening the neck of the Halifax bottle. The Canadian Government Railways could no doubt handle from three to four times the present volume of traffic at Halifax were the line double-tracked from Moncton. Such an outlet for another eight or twelve hundred cars daily would not only relieve traffic congestion, but also, for the reasons outlined above, would be equivalent to a substantial increase in the number of freighters and transports under the Allied flags. The cost of this double-tracking would probably not exceed $12,000,000. It should be voted from the funds of the last Victory Loan, without hesitation and without delay, at the present session of Parliament.

GOVERNMENT OFFICE BUILDING

TENDERS are now being called by the Public Works Department for the construction in Ottawa of a nine-story office building which is being opposed by some Ottawa engineers and architects upon the ground that it does not conform with the excellent plan completed two years ago by the Federal Plan Commission, and that it will only anchor permanently what is now but the temporary inconvenience of the scattered location of war-time department overflows.

The government has been urged to adhere to the principles of the Federal District plan, and to construct this $1,500,000 building on government property in such location as to conform with the plan. There being no accepted or determined architectural design for the large group or main scheme of department buildings, it has been suggested that for the present only the steel and concrete be erected and fitted with factory sash, the outer shell of decorative stone to be added later when more funds are available and when the whole group of buildings has been finally designed. It has been said that this would permit at a minimum cost of a thoroughly hygienic and economical building, with all heating, ventilating and other equipment permanently in place.

In reply to an enquiry from *The Canadian Engineer* whether the government had given consideration to the Federal District plan in designing this building, Hon. Frank B. Carvell, Minister of Public Works, writes:—

"We have considered the Federal District plan for Ottawa very carefully, and the construction of the proposed office building in no way interferes with the suggestions therein provided for. The plan, so far as the government was concerned, practically made a suggestion as to what should be done on the north side of Wellington Street. The government of Canada is to-day paying $650,000 annually to the landlords of Ottawa, some of these rentals being on a fair basis and others amounting to little short of extortion. The war has brought an enormous influx of new officials to the service, and the Public Works Department is practically at its wits' end to find accommodation for them. Were we to commence the construction of a building on the general plan and along any plan which would be commensurate with buildings of that nature from an architectural standpoint, it would take two and a half to three years to get any unit ready for occupation, at a cost of 100 per cent. above normal and probably with an office capacity of not more than 60 per cent. of that which we could furnish on the proposed scheme.

"We, therefore, decided to build south of Wellington Street between Albert and Queen, in a central location, an ordinary nine-story office building, which, we believe, could be completed by the 1st of July, 1919, and, while it would cost more than it would in peace times, yet, if the architects could get down to earth and design an ordinary business building, we estimate that we would obtain about 140,000 square feet of office space at a cost, including everything, not exceeding 70 cents per foot. The erection of this building in no way interferes with the city of Ottawa."

The report of the Federal Plan Commission was summarized in our issue of April 20th, 1916. The members of the commission were Sir Herbert Holt, chairman; Sir Alexander Lacoste, K.C., of Montreal; Frank Darling, of Toronto; R. Home Smith, of Toronto; and the mayors of Ottawa and Hull. The commission selected E. H. Bennett, of Chicago, as town planning expert, and E. L. Cousins, general manager of the Toronto Harbor Commission, as chief engineer. A number of assistant architects and engineers were engaged for a considerable period, and the cost of the plan is said to have approximated $70,000.

A public statement by Messrs. Cousins and Darling whether the proposed 700-room office building interferes with the Federal Plan or not, and if so, how seriously, would be timely and should be secured and published by Mr. Carvell. Their advice in this matter would appear to be almost invaluable.

ENGINEERING PRESTIGE

LAST year the executive of the Toronto Branch of the Canadian Society of Civil Engineers appointed a committee to investigate how the prestige and influence of the branch might be promoted. In this issue we publish the draft report written by the chairman of that committee. This report covers a great field for consideration. It refers to the part which was taken by engineers in the past and what will be expected of them in the future in connection with the immense business of reconstruction of the commercial, industrial, political and social organizations of the civilized world. The relation between the engineering societies and the public is dealt with in a comprehensive manner.

The personal phases of the problems which confront the branch, and indeed the whole of all engineering societies, demand serious attention. These include papers which might be read and discussed, the question of registration or licensing of engineers, organized bureaus for employment, rate of pay, benevolence and other matters of importance. These will all be discussed at a general meeting to be held soon, when resolutions will be submitted for the members to accept, reject or amend.

The questions which are reported upon do not pertain to the Toronto branch alone. They are common to all engineers in Canada. The information collected, the arguments presented and the criticisms offered should induce engineers throughout the country to take an active interest in the whole subject. Isolated action by the Toronto engineers will fizzle out like a squib in the dark unless other engineering bodies help to light the path.

Engineers should occupy the national position to which they are entitled, not only by virtue of their work and achievements, but also on account of the fact that the community depends upon them for almost everything that it enjoys. Lawyers have attained a national status of great importance, but the community could exist without lawyers. Without engineers it would soon starve, yet the engineers apparently do not hold the esteem of the public so fully as is their due.

We urge that this report, though long, be read by the engineers, and hope that the discussion at the meeting will lead to something tangible and beneficial.

PERSONALS

R. O. WYNNE-ROBERTS has been appointed consulting engineer by Sault Ste. Marie, Ont., in connection with the construction of a new pumping station.

WILLIAM NEWMAN, naval architect and works manager of the Polson Iron Works and Steel Shipbuilding Co., Toronto, has resigned and is considering an offer from Hugh Mackenzie, of the United States Fleet Corporation, of Hog Island, Philadelphia, the largest shipbuilding company in the United States. During his connection with the Polson Company Mr. Newman, who received his early training with the Bertram Shipbuilding Co., of Toronto, supervised the launching of fifty-four vessels, all of steel construction, which is about one-half the total number of vessels of all kinds launched in Toronto during the past half-century. Probably the greatest shipbuilding feat supervised by Mr. Newman was accomplished a few years ago, when a 24-inch hydraulic dredge for government service in Hudson Bay was constructed in eighty-seven days. He also established a record when a lighter for service in the Hudson Bay district was constructed in thirty days.

EDWARD DE V. TOMPKINS, M.Am.Soc.C.E., consulting and constructing engineer, who has for the past seven years had offices in the Professional Building, New York City, has moved to Chicago to take the general agency of the Cement-Gun Co., Inc., of Allentown, Pa., in charge of their mid-west territory. During the past twenty-five years Mr. Tompkins has designed and built many important water-front developments, including bulkheads, piers, power houses, factory buildings, conveyer systems, etc. He has also executed many contracts of magnitude for federal and municipal governments, including piers, bridges and sewers. He was bridge engineer of New York City for six years, and during the past administration was deputy commissioner of the Department of Docks and Ferries of that city. His previous commercial experience was as manager of the New York office of the Trussed Concrete Steel Co., manager of the Philadelphia office of the Columbian Fireproofing Co., and manager of the New York office of the Maine Electric Co.

ENGINEERS' CLUB SMOKER

About seventy members of the Engineers' Club of Toronto were present at the annual smoker, last Thursday, April 11th. Lieut.-Col. McKendrick related some of his experiences while at the front, especially road building. L. V. Rorke, president of the club, acted as chairman.

ENGINEERING INSTITUTE OF CANADA

Sir Herbert Ames' bill changing the name of the Canadian Society of Civil Engineers to "The Engineering Institute of Canada," was adopted last Friday by the Private Bills Committee of the House of Commons. The bill must now be approved by the Commons and by the Senate before the new name is officially adopted.