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PLEASE bear our publication in mind at ALL times and send us news—news of the commencement, progress or the completion of work; news of contracts to be let; personal items telling of the promotion or transfer of engineers and contractors.

The Canadian Engineer

WEEKLY

ESTABLISHED 1893

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The Canadian Engineer

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CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

Editor—E. A. JAMES, B.A. Sc.
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Address all communications to the Company and not to individuals. Everything affecting the editorial department should be directed to the Editor.

NOTICE TO ADVERTISERS

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TORONTO, CANADA, MAY 7, 1909.

CONTENTS OF THIS ISSUE.

For copies of our issues for March 19th or April 9th, 1909, we will give one month's extension of subscription. If you do not require your copies, kindly forward them to The Canadian Engineer, Toronto.

MACDONALD BUILDING, McGILL.

McGill University added another splendid college building to her already large university group when, a few evenings ago, the formal opening of the new Macdonald Engineering Building took place. The Board of Governors entertained the graduates and undergraduates in engineering, and these, together with many friends of the university not connected directly with the department of engineering, had the pleasure of inspecting the new building, handsome in design, convenient in arrangement and complete in equipment, which will in the years to come be the training ground of some of the brightest and best-equipped men who will enter into the engineering profession, not only in Canada, but in countries the world over.

A model in every way, and architecturally beautiful, the arrangement of class-rooms and laboratories, heating and ventilation, make it a building where the young man may study not only correct methods, but also where these methods are in evidence.

Since its foundation in 1821, McGill has grown rapidly, both in numbers and influence—deservedly so. Her graduates in every department have been leaders in commerce, in the professions, and in the direction of the social and political life of the country. The President and Board of Governors of McGill have met many discouragements in the building up of this large university, and April 5th, 1907, was a dark day for McGill. But her friends were many, and above the ruins of the old building has arisen a more modern structure that will be the pride of the university and the college of the men who will be foremost in controlling the operations that affect the industrial life of this young country.

ASPHALT PAVEMENTS.

With the opening of spring the repair of city pavements is one of the important works that come under the direction of the municipal engineer, and of the many pavements used none require greater care in the matter of repairs than the asphalt pavements. Neglect of repair is a serious error on the part of many city officials.

There are many causes of defects in these pavements, but, perhaps, the most important is improper specifications, covering, as they do, every phase but one that has to do with the making of a good road. Frequently these pavements are laid with too weak a base, and cracks develop in every direction. This is a weakness that repair cannot improve. Occasionally the lateral support is not rigid, and for great distances along the street car tracks we find the asphalt covering destroyed. Street car rails should be well embedded in concrete and guarded by rows of bricks or blocks at least a foot wide on every side of the rails. Where the asphalt surface disintegrates in spots, it may be found that the disintegration is due to leaks from gas mains. It is useless to repair these spots until the leaks have been stopped, as the patches will soon disintegrate also.

THE RESISTANCE OF PAVEMENTS.

Elsewhere in this issue will be found a paper on this subject by Mr. A. C. D. Blanchard, assistant city en-

gineer, Toronto. The author does not maintain that it covers every phase of this interesting question. The experiments made were recorded with a view to gathering information on a particular aspect of this problem, and the results obtained are of considerable value to those interested in the kind of pavements used on city streets.

The most interesting experiment was that in connection with asphalt pavement, where it was found that the results varied not only with the weather conditions, but also with different temperature conditions. It is interesting to notice how the relative position of curves representing tractive resistance change positions under wet and dry weather conditions.

It is to be hoped that these experiments will be continued, as well as other experiments, testing, as far as possible, the foothold the various pavements afford for the horses and the limits of the load that may be drawn on various pavements of varying grades.

EDITORIAL NOTES.

The council of a New Brunswick city have decided that they cannot carry on a certain municipal work because they only received one bid when tenders were called for. During the past few weeks we have received similar information from other municipalities. So many municipalities have got into the habit of advertising in the local papers only. Those informed of the work to be done comprise a very limited circle, and it is only by familiarizing contractors on the outside with the requirements that these municipalities will secure a larger number of tenders and fairer prices.

* * * *

The city engineer of Calgary is to be congratulated upon the promptness with which he resented interference by aldermen in the carrying out of the work of his department. Too many aldermen are anxious to pose as engineers, and their continued interference has disorganized, in some cities, the engineer's department. Mr. Child's action is very refreshing, and if more of our city engineers displayed the same firmness and vigor in dealing with such as interfere in an unwarranted manner, business methods would characterize their departments and the profession would receive more consideration from its clients.

* * * *

The Canadian Clay Products Manufacturers' Association are leading an agitation to secure a course in Ceramics at the University of Toronto. The clay products of Ontario are important, amounting to well over three million dollars annually. No one can doubt the importance of the industry, and all recognize the necessity and value of technically trained men for the different enterprises of this industry. We think, though, that the men anxious to engage in this class of work will be able to secure the necessary training from the courses as now arranged in our provincial institutions. A Ceramic school—then why not a Cement School and a Woodworkers' school? Specialization is very necessary. But the man who first secures a broad, general training will have become familiar with tools which will enable him to make quick progress in his chosen department. Let the highly specialized work be done at the expense of the individual and the industry and not at the expense of the State.

BROKEN RAILS.

The steel rail for steam railways is the most difficult question our railway engineers and rail manufacturers have to deal with. To manufacture a rail that will stand the heavy traffic now going over our roads, and also a rail equally serviceable in all seasons, appears to be a difficult problem.

The chief engineer of the T. and N.O. Railway in his annual report gives a list of 109 broken rails, date of fracture, and also the probable cause of the break. We have tabulated these breaks according to months and probable cause of fracture. The returns for 1908 show that almost seventy-five per cent. of the breaks occur in the winter months, and that fifty per cent. are from causes unknown.

Broken Rails on T. and N.O. Railway.

	Flaws.							
	Split or piped.	Clean* break.	In base.	In web.	In flange.	Shear.	Injury.	
Jan. ..	2	..	..	..	..	2	..	4
Feb. ..	5	19	..	..	..	..	1	25
Mar. ..	3	22	1	2	3	..	1	32
April ..	..	11	..	..	..	1	2	14
May ...	1	1	2	..	..	..	1	5
June ..	..	..	..	..	..	..	2	2
July ...	..	1	..	..	..	..	..	1
Aug. ..	1	..	3	..	..	..	..	4
Sept. ..	..	1	2	..	..	..	..	3
Oct. ...	..	1	5	1	..	..	..	7
Nov. ..	..	6	4	..	..	..	..	10
Dec. ..	..	..	1	1	..	..	..	2
	12	62	18	4	3	3	7	109

* Causes unknown.

TIMBER FOR USE IN MINES.

A method of treatment of timber, known as the Henry Aitken method, is now used at many collieries. In this process the idea is to soak the timber in water, raised to a temperature of from 190 to 200 degrees Fahr., containing enough common salt to form a thoroughly saturated solution.

RAILROAD EARNINGS

Name of Company	For Month of April, 1909	For Month of April, 1908	+ or — *	From Jan. 1st to April 30th, 1909	From Jan. 1st to April 30th, 1908	+ or — ‡
	$	$	$	$	$	$
C.P.R.	6,260 000	5,390 000	+ 870,000	22,281,860	19,238 000	+ 3,043,860
C.N.R.	741,200	686,100	+ 55,100	2,508,700	2,375,200	+ 133,500
G.T.R.	3,142,748	2,976,664	+ 166,084	11,494,097	11,216,514	+ 277,583
T. & N.O.	133,141	65,827	+ 67,314	429,661	222,825	+ 206,866
Mon. St. ..	270,416	259,508	+ 10,908	1 082,346	1.023,010	+ 59,336
Tor. St.....	276,396	254.479	+ 21,917	1.136,961	1,057,046	+ 79,918
London St..	17.881	16.867	+ 1,014	69,328	66,257	+ 3,071
Totals	10 841,782	9.649.445	1 122.307	39.002 956	35.108,852	3,894,104

*Increase or decrease over 1908
‡Aggregate increase or decrease over 1908.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Apr. 30		STOCK QUOTATIONS TORONTO				MONTREAL			
				1909	1908	Price Apr 30 '08	Price Apr. 22 '09	Price Apr. 29 '09	Sales Week End'd Apr 29	Price Apr. 30 '08	Price Apr. 22 '09	Price Apr. 29 '09	Sales Week End'd Apr 29
Canadian Pacific Railway	8,920.6	$150,000	$100	1,814.000	1,463,000	.....	177 175¾	177½	425	156 155½	176¾ 176½	177¼ 177	1436
Canadian Northern Railway	2,986.9	.....	.....	193,600	172,200	.....	.....		.....	.....	.....	.....	.....
*Grand Trunk Railway	3,536	226,000	100	955,171	902,112	.....	*1st. pref. 108¼, 3rd pref. 53¾, ordinary 22½		.....	.....	.....	.....	.....
T. & N. O.	334	(Gov. Road)	.....	40,066	17,685	.....	.....	.....	.....	.....	.....	.....	.....
Montreal Street Railway	138 3	18,000	100	67,753	66,393	.....	.....	.....	.....	181 180	209¼ 209	208¼ 208	217
Toronto Street Railway	114	8,000	100	67,148	63,284	.....	124	.....	91	100 99½	124 123¾	124 123¾	533
Winnipeg Electric	70	6,000	100	.....	.....	143⅜ 143½	170 123	168	92	.....	167¾	167¾	10

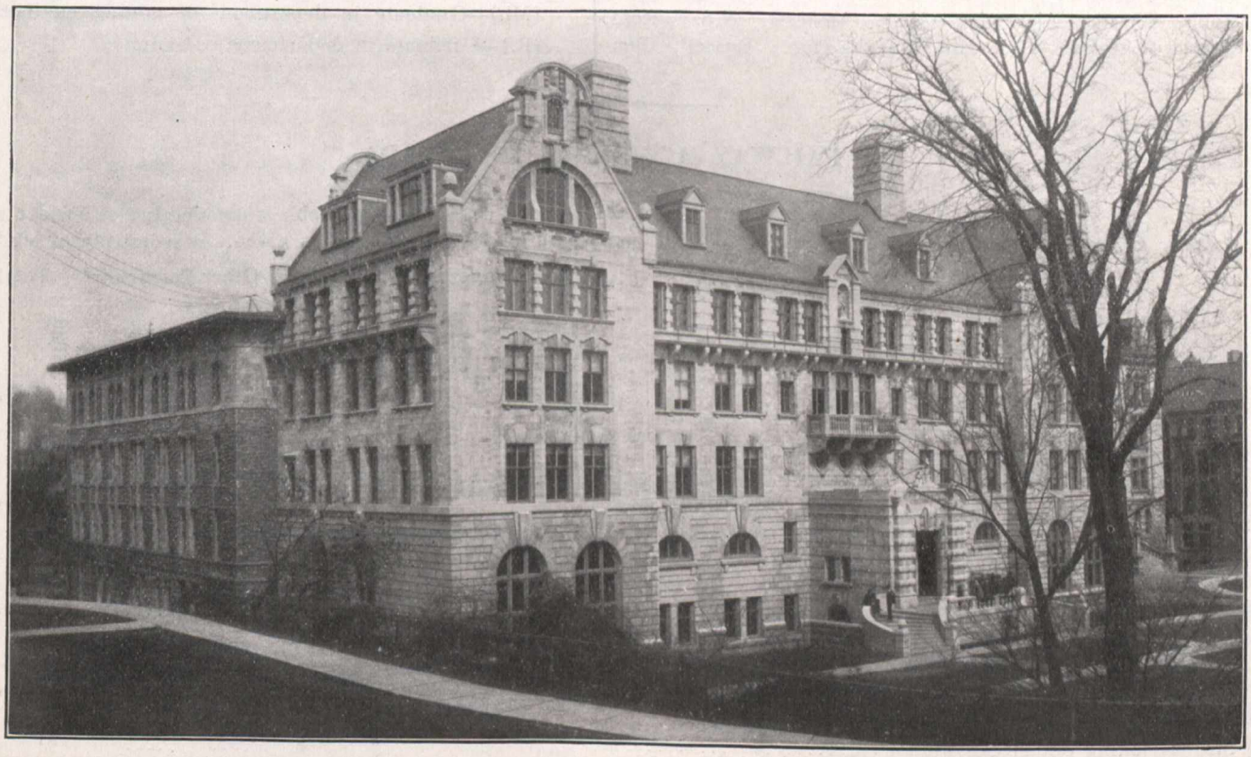
* G.T.R. stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

MACDONALD ENGINEERING BUILDING, McGILL UNIVERSITY, MONTREAL, CANADA.

The formal opening of the new Macdonald Engineering Building at McGill University took place April 27th, 1909.

The new Engineering Building was erected to replace the old structure, which was burned to the ground on April 5th, 1907. Hardly had the ashes cooled before workmen were busy tearing down the walls, and very soon a new structure began to rise from the ruins. By the opening of the fall session of 1908 the building was ready for use, although some of the interior was yet to be completed.

The style of architecture made use of is severe in type, a modern Anglo-Classic style, but yet somewhat reminiscent of the old Scottish methods in regard to its details. The building practically lacks ornamentation, but what there is is symbolic of the different branches of science carried on within the walls. The external wall line of the building of 1893 was kept, except in regard to a rear wing, which was added to include a large lecture theatre, with a seating capacity of over two hundred persons. The structure is five storeys in height, and by means of an extra storey on the Workman Building 4,500 square feet of extra space has been added. One special feature of the new building, for which much was sacrificed, is the large laboratory on the ground floor, which is twenty-three feet in height.



Macdonald Engineering Building, McGill University.

The whole erection has been laid out with great care, and the large drafting and lecture-rooms, together with other rooms for every possible branch of the work carried on in the building, show with what care and foresight the designs have been made.

The ventilating system is of the most advanced type, providing, as it does, for from four to eight changes of purified and humidified air every hour by means of a fan furnishing 55,000 cubic feet of air per minute.

The fireproofing is also complete. Not only is everything constructed of non-inflammable material as far as possible, but the building itself has also been divided into six compartments by means of automatic fire doors, thus insuring absolute safety for at least five-sixths of the building.

It can thus be said that the new Macdonald Engineering Building is second to none on the continent, and Montreal may be proud of the fact that it is a "home-made" product, having for its architect, Professor Nobbs.

Reunion of Graduates.

All Wednesday morning and afternoon there was a steady influx of Science graduates from all over the world, returning to celebrate the first reunion in the thirty years of the existence of the Science Faculty at McGill.

The opening of the new building was one of the special features of this reunion, and the surprise and admiration with which each of the graduates entered the building was a striking tribute to those who have given their time and labor to its construction.

Any list of those present would of necessity be so inadequate that it is perhaps better to say that the invitations were issued, as much as possible, to engineers and to leading manufacturing and financial people, that is to say, to those who would especially take an interest in the Faculty of Applied Science. The old friends of the University were also present almost without a single exception. The formal opening of the new building, however, was only an incident in the reunion of the Science graduates. On Wednesday evening they held a large banquet at the Place Viger Hotel, Thursday they visited the Macdonald College at Ste. Anne de Bellevue, and on Friday they visited the Convocation of the Faculties of Applied Science and Arts.

Degrees in Faculty of Science, McGill.

The following were successful in securing their degree: Allen, Leslie Wilbur (El.), Haywards, Cal.; Baillie, Archibald F. (Ch.), Montreal; Babson, George Low (Mi.), Montreal; Baylis, Harold A. (Ci.), Montreal; Bradshaw, Walter Everett (Ci.); Briegel, Walter Oscar (El.), Montreal; Briggs, Arthur Francis Mayou (El.), St. Catharines, Ont.; Brown, Lindsay Osborne (Ci.); Brunton, Frederick Kemble (Met.), Denver, Col.; Burbidge, George Harrison (Ci.), Ottawa; Bryne, John H. (Arch. E.), Ottawa; Cate, Carroll (El.), Sherbrooke; Cantley, Charles Lang (Mi.), New Glasgow, N.S.; Cheesborough, A. Gordon (Ch.), Westmount; Conway, Edmund John (Met.), Ladysmith, B.C.; Coulin, Louis August (R.), Montreal; Davies, Harold Cameron, B.Sc. (El.), Hull, Que.; Dawson, Frederick James (Co.), Truro, N.S.; McLancey, James Arnold (Ci.), Middleton, N.S.; Dennis, W. Melbern (Ci.), O'Leary, P.E.I.; Dickieson, Arthur Logan (El.), Ottawa; Dickson, Garnet Horace (Ci.), Westmount; Drysdale, Charles W. (Mi.); Dwight, Herbert Bristol (Ed.), Picton, Ont.; Eakins, James Macdonalds (Mi.), Toronto; Edwards, Godfrey Basil (El.), Ashleworth, Eng.; Ford, Walter Stimson (Me.), Winnipeg;

Fox, Charles Harry (Ci.), Winnipeg; Fraser, Archibald N. (El.), Coaticook, Que.; Galbraith, William John (Ml.), Cap Rouge, Que.; Gall, Douglas Meikle (El.), Lachute; Goode, John Dudley (Me.), Westmount; Grove, Humphrey Shakespear (Me.), London, Eng.; Hague, Owen, C. F. (El.), Montreal; Heywood, Edward Percival (Ci.), Cambridge, Mass.; Hilborn, Percy R. (Mi.), Berlin, Ont.; Johnston, Harold Stanley (Ci.), Gananoque, Ont.; Kennedy, W. Alan (Mi.), Vancouver, B.C.; Ker, Frederic Innes (R.), Montreal; Layton, Shirley Thompson (Ci.), Letourneau, Marius (Ch.), Montreal; Lindsay, Alexander Mollison (El.), Invercargill, New Zealand; Lundy, T. H. D. (El.), Brantford, Ont.; McDougall, J. Cecil (Arch. E.), Montreal; McKinnon, Kenneth Royal (Me.), New Glasgow, N.S.; Will Falconer (El.), Douglastown, N.B.; McLean, Douglas Lauchlin (Ci.), Ottawa; Montague, T. Mortimer (Ci.); Mulock, Reford Henry (El.), Winnipeg; Murphy, A. A. (B.Sc., Queen's), (El.); Nairn, John Spencer (Mi.), Truro, N.S.; O'Neill, John J. (Mi.), Port Colborne, Ont.; Powell, William Hall (Ci.), Little Harbor, N.S.; Renaud, Bruce Gordon (Me.), Montreal; Richardson, Charles Edward (Me.), St. Mary's, Ont.; Rider, Ezra Byron (Mi.), Fitch Bay, Que.; Robb, Charles Alexander (Me.), Amherst, N.S.; Ross, Charles Catamer (Ci.), Hiltonburgh, Que.; Russell, Benjamin (Ci.), Halifax, N.S.; Sailman, Robert Thomas Heathfield (Ci.), Malvern, Jamaica; Saunders, Charles W. M. (Met.), Smith, George W. (Ci.), Montreal; Smith, Stanley M. (El.), St. John, N.B.; Soper, Arthur John (El.), Brockville; Spencer, Walter Hutchins, B.Sc. (Me.), Montreal; Stansfield, Maurice (Me.), Blackburn, Eng.; Stewart, Leighton (Mi.), Summerside, P.E.I.; Sutherland, Luther H. D. (Mi.), Montreal; Trotter, Clifford T. (El.), St. Johns, Que.; Wilson, Alexander (El.), Montreal; Winslow, Rainsford H. (Mi.), Fredericton, N.B.; Wisdom, Stuart (Mi.), Montreal; Yuill, Harry Hogg (Mi.), Truro, N.S.

(Arch. E.)—Graduate in department of architectural engineering.

(Ch.)—Graduate in department of chemistry.

(Ci.)—Graduate in department of civil engineering.

(El.)—Graduate in department of electrical engineering.

(Me.)—Graduate in department of mechanical engineering.

(Met.)—Graduate in department of metallurgy.

(Mi.)—Graduate in department of mining engineering.

(R.)—Graduate in department of railways.

RAILWAY ACCIDENTS IN CANADA.

For the year ending March 31st, 1908, the Board of Railway Commissioners for Canada report a total of 529 killed. In the following table a detailed list of accidents and class of persons affected is given. It is worthy of study:—

Character of Accident.	Passengers.		Employees.		Other Persons.		Total.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Derailment	25	213	19	55	....	....	44	268
Head-on collision	13	13	19	36	....	....	32	49
Stealing ride	....	....	....	....	6	5	6	5
While shunting	....	1	5	11	....	....	5	12
Riding on cars	....	....	1	....	....	....	1	....
Highway crossing	....	....	....	....	44	47	44	47
Falling off freight cars	....	....	5	39	2	1	7	40
Trespassing	....	....	....	....	92	53	92	53
Body found on track or bridge	3	....	7	....	51	....	61	....
While switching	....	20	29	74	2	1	31	95
Pitch-in with hand car	....	....	15	4	....	....	15	4
Died in train, natural cause	5	....	....	....	....	....	5	....
Working under cars	....	....	4	2	....	....	4	2
Struck looking out of cab window	....	....	3	8	....	....	3	8
Suicide (attempted to)	1	1	....	....	4	2	5	3
Struck by switch stand	....	....	....	7	....	....	....	7
Adjusting couplers, coupling and uncoupling	....	1	17	67	....	....	17	68
Passengers falling off passenger trains	4	14	....	....	....	....	4	14
Working on track	....	....	13	21	....	....	13	21
Working on bridge	....	....	....	2	....	....	....	2
Collision, rear-end	....	9	7	28	....	....	7	37
Collision, street car and steam car	....	....	....	....	1	5	1	5
Attempt to get on train while in motion	3	11	9	20	5	15	17	46
Side ladders	....	....	1	3	....	....	1	3
Falling between cars, walking on top of train while in motion	....	....	6	3	1	....	7	3
Fell off work train	....	....	....	2	....	....	....	2
Falling off hand-car	....	....	3	3	....	....	3	3
Farm crossing	....	....	....	....	1	....	1	....
Bridge burnt	....	....	3	....	....	....	3	....
Collision with cars standing foul or in yard	....	2	....	7	....	....	....	9
Private crossing	....	....	....	....	2	1	2	1
Working under engine	....	....	....	1	....	....	....	1
Locomotive explosion	....	....	5	6	....	....	5	6
Jumping off train while in motion	6	15	4	20	2	5	12	40
Riding on pilot of engine	....	....	3	6	....	....	3	6
Working on cars and engines	....	....	1	5	....	....	1	5
Overhead bridge	....	....	....	4	....	....	....	4
Unclassified	4	26	67	372	6	42	77	440
	64	326	246	806	219	177	529	1,309

THE STABILITY OF WALLS.

By Henry Adams, M.Inst.C.E., M.I.Mech.E., F.S.I., F.R.San.I.

(Continued from last week, Page 589.)

When the wind pressure is sufficient to cause the resultant to cut the base beyond the middle third there are two possible conditions, (a) owing to freshness of the work no tension is allowable on inner edge, (b) matured work permitting tension on inner edge. In the first condition, of no tension, the generally accepted theory is due to Prof. Crofton, of the Royal Military Academy, Woolwich, and is shown in Fig. 8. The base of the parallelogram of mean pressure and triangle of reactions, is set out three times the length of the distance from the resultant to the overturning edge; the depth of parallelogram is made equal to the mean pressure on the base supposing only that portion of the thickness effective, and the depth of triangle will be double the parallelogram. From this it results that the maximum pressure at outer edge will be

$$\frac{W}{3d} \times 2 = \frac{2}{3} \times \frac{W}{d} \quad \ldots\ldots (13)$$

Now the author finds some difficulty in accepting this theory, it appears to him reasonable that, as the base may be looked upon as a rigid body resting on a plane, the pressure might be divided in some way over the whole area, and he finds that Fig. 9 complies with all the theoretical tests he has been able to bring to bear upon it, and he offers this as an alternative to Prof. Crofton's theory. If it be the correct view it is important to give it due consideration, as the maximum pressure shown by it is greater than by the ordinary method. The maximum pressure K and the pressure directly under the resultant R, are given by the following formulæ:

$$K = W\left(\frac{2}{d} - \frac{4}{t}\right) \quad \ldots\ldots (14)$$

$$R = W\left(\frac{4d}{t^2}\right) \quad \ldots\ldots (15)$$

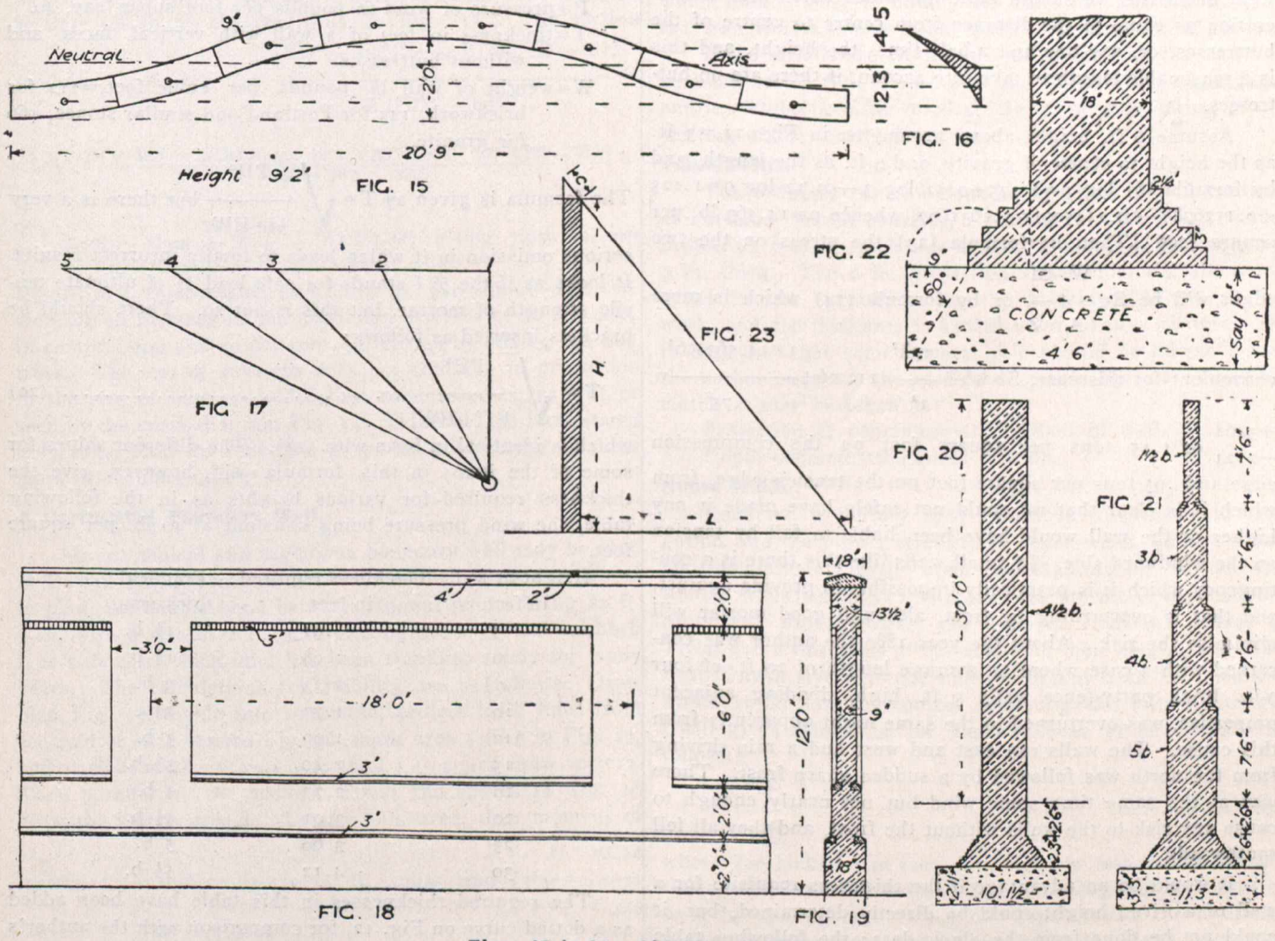
In the second possible condition, of the work being sufficiently mature to permit the mortar to resist tension on the inner edge, the ordinary formula for combining a longitudinal and transverse load, or direct load and bending moment, may be adopted—viz.:

$$S = \frac{W}{A} + \frac{M}{Z} \quad \ldots\ldots (16)$$

where S = stress in pounds per square foot at the edges, the + value being for compression side and — value for the tension side.

M = bending moment in pound-feet.

Z = modulus of section,* in foot units = $\frac{1}{6}$ t² for 1 ft. run of wall, or $\frac{1}{6}$ b h² for any other rectangular section. This will give reactions as in Fig. 10, and it is worth noting that whether the resultant is pushed over to the given position by wind pressure, or is there by reason of a direct vertical non-axial load, the resulting stress is the same.



Figs. 15 to 23.—Stability of Walls.

* Paper read before the Society of Architects.

* This section modulus Z is sometimes wrongly called moment of resistance, as for instance in catalogues of rolled joists where it appears as "moment of resistance in square inches."

Or, for 1 ft. run of a plain rectangular wall, the equation (16) may be conveniently given in the form

$$S = wh + \frac{3ph^2}{t^2} \quad \ldots\ldots (17)$$

Or by transposition

for compression $t=\sqrt{\frac{3ph_2}{Sc-wh}}$ . . . . . (18)

for tension $t=\sqrt{\frac{3ph^2}{St+wh}}$ . . . . . (19)

Stresses on Given Wall.

Now suppose we wish to determine the safe height for a 9in. wall in stock bricks and grey lime mortar, the formula and table show that the probable wind pressure will vary with the height and length, but in the case of a boundary wall it would manifestly be unsafe to take the whole length in estimating the wind pressure, as it is possible for a portion of it to blow down and leave the remainder standing. If there were buttresses we should limit the width taken into consideration as equal to the distance from centre to centre of the buttresses, or, say one and a-half times the height, and this is a reasonable length to take into account if there are no buttresses.

Assume 6 ft. height above ground as in Fig. 11,=3 ft. as the height to centre of gravity, and 9 ft. as the length, and by formula (6) log p=1.125+0.32 log 3 — 0.12 log 9=1.125 +0.1526788 — 0.1145091=1.1631697, whence p=14.563 lb. per square foot. Then by formula (13) the stress on the two edges will be $S=\frac{W}{A}+\frac{M}{Z}$, or by formula (14) which is more convenient for this case, $S=wh+\frac{3ph^2}{t^2}=112\times6+\frac{3\times14.563\times6^2}{.75^2}=$ $+3468$ -2124 or 1.55 tons per square foot on the compression edge and .95 tons per square foot on the tension edge, from which it is clear that we could not safely have made it any higher or the wall would have been liable to fail by tension on the windward side. In small walls like this there is a contingency which it is practically impossible to provide against, and that is overturning by frost, although good mortar will minimise the risk. About the year 1880 the author was concerned with a case where an average length of 20 ft. of four 9-in. brick party-fence walls 5 ft. high, dividing adjacent properties, was overturned in the same night apparently from this cause. The walls ran east and west and a rain driving from the north was followed by a sudden sharp frost. There was at the same time some wind but not nearly enough to cause any risk to the walls without the frost, and they all fell southwards.

It would be an advantage if the thickness requisite for a wall of a given height could be directly determined, but it could not be done from the above data; the following table may, however, assist in designing plain boundary walls upon the basis of formulæ (7) and (16).

Safe Thickness of Plain Boundary Walls.

Height of wall in feet.	Wind pressure allowed for in lbs. per sq. ft.	Thickness required in feet. For compression	For tension	say
5	14.04	.41	.61	1 b.
6	14.56	.5	.73	1 b.
7½	15.22	.66	.91	1½ b.
10	16.13	.93	1.29	2 b.
12	16.87	1.16	1.42	2 b.
15	17.09	1.51	1.71	2½ b.
18	18.13	1.93	2.03	3 b.
20	18.52	2.23	2.23	3 b.
25	19.82	3.0	2.67	4 b.
30	20.00	4.0	3.10	5½ b.

The figures are plotted to curves on diagram Fig. 12, and it is interesting to note that below 20 ft. high the wall would be likely to fail by tension and above 20 ft. by compression, as the curves cross each other at that limit. Curves for the other formulæ are also shown upon the same diagram.

In deciding upon the thickness of a wall it should be remembered that the compression may be increased with less risk than the tension.

Hurst's Formula.

Hurst's Architectural Surveyors' Handbook (13th edition, p. 121) gives a formula for the stability of enclosure walls as follows:

f = the adhesive force per foot super attained by the mortar at the end of, say, six months, for brickwork in cement mortar 1 cement to 1 sand=6,000 lb., 1 to 2=5,000, 1 to 3=4,000; for brickwork in grey lime water 1 to 2=3,600; for brickwork in ordinary lime mortar 1 to 2=3,000.

H=height in feet above ground.

P=pressure of wind in pounds per foot super, say, 40.

T=thickness in feet of a wall with vertical faces and without buttresses.

W=weight of wall in pounds per cubic foot,=112 for brickwork, 145 for Portland and similar stones, 166 for granite.

The formula is given as $T=\sqrt{\frac{PH^2}{\frac{1}{2}f+HW}}$ but there is a very serious omission in it which leads to totally incorrect results. It looks as if the ⅓ f stands for safe load ⅓ of ultimate tensile strength of mortar, but this is not so. There should be brackets inserted as follows:

$$T=\sqrt{\frac{PH^2}{\frac{1}{3}(f+HW)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (20)$$

which is identical in form with (18). The different values for some of the items in this formula will, however, give the thickness required for various heights as in the following table, the wind pressure being constant at 40 lb. per square foot.

Height of wall in feet.	Thickness required in feet.	Practical thickness.
5	.91	1½ b.
6	1.08	1½ b.
7½	1.33	2 b.
10	1.73	2½b.
12	1.99	3 b.
15	2.40	3½ b.
18	2.77	4 b.
20	3.01	4½ b.
25	3.60	5 b.
30	4.12	5½ b.

The required thicknesses in this table have been added as a dotted curve on Fig. 12, for comparison with the author's own values, which he believes to be safe.

A straight line formula has also been given for the thickness of fence walls—viz.:

$h=6\frac{2}{3}\,t$ . . . . . (21)

whence $t=\frac{3h}{20}$ . . . . . (22)

This would give proportions as shown by line A on Fig. 12.

For a practically safe and simple rule the author would suggest that the minimum thickness of any fence wall should be 1/9 of the height which is shown by line B on Fig. 12.

Practical thickness.	Maximum height. Ft.	In.
1 b.	6	9
1½ b.	10	1½
2 b.	13	6
2½ b.	16	10½
3 b.	20	3
4 b.	27	0

Walls With Piers.

A boundary wall may be strengthened by the simple addition of projecting piers or pilasters built at intervals of,

say, 1½ to 2½ times the height or 15 or 20 times the thickness on one or both sides of the wall, either opposite each other or "breaking joint" with each other at equal intervals. Technically a pier on the side next the wind is a counterfort and a pier on the opposite side is a buttress.

A very curious anomally occurs in connection with these buttresses, which would not be credible except for mathematical proof. An illustration will explain. Assume a 9-in. brick wall 6 ft. high and consider a length of 12 ft. unattached; let the brickwork weigh I cwt. per cubic foot and the wind blow horizontally with a force of 28 lb. per square foot at right angles to the face. Then the maximum stresses on the base will be $\frac{W}{A} \pm \frac{M}{Z} = \frac{12 \times 6 \ .75 \times 112}{12 \times .75} \pm \frac{12 \times 6 \times 28 \times 3}{\frac{1}{6} \times 12 \times .75^2} = 672 \pm 5{,}376$ $= 6{,}048$ lb. per square foot compression, and 4,704 lb. per square foot tension. Now add a buttress 18 in. wide and projecting 4½ in. in the centre as in Fig. 13. The section modulus will be

$$Z = \frac{(BD^2 - bd^2)^2 - 4\,BDbd\,(D - d)^2}{6\,(BD^2 - bd^2)} =$$

$$\frac{(12 \times 1{\cdot}125^2 - 10{\cdot}5 \times {\cdot}375^2)^2 - 4 \times 12 \times 1{\cdot}125 \times 10{\cdot}5 \times {\cdot}375\,(1{\cdot}125 - {\cdot}375)^2}{6\,(12 \times 1{\cdot}125^2 - 10{\cdot}5 \times {\cdot}375^2)} =$$

$\frac{68.4}{82.3} = 0.83$. Then $\frac{W}{A} \pm \frac{M}{Z} = 672 \pm 7{,}287$ giving 7,959 lb. per square foot compression and 6,615 lb. per square foot tension, or an increase in the maximum stresses of 30 per cent in compression and 40 per cent. in tension by adding the buttress. The loss of strength does not continue in proportion to the size of buttress added, but soon reverses, as will be seen by the curve diagram Fig. 14. However, the facts stated give some food for reflection as to the advisability of these piers in ordinary cases.

A Corrugated Boundary Wall.

An economical and ingenious boundary wall may be seen at Easton Park, Wickham Market, Suffolk. It is corrugated in plan, the double bend between tangent points being 20 ft. 9 in. with a rise of 2 ft., and although it is 9 ft. 2 in. high it is only 9 in. thick, and has been standing safely for many years. The calculations for stability are as follows: Draw plan Fig. 15, divide into segments, project force lines from centroid of each toward Fig. 16, mark area 1 to 5 in Fig. 17, and at right angles draw 1 — 0=half 1 — 5, and draw vectors. Then parallel to the vectors across the spaces in Fig. 16 draw the inertia area a. Let A=total area, then moment of inertia $I = Aa = 16 \times 0.64 = 10.24$ ft. units, and $Z = \frac{I}{y} = \frac{10.24}{1.375} = 7.44$. Ratio $\frac{W}{A} = \frac{112 \times 9\frac{1}{6}}{1} = 1{,}026$ lb. per square foot, and for a maximum stress of 3 tons per square foot, $\frac{A}{W} + \frac{Z}{M} = 3 \times 2{,}240$; $\frac{W}{A} = 1{,}026$, therefore $\frac{M}{Z} = 6{,}720 - 1{,}206 = 5{,}694$, whence $M = 5{,}694 \times 7.44 = 42{,}363$ lb.-ft. The leverage of the wind pressure $= \frac{9.16}{2} = 4.58$ ft., therefore $\frac{42{,}363}{4.58} = 9{,}249$ lb. total allowable pressure. Area of unit of wall $= 20.75 \times 9.16 = 190.2$ sq. ft., giving the maximum wind pressure per square foot $= \frac{9{,}249}{190.2}$ $= 48.56$ lb. With this wind pressure the stress on the inner edge will be $\frac{W}{A} - \frac{M}{Z} = 1{,}026 - 5{,}694 = -4{,}668$ lb. or 2.085 tons per square foot tension, whence it appears that the maximum safe wind pressure is 48.56 lb. per square foot for a maximum compression of 3 tons per square foot and tension of 2 tons per square foot.

Panelled Walls.

Panelled walls, Figs. 18 and 19, may be desirable on account of appearance, but they involve extra labor, and their weight being reduced they have less stability than a solid wall. They would be calculated at the base the same as a solid wall of the reduced weight, at the top of plinth in the same way, and at base of panel the same as a wall with buttresses and counterforts.

Walls With Set-Offs.

By making a series of set-offs on each side of a wall 30 ft. high, at heights of 7 ft. 6 in., about 20 per cent. may be saved in the bulk above ground line, as shown in Figs. 20 and 21, but the extra cost of blue brick weathering at each set-off must be added, together with the increased cost of wider foundations, to obtain the same life and stability, so that no ultimate saving would result from this form of section.

If the set-offs are all on one side of the wall the wall will be more stable than above with the wind on the plain face, and less stable with the wind on the set-off side, owing to the shifting of the centre of gravity.

Foundations.

The ordinary concrete foundation under a wall consists of Portland cement concrete, 1 cement, 2 sand, 5 aggregate, projecting 6 in. on each side of bottom course of footings and 9 in. thick. The 6 in. projection arises from the allowance given in the excavation for the bricklayer to get at his work, and the thickness is settled upon no rule whatever. It is desirable that some general rule should be adopted, and the author suggests the method shown in Fig. 22. Approximately it may be taken as

Projection of concrete=½ thickness of wall.

Depth concrete=thickness of wall.

House Walls.

Rondelet, a century ago, undertook a scientific investigation into the proper strength of house walls, and he based his calculations largely upon an examination of ancient Roman walls which had withstood the storms of eight or ten centuries. Among these, the walls of Hadrian's palace at Tivoli had a thickness of one-sixteenth their height, and that, Prof. Unwin states, is not widely different from the thickness which would now be required in strong and lofty buildings. Gwilt gives a formula for the thickness of brick walls as follows:

$$T = \frac{HL}{ND} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (23)$$

where T=thickness in feet, H=height in feet, L=length between party or cross walls in feet, D= diagonal of length of walk by scaling or $\sqrt{H^2+L^2}$, N=constant=22 for dwelling-houses, 20 for warehouses, 18 for public buildings, increased to 27, 23 and 20 respectively when H is less than ½L Rubble stone walls to be ⅓ thicker than those of brick.

His rules for modern use can be put into a formula as follows:

$$t = \frac{Lc}{\sqrt{L^2+H^2}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (24)$$

where t=thickness of wall in feet, H=height in feet, L= length of wall in feet, $c = \text{constant} = \frac{H}{12}$ for warehouses, and $\frac{H}{20}$ for dwelling-houses. Graphically it may be worked as shown in Fig. 23.

According to Mitchell's Brickwork and Masonry (second edition, p. 195) it has been stated by an "eminent authority" that he should consider a wall overhanging 1 in 24 not unsafe, and dangerous when it overhangs 1 in 12; but, from the principles which have been placed before you this evening, it is clear that any statement of this kind is irrational, unless made in connection with a wall of a given height and thickness, as the stability will be affected by both these dimensions when the rate of overhang is constant.

THE
Sanitary Review
SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

SEWAGE DISPOSAL.

Removal of Suspended Matters.

Sewage generally may be said to consist of a mixture of saline matter in solution and nitrogenous carbonacious organic matter in solution and suspension together with a certain amount of grit and mineral matter. The objects to be aimed at in its purification are the removal of the suspended matters and the oxidation of the remaining organic matter and ammonia.*

It is generally accepted that the removal of the suspended matters, and the matters in solution form two distinct processes, and are now generally treated separately by works dealing with sewage disposal.

It is possible to combine the two processes in one. Sewage from which the solids have not been previously removed has been for a short period successfully treated by coarse filters, but it has not been found practicable to continue this process, as the filters are clogged by the retained solids, which are only oxidized at very slow rates. Apart from the organic solids amenable to oxidation, there is also, especially when the combined system of drainage is in vogue, a large quantity of indissoluble matter such as sand and earth from the streets and roads. It is, therefore, found expedient to remove from sewage practically the whole of the inorganic solids and coarse organic solids together with as large a percentage of the finer organic solids as possible, before subjecting the sewage liquor to oxidation or nitrification.

Particular conditions occasionally occur when only the first process "removal of solids" is necessary in connection with sewage disposal. Such is the case, when it is required only to remove matter creating visible offence, it not being a question of providing against contamination of water supply, or discharging a liquid subject to putrefaction into a small body of water.

Ordinarily, the strength of domestic sewage depends on the amount of dilution by water supply. Towns using from 25 to 30 gallons of water per head per day present a fairly strong sewage, containing about 40.00 parts of suspended solids per 100,000. Sewage of about average strength contains about 30 parts of suspended solids per 100,000 and may represent a water supply of from 30 to 40 gallons per head per day, while weak sewage may be represented by anything of from 10 to 20 parts of suspended solids depending on excess of water either from waste or subsoil connections to the sewers.

It will be at once seen that the amount of actual solids in suspension in sewage in proportion to the total volume is small. Taking strong sewage at 40 parts in 100,000, this only represents 2.4 cubic yards of solids per 1,000,000 gallons of sewage.

Although the suspended solids in sewage only represent about one-tenth of the objectionable matter, they provide more difficulty in treatment than the remaining nine-tenths. In fact it is the solids which present the sludge difficulty in connection with sewage treatment. It is not only a question of separating the liquid from the solids, but it is a question of what is to be done with the solids after separation.

* Royal Commission Report on Sewage Disposal, 1908.

This remains just as much a difficult problem as it did before the modern methods of biological sewage treatment were introduced.

So called "natural sludge destroyers," tanks built on certain principles designed to eliminate sludge by putrefactive processes are now acknowledged failures.

It is the purpose of this and following articles to deal with various methods of separating solids, their after treatment and disposal.

Sedimentation.

The most simple method of removing solids in suspension from sewage is by sedimentation, or making use of the power of gravity to drag down the heavier matters contained in sewage.

Liquid sewage is ordinarily capable of retaining in suspension matter heavier than the liquid, because of the velocity at which it travels. In order to maintain in a sewer a condition which does not allow of solids settling in the sewer, it is necessary to maintain a velocity of at least two feet per second running half full. The moment the travelling velocity falls below this rate, sediment at once collects, and we have what is called a sedimentation tank.

The amount of solids which can be extracted from sewage depends greatly upon the character of the sewage, some forms of sewage which may contain brewery or tannery waste are difficult to settle; and no absolute rule can be laid down either as to the reduction of velocity or the time required to obtain the maximum amount of settlement.

When the sewage is allowed to stand in a quiescent state in a tank for a length of time and then the supernatent liquor carefully drawn off by means of a floating arm, a maximum amount of settlement is obtained. This system has, however, practical objections, requiring constant attention, and this maximum settlement is probably in very few cases required.

Maximum settlement of solids is required when a very high degreee of purification is aimed at by sand or other fine material filtration.

The method of settlement generally adopted is that known as "Continuous Flow Sedimentation."

The principal is, that the sewer is widened out into a large area, either rectangular or circular in shape, forming a large deep pool producing partial quiescence, but yet allowing the whole of the sewage to flow through at rates of about ⅛-inch to ⅓-inch per second.

The following experiments carried out by the Royal Commission at Clifton, Halton, Oswestry and Dorking with rectangular tanks are interesting, showing the results of extraction of solids at different times of settlement and rates of flow: —

	Tank	Time allowed	Rate of flow per minute	Percentage extraction of solids
Clifton	39′ × 5′ × 4′	5.3 hrs.	1′ 7″	51%
Halton	25′ × 12″ × 6′	15.5 hrs.	.66″	40%
Oswestry ..	70′ × 15′ × 4′ 6″	4.1 hrs.	3′ 40″	53%
Dorking ...	18′ 6″ × 4′ 6″ × 4′ 9″	11.9	.31	50%

The amount of settlement does not depend alone on the period of flow, but also on various other factors such as the shape of the tank, the nature of the suspended matter in the

sewage, and the length of time the tank is used without being cleaned.

If the tank is not cleaned out frequently, the deposited sludge begins to ferment and the gas produced carries suspended matter with it, as it rises to the surface of the liquid, considerably diminishing the extractive efficiency of settlement.

The question, generally, of rectangular tanks, their size and shape, and velocity and time of settlement will receive further attention in future issues.

We wish in this issue to deal more particularly with a form of tank used for "Continuous Flow Sedimentation," known generally as the Dortmund form of tank.

This tank is circular, built in the form of an inverted cone, and is made very much deeper than rectangular tanks.

The form is of particular interest at present, as we understand a modification of the type is about to be adopted at Toronto's proposed sewage works.

The main advantage which is claimed for this form of tank, is facility for sludge removal. Fig. 1 shows a section,

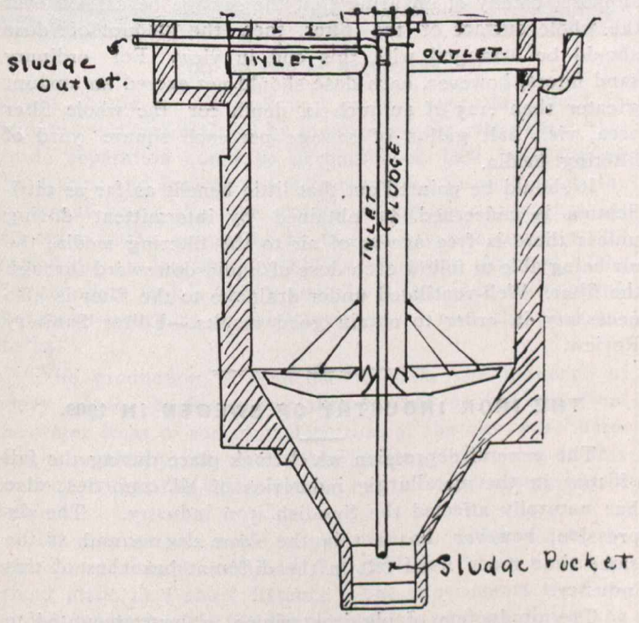


Fig 1. Dortmund Tank.

and gives a general idea of this form of tank. It was constructed by Kniebuhler at Dortmund, in 1886. It was made about 45 feet deep and about twenty feet diameter at top tapering into the pocket or inverted cone at the base. The sewage is conveyed into the tank and discharged at a point in line with the head of the inverted cone, or at about two-thirds the depth of the tank. The sewage rising at a velocity of about .02 inch per second, the solids in suspension leave the sewage and collect in the inverted cone, and are either pumped through the pipe let down into the pocket, or extracted as shown in Fig. 3.

By the latter method of extraction the head of sewage is utilized to drive out the sludge.

The principal advantage of this form of tank, or well as it may be more properly defined, consists in the concentration of sludge in a pocket from which it can be more readily extracted, than from the flat base or partially inclined base of a rectangular tank.

Although the Dortmund is generally taken as the basis of this form of tank, we also show a form of tank which preceded it in Germany, viz. (Fig. 2), the Muller and Vahnsen tank. A glance at the section will show that the principal is the same in both cases.

This form of tank has received very little favor in Great Britain, in fact most eminent experts have declared that deep tanks are only applicable when sedimentation is accompanied by chemical precipitation, and practically in this sense only have these tanks been adopted.

They received most attention about fifteen years ago in the form of a patented process called "Ives Patent," which consisted simply of a Dortmund tank in which sedimentation was assisted by allumino ferric.

A few years ago Mairich demonstrated that good results can be obtained from well tanks at Stargard and Neustadt in Upper Silesia, and this without the use of chemicals. Mairich has since constructed similar tanks at Ohrdruf, Langensalya, and at Guben, where 84 tanks are in use. He aims at

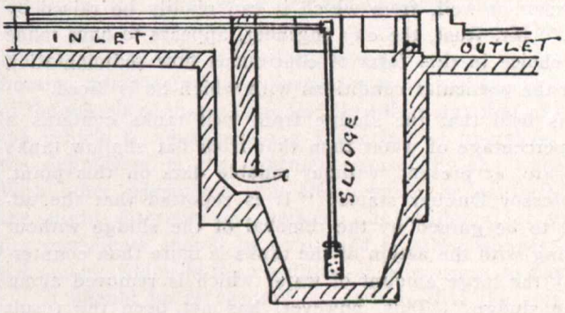
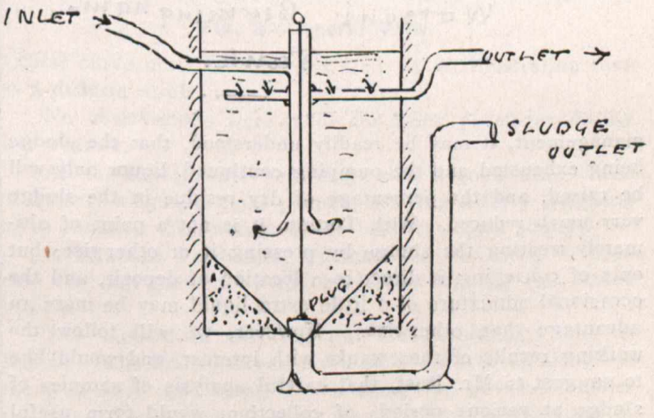


Fig 2.
Müller & Hansen Tank.

a capacity equal to two hours flow with an upward velocity .02 inch per second, and has invariably obtained good results. The opinion as expressed by English experts, noted above, requires modification.

The only engineer of repute (to our knowledge) who has adopted this form of tank is Mr. John Watson, of Birmingham; paragraph 54 Royal Commission Report states: "At Birmingham Mr. J. D. Watson interposes modified Dortmund tanks between the septic tanks and the continuous filters. He states that the average of nearly a year's observations shows that the Dortmund tanks removed 75 per cent. of the suspended matter from the Birmingham septic tank linquor." *



Mairich's Tank
Fig 3

At Birmingham no chemicals are used and simple sedimentation is relied on.

Fig. 4 shows the modified form of Dortmund tank as adopted at Birmingham. Watson is, we think, rightly of the opinion, that the cylindrical portion of the Dortmund tank is unnecessary, since the velocity of the sewage in this portion must be uniform. He attaches the greatest importance to the conical shape, in which the velocity must diminish as it rises. In Birmingham the sludge is removed from the tank by the head exerted by the contained sewage.

---

* Septic tank liquor at Birmingham contained (year 1904) 19.5 parts per 100,000.

Watson recommends the adoption of these deep well tanks, because the sludge is concentrated and more easily removed.

There is a decided objection to their adoption for small installations, because the constant removal of sludge requires constant attention; on the other hand when it is a question of daily removal of sludge (as at Toronto), there is no reason but that they should be eminently suitable.

At Toronto it appears to be a question of daily pumping the sludge by means of electric pumps. It is therefore very necessary that the sludge should be automatically presented in a pocket or well, from which it can readily be raised by suction. Mr. Rust, the city engineer, appears to have made a wise choice in this form of continuous flow sedimentation to meet the particular conditions with which he is faced.

It is held that the sludge from well tanks contains a larger percentage of water than that from flat shallow tanks but we are, at present, without reliable data on this point.

Professor Dunbar states: "It is reported that the advantage to be gained by the removal of the sludge without interfering with the action of the tanks is more than counteracted by the large amount of water which is removed along with the sludge." This, however, has not been the result at Birmingham. With careful management, we see no reason for this criticism. On the other hand, with careless

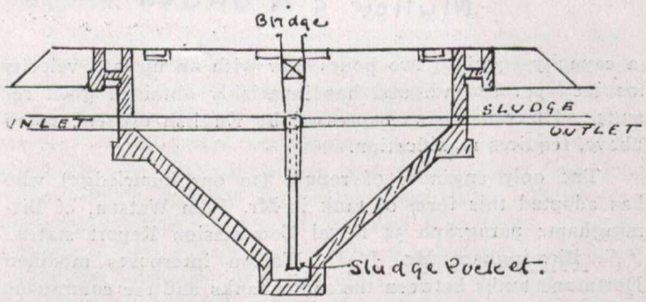


Fig. 4.

Watson's Birmingham Tank.

management, it may be readily understood, that the sludge being exhausted and the pumping continued, liquor only will be raised, and the percentage of dry residue in the sludge very much reduced. With Toronto it is not a point of ultimately treating the sludge by pressing it or otherwise, but only of conveying it direct to a location of deposit, and the occasional admixture of a little extra liquid may be more an advantage than otherwise. However, we will follow the working results of these tanks with interest, and would like to suggest to Mr. Rust, that careful analysis of samples of sludge at various periods of collection, would form useful engineering data. It is obvious that the sludge being allowed to accumulate to a certain depth, the lower layers will contain less water than the upper. Just how much sludge at each time of pumping should be extracted so as to give a maximum percentage of dry residue, without interfering with the only partially settled layer, would be interesting and useful.

In our next issue we intend to treat more particularly with rectangular tanks.

(To be Continued.)

In our issue of April 23rd, on page 572, we stated that the Toronto, Hamilton and Buffalo Railway Company were acquiring property for a new union station in Hamilton. We are informed by Mr. Fisher, general superintendent of the road, that this is entirely incorrect.

QUESTIONS AND ANSWERS

Questions or Suggestions are welcomed. They will be carefully considered by experts

E. R. G. writes further with regard to a small sewage disposal system, the particulars of which he gives as follows:—

Sewage discharge per day, 250 gallons; treated in septic tank, 18 hours' flow capacity; sub-surface filters, taking .14 gallons per square foot per day, distributed by 3-inch drain tiles, the tiles being 12 to 18 inches below the surface of the filters, the filtering media in one case being coarse, washed sand, and in the other, sandy loam.

It is asked, How often should the filter beds be dosed and yet maintain efficiency?

Ans.—It is evident from the amount, .14 gallons per day per square foot, given by "E. R. G.", that the quantity per day is exceedingly small with which the filters have to deal. With such an arrangement as described, if it is required to dose the filter intermittently, for purposes, we suppose, chiefly of ensuring that the sewage be carried over the whole surface of the filter, then the amount of dose should be arranged with this end in view. For ordinary sand filters, however, each dose should not exceed an amount greater than .125 of an inch in depth for the whole filter area, viz., half gallon of sewage per each square yard of filtering media.

It should be pointed out that little benefit as far as nitrification is concerned is obtained by intermittent dosing unless there is free access of air to the filtering media, the air being able to follow each dose of liquid downward through the filter. Well-ventilated under drainage to the filter is also necessary in order to obtain good results.—Editor Sanitary Review.

THE IRON INDUSTRY OF SWEDEN IN 1908.

The general depression which took place during the fall of 1907 in the metallurgic industries of all countries, also has naturally affected the Swedish iron industry. The depression, however, has not in the same degree and at the same time made itself felt in the different branches of this industry.

The production of pig iron, which in 1906 amounted to about 600,000 tons and in 1907 reached 615,000 tons during 1908, again went down to 560,000 tons. The export of pig iron during 1908 went down some 22,700 tons, viz., to 107,100 tons as compared with the export in 1907.

The yearly production for each of the years 1906-1908 shows the following figures for the different kinds of iron:—

Year	Pig iron	Smelting iron	Bessemer Cast iron goods	Martin Cast iron goods
1906—tons	595,200	178,300	86,400	302,400
1907 "	603,400	177,100	77,000	334,200
1908 "	563,300	148,500	79,500	347,600

The export for the same period of the corresponding k nds of iron was:—

Year	Pig iron	Smelting iron	Cast iron	Bar iron
1906—tons	112,200	27,000	16,200	200,700
1907 "	129,800	32,700	11,700	313,100
1908 "	102,100	20,200	6,400	359,000

The total export in 1908 of iron of different kinds shows a decrease of 86,400 tons as compared with the export in 1907.

During the late years considerable amounts of money have been spent on the equipment of the Swedish iron ore mines with modern machinery. This industry has thus become one of the most important export branches of the country and has considerable influence on the trade balance. The quantity of iron ore exported during 1908 amounted to 3,654,186 tons, of which the greater part or about 86 per cent. comes from mines in Norland and Central Sweden.

SOME EXPERIMENTS ON THE RESISTANCE OF PAVEMENTS.*

By A. C. D. Blanchard, A.M. Can. Soc. C.E., Assistant Engineer, Toronto, Ont.

The City of Toronto, in the year 1908, was party to an application before the Dominion Board of Railway Commissioners for the abolition of grade crossings along its water-front. The railway companies interested held that the

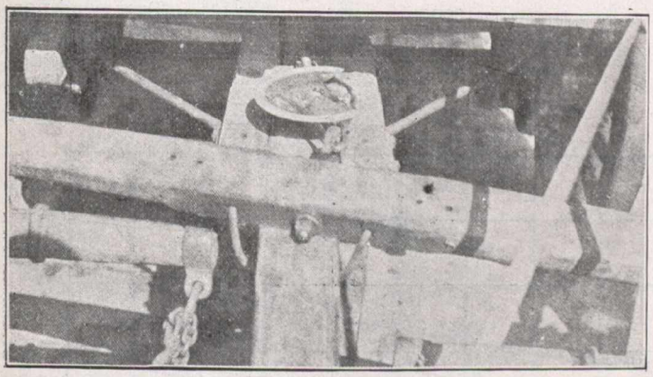


Fig. 1—Top of Apparatus.

streets should be elevated and carried over the tracks by bridges. It was claimed by the city, on the other hand, that grade separation could be accomplished best by elevating the tracks and leaving the streets at the present level, the argument being that the grades on bridge approaches for vehicular traffic, suggested by the railway companies, would exceed the grades which would be otherwise obtained. The city therefore took a strong attitude in favour of maintaining the street-crossings at the present level and elevating the tracks.

The production of evidence to show the influence of heavy grades in increasing the expense of haulage from the water front to the central portion of the city was, therefore, a necessary part of the city's case; and it was in this connection that the writer carried out the experiments herein set forth.

No attempt was made to ascertain the endurance of the horses or the amount of load that could be drawn up an inclined plane in a short distance. The experiments were intended to cover solely the simple problem of determining the resistance of pavements to tractive effort.

The pavements included in the experiments are as follows: Asphalt, bithulithic, brick, cedar block, granite block, and treated wood block.

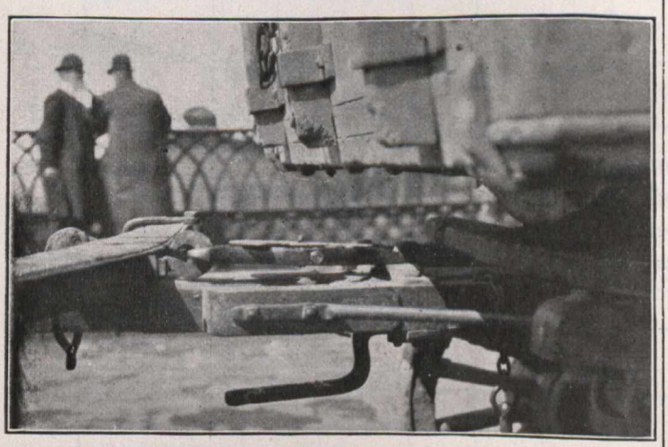


Fig. 2—Side View of Apparatus.

It seemed advisable to separate the results obtained under the conditions of wet and dry weather.

All the experiments were made in the month of May, 1908, under various conditions of summer weather, and several different classes of pavements were investigated with the view of making comparisons. For this purpose a selection was made from a list of a large number of paved streets having different characteristics with regard both to gradient and condition. The average pavement of each class is probably represented in the curve showing average results.

It will be seen from analysis of the results that the curves plotted approximate straight lines, and they have been made to correspond to straight line formulae.

Some slight discrepancy will be noticed between the results obtained under conditions of wet and dry weather among all the pavements considered, but the only serious difference occurred in the case of asphalt. In dry weather, owing to the increase of temperature and the heat of the day, the results for asphalt varied considerably from hour to hour. Under the influence of the sun the pavement became much softer, and formed a wavy surface in advance of the wheels of the vehicle, and the effect was that of causing the vehicle to advance along a continuous up-grade, due to the depression in the pavement caused by the wheel load. With other pavements this effect would be negligible, and the slight discrepancies between the readings for wet and dry pavements should be attributed to other sources, principal among which is the condition of each separate pavement.

It should be recognized, of course, that the soft conditions of an asphalt pavement occurs only during the summer months, and is not a feature throughout the year. It should be stated also that while the curve has been given for this pavement during the warm weather conditions, this particular curve must be regarded more as an illustration than as a definite result.

Fig. 3—General View.

No observations were made for brick pavement during wet weather.

All the experiments were made with a good steady team of horses, weighing 2,940 pounds, drawing a lorry weighing 2,710 pounds. The weight of the load was 8,570 pounds.

A standard Fairbanks dynamometer was used to indicate the pull exerted by the horses in drawing the loaded vehicle.

The method of carrying out the experiments was as follows: The first observer paced off the distances alongside the load as it was being drawn along the pavement under the test. The second observer was stationed at the front of the lorry, in such a position that he could watch the readings shown by the dial of the dynamometer. At each ten paces the first observer called out the tally, and the second observer gave the first observer the average reading of the dial during the ten paces. This was noted by the first observer in his note book, while continuing his pacing.

The lorry was of the ordinary type, and the dynamometer was arranged between the double tree of the lorry and the rear end of the tongue in such a way that all the load was carried through to the dynamometer, the tongue serving merely as a guide for the vehicle.

A summary of the observations made, and three illustrations of the method of attaching the dynamometer, and the plotted curves of the average results of the experiments, are submitted herewith.

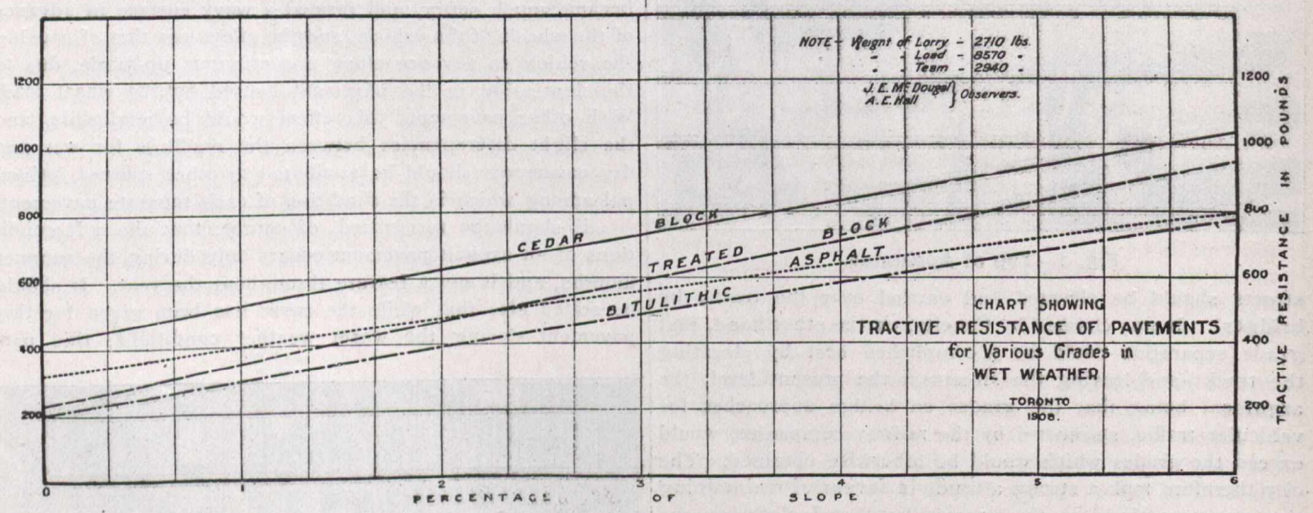
The work was supervised by the writer under instructions from Mr. C. H. Rust, M. Can. Soc. C.E., city engineer, Toronto.

* Read before the Canadian Society of Civil Engineers, April 29th, 1909.

PAVEMENT—ASPHALT.

Observations made May 14th and 18th, 1908.

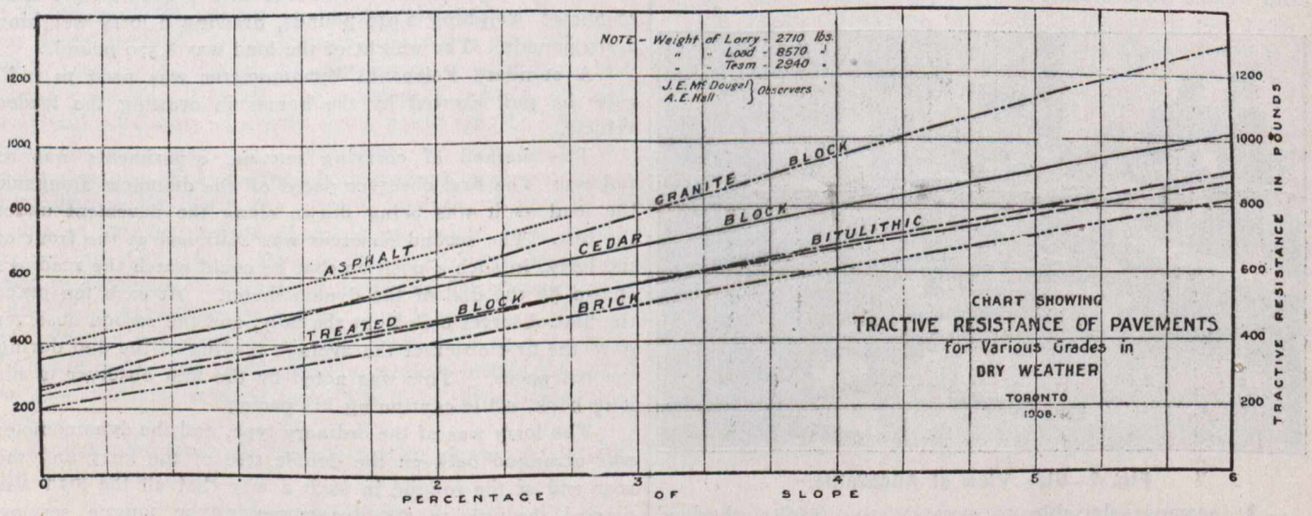
Street	Distance	Grade	WET Starting Pull	WET Average Pull	DRY Starting Pull	DRY Average Pull	Remarks
Yonge Street—	Cumberland to Yorkville	.2	1,300	325	1,400	400	Badly worn
	Agnes to Edward	.37	1,300	330	1,400	520	Good condition
	Edward to Elm	.75	1,400	360	1,500	600	Good condition
	Davenport to Collier	1.00	1,400	425	1,400	480	Poor condition
	180 feet North of Severn	2.60	1,400	500	1,400	650	Poor condition
	McGill to Carlton	2.47	1,200	530	1,500	760	Good condition
	Carlton to Wood	2.65	1,400	540	1,450	760	Good condition
Bain Avenue—	100 feet east of Broadview	4.0	.....	...	1,500	650	Good condition
Gerrard Street—	Logan to Howland	1.6	.....	...	1,400	500	Good condition



PAVEMENT—BITULITHIC.

Observations made May 13th and 14th, 1908.

Bain Avenue—	200 feet west of Carlaw	1.09	.....	...	1,200	370	Good condition
	200 feet west of Pape to 300 feet west	1.5	.....	...	1,200	400	
	100 feet west of Pape to 200 feet west..	3.0	.....	...	1,300	575	
	100 feet west of Pape to 200 feet west..	4.0	.....	...	1,400	675	
Park Road —	100 feet from Bloor	.73	1,200	275	.....	...	
	100 feet north to 200 feet north of Bloor	.2	.....	200	.....	...	Good condition
	200 feet north to Bismarck	.3	.....	250	.....	...	
Collier Street—	100 feet west from Park Road	3.4	1,400	575	.....	...	
	100 feet west to 200 feet west	3.1	.....	450	.....	...	
	200 feet west to 300 feet west	.73	.....	375	.....	...	Good condition
	300 feet west to 500 feet west	1.32	.....	300	.....	...	
	500 feet west to 550 feet west	.16	.....	200	.....	...	



BRICK PAVEMENT.

Observations made June 4th, 1908.

Dundas Street—	400 feet north of Queen	1.06	No results recorded on		1,000	290	Good condition
Queen to Arthur—	400 ft. north to 800 ft. north of Queen	.87	this pavement in		.....	300	
	800 ft. north to 900 ft. north of Queen.	1.25	wet weather		.....	350	
	900 ft. north to 1,000 ft. north of Queen	1.09	.....	...	.....	300	

		WET		DRY		
		Starting Pull	Average Pull	Starting Pull	Average Pull	Remarks
1,000 ft. north to 1,100 ft. north of Queen	2.41	.....	...	.....	350	
1,100 ft. north to 1,400 ft. north of Queen	2.60	.....	...	1,000	400	
1,400 ft. north to 1,600 ft. north of Queen	2.75	.....	...	.....	475	
1,600 ft. north to 1,900 ft. north of Queen	2.16	.....	...	.....	400	
Queen St. Subway West Grade —200 feet east of Dufferin	None	.....	...	900	200	
100 feet west of Dufferin	4.58	.....	...	.....	700	
100 feet east to 200 feet west of Dufferin	4.2	.....	...	.....	700	Good condition
200 ft. west to 300 ft. west of Dufferin	3.95	.....	...	.....	700	
300 ft. west to 400 ft. west of Dufferin	1.85	.....	...	.....	450	
Close Avenue Springhurst to King —400 feet north of Springhurst	3.35	.....	...	900	520	
400 feet north to 600 feet north	2.25	.....	...	.....	450	
600 feet north to 800 feet north	2.0	.....	...	.....	400	Good condition
800 feet north to 900 feet north	1.3	.....	...	.....	300	
900 feet north to 1,200 feet north	.9	.....	...	.....	275	
Logan Avenue—300 feet south of Queen	1.58	.....	...	1,200	420	
300 ft. south of Queen to 800 ft. south of Queen	1.06	.....	...	.....	475	
800 ft. south of Queen to 1,100 ft. south	.57	.....	...	.....	400	Good condition
1,100 ft. south to 1,700 ft. south	.25	.....	...	.....	350	
1,700 feet south to 2,100 feet south	.62	.....	...	.....	415	
Gerrard Street—Bridge to River Street	....	.....	...	.....	...	
140 feet to 240 feet west	1.36	.....	...	.....	500	
240 feet to 340 feet west	2.44	.....	...	.....	650	
340 feet to 440 feet west	3.21	.....	...	.....	675	Good condition
440 feet to 550 feet west	3.78	.....	...	.....	750	
550 feet to River	3.8	.....	...	.....	800	
Church Street—100 feet from Esplanade	.65	1,100	500	1,400	400	
100 feet to 200 feet north	1.85	.....	600	.....	500	Good condition
200 feet to 300 feet north	4.3	.....	850	.....	800	
300 feet to Front Street	6.0	.....	1,050	.....	1,000	
PAVEMENT—GRANTE BLOCK.						
Esplanade St.—500 feet west to Berkeley	.15	.....	...	1,200	280	Good condition
500 feet to 1,000 feet west	.15	.....	...	.....	270	
1,000 feet to 1,500 feet west	.15	.....	...	.....	210	
1,500 feet to 2,000 feet west	.25	.....	...	.....	260	
2,000 feet to 2,500 feet west	.25	.....	...	.....	240	
2,500 feet to 3,000 feet west	.25	.....	...	.....	210	
3,000 feet to Scott Street	.25	.....	...	.....	225	
Lane, 1st east of Simcoe off Wellington—200 feet	1.3	900	425	.....	...	Good condition
Yonge Street—Esplanade to Front	....	.....	...	.....	...	Good condition
100 feet north from Esplanade	2.4	.....	...	1,100	750	Very rough
100 feet to 200 feet north	5.0	.....	...	1,200	950	
200 feet to 300 feet north	4.4	.....	...	.....	1,000	
PAVEMENT—TREATED BLOCK.						
Observations made May 12th, 1908.						
Nelson —John to Simcoe	None	1,000	250	1,200	240	Good condition
Court Street—Church to Toronto	.18	900	225	1,100	290	Good condition sticky when dry
Wellington —Yonge to Bay	.44	1,000	266	1,200	325	Good condition sticky when dry
York St. Bridge, North Approach—350 feet south from Front	4.6	1,200	800	1,200	725	Fair condition greasy when wet
South-West Approach—100 feet from west end	5.0	1,200	800	1,200	800	Good condition
Simcoe Street—Station to Front	5.1	1,400	800	1,200	690	Good condition

A new advertiser from Winnipeg is noted in this issue, viz., the Dominion Equipment and Supply Co. This firm has been in business for a number of years, and is well known throughout the West. They handle all lines of railroad and contractors' supplies, including Buda bars, Buda jacks, track tools, rails, locomotives, McCully rock crushers, steam shovels, wheel and drag scrapers, wheelbarrows, hoisting engines, concrete mixers, etc. They handle the lines of such well-known firms as the Indiana Road Machine Co., Koehring Machine Co.'s line of concrete mixers, and all the lines of the Buda Foundry Co., of Chicago. Mr. J. A. Coyle is manager of the company, and they have an office in Fort William, as well as in Winnipeg.

TECHNICAL LITERATURE AND THE ENGINEER.

The question of engineering literature is one that should interest all readers of the technical press. There are some people who are sadly mistaken in their idea of the powers of an editor of a journal. It is a common idea to think of the editor's chair as a sort of autocratic throne from which laws and principles can be enunciated which will mould public thought and sentiment.

Nothing of the kind. An editor is simply the slave of public thought and the journal; if operated on successful and proper lines, is simply the reflection of public thought. Waves of opinion, of socialistic and scientific progress, have their real origin or birth and are matured in the general public mind. These forces, like vibratory waves, simply act upon journalism, which has the power of concentrating, and so becomes a recording instrument by which the evolutionary history of the subject may be traced and analyzed. It is true that the characteristic of a dead nation may be traced and understood by an examination of the existing relics of their arts. From the immense and mathematical proportions of the Egyptian pyramids we can endow the ancient Egyptians with certain characteristic features. From the decorative and floral architecture of ancient Greece we can picture a people capable of producing the Epictetus. From the colonnades and vast substantial soundness of the Roman amphitheatres and temples we can conjure up a people born to conquer and rule by laws based on human logic.

So in the pages of the engineering literature of our young country, engineering literature reflects the development of the country, the improvement in transportation, construction methods, and is a record of the styles, systems and developments of each decade. I do not care to take you back to the middle ages and follow through history the adaptations of different materials of construction, but we might refer to the engineering literature of our own country. I have taken the trouble to analyze rather carefully the editorial pages of Canadian and United States journals, and I find the story they tell is pretty much the story told by the journals in older lands—in other days. In the pioneer days of a country we find that seventy-five per cent of the engineering literature deals with exploration and road-making, but gives very little space to railway construction and operation. You will find, too, that the engineering literature of any one year does not reflect the work of that year, but of the year immediately preceding it; and if this indicates anything, it indicates that the engineer is not seeking publicity, that he is reticent as to telling what he has accomplished, and that he is the very opposite of the promoter, who readily prepares pages of literature on schemes that are not half thought out.

As a country develops, its engineering literature takes on a new phase, and the engineer devotes his energies to providing for the convenience, comfort and health of the community. For a period lighting plants spring up all over the country, and the engineering literature is full of descriptions of the most modern, most up-to-date and most economical of these necessities of recent days.

As we turn over the back numbers a faint electric spark illuminates the dusky pages. The spark grows into an electric current, and we find the powers of Nature harnessed by the people, whipped and driven over transmission wires to unburden the load in moving freight or breaking forth in illumination.

With the harnessing of electric energy and the desire for rapid and comfortable transportation, we find settled districts honeycombed with electric railways and the engineering literature flooded with descriptions of central stations, car equipment and car lines. Having provided for the development of the country and the pleasure of its people, the next stage appears to be the safety and health of the community, and here we find a field for the sanitary engineer. Population becomes congested, the health of the people demands saner regulations and surer methods of refuse destruction; the engineer adapts himself to the requirements of the hour, and the engineering literature reflects the work of the engineer.

We find a paragraph meagre and crude in its definition of someone who proposes to strengthen a column or a beam of concrete by inserting steel wire. And note what strides reinforced concrete as a material of construction has made.

What I have said is true of the engineering journal, but it is equally true of published text books. If you take the trouble to classify by years of publication the published books dealing with engineering problems you will find that to a very noticeable degree books dealing with the same problems are confined to the same years or cycles of years. You will not be surprised at this, of course, for both the demand and the experience govern to a large extent their publication.

Just a few words as an aside. Over a quarter of a century ago there was established in New York city a journal that has developed into the most powerful of technical publications. It was originally published in the interests of the surveyor, and at that time found a field large enough for such a publication, but with the growth of the country and its development the surveyor gave place to the engineer, and for financial reasons the journal had to change its policy. Since then the value of the surveyor as a possible purchaser has become less and less and the engineer a greater factor in the industrial life of the country. This journal first came upon the field as a dollar publication. The publishers found that it was not financing itself, so they doubled the subscription. After waiting to see what the effect would be, they found that the circulation did not decrease. But they also found they could not increase the circulation, and they dropped back to a dollar. This did not increase the circulation, and in a short time they advanced the subscription price to three dollars, and to their surprise the circulation did not decrease. They improved the character of their journal, gave their readers what they were seeking for, and then their circulation did increase; and with the increased circulation they increased the subscription price to five dollars. To you, as engineers, this piece of news may not be of very great interest. Yet it bears out the point I would like to make: that the technical press to secure support must give the reader what he is seeking for, and the test of any publication will be the amount of service it renders to its readers.

By engineering literature I would not have you understand that I mean the intricate calculations and discussions that one finds in standard text books, nor the theorizing that one comes in contact with in scientific publications, but rather those articles which describe methods of design, requirements of the structure or the machine, method and cost of construction, and the suitability or unsuitability of this particular work for the purpose in mind. As one travels, it is not difficult to fix the period of construction of completed works by studying the design and treatment. Each decade has methods of design and construction peculiar to that period, and by engineering literature we mean those descriptions that describe faithfully the completed works.

Style in Engineering Literature.

I do not know whether you have given the subject of style in engineering literature a moment's thought, but I would like to impress upon you if I can the necessity for the engineer developing a clear, concise and easy style of writing. I am glad to know that our universities recognize that the study of English composition and English literature is a necessary study for students in engineering. I fear we have been too long concerned with the immediate commercial value of our graduates and have neglected those who would be something more than "hewers of wood and drawers of water." The value of the study of English composition and rhetoric is not fully appreciated by many until after graduation, and then they find the error exceedingly difficult to correct. Every engineer will find it necessary to prepare and present reports, read papers before scientific bodies, enter into discussions; and how much more effective would be his statement of facts if they were presented clearly, concisely and without hesitation. In no other profession is the faculty

of clear writing and effective speaking of more value than in engineering. Some small experience has taught me the difficulty of including all useful subjects in a four-years' curriculum, but I do not consider any course in engineering well-balanced unless it gives the proper amount of time to English.

Composition and Rhetoric.

Our university course must supplement the training given in these subjects by the preparatory schools. And while in this vein I would like to impress upon you the necessity of availing yourselves of every opportunity to take part in debates and discussions. To be able to think clearly and to express one's ideas connectedly when upon one's feet in the presence of men somewhat familiar with the subject in hand requires not only knowledge, but practice. And the successful engineer will be able to turn many a difficult situation to his advantage if he can present pleasantly his views to his assembled clients.

Purpose of Engineering Literature.

It is surprising how reticent many men are to tell of their experiences, their methods of accomplishing certain results, their reasons for certain designs, and the care with which they guard their own practices. One would imagine from this that engineering, instead of being a profession, was a company controlling a number of trade secrets which by some means had been acquired. Just so long as that spirit of selfishness continues, just so long will it be difficult to impress the dignity and high calling of engineering as a profession. The profession is not built up by each practitioner centering in himself all the wisdom and knowledge of the day, nor is the individual less in standing because he discusses clearly and intelligently the methods he is familiar with and that have counted for success. The better equipped the profession, the higher stand will the individual member be able to secure. Confidences will increase with the knowledge that the members of the profession are endeavoring to evolve the best methods. At the same time, the engineer will not be the man to leave the impression that "we are the people, and wisdom shall die with us." The purpose of engineering literature should be, then, to keep the profession informed as to what is being done and how it is accomplished. To bring together the men from the East and from the West, to record the experiments and opinions of those who have worked so that energy may not be expended uselessly nor the worker subjected to bitter remarks because he has ignored the teachings of his predecessors.

Now, when an editor carefully considers and weighs this underlying principle which so directly connects his work with present demands and requirements, he awakens to the editorial fact that he is no longer a specific identity, but must at all times be prepared to subject himself to the vibratory waves which concentrate their force upon his editorial sheet.

It should also be remembered that, apart from the mere editor of a journal, there is also connected with it a gentleman of no little importance—the business manager. The business manager, however, like the proverbial mother-in-law, has, perhaps, been much misrepresented. He is generally depicted as a man who looks upon the literary pages of a journal as just so much waste space which ought to be taken up with advertisements. Yet it must be taken for granted that the literary qualities of a paper may generally be tested by the amount and character of the advertising columns. There exists no better test of the success of a journal than analysis of the matter which the public are willing to pay sums of money for its production. But it is just in this connection that the editor is called upon to use a wise and lenient discrimination. The original articles supplied for publication may be in every sense of the word news of scientific value and engineering interest. On the other hand, its contributor may have as a prime motive not educational ideas merely, but a somewhat mean attempt to gain cheap advertising under the cloak of literary comment. Such communications may, however, be generally judged by the test of the amount of apparent unscientific exaggeration in favor of the special subject. The supreme effort of an editor should not be to thrust his own views upon the public or the views of any minority or interested section, but to strive to exert a magnetic force, attracting all and varied views to a focus of concentration in his paper so that the paper may be a true representative of scientific or engineering feeling prevailing as a whole throughout the field of its circulation. When a journal puts in precise words an idea or a principle, which, although not previously formulated, but which has had an undefined existence in public mind, then that journal has performed successful work. It has recorded and fixed on the chart of history that which before was unregistered and uncatalogued. A man reads, for instance, an article on, say, the elements which exist in and make up an atom. "That is what I always thought. There must be some means of dividing an atom. It is absurd to say such is undivisible. This paper is really worth reading. It is in advance of the age. It exactly explains that which I have had in mind."

A fanciful illustration such as this simply conveys the principle that people want to read about things which they really had in mind. In fact that the principle of education, consists in developing a given mind rather than attempting to create a new or artificial mind. Now, I am afraid that you will say all this is certainly not new to you, and pretty much bears the stamp of what you might have made a guess as far as editorial work is concerned. If that be true, I feel satisfied that as an editor I have been able to reflect to you your own thoughts rather than bother you with mine.

GRAND TRUNK RAILWAY ANNUAL REPORT.

The Grand Trunk Railway Company of Canada recently held their annual meeting. Their financial report includes a statement up to January 1st, 1909.

This company has passed through the recent trade depression as successfully as the other Canadian roads, and, although the gross earnings were almost six million dollars less than the previous year, the net earnings were only one million dollars less, a most satisfactory showing, due no doubt to the economies introduced by the management, the fall in price in material and the small expenditure on repair and maintenance account. It was fortunate the road bed and rolling stock was in such a high state of efficiency as not to require much attention else the net earning would not have shown up so well. It is much easier to secure money for maintenance when the traffic is large and the profits good and years of active trade should be years of active improvement.

In the last ten years the carrying capacity of the road has been increased by expenditure out of revenue upon new bridges, ballasting and the laying of heavier rails. The carrying capacity of the road has been doubled during recent years without any great addition to the capital account.

The length of G.T.R. maintained and operated during 1908 was 3,536 miles, or one mile more than it was in 1907.

The expenditure during 1908 for maintenance of way and structures was $3,966,190.22, as against $4,239,490.35 in 1907, being a decrease of $273,300.13, or 6.45 per cent.

The outlay on track and permanent way, including ballast and ballasting, clearing snow, renewals of rails and ties, also including their proportion of the cost of superintendence, was $3,047,731.90 in 1907, or at the rate of $862.16 per mile. In 1908 the amount was $2,871,503.78, or at the rate of $812.08 per mile, a decrease of 5.8 per cent.

The cost of repairs and renewals of buildings and fixtures amounted to $604,066.54 in 1908, as compared with $760,297.32 in 1907, a decrease of $156,230.78, or slightly over 20 per cent.

During the half year fifteen engines were scrapped, leaving at the end of the half year fifty-three old light capacity engines set aside to be scrapped.

Two new ten-wheel passenger engines, twenty compound consolidation freight engines, ten mogul freight engines, and five switch engines were purchased during the half year.

The materials used for repairs and renewals of the main track and sidings were:—

New steel rails laid in track.....	37,957	tons
Re-rolled steel rails laid in track.....	15.40	"
Partially-worn steel rails laid in branch lines and sidings	7,729.8	"
New ties placed in track	1,643,539	
Ballast (cubic yards)	542,996	

Expenses Per Mile in Cents.

31 Dec., 1908.	ENGINES, PER ENGINE MILE. WORKING EXPENSES. Locomotive engineers, firemen, etc.	Fuel.	Water supply.	Oil and sundries.	Total cost of working.	Repairing.	Total working and repairing.	Cars per train mile. Total cost of maintaining car stock per train mile.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
July	7.27	15.18	.43	.39	23.27	8.99	32.26	7.52
August	7.45	15.62	.52	.44	24.03	8.92	32.95	7.44
September .	7.44	15.35	.77	.43	23.99	9.84	33.83	8.35
October ..	7.42	16.18	.38	.36	24.34	13.85	38.19	8.72
November ..	7.36	15.83	.54	.29	24.02	10.05	34.07	8.23
December ..	7.38	17.89	.90	.39	26.56	10.95	37.51	3.07
1908—Av. ...	7.39	16.02	.59	.38	24.38	10.46	34.84	7.22
1907—Av. ...	7.57	16.49	.57	.56	25.19	9.64	34.83	12.26

The average number of passenger cars per train was 4.3, and the average number of freight cars per train was 26.4 during the last six months of 1908.

The table of expenses per mile in cents for engines per engine-mile is of interest and shows a saving over the last six months of 1907.

The cost per train per train-mile was as follows:—

Half-year ended.	Train Mileage.	Rate of Expense per Mile. Train.		Engine.		Car.	
		Cents.	d. stg.	Cents.	d. stg.	Cents.	d. stg.
Dec.—1908	9,793,226	44.54	21.96	34.84	17.18	2.76	1.36
Dec.—1907	10,525,322	45.78	22.08	34.84	17.18	2.93	1.44

A decrease in expenditure of $456,053 or 9.47 per cent. compared with a decrease in train miles of 732,096 or 6.96 per cent.

INCOME STATEMENT OF GRAND TRUNK RAILWAY COMPANY.

Year to Dec. 31st.	Miles.	Gross Earnings.	Operating Expenses and Taxes.	Ratio %.	Net Earnings.	Miscellaneous Income.	Net Income.	Charges.	Balance.
1908	4,640	$40,531,355	$30,793,310	75.98	$9,738,045	$1,288,260	$11,026,355	$8,136,235	$2,890,070
1907	4,639	46,122,020	35,221,925	76.37	10,900,095	1,365,795	12,265,890	8,030,535	4,235,355
1903	4,203	36,542,865	26,903,140	73.61	9,639,725	918,685	10,558,410	7,281,025	3,277,385
1898	4,183	24,770,525	17,048,250	68.80	7,727,275	1,042,500	8,769,775	7,192,355	1,577,470
1893	4,025	25,750,585	19,093,965	74.15	6,657,120	278,355	6,935,475	6,251,320	684,155
1890	4,003	25,087,385	18,289,820	72.90	6,797,565	460,670	7,258,235	5,965,360	1,292,875

IMPORTANT DEVELOPMENTS IN BITUMINOUS GAS PRODUCERS.

For a number of years the Westinghouse Machine Company has been engaged in the development of a satisfactory form of producer suitable for gasifying the usual grades of bituminous fuels. The unusual difficulties encountered in the utilization of this kind of fuel have resulted in the trying out of many different types, both of the producer itself and of the necessary auxiliaries for producing clean gas. For the past year and a half, however, the company has been engaged in carrying out upon a commercial scale, a producer plant which is now upon the market. These tests have not been conducted with a toy apparatus, but with a full-sized equipment of 175 horse-power, including a standard gas engine of about the same power, by means of which the actual power value of the gas produced and the overall efficiency obtainable, were determined without possiblity of error.

The above-mentioned tests were brought to a conclusion on April 3rd, by drawing the fire in the producer after it had been in continuous operation on various loads and on various fuels for a year past, these twelve months having been devoted to tests of one to four weeks' duration, both ten and twenty-four hours per day on standard fuels available for power purposes. These fuels included Pittsburg slack and run-of-mine, lignites from Northern Colorado, Texas and South America, also peat and other fuels from various parts of the country. Most of the tests the load on the equipment was maintained at full rating, although one special test of one month and a half duration was made to determine accurately the standby loss of the producer standing idle.

The fire was drawn without trouble or interruption as large clinker formations were entirely absent, although the lining of the producer was found to be practically intact and producer had, just previous to this occasion, been running on a full-load test for one month, using Pittsburg coal. The in quite good enough condition for continued operation for an unlimited period.

The most important feature of the demonstration was the entire obsence of tar formed in the producer gas. A similar examination of the mixing and inlet valves of the engine which has been used for the past year on this test, showed practically no deposits of tar or lampblack, such as would interfere with the operation of the engine. The Westinghouse plant uses no tar extractors, as no tar is made, simply a static washer of small size in the place of the usual bulky coke scrubber. A rotary exhauster draws the gas from the fuel bed and delivers it to the engine at a definite pressure.

The various fuels which have been used in this producer on test, have been gasified successfully, and have run as high as 34 per cent. moisture, 35 per cent. volatile and 15 per cent. ash and 1½ per cent. sulphur. The results of the tests show that with coal, such as Pittsburg slack or run-of-mine, an overall economy of 1.1 lbs. per brake horse-power hour can be secured, equivalent to a little over 9/10 lbs per indicated horse-power hour. Moreover, the producer efficiency does not vary more than 10 per cent. from full load on the plant to no load.

The results of this past year's tests have fully convinced the builders that the apparatus experimented with possesses unusual commercial value, and preparations are being made for extensive manufacture. A plant of this type has been in operation for over six months on Colorado lignite coal with equal success, as evidenced by an order recently placed with the Westinghouse Machine Company for duplicate equipment.

ENGINEERING SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, R. Percy Barnes, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Secretary, 1207 Traders Bank Building.

AMERICAN MINING CONGRESS.—President, J. H. Richards; Secretary, James F. Callbreath, Jr., Denver, Colorado.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Boston & Maine Railway, Fitchburg, Mass; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.; Secretary, Alcide Chaussé, P.O. Box 259, Montreal, Que.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, E. Grandbois, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, C. F. Pulfer, London, Ont.; Secretary-Treasurer, Alfred E. Uren, 62 Church Street, Toronto.

CANADIAN ELECTRICAL ASSOCIATION.—President, N. W. Ryerson, Niagara Falls; Secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, J. F. Demers, M.D., Levis, Que.; Secretary, F. Page Wilson, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, W. G. Miller, Toronto; Secretary, H. Mortimer-Lamb, Montreal.

CANADIAN RAILWAY CLUB.—President, L. R. Johnson; Secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Geo. A. Mountain; Secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1909.

QUEBEC BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—96 King Street West, Toronto. Chairman, J. G. G. Kerry; Secretary, E. A. James, 62 Church Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

MANITOBA BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

CANADIAN STREET RAILWAY ASSOCIATION.—President, J. E. Hutcheson, Ottawa; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto. President, C. A. Jeffers, Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, R. H. Campbell, Ottawa.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Secretary, T. Nash.

EDMONTON ENGINEERING SOCIETY.—President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alta.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. Prtsident, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION.—Homer R. Linn, President; Walter A. Sittig, Secretary, 61 Ward Street, Chicago, Ill.

MANITOBA LAND SURVEYORS.—President, Geo. McPhillips; Secretary-Treasurer, C. C. Chataway, Winnipeg, Man.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. H. Winfield; Secrttary, S. Fenn, Bedford Row, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, Louis Bolton; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. Andrew Allen, President; J. H. Warder, Secretary.

COMING MEETINGS.

American Society of Civil Engineers.—Annual convention, Mount, Washington Hotel, Bretton Woods, N.H., July 6 to 9. Secretary, Chas. W. Hunt, 220 West 57th Street, New York.

Air Brake Association.—May 11 to 14. Annual meeting at Richmond, Va. Secretary, F. M. Nellis, 53 State Street, Boston, Mass.

American Electrochemical Society. — May 6-8. Annual meeting at Niagara Falls, Canada. Secretary, Jos. W. Richards, Lehigh University, South Bethlehem, Pa.

American Foundrymen's Association.—May 18-20. Annual meeting at Cincinnati, Ohio. Secretary, Richard Moldenke, Watchung, N.J.

American Railway Association.—May 19. Annual meeting at New York City. Secretary, W. F. Allen, 24 Park Place, New York City.

American Waterworks Association.—June 8-12. Annual convention at Milwaukee, Wis. Secretary, John M. Diven, 14 George Street, Charleston, S. C.

American Railway Master Mechanics' Association.—June 16-18. Annual convention at Atlantic City, N.J. Secretary, Jos. W. Taylor, 390 Old Colony Building, Chicago, Ill.

American Railway Bridge and Building Association.—October 19-21. Nineteenth annual convention at Jacksonville, Florida. Secretary, S. F. Patterson, Boston & Maine Railway, Concord, N.H.

American Institute Electrical Engineers, Toronto Section.—Friday, April 23, at 8 p.m. Address by Mr. Alexander Dow, Mem. A.I.E.E., of Detroit, on "Underground Conduits and Cables."

International Railway General Foremen's Association.—June 1 to 5, 1909, at Chicago. E. C. Cook, Royal Insurance, Chicago, Ill.

Master Car Builders' Association.—June 21 to 23, 1909, at Atlantic City, N.J. J. W. Taylor, Old Colony Building, Chicago, Ill.

National Electric Light Association.—June 1 to 4. Thirty-second convention, Atlantic City, N.J. Secretary, John F. Gilchrist, 29 West 39th Street, New York.

National Fire Protection Association.—May 25 to 27. Annual meeting at New York City. Secretary, W. H. Merrill, 382 Ohio Street, Chicago, Ill.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS.

Quebec.

MONTREAL.—Tenders will be received until 11th May, 1909, for 12,000 tons soft steam coal, for the low level pumping station, Point St. Charles. L. O. David, City Clerk.

MONTREAL.—Tenders will be received up to the 10th May for the supply of iron and copper wires, cable, conduit, sheet lead, iron braces, iron bolts, side blocks, glass insulators, nails, screws, iron washers, rope, paint, varnish, top pins, cross arms, etc. L. O. David, City Clerk.

QUEBEC.—Tenders will be received until the 10th May for the construction of an Annex to the Jacques-Cartier Normal School, on Parc Lafontaine, Montreal, P.Q. Alphonse Gagnon, Secretary, Department of Public Works.

Ontario.

BROCKVILLE.—Tenders will be received up to May 6th for lumber, salt glazed vitrified sewer pipes, cut and steel wire spike, Portland cement and sand for granolithic walks. Geo. P. Gamble, Chairman Board of Works.

BRANTFORD.—Tenders will be received till May 10th, 1909, for the construction of local improvement concrete curbs, and combined concrete curbs and gutters, to be built by the City of Brantford during 1909. T. Harry Jones, City Engineer.

DUNNVILLE.—Tenders for the erection of a House of Refuge at Dunnville for the County of Haldimand will be received up to Wednesday, May 12th. Lowest or any tender not necessarily accepted. Munro & Mead, architects, Chancery Chambers, Main Street, Hamilton.

ESTEVAN.—Tenders will be received until May 19th, for constructing a waterworks system and a main sewer. Further particulars appear elsewhere in this issue. Willis Chipman, C.E., Chief Engineer, 103 Bay Street, Toronto.

KINCARDINE.—Tenders for electric light wiring, Kincardine Post Office, will be received until May 11th. Further particulars can be obtained from Mr. Angus Kerr, Clerk of Works, Kincardine, and Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

KINGSTON.—Tenders will be received until May 15th for the installation of a new water supply at the Royal Military College. Eug. Fiset, Deputy Minister of Militia and Defence, Ottawa.

LINDSAY.—Tenders will be received until May 17th for plumbing, steam heating, plastering, masonry brick-work and concrete, galvanized iron work, carpentry and painting and glazing. C. Callaghan, secretary.

LINDSAY.—Tenders will be received until May 11th for the installation of a Central Heating System for the buildings on the Court House Square, Lindsay, and other improvements. Plans and specifications may be seen at the office of G. M. Miller & Company, Toronto General Trust Building, Toronto. J. R. McNeillie, County Clerk.

LONDON.—Tenders for poles, wires, cross-arms and insulators will be called for by the Power Committee of the City Council. E. I. Sifton is the city electrical engineer.

NORTH BAY.—Tenders will be received until May 15th for equipment required in the Normal School at North Bay, including opera chairs, opera seats with tablet arms, school seats and desks, library tables, book cases, art tables, laboratory tables, staging, apparatus cases, lockers and cupboards, domestic science tables and work tables for manual training and other equipment. H. F. McNaughten, Secretary of Public Works, Toronto.

O'CONNELL.—Tenders will be received up to May 15th for the steel superstructure of a bridge and for the concrete abutments. W. M. Shields, Clerk of the Township of Rama.

OTTAWA.—Tenders will be received up to 31st May, 1909, for work required in connection with the abutments and approaches of the new bridge below the waste weir at Kingston Mills Lock Station on Rideau Canal. L. K. Jones, Secretary, Department of Railways and Canals.

PORT ARTHUR.—Tenders will be received up to May 8th for the excavation and filling in of trenches for the installation of water and sewer mains. J. McTeigue, City Clerk.

PORT ARTHUR.—Tenders will be received up to May 7th for the supply and delivery of 2,500 tamarac and cedar railway ties, standard and cull. J. McTeigue, Secretary, E.R.L. & T. Commissioners.

STRATFORD.—Tenders for the erection of an addition to Stratford Collegiate Institute will be received up to May 12th. Plans and specifications may be seen at the office of J. S. Russel, architect, 21 Downie Street.

ST. THOMAS.—Tenders will be received until May 18th for building a sewage disposal plant. James A. Bell, City Engineer. (Advertised in The Canadian Engineer.)

TORONTO.—Tenders will be received until June 8th, 1909, for the construction of sewers. John J. Ward, vice-chairman, Board of Control, City Hall. (Full particulars advertised in The Canadian Engineer.)

TORONTO.—Tenders will be received until May 11th for asphalt, brick, bitulithic and concrete pavements, concrete curbs, walks and sewers. Specifications, etc., car be obtained at the City Engineer's office. John J. Ward vice-chairman, Board of Control.

TORONTO.—Tenders will be received until May 18th, 1909, for the supply of material and the construction of a water filtration plant. Further particulars appear in our advertising pages. Joseph Oliver (Mayor), Chairman, Board of Control.

TOWNSHIP OF McNAB.—Tenders will be received up to Tuesday, May 18th, for the construction of a concrete arch bridge and abutments with filling and fencing, addressed to Mr. John McGregor, clerk of the Township of McNab. Plans and specifications have been prepared by Messrs. Macallum & McAllister, engineers, 612 Continental Life Building, where the same may be examined.

WATERFORD.—Tenders will be received until May 8th for building of bridge abutments near Waterford. James Ross, clerk.

WATERLOO.—Tenders for the construction of sewers will be received up to Monday, May 10th. Charles Moogk, town engineer. Ford S. Kumpf, Secretary Sewer Commission.

Manitoba.

WINNIPEG.—Tenders for grading, curbing and construction of 49,672 square yards of asphalt pavements will be received until May 20th. H. N. Ruttan, City Engineer. M. Peterson, Secretary Board of Control. (Advertised in The Canadian Engineer.)

Saskatchewan.

ESTEVAN.—Tenders will be received until Wednesday, May 19th, for constructing a waterworks system and a main sewer, comprising 7,300 feet of water mains, 2,400 feet of tile sewer, also steel water tower, gasoline engines and power pump. Willis Chipman, C.E., 103 Bay Street, Toronto, Ont.

MOOSE JAW.—Tenders will be received until May 31st for the sinking of a test well for gas, oil or water. John D. Simpson, city clerk. (Advertised in The Canadian Engineer.)

SASKATOON.—Tenders will be received until May 8th, at the Bank of Montreal, Saskatoon, for the general contract

in the erection of a bank building. Plans, etc., may be seen on application to the Bank of Montreal, Saskatoon, or to Peden & McLaren, architects, Montreal.

Alberta.

LETHBRIDGE.—Tenders for a waterworks pump, to be installed by the City of Lethbridge, Alberta, will be received until May 17th, by Smith, Kerry & Chace, Consulting Engineers, Confederation Life Building, Toronto, from whom specifications, etc., may be obtained. (Advertised, Canadian Engineer.)

British Columbia.

VICTORIA.—Tenders will be received up to Monday, the 31st May: (1) For the erection and completion of a reinforced concrete and brick building; (2) for the erection and part completion of a reinforced concrete and brick building. Evered Criddle, supervising architect, Public Works Department, Victoria, B.C.

VANCOUVER.—Tenders will be received up to Wednesday, June 2nd, 1909, for the supply of waterpipe for the City of Vancouver. Specification may be obtained from the waterworks office, City Hall. Wm. McQueen, city clerk.

CONTRACTS AWARDED.

Nova Scotia.

SYDNEY.—The Dominion Iron and Steel Company has received an order from the Great Northern Railway Company, of Sheffield, England, for 5,000 tons of steel rails, 85 pounds weight.

New Brunswick

ST. JOHN.—On April 28th, at a meeting of the City Council, the following tenders were opened:—Asphalt, A. M. Rowan, 625 barrels coal tar, $3.50 a barrel; 275 barrels Trinidad, $4.50 a barrel, accepted. Other tenders, Carritte, Patterson Company, $3 and $5; Robert Reford Company, $3.80 and $4.65. Wood Block Paving Material and Cord Wood: H. M. Woods, 8,000 sq. yds. material, 53 cents sq. yd.; 55 cords hardwood, $5.95 per cord. Jas. J. Whelly, cord wood, $7.20 cord. Francis Kerr, $8.50 cord. F. E. Sayre & Company, 2,000 paving material, 55 cents yard. Dandoulph and Baker, 6,000 yds., 60 cents sq. yd. The tenders of H. M. Wood for 6,000 square yards, and F. E. Sayre and Company for 2,000 square yards were accepted. Sayre tendered to deliver wood at the Union depot for seven cents per sq. yd. Coal:—Francis Kerr, 160 tons Springhill run of mine, $4.25 per ton; Starr Company, 160 tons Springhill Reserve Mine, $3.65 per ton; Gibbon Company, 160 tons Springhill run of mine, $3.90 per ton; Dick Company, 160 tons Springhill run of mine, $4.45 per ton. There being but one tender received in the orthodox course it was decided to call for new tenders. Sand:—Herbert Creighton, to be supplied as required at $1.20 per load; John Knox, supplied as required at $1.10 per load; Wm. Knox, one cent below the lowest tenderer. The last tender was ordered thrown out and that of Herbert Creighton accepted.

Quebec.

MONTREAL.—The panelboards for the St. Ann's Convent at Lachine, Que., are being furnished by The Hill Electric Switch and Manufacturing Company, Limited, of Montreal. The wiring is being done by Messrs. Picard & Lalonde of Montreal.

MONTREAL.—The Roads Committee have accepted the tender of The Warren Paving Company, $25,500, for an asphalt plant. The Iroquois Iron Work's tender $33,140 was next.

Ontario.

GUELPH.—The Board of Works recommended the acceptance of C. H. Conery's contract for laying cement walks at 9¾ cents a foot. H. Barber's tender for cement pipe was accepted.

BERLIN.—The Light Commission on Monday opened tenders for wrought and cast iron pipe for new gas mains and extensions. Seven tenders were received for 4-inch pipe, and that of P. Hymmen & Company, of Berlin, was the lowest, $27.24 2-5 per 100 feet, net, 30 days. The tenders ran up to $28.25 per 100 feet. There were three tenders for the six-inch cast iron pipe, and the lowest was $48 per 100 feet, net 30 days. The highest tender was $50.25. The successful tenderer was the Gartshore Thompson Company, of Hamilton.

BRANTFORD.—Mr. Wyse, formerly manager of the Brantford Electric and Operating Company, now of Toronto, has secured the sub-contract for the erection of the telephone line in connection with the Hydro-Electric installation. The contract runs into nearly $100,000.

ST. THOMAS.—Tenders for cement and curbing work were received by the City Council as follows:

	G. A. Ponsford per linear foot.	A. E. Ponsford per linear foot.
Cement walks—Sand finish...	10¾ cents	10 cents.
" " Granite finish	13 "	12 "
Curbing	26 "	23 "
Curbing and gutter	36 "	38 "
Walks	11 "	10½ "

That of A. E. Ponsford was accepted.

TORONTO.—The Barber Asphalt Company's tender of $35,900 for paving Queen Street, from the Grand Trunk Railway tracks to Greenwood Avenue with asphalt was accepted by the Board of Control.

Saskatchewan.

REGINA.—The city have awarded the contract for 100 barrels of cement to Peart Bros. for $245.

SASKATOON.—The successful tenderers in connection with water mains and sewer pipe and their tenders are: Section 1, Harry Welch, Saskatoon, $13,725; Section 2, Reginald Boulton, Prince Albert, $17,900; Section 3, William Cook, Saskatoon, $9,756.25.

Alberta.

CALGARY.—The Calgary Paving Company have submitted to the City Council the following comparative costs of paving 1st St. West subway, 400 feet in length, 26½ feet in width:

Asphalt on a 5-inch concrete base.....	$3,237 67
Double track street railway, 400 feet in length with two rows sand stone blocks each side of each rail, asphalt paving in between	4,800 00
Total	$8,037 67
"Cobbloid" over entire surface (except the two rows of sandstone blocks on each side of each rail) and upon a 6-inch concrete base	$4,591 60
Street railway	5,260 00
Total	$9,851 60
"Cobbloid" on each side of railway tracks, asphalt between tracks and devil strip	$4,591 60
Street railway	4,800 00
Total	$9,391 60
Twelve rows (6-inch wide) sandstone blocks both sides of street railway tracks, and the balance asphalt (except the two rows sandstone each side of each rail)	$4,971 00
Street railway	4,800 00
Total	$9,771 00
Entire surface sandstone blocks	$7,064 00
Street railway	6,100 00
Total	$13,164 00

CALGARY.—Carter, Halls, Adlinger & Company have secured a contract for erecting a large dam on the Bow River in connection with big irrigation ditch.

STRATHCONA.—Contracts amounting to $70,000 have been awarded to the Bitulithic and Contracting Company, of Winnipeg, Man., for street paving.

CALGARY.—Bitulithic and Contracting, Limited, of Winnipeg, Man., have been awarded a contract for 45,000 square yards of bitulithic pavement for this city.

CALGARY.—The commissioners of the City Council have recommended the acceptance of Mr. R. A. Brocklebank's offer to pave a number of streets, approximately 20,000 square yards, at $1.92 per square yard. For the same area $2.50 per square yard was quoted for laying granatoid on a crushed rock base.

LETHBRIDGE.—Janse & McDonnell, of Lethbridge, have secured the contract for the construction of the C.N.R. cut-off at Stanley Junction, west of Port Arthur. The work is 10 miles in length and involves the moving of about 300,000 cubic yards of earth and rock.

British Columbia.

VICTORIA.—The following tenders for material required in the installation of the high pressure system were accepted: Fine wire, Hawkins & Hayward, 18½c. per pound; stempipe line, Marine Iron Works Company, $350; water suction connections and valves, Marine Iron Works Company, $450; condensing equipment, tender not awarded though the apparatus offered by the Hutchinson Bros. Company, the lowest tenderers, at $1,750, is recommended.

VICTORIA.—The following tender was submitted to the City Council by the Warren Construction Company, Portland: Bithulithic pavement on a bituminous base, six inches in depth, $2.75 per square yard; curb, 40c. per lineal foot; sidewalks, 20c. per square foot; boulevard, 50c. per lineal foot. If any excavation or filling was required the prices would be 30c. a cubic yard for scraper work, 60c. for wagon haul and 80c. for gravel fill.

RAILWAYS—STEAM AND ELECTRIC.

Ontario.

OTTAWA.—A meeting of the provisional directors of the Ottawa and St. Lawrence Electric Railway was held last week. Mr. A. H. N. Bruce, C.E., is the engineer.

Alberta.

CALGARY.—A grading outfit with two hundred teams has arrived at Airdrie and taken up quarters. It is stated they will shortly commence work on a section on the new Canadian Pacific line between Stettler and Cheadle.

British Columbia.

VANCOUVER.—The by-law has been introduced in the council of the municipality of Burnaby to grant a forty-year, though not exclusive, franchise to the British Columbia Electric Railway Co. It is proposed to construct an electric line from the east boundary of Hastings townsite through the municipality.

VANCOUVER.—The British Columbia Electric Railway has been advertising for tenders for the erection of trolley poles, crossarms, braces, etc., along the line of its Eburne-Westminster branch.

VICTORIA.—Over three hundred thousand dollars will be spent on the E. and N. Railway this year on general improvements. A new cantilever steel bridge over the Niagara Canyon, fifteen miles from Victoria, will be erected.

SEWERAGE AND WATERWORKS.

Quebec.

LIMOILOU.—Messrs. Ouimet and LeSage, of Montreal, against whom suit was taken for the sum of $5,000 for statements concerning the quality of supplies proffered them in connection with the Limoilou sewerage system, and which supplies were refused by them, have received judgment in their favor.

Ontario.

COBALT.—The Ontario Railway and Municipal Board has validated the town's by-law to raise $75,000 for sewerage and waterworks system. Galt & Smith, Toronto, are the engineers.

PORT ARTHUR.—City Engineer Antonisen is preparing estimates for proposed extensions to the waterworks and sewerage plants.

Alberta.

MACLEOD.—Work is to be started at once on the $50,000 sewerage system.

Saskatchewan.

YORKTON.—The town of Yorkton is making preparations to supply the Canadian Pacific Railway with twenty thousand gallons of water a day. On account of the good work done by the waterworks system at a recent fire, inquiries have been received from other towns wishing to make an installation, the latest being from Neepawa, Man.

British Columbia.

VANCOUVER.—At a recent meeting, the reeves of Point Grey, South Vancouver, Burnaby and Richmond decided to appoint Messrs. Cleveland & Dutcher, of Vancouver, to report on a joint water system for their municipalities.

LIGHT, HEAT, AND POWER.

Saskatchewan.

WEYBURN.—The offer of eighteen thousand dollars made by the town to the Electric Light Company for their plant has been turned down. The company will improve the plant to the extent of ten thousand dollars.

FINANCING PUBLIC WORKS.

Ontario.

BLOOMFIELD.—Debentures amounting to $8,000 for roads and concrete walks are offered for sale until May 15th. C. H. Sayler, Clerk.

HAMILTON.—Tenders will be received until 27th May for the following debentures: $65,000 sewer, $50,000 waterworks, $112,000 special, $125,000 permanent roadway, all 4 per cent. half-yearly.

KINGSTON.—The city council have passed a by-law for walk construction debentures amounting to $35,000.

ST. MARY'S.—The by-law to guarantee the bonds of the St. Mary's Portland Cement Co. to the amount of $40,000 was carried here by a majority of 124 votes over the required two-thirds of the qualified electors. The vote stood 591 for and 48 against.

WOODSTOCK.—Until June 7th the county of Oxford will receive tenders for $50,000 5 per cent. 30-year road improvement debentures.

Manitoba.

MINIOTA.—The municipality will receive offers for $12,000 debentures for the completion of a telephone system. Wm. Howard, Secretary.

Saskatchewan.

MOOSE JAW.—The following money by-laws were passed by the ratepayers: To complete and equip the Collegiate Institute and buy more ground, $42,000; construction of concrete and plank walks and pavements, $20,500; to sink a test-well for gas, water or coal, $30,000. These, with the sewer and water extension by-law passed some weeks ago, make the total amount voted for civic improvements this year total $147,500.

SASKATOON.—On May 19th by-laws to provide $300,000 will be voted on. Included in the improvements are extensions to the light and power plant.

TELEPHONY.

Quebec.

MONTREAL.—This year the Canadian Pacific Railway telegraphs will construct a metallic circuit from White River to Fort William, making 502 miles of copper wire for train despatching. They will likewise string two copper wires between Winnipeg and Brandon, 133 miles; and also from Swift Current to Medicine Hat, 147 miles; from Winnipeg to

Field, B.C., 971 miles, which is to be used for telegraph purposes, while a copper wire will be erected from Calgary to Cranbrook, 276 miles, this also being for commercial purposes, and making 2,500 miles of new copper wire to be put up by the company during the coming season. They are also engaged rebuilding over 600 miles of pole lines in different parts of the system, besides which several hundred miles of new wire will be spread over the new western provinces, and many new offices opened.

Ontario.

ALTONA.—The Central Telephone Company has been incorporated with a capital of $40,000. J. Underhill is one of the incorporators.

PERTH.—Three independent telephone lines will be constructed in this district during the summer.

CURRENT NEWS.

Quebec.

MONTREAL.—A new travelling crane designed by Mr. F. W. Cowie, harbour engineer, was given a test on April 30th. The machine was shown to have tremendous power, and lifted with great ease a 40-ton weight. It will be used for loading and unloading ships.

Alberta.

EDMONTON.—The Joint Civic Committee, representing Edmonton and Strathcona, has decided that the proposal that the two cities, assisted by the Provincial Government, should build a half million dollar high level bridge across the Saskatchewan River, entails too great an expenditure, and the scheme has been unanimously rejected. It was decided to appeal to the C.P.R. to proceed with the proposed railway bridge, which would be assisted by the two cities and by the Government.

Saskatchewan.

SASKATOON.—Mr. W. P. Bate is advertising for competitive plans for a collegiate building to cost $90,000.

SASKATOON.—Competitive sketch plans are invited for a Collegiate Institute building to be erected in Saskatoon to cost $90,000. For particulars apply to W. P. Bate.

MELVILLE.—The municipal council has passed the following by-laws: Site for fire hall and for erection of building thereon, $2,050; police barracks, $550; water supply for fire purposes, $1,500; cemetery, $400; sidewalks, crossings and street improvements, $8,000.

British Columbia.

VANCOUVER.—The B.C. Electric Railway Company have decided, in view of the prohibitive cost of reclaiming the Sumas district, that they will not be able to proceed with the scheme. A large amount of money has been spent in making the most careful survey of the works, and estimates of the cost of alternative schemes have been carefully prepared by the most eminent engineers obtainable. Mr. G. Lebaron, C.E., in his final report, recently submitted, deals in a most comprehensive and exhaustive manner with every detail of the undertaking. To carry out the work in the substantial manner required to make the scheme absolutely safe and permanent entailed a very large increase over the original estimates, and as the revised estimates of cost exceed by a very considerable sum the amount which the company was

VANCOUVER.—Mr. William Whyte, second vice-president of the Canadian Pacific Railway, intimated during his recent visit that the company would very shortly begin the erection of elevators here on a site reserved for the purpose some years ago.

MISCELLANEOUS

Ontario

PORT ARTHUR.—Work has commenced on the business block to be built of reinforced concrete at a cost of $80,000.

Manitoba.

WINNIPEG.—The city proposes to spend $19,848 on road improvements.

PERSONAL.

MR. F. ROCKHILL has been appointed bridges and building master of the southern division of the G.T.R.

MR. SIFROY LEGER has been appointed contracting agent of the Canadian Northern-Quebec and Quebec and Lake St. John Railways in Montreal.

DR. W. F. KING, chief astronomer for the Dominion of Canada has been appointed superintendent of a new department, "The Geodetic Survey of Canada."

MR. L. M. JONES, Assoc. Mem. Can. Soc. C.E., has resigned his position as assistant city engineer of Port Arthur to join the staff of Messrs. Smith, Kerry & Chace, consulting engineers, Toronto.

OBITUARY.

MR. JOHN WILLIAMS, city bridge engineer, Toronto, died May 1st, 1909. The deceased engineer, who had been in the city's service for twenty-two years, and was well liked by all the civic officials, was born in Manchester, England, sixty-seven years ago. He came to Canada in 1870, when he entered the service of the old Great Western Railway at Hamilton. He remained there four years, and returned to England. He came to Canada again in 1887, and became mechanical draughtsman in the city engineer's department, Toronto. In a short time he was promoted to the position of bridge engineer, and he supervised the construction of the Queen Street Subway, and the following bridges: Sherbourne Street, Huntley Street, Queen Street East, Don, Dundas Street, Wallace Avenue and Lansdowne Avenue. The late Mr. Williams was a member of the Canadian Society of Engineers and the Engineers Club, Toronto. Mr. Fred Williams, C.E., of Cleveland, Ohio, is a son.

MR. WILLIAM LEWIS LESLIE, A.M. Can. Soc. C.E., engineer in charge of parliamentary estimates and railway subsidies in the Department of Railways and Canals at Ottawa, died on May 1st, 1909. He was fifty-four years of age, had been twenty years in the Civil Service, and was a prominent civil engineer. He was a native of St. Catharines, Ont. His late father, Lewis Leslie, was a civil engineer in the service of the Government on the old Welland Canal.

LATE TENDERS.

Ontario.

TORONTO.—Tenders for reinforced concrete work, steel and iron work, tiling and other work required in the erection of a floor to the new engine-room at the High Level Pumping Station will be received by 18th May, 1909. John J. Ward, Vice-Chairman Board of Control.

TORONTO.—Tenders will be received up to June 1st, 1909, for the reconstruction of the bridges on Dundas Street, over the tracks of the Grand Trunk and Canadian Pacific Railways. John J. Ward, Vice-Chairman, Board of Control. (Advertised in The Canadian Engineer).

TORONTO.—Tenders will be received up to 20th May, for the supply of coal and wood required at Government House, Parliament Buildings, Osgoode Hall, Normal and Model Schools, Toronto, and for the Normal Schools at Ottawa, London, Peterborough, Hamilton, Stratford and North Bay, the Institution for the Deaf and Dumb, Belleville, and Institution for the Blind, Brantford, for the twelve months ending 30th June, 1910. H. F. McNaughten, Secretary Public Works, Ontario.

Saskatchewan.

YORKTON.—Tenders will be received until Monday, the 24th May, for the construction of sewers as follows:—2,000 feet of 12-inch, and 15,000 feet of 8-inch, with all necessary appurtenances. F. T. McArthur, Town Engineer, R. H. Lock, secretary-treasurer.

CANADIAN RAILWAY CLUB ELECT OFFICERS.

At the annual meeting of the Canadian Railway Club which was held May 4th, 1909, at the Windsor Hotel, Mr. H. H. Vaughan, assistant to the vice-president of the Canadian Pacific, was elected president.

The other officers elected for the year were:—

Vice-President—A. A. Maver, master mechanic, G.T.R.

2nd Vice-President—A. A. Goodchild, auditor of stores and mechanical accounts, C.P.R.

Executive Committee—J. Coleman, A. W. Wheatley, C. Manning, and P. R. Diamond.

Audit Committee—W. H. Stewart, H. A. White, and J. S. Johnstone.

Secretary—James Powell.

Treasurer—S. S. Underwood.

The members of the nominating committee present were: Messrs. C. W. Van-Buren, D. B. Swinton, F. A. Purdy, J. Hendry, J. S. Johnstone, and H. Osborne.

The annual report showed the club to be in a very flourishing condition, there being a balance in hand of $2,287 with all accounts paid including the amount of the scholarship which was won by Mr. J. Bruce Robb, son of Mr. W. D. Robb, past president of the club and superintendent of motive power of the Grand Trunk. The club dues of which $215 are still to collect, amounted to $1,238 as against $781 last year. The membership is 722.

MARKET CONDITIONS.

Toronto, May 6th, 1909.

To-day's advices from London are that the metals market is buoyant, and everywhere prices firm to a degree unusual in recent weeks. A strong tone characterizes metals here, and the demand is improving. Roofing felt and building paper, tar and pitch, slate and ready roofings find steady request. Bricks are moving freely and small orders for cement and drain pipes continue regular. Lumber is firmly held, and a steady demand is apparent.

In Toronto, house-building shows much activity. For four months this year the approximate value of buildings in the city was $4,940,298, where in the same period last year it was $2,740,858, the number of buildings erected in that period being 1,871 in 1909, against 1,418 in 1908.

The following are wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:—

Antimony.—The market fairly active; price continues at 9½c.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.75; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $18.50 to $19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. An increased demand is reported.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10, for common. Don Valley pressed brick move also freely. Red and buff pressed are worth, delivered, $18; at works, $17.

Cement.—Price in 1,000-barrel lots $1.70 per barrel, including bags, or $1.30 without bags. Similar quantities, $1.55 to $1.60 per barrel, in load lots delivered in town, and bags extra. Movement confined mainly to small parcels.

Coal Tar.—In much greater request at former price, $3.50 per barrel.

Copper Ingot.—Firm and active, both abroad and here. Local price continues at 13½c. to 14c.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1.

Dynamite, per pound, 21 to 25c., as to quantity.

Roofing Felt.—A very decided increase in business this month, prices not yet advanced; we quote $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000. The demand has become quite active, and stocks are low.

Fuses.—Electric Blasting.—Double strength, per 200, 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5. Bennett's double tape fuse, $6 per 1,000 feet.

Galvanized Sheets.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.05; 12-14-gauge, $3.15; 16, 18, 20, $3.35; 22-24, $3.50; 26, $3.75; 28, $4.20; 29, $4.50; 10¾, $4.50 per 100 lbs. Fleur de Lis—28-gauge, $4.30; 26-gauge, $4.05; 22-24-gauge, $3.50. Queen's Head—28-gauge, $4.50; 26-gauge, $4.25. Sheets continue in active request.

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40.

Bar Iron.—$1.95 to $2, base, from stock to wholesale dealer. Market well supplied.

Iron Pipe.—Black, ¼-inch, $2.03; ⅜-inch, $2.26; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.90; 2½-inch, $15.81; 3-inch, $20.76; 3½-inch, $26.13; 4-inch, $29.70; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.50. Prices firmly maintained.

Lead.—Prices steady outside. This market holds firm at $3.80 to $3.90, with an active movement.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b., car. More is moving, in medium to small lots.

Lumber.—The greater ease in the money market having permitted or encouraged more building of warehouses or factories, the result is felt by the lumber trade in a marked demand for Southern pine of large dimensions. This wood, which has been scarce in this market, is beginning to come in freely, and some beautiful clear stuff, as large as 10 by 20 inches, is in stock. For hemlock there is a fair demand, with a scarcity of the longer lengths. It is noticeable that 32-inch lath are rising in price, as we foreshadowed a week or two ago, sales of several cars have been made lately at $1.50. Prices are rather stiff, all along the line. Dressing pine quotes $32 to $35 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $3.20; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.50.

Nails.—Wire, $2.25 base; cut, $2.70; spikes, $3. Moving freely.

Pitch.—The demand continues slow, perhaps because buildings are not far enough advanced yet. Price so far unchanged at 70c. per 100 lbs.

Pig Iron.—There is more activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20.

Plaster of Paris.—Calcined, wholesale, $2; retail, $2.15. Trade normal.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05.

Ready Roofing.—In very active request at prices per catalogue. It is impracticable to quote figures, so great is the variety of this kind of goods, but prices are firmly held.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Pennsylvania slate 10 x 16 may be quoted at $7.25 per square of 100 square feet, f.o.b., cars, Toronto.

Rope—Sisal, 9¼c. per lb.; pure Manila, 12½c., Base.

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

In steady demand; price 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. Small lots subject to advance.

Steel Beams and Channels.—Quiet. We quote:—$2.50 to $2.75, according to size and quantity; if cut, $2.75 to $3; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over: Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43.

Sheet Steel.—Market steady, at the former prices; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a quantity of light sheets moving.

Tank Plate.—3-16. $2.40 100 lbs.

Tool Steel.—Jowett's special pink label, 10½c. Cyclops, 16c. "H.R.D." high speed tool steel 65c.

Tin.—Market firm and demand good. The price continues at 31c. to 31½c.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, per dozen, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each.

Zinc Spelter.—Business active, market firm at $5.25 to $5.50, outside market improved.

* * * *

Montreal, May 5th, 1909.

Conditions in pig-iron and finished and semi-finished material in the United States, are reported to be showing considerable improvement, this week, especially with respect to the tonnage moving. Several furnace interests have booked sufficient orders ahead to warrant them in retiring from the market, and they are declining to accept further business at to-day's prices. Alabama furnaces, which were a few weeks ago taking orders at $10.50 per ton, at furnaces, are now asking $11.50 to $12, and it is understood that Eastern and Valley furnaces have also stiffened their ideas considerably. Lake furnaces are booking the bulk of the business just now, especially for water shipment to New England points. Stocks in makers' hands are still large, but there is a more optimistic feeling, and the opinion seems to prevail that once tariff matters have been straightened out, activity will prevail. It is likely that the tariff question will be settled by the end of this month. In finished steel products, structural steel, bars, plates, etc., an exceptionally heavy tonnage is changing hands and an advance of 5c. per 100 lbs. has been established during the past week. It is a little difficult to say what the course of trade will be, but everyone seems to be feeling more optimistic this week.

The English market is quiet, but steady, with a more hopeful tone. Good orders are being booked for home account, and the export demand is rather better than looked for. Prices have not shown any material change since the recent advance, but makers are more busily occupied. Pig-iron is held firm at the recent advance of 2s. per ton.

Locally, the market is in a fair condition, an encouraging volume of business being booked. The tone is generally optimistic, and Canadian furnaces are asking and receiving prices which were not possible a few months ago. The general foundry trade, which is the index of iron market conditions, shows a decided improvement, not only in the matter of tonnage consumed, but also in the fact that a greater number of the establishments, including the smaller foundries, are now in receipt of good orders. Hurry-up orders are being received, thus showing that supplies throughout the country are short, and that the need for metal to take care of requirements is pressing.

Prices throughout the market are holding about steady, the following list showing a fair range of quotations:—

Antimony.—The market is dull at 8¾ to 8¾c.

Bar Iron and Steel.—Prices are steady and trade is better. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.8, for 1 x ⅜-base; tire steel, $1.95 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; smooth finish, $2.70.

Boiler Tubes.—The market is steady, quotations being as follows:—2-inch tubes, 8¼c.; 2½-inch, 10c.; 3-inch, 11½c.; 3½-inch, 14¼c.; 4-inch, 19c.

Cement.—Canadian cement is now so cheap that it holds the market. Quotations are for car lots, f.o.b., Montreal. Canadian cement is readily available at $1.40 to $1.50 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2¼c. extra, or 10c. per bbl. weight.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.60 per 100 pounds; felt paper, $2.40 per 100 pounds; tar sheathing, No. 1, 35c. per roll of 400 square feet; No. 2, 35c.; dry sheathing, No. 1, 45c. per roll of 400 square feet, No. 2, 28c. (See Roofing; also Tar and Pitch).

Chain.—The market is steady as follows:—¼-inch, $5.30; 5-16-inch, $4.05; ⅜-inch, $3.65; 7-16-inch, $3.45; ½-inch, $3.20; 9-16-inch, $3.15; ⅝-inch, $3.05; ¾-inch, $3; ⅞-inch, $2.95; 1 inch, $2.95.

Copper.—Prices are firm at the recent decline to 13¾ to 14c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 18c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1. Electric

blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strentgh, per 100 fuses:—4-ft. wires, $3.50; 6-ft. wires, $4; 8-ft. wires, $4.50; 10-ft. wires, $5. Double strength fuses, $1 extra, per 100 fuses. Fuses, time, double-tape, $6 per 1,000 feet.

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's eHad, $4.40; Comet, $4.25; Gorbal's Best, $4.25; Apollo, 10¾ oz., $4.35. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge. American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—The outlook is steady. The following prices are for carload quantities and over, on cars, Montreal, delivery from dock being 35c. less; Canadian pig, $18.50 per ton, Montreal; No. 1 Summerlee, $18.75 to $19; selected Summerlee, $18.25 to $18.50; soft Summerlee, $17.75 to $18; Clarence, $17 to $17.25 per ton.

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.60 to $3.70.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight rate of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $22 to $25. Spruce, 1-in. by 4-in. and up, $16 to $18 per 1,000 ft.; mill culls, $14 to $16. Hemlock, log run, culls out, $14 to $16. Railway Ties; Standard Railway ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X, $1.50; XX, $2.50; XXX, $3.

Nails.—Demand for nails is poor, but prices are steady at $2.30 per keg for cut, and $2.25 for wire, base prices.

Pipe.—Cast Iron.—The market continues steady at $33 for 8-inch pipe and larger; $34 for 6-inch pipe; $34 for 5-inch, and $34 for 4-inch at the foundry. Pipe, specials, $3.10 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—The market is steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized. The discount on the following is 69 per cent. off for black and 50 per cent. off for galvanized; ½-inch, $8.50; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-nch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. (See Building Paper; also Tar and Pitch).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 11c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $6; ⅝, $7.25; ¾, $8.50; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are in dull demand and prices are steady at $2.30 per 100 pounds, base of 5½ x 9-16. Ship spikes are also dull and steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Steel Plates.—The market is steady. Quotations are: $2.15 for 3-16; $2.25 for ⅛, and $2.15 for ¼ andthicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.75 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 90c. per 100 pounds; and No. 2, 50c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; pine pitch, $4 per barrel of 180 to 200 pound. (See building paper; also roofing).

Tin.—Prices are unchanged, at 32 to 32½c.

Zinc.—The tone is steady, at 5½ to 5¾c.

* * * *

Winnipeg, May 4th, 1909.

The weather conditions in the West during the past week or ten days have not been favorable, at least so far as the country is concerned, and the getting in of the seed, but at the time of writing indications are that the weather will now continue favorable, and the seeding will have to be completed in rush time.

In so far as business in the building and contracting lines is concerned, the dealers report business very good, but they also would be benefited by finer and warmer weather. The building permits in Winnipeg continue to grow, and the outlook for a good season were never brighter. A number of the large buildings to be erected this year are making good progress. The Dominion Bridge Company, have practically completed the structural work on the new Union Depot, the enlargement of the T. Eaton Company's giant building is also being rushed, and there does not seem to be many of the laboring class idle. The lumber dealers are pleased with the way business is coming, and report prices to be steady. No change in other quotations is reported, and the demand in all lines is very good. Hardware dealers are taxed to their utmost to supply the demand for traps in southern Manitoba, where they are being overrun by a rat invasion.

Winnipeg prices are as follows:—

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50.

Bar Iron.—$2.50 to $2.60.

Beams and Channels.—$3 to $3.25 per 100 up to 15-inch.

Building Paper.—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain, 60c.; No. 2 tarred, 62½c.; plain, 56c.

Bricks.—$11, $12, $13, per M, three grades.

Cement.—$2.25 to $2.50 per barrel, in cotton bags.

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 7-16-inch, $4.75; ½-inch, $4.40; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ½-inch, $8.50; jack iron, single, per dozen yards 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Dynamite.—$11 to $13 per case.

Hair.—Plaster's, 80 to 90 cents per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5½c. per lb.; 12 inches up, per lb., 4½c.

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., Toronto.

Pipe.—Iron, black, per 100 feet. ¼-inch, $2.50; ⅜-inch, $2.80; ½-inch, $3.40; ¾-inch, $4.60; 1-inch, $6.60; 1¼-inch, $9; 1½-inch, $10.75; 2-inch, $14.40; galvanized, ½-inch, $4.25; ¾-inch, $5.75; 1-inch, $8.35; 1¼-inch, $11.35; 1½-inch, $13.60; 2-inch, $18.10. Lead, 6½c. per lb.

Picks.—Clay, $5 dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb.

Pitch.—Pine, $6.50 per barrel; in less than barrel lots, 4c. per lb.; roofing pitch, $1 per cwt.

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—

Nails.—$4 to $4.25 per 100. Wire base, $2.85; cut base, $2.90.

Tool Steel.—8½ to 15c. per pound.

Timber.—Rough, 8 x 2 to 14 x 16 up to 32 feet, $34; 6 x 20, 8 x 20, up to 32 feet, $38; dressed, $37.50 to $48.25.

Boards.—Common pine, 8-inch to 12-inch wide, $38 to $45; siding, No. 2 white pine, 6-inch, $55; cull red or white pine or spruce, 6-inch, $24.50; No. 1 clear cedar, 6-inch, 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 6-inch, $55; No. 3, $45.

TENDERS CALLED FOR

NOTICE TO CONTRACTORS FOR SEWERS

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **June 8th, 1909,** for the construction of Sections Nos. 4 and 5 of the High-level Interceptor. The following is an approximate statement of the work to be done:—

Section No. 4—Total length, 4,211 feet, made up as follows:—

	Diameter.
73 linear feet of circular sewer.....	7 ft. 6 in.
1,865 " " "	7 ft. 3 in.
2,273 " " "	7 ft. 0 in.

Section No. 5—Total length, 6,481 feet, made up as follows:—

	Diameter.
2,493 linear feet of circular sewer.....	6 ft. 6 in.
3,974 " " "	6 ft. 0 in.
14 linear feet of bellmouth.	

The work includes the building of connections, with intercepting sewer, syphons, manholes, etc.

Plans may be seen and specifications and forms of tender obtained at the office of the City Engineer.

The usual conditions relating to tendering as prescribed by city by-law must be strictly complied with or the tender will not be entertained.

The lowest or any tender not necessarily accepted.

JOHN J. WARD (President),
Vice-Chairman, Board of Control.

City Hall, Toronto, May 3rd, 1909.

CONDUIT

The city of Toronto will shortly call for tenders for the laying of underground conduit. For specifications, apply to the Electrical Department, City Hall.

NOTICE TO CONTRACTORS

TENDERS will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, June 1st, 1909, for the reconstruction of the Bridges on Dundas Street, over the tracks of the Grand Trunk and Canadian Pacific Railways, consisting of the following work:

Supply of five new trusses of the following spans:
105 feet 4 inches.
93 feet.
86 feet 8 inches.
82 feet 8 inches.
62 feet
and three new columns supporting same.

Supply of complete new floor system.

Supply of new rollers, shoes, bed plates, etc., for present trusses.

Erection and painting.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the City Engineer, Toronto.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders will not be entertained.

The lowest or any tender not necessarily accepted.

City Hall, Toronto, May 4th, 1909.

JNO. J. WARD (President),
Vice-Chairman of Board of Control.

City of Lethbridge, Alberta, Canada

TENDERS FOR WATERWORKS PUMP

TENDERS will be received up to the 17th day of May, 1909, for a steam pumping equipment to deliver 2,000,000 gallons per 24 hours.

Specification, drawings, and form of Tender, may be obtained from Messrs. Smith, Kerry & Chace, Confederation Life Building, Toronto, on and after May 3rd.

Tenders are to be addressed to Messrs. Smith, Kerry & Chace, Toronto.

Each tender must be accompanied by a certified cheque, payable to the order of the Secretary-Treasurer, City of Lethbridge, for ten per cent. (10%) of the amount of the tender, which cheque will be returned unless the tenderer fails upon request to enter into a contract at the rate stated in the tender.

The lowest or any tender will not necessarily be accepted.

TOWN OF ESTEVAN

PROVINCE OF SASKATCHEWAN.

Tenders Wanted

Sealed Tenders will be received by the Secretary-Treasurer until Wednesday, May 19th, for constructing a Waterworks System and a Main Sewer, comprising 7,300 feet of Water Mains, 2,400 feet of Tile Sewer, also Steel Water Tower, Gasoline Engines, and Power Pump.

Plans and Specifications may be seen at the office of the Secretary-Treasurer, Estevan, or of the Chief Engineer, 103 Bay Street, Toronto, on and after April 22nd.

No Tender necessarily accepted.

L. A. DUNCAN, Esq., Secretary-Treasurer, Estevan, Sask.
WILLIS CHIPMAN, C.E., Chief Engineer, 103 Bay St., Toronto, Ont.

TOWN OF ESTEVAN

Province of Saskatchewan.

TENDERS WANTED

The time for receiving tenders for Waterworks System and Main Sewer has been extended to Wednesday, May 26th.

Plans and Specification may be seen at the following offices: Chief Engineer's Office, Toronto, 103 Bay Street; Chief Engineer's Branch Office, Winnipeg, Room 47, Canada Life Building; Secretary-Treasurer's Office, Estevan.

No tender necessarily accepted.

L. A. DUNCAN, Esq., Sec.-Treas., Estevan, Sask.
J. G. HASTINGS, Esq., Mayor, Estevan, Sask.
WILLIS CHIPMAN, C.E., Chief Engineer, Toronto and Winnipeg.

TENDERS

Sealed tenders addressed to the undersigned, and marked "Tender for Sewage Disposal," will be received up to noon on **Tuesday, the 18th inst.,** for the building of a Sewage Disposal Plant for the City of St. Thomas. Plans and specifications can be seen and blank forms of tender obtained at the office of the undersigned. A marked cheque, payable to the Treasurer of the City of St. Thomas for $500.00, must accompany each tender as a guarantee of good faith.

JAS. A. BELL,
City Engineer.

St. Thomas, Ont.

TENDERS CALLED FOR

TOWNSHIP OF McNAB

TENDERS FOR CONCRETE ARCH BRIDGE

Sealed tenders addressed to the undersigned will be received till noon of **Tuesday, May 18th,** for the construction of a Concrete Arch Bridge over Dochart Creek at Dochart Village, near Arnprior.

Each tender shall be accompanied by a certified cheque, payable to the Treasurer of the Township of McNab, for 5 per cent. of the amount of tender, which will be returned to the tenderer unless he fail to execute an agreement should contract be awarded to him.

Plans and specifications may be seen at the Clerk's office, near Burnstown, at J. E. Thompson's office, Arnprior, or at the office of A. F. Macallum, C.E., 612 Continental Life Building, Toronto, and at the office of the Canadian Engineer, 62 Church Street.

Tenders will be opened by the Council at the Township Hall, Stewartville, on Wednesday, May 19th, at 12 o'clock noon. The lowest or any tender not necessarily accepted.

JOHN McGREGOR,
Clerk of Township of McNab,
Burnstown P.O., Ont.

April 30th.

TENDERS FOR ASPHALT PAVING

Sealed proposals addressed to the Chairman, Board of Control, Winnipeg, Man., and endorsed as above, for grading, curbing and construction of asphalt pavements, approximately 49,672 square yards, will be received at the office of the undersigned up to **11 a.m. on Thursday, May 20th, 1909.** Plans, specifications and forms of tender, together with conditions governing tender as prescribed by by-law, may be obtained at the office of H. N. Ruttan, City Engineer, 233 James Street, Winnipeg. The lowest or any tender not necessarily accepted.

M. PETERSON,
Secretary.

Board of Control Office, Winnipeg, April 20th, 1909.

CITY OF MOOSE JAW, SASKATCHEWAN

Tenders will be received by the City of Moose Jaw, addressed to the undersigned, on Monday, May 31st, at 8 o'clock p.m. for the sinking of a Test Well for Gas, Oil, or Water, the contractor to undertake to complete the Well before being entitled to any portion of his contract and to provide a schedule showing the allowance he will make on his full contract price if the city call him to stop work at less than the depth agreed upon; the Contractor to provide everything necessary except the well casing now in possession of the City, which he shall take over and allow for at a price to be named in his tender. Tenders are to be accompanied by a deposit of 5 per cent. on the contract price, said deposit to be returned to the Contractor as soon as the plant has been put in operation on the ground.

Alternative tenders are required for a well 2,500 feet and 3,000 feet respectively, the lowest or any tender not necessarily accepted.

JOHN D. SIMPSON, City Clerk.

Moose Jaw, April 27th, 1909.

CONTRACTOR'S SUPPLIES

NEW INCORPORATIONS.

Kingsville, Ont.—Kingsville Electric Light Company, $20,000; R. S. Stewart, M. B. Stewart, G. V. Lothrop, Detroit.

Morrisburg, Ont. — Canadian Sheet Steel Corporation, $750,000; A. White, R. Kelly, J. F. Hollis, Toronto.

Fashions in steel manufacture appear to be undergoing a change. In the United Kingdom the production of Bessemer steel is steadily declining in favor of that produced by the open-hearth process, while in the United States, although the production of Bessemer still exceeds that of open-hearth steel, the output of the latter is growing rapidly, and most of the new steel-making plants are of the open-hearth type. In Germany, on the other hand, about two-thirds of the total production is Bessemer steel, and nearly the whole of this is basic steel, owing to the characteristics of the native ores. In the United States nearly the whole of the open-hearth steel is basic steel, whereas that produced by the Bessemer process is acid steel. In this country most of the steel produced, whether by the Bessemer or the open-hearth process, is acid steel, and for this reason large imports of foreign ores are essential. Manganese ore is an important element in the production of steel. The largest source of supply is British India, which had an output in 1907 of, approximately, 898,345 tons, or practically half the total production.

BUYERS' REFERENCE

Numbers indicate pages on which may be found advertisements of desired materials.