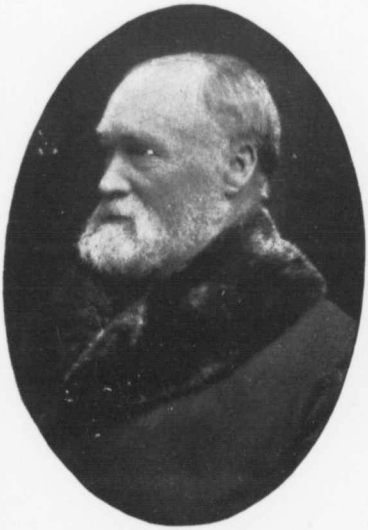
F. F. PASSMORE, P.L.S.



HUGH WILSON, F.G.S.

A. C. WEBB, P.L.S.

PROCEEDINGS

OF THE

ASSOCIATION OF

PROVINCIAL LAND SURVEYORS

OF ONTARIO

AT THE ANNUAL MEETING HELD AT TORONTO,
ON THE 22ND, 23RD AND 24TH

FEBRUARY

1892

The Eighth Annual Meeting (First Annual Meeting of the Association of Ontario Land Surveyors) will be held in Toronto, on Tuesday, 7th of February, 1893.

PRINTED FOR THE ASSOCIATION
BY
T. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO.

HUGH WILSON, F.G.S.

PROCEEDINGS

OF THE

ASSOCIATION OF

PROVINCIAL LAND SURVEYORS

OF ONTARIO

AT ITS SEVENTH ANNUAL MEETING, HELD AT TORONTO,
ON FEBRUARY 23RD, 24TH, AND 25TH,

1892.

The Eighth Annual Meeting (First Annual Meeting of the Association of Ontario Land Surveyors) will be held in Toronto, on Tuesday, 28th of February, 1893.

PRINTED FOR THE ASSOCIATION
BY
C. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO.

PATRONIZE OUR ADVERTISERS.

NOTICES.

The attention of the members is called to the list of Standing Committees as given on page 6. Each member should assist the Standing Committees as much as possible.

Members can be supplied with copies of the Proceedings for 1887, 1888, 1889, 1890, or 1891 by remitting fifty cents to the Secretary.

Copies of the Act of Incorporation will be sent upon receipt of three-cent stamp.

PATRONIZE OUR ADVERTISERS.

PREFACE.

To the Members of the Association of Provincial Land Surveyors of Ontario:

THE Proceedings of the Association at its Seventh Annual Meeting are herewith presented.

The registered attendance at this meeting exceeded that of either of the two preceding meetings.

As a result of affiliation with the Association of Dominion Land Surveyors two papers read before that Association are published herein.

Since the date of the Seventh Annual Meeting the Act of Incorporation of the Ontario Land Surveyors has become law and our standing assured. A copy of the Act will be found in this issue.

The hearty co-operation of all our members is requested, in order that the benefits of the new status of the Association may be felt by each member.

Respectfully submitted on behalf of the Executive Committee.

A. J. VANNOSTRAND,
Secretary.

CONTENTS.

ASSOCIATION OF

PROVINCIAL LAND SURVEYORS

OF ONTARIO.

ORGANIZED 23RD FEBRUARY, 1886.

Officers for 1892-3.

PRESIDENT.

Elihu Stewart, P.L.S., Collingwood.

VICE-PRESIDENT.

M. J. Butler, P.L.S., Napanee.

SECRETARY-TREASURER.

A. J. VanNostrand, P.L.S., Toronto.

COUNCILLORS.

J. McAree, D.T.S., Toronto.
M. Gaviller, P.L.S., Barrie.
P. S. Gibson, C.E., Willowdale.

BANKERS.

Imperial Bank of Canada.

STANDING COMMITTEES.

LAND SURVEYING.—M. Gaviller (Chairman), H. J. Browne, T. B. Speight, P. S. Gibson, C. F. Miles, L. B. Stewart.

DRAINAGE.—J. C. Macnab (Chairman), R. Coad, J. M. Tiernan, M. Gaviller, J. Robertson, W. R. Burke, Geo. Ross, C. A. Jones, L. Bolton, A. G. Cavana, B. J. Saunders, C. F. Miles.

ENGINEERING.—G. B. Abrey (Chairman), C. F. Aylsworth, John McAree, H. D. Ellis, J. Galbraith, T. H. Jones, Jas. Warren, H. J. Bowman, H. K. Wicksteed.

LEGISLATION.—J. Dickson (Chairman), O. J. Klotz, A. Niven, G. B. Kirkpatrick, Willis Chipman, C. Unwin, W. Ogilvie, Joseph Cozens, J. P. B. Casgrain, W. R. Aylsworth.

ENTERTAINMENT.—F. L. Foster (Chairman), Chas. Murphy, H. D. Ellis, G. B. Abrey, T. B. Speight, H. B. Proudfoot, W. A. Browne.

PUBLICATION.—H. L. Esten (Chairman), H. J. Browne, F. L. Foster, Willis Chipman, Chas. Murphy, John McAree.

INSTRUMENTS.—W. S. Drewrey (Chairman), Thos. Fawcett, F. L. Blake, W. A. Browne, J. W. Tyrrell, J. F. Whitson, W. Ogilvie.

PROGRAMME OF THE

ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO

AT ITS SEVENTH ANNUAL MEETING HELD IN TORONTO, FEBRUARY 23RD, 24TH AND 25TH, 1892.

PROGRAMME.

Tuesday, February 23rd—Morning, 10 o'clock.

Meeting of Executive Committee.
Meeting of Standing Committees.

Afternoon, 2 o'clock.

Reading of Minutes of Previous Meeting.
Reading of Correspondence.
Report of Secretary-Treasurer.
Appointment of Auditors.
President's Address.
Report of Committee on Land Surveying, with Question Drawer. A. Niven, P.L.S., Chairman.
Report of Committee on Engineering, with Question Drawer. G. B. Abrey, P.L.S., C.E., Chairman.
Announcements by Committee on Entertainment. F. L. Foster, P.L.S., Chairman.

Evening, 8 o'clock.

Paper—"Cement and Cement Mortars." M. J. Butler, P.L.S., C.E., Napanee, Ont.
Paper—"Does the Passing of an Act of Parliament always do Justice?" A. Niven, P.L.S., Haliburton.
Paper—"Hints to a Surveyor about to Survey a Township for the Ontario Government." W. R. Burke, P.L.S., Ingersoll, Ont.
Paper—"Exploratory Surveys." Wm. Ogilvie, P.L.S., Ottawa.

Wednesday, February 24th—Morning, 10 o'clock.

Discussion—The Drainage Act.
Paper—"Compass Lines." John McAree, D.T.S., Toronto.
Paper—"The Value of Old Records in Relation to Municipal Surveys." G. B. Kirkpatrick, P.L.S., Crown Lands Dept., Toronto.

Afternoon, 2 *o'clock.*

Discussion—Incorporation.

Paper—"Sewerage for Towns and Villages." H. J. Bowman, P.L.S., C.E., Berlin, Ont.

Paper—"Georgetown Water Works." James Warren, P.L.S., C.E., Kincardine, Ont.

Paper—"Hamilton and Barton Incline Railway." J. W. Tyrrell, P.L.S., C.E., Hamilton, Ont.

Paper—"Are the Great Lakes Retaining their Ancient Level?" J. G. Boulton, R.N.

Thursday, February 25th—Morning, 10 *o'clock.*

Paper—"Exploring for Nickel." C. E. Fitton, P.L.S., Orillia.

Paper—"Railway Surveys." H. K. Wicksteed, P.L.S., C.E., Cobourg, Ont.

Paper—"Rock Blasting of Trenches for Water Works and Sewerage Purposes." A. L. McCulloch, P.L.S., C.E., Galt, Ont.

Report of Committee on Drainage. J. C. Macnab, P.L.S., C.E., Chairman.

Afternoon, 2 *o'clock.*

Report of Committee on Legislation. W. R. Aylsworth, P.L.S., Chairman.

Report of Committee on Incorporation. A. Niven, P.L.S., Chairman.

Report of Committee on Publication. John McAree, D.T.S., Chairman.

Report of Committee on Instruments. W. Ogilvie, P.L.S., Chairman.

Report of Committee on Entertainment. F. L. Foster, P.L.S., Chairman.

Unfinished business.

Election of Associate Members, Junior Members, and Honorary Members.

Nomination of Officers.

Appointment of Scrutineers—Ballot of 1892.

New Business.

Adjournment.

Full discussion after each Paper and each Report.

ASSOCIATION OF

PROVINCIAL LAND SURVEYORS

OF ONTARIO.

MINUTES OF THE SEVENTH ANNUAL MEETING,

FEBRUARY 23RD, 24TH AND 25TH, 1892.

The Association met at 2 p.m. on February 23rd, in the Library of the Canadian Institute, 58 Richmond Street East, Toronto.

The President, Villiers Sankey, Esq., in the Chair.

Moved by A. J. VanNostrand, seconded by A. Niven, That the minutes of last meeting, as printed in the Proceedings, be confirmed as read. Carried.

The Secretary read a letter from Professor Galbraith, in reference to the admission of Provincial Land Surveyors to the School of Practical Science.

Mr. VanNostrand, the Secretary-Treasurer, then read his Annual Report.

Moved by M. Gaviller, seconded by H. D. Ellis, That the Report of the Secretary-Treasurer be received and adopted, and that the Financial Statement be referred to the Auditors for their report. Carried.

Moved by M. J. Butler, seconded by Mr. Fawcett, That Messrs. Campbell and Gaviller be the Auditors for the current year. Carried.

The President then read his Annual Address.

Moved by A. Niven, seconded by C. F. Aylsworth, That the thanks of the Association be given to the President for his address and the many practical suggestions contained therein. Carried.

The report of the Committee on Land Surveying was presented by the Chairman of the Committee, Mr. Niven. After discussion, on motion of Mr. Niven, seconded by Mr. Aylsworth, the report was received and adopted.

Mr. Burke read a paper prepared by him, entitled "Hints to a Surveyor about to Survey a Township for the Ontario Government."

Moved by A. Niven, seconded by T. H. Jones, That the paper read by Mr. Burke be received, and that he be tendered the thanks of the Association. Carried.

The matter of Incorporation was then taken up and discussed, after which Mr. Foster announced that on account of the meeting at the School of Practical Science, on the following evening, the Committee concluded to dispense with the customary Annual Dinner.

The meeting adjourned at 5.15.

Evening Session, 8 p.m.

The President in the Chair.

Mr. Niven read his paper on "Does the Passing of an Act of Parliament Always do Justice?"

Moved by T. H. Jones, seconded by T. B. Speight, That the paper of Mr. Niven be accepted, and that the thanks of the meeting be tendered him. Carried.

Mr. Alan Macdougal, on behalf of the Canadian Institute, gave a short address, welcoming the members of the Association, to which the President, on behalf of the Association of Provincial Land Surveyors of Ontario, replied.

Mr. M. J. Butler then addressed the meeting on the subject of "Cements and Cement Mortars." A full discussion followed. On motion of Willis Chipman, seconded by A. Niven, a vote of thanks was tendered Mr. Butler for his address.

The paper read by Mr. Gaviller at the last Annual Meeting, on "Descriptions," was then discussed till the adjournment, at 10 p.m.

WEDNESDAY MORNING SESSION, 10 A.M.

The President in the Chair.

The Secretary read a letter from Mr. J. B. Rankin, Chairman of the Ontario Drainage Commission, in reference to the appointment by the Association of the members to meet the Commission *re* changes in Drainage Act. Also a letter from Mr. W. G. McGeorge, regretting his inability to attend the meeting.

Mr. McAree then read a paper, prepared by him, on "Compass Lines," after which, on motion of Mr. Stewart, seconded by Mr. Niven, the thanks of the Association were tendered Mr. McAree for his paper.

Mr. George B. Kirkpatrick read his paper on "The Value of Old Records in Relation to Municipal Surveys." After discussion a vote of thanks was tendered Mr. Kirkpatrick.

Owing to the absence of Mr. C. E. Fitton, of Orillia, the paper prepared by him on "Exploring for Nickel" was read by the Secretary.

Moved by E. Stewart, seconded by P. S. Gibson, That a vote of thanks be tendered Mr. Fitton for his paper on "Exploring for Nickel." Carried.

AFTERNOON SESSION.

The Vice-President, Mr. E. Stewart, in the Chair.

Mr. Niven read the report of the Committee on Incorporation, which, on motion, was adopted. The discussion on Incorporation was continued for some time, when it was moved by M. J. Butler, seconded by Willis Chipman, That the following be a committee of this Association to wait upon the Attorney-General and Commissioner of Crown Lands *re* Incorporation, and to use every endeavour to secure the passage of the Bill, No. 63, now before the Legislature, and to accept the Bill, provided the clauses retaining the management of the Association be not expunged: E. Stewart, P. S. Gibson, V. Sankey, A. J. VanNostrand, W. Chipman, C. Unwin, H. J. Browne, G. B. Kirkpatrick, A. Niven, O. J. Klotz; three to form a quorum. Carried.

Mr. H. J. Bowman then read his paper on "Sewerage for Towns and Villages," and also exhibited some specimens of sewer pipe. After discussion a vote of thanks was tendered Mr. Bowman for his paper.

Mr. J. W. Tyrrell next read his paper on "Hamilton and Barton Incline Railway," showing plans of the structure, for which the thanks of the Association were tendered him.

The meeting adjourned at 5.45.

THURSDAY MORNING SESSION, 10 A.M.

The President in the Chair.

Moved by C. F. Aylsworth, seconded by A. Niven, That owing to the fact that Mr. D. S. Campbell, one of the Auditors appointed, is unable through illness to attend to the business of accounts, Mr. H. D. Ellis be appointed to act as Auditor with Mr. M. Gaviller. Carried.

Mr. James Warren's paper on "Georgetown Waterworks" was read by the Secretary, owing to the inability of Mr. Warren to be present.

Moved by Geo. Ross, seconded by A. L. McCulloch, That a vote of thanks be tendered to Mr. Warren for the paper on "Georgetown Waterworks." Carried.

Mr. A. L. McCulloch followed with a paper on "Rock Blasting of Trenches for Waterworks and Sewerage Purposes."

Moved by Mr. Abrey, seconded by Mr. McAree, That a vote of thanks be given to Mr. McCulloch for his interesting paper. Carried.

The report of the Drainage Committee was read by the Secretary.

The President then read the letter of Mr. Rankin, which had been previously read, and advised that some action be taken on it. After discussion it was moved by Mr. Niven, seconded by P. S. Gibson, That, complying with requests in correspondence from the Ontario Drainage Commission, the following be appointed a committee of this Association (with power to add to their numbers) to discuss the various Drainage Acts, and represent this Association before the Ontario Drainage Commission: J. C. Macnabb (Chairman), R. Coad, J. Tiernan, M. Gaviller, J. Robertson, W. R. Burke, G. Ross, C. A. Jones, and Lewis Bolton. Carried.

Moved by P. S. Gibson, seconded by Jno. McAree, That Mr. Wicksteed's paper on "Railway Surveys" be considered as read, and that the thanks of the Association be given to the author. Carried.

The Drainage Act was then taken up and discussed at length.

Afternoon Session.

The President in the Chair.

The report of the Auditors was read by the President.

Moved by Mr. Gibson, seconded by Mr. Aylsworth, That the Financial Statement of the Treasurer be adopted. Carried.

The President announced that the Committee on Legislation have no report to make at the present time.

Mr. McAree, Chairman of the Committee on Publication, read the report of said Committee. Moved by Mr. Niven, seconded by Mr. Speight, That the report be received and adopted. Carried.

The President, speaking for Mr. Ogilvie, Chairman of the Committee on Instruments, stated that nothing had come before them in the way of improvements on instruments or anything worthy of report to this Association during the past year.

The report of the Committee on Engineering was read by the Chairman of the Committee, Mr. Abrey, and on motion of J. McAree, seconded by M. J. Butler, was received and adopted.

The Secretary intimated that, owing to some unaccountable delay, Mr. Rogers' paper on "Storage of Water on the Trent System" had not yet arrived. It was moved by Mr. Niven, seconded by Mr. Abrey, that it be received and printed with the Proceedings. Carried.

The application of Mr. W. I. Mackenzie, Jr., for admittance as junior member of the Association of Provincial Land Surveyors of Ontario, was received and Mr. Mackenzie admitted as a member, being recommended by T. B. Speight and P. S. Gibson.

Moved by Willis Chipman, seconded by A. Niven, That the reports not now presented by the Chairmen of the Committees on

Entertainment, Instruments, and Legislation be printed in the Proceedings when received. Carried.

Moved by E. Stewart, seconded by A. Niven, That we, the members of this Association here assembled, desire to place on record our feelings of regret at the removal by death of two distinguished members of our profession, viz.: Lieut.-Col. A. C. Webb, P.L.S., of Brighton, and Mr. F. F. Passmore, P.L.S., of Toronto, both of whom were members of the Board of Examiners of Provincial Land Surveyors for this Province, and were universally respected and esteemed as honoured members of our profession. We feel that their departure has left a blank in our ranks which it will be very difficult to fill, and we desire to convey to the members of their respective families this expression of the esteem in which we hold their memories. Carried.

Moved by G. B. Abrey, seconded by M. J. Butler, That the usual salary be paid to the Secretary-Treasurer. Carried.

Moved by T. B. Speight, seconded by F. Purvis, That any omissions or clerical errors in the record of Proceedings of this meeting, now in the hands of the Stenographer and the Secretary, be corrected by the Committee on Publication before being printed. Carried.

The nomination of officers for the ensuing year was then proceeded with.

Moved by Mr. Butler, seconded by Mr. Gibson, That Mr. E. Stewart be President for the ensuing year. Carried.

Moved by Willis Chipman, seconded by A. Niven, That Mr. M. J. Butler be Vice-President for the ensuing year. Carried.

Moved by T. H. Jones, seconded by W. R. Burke, That Mr. A. J. VanNostrand be re-elected as Secretary-Treasurer of this Society for the coming year. Carried.

The following gentlemen were then nominated as Councillors :— Messrs. G. B. Abrey, T. H. Jones, P. S. Gibson, M. Gaviller, T. B. Speight, O. J. Klotz, C. F. Aylsworth, H. J. Bowman, A. M. Bowman, J. L. Morris, Jas. Robertson, Jno. McAree.

Moved by M. J. Butler, seconded by P. S. Gibson, That Messrs. F. L. Foster and H. J. Browne be Scrutineers for the ensuing year. Carried.

Moved by Willis Chipman, seconded by M. J. Butler, That the Secretary send to every member of the profession a copy of Bill No. 63, now before the Legislature, asking for his hearty co-operation to assist by every means in his power to carry the said Bill in its present form. Carried.

Mr. Gibson moved, seconded by Mr. McAree, That the President do now leave the chair, and that Mr. Stewart take it.

Mr. Gibson, in moving a vote of thanks to the retiring President, said : "I consider our retiring President has filled the position with credit to himself and honour to the Association. I need not say any thing more now, and I have much pleasure in moving a vote of thanks to him for the able manner in which he has conducted the affairs of

the Association during the past year." Mr. Niven seconded the motion, and it was carried unanimously.

Mr. Sankey, the retiring President, replied. (See page 46.)

Moved by Mr. Butler, seconded by Mr. Gibson, That the meeting do now adjourn. Carried.

The meeting was then declared closed. 4.45 p.m.

MEMBERS IN ATTENDANCE AT SEVENTH ANNUAL MEETING.

Abrey, G. B.	Gaviller, M.	Paterson, J. A.
Aylsworth, C. F., Jr.	Gibson, P. S.	Purvis, F.
Bolton, L.	Johnston, R. T.	Rainboth, E. J.
Bowman, A. M.	Jones, T. H.	Roberts, V. M.
Bowman, H. J.	Jones, C. A.	Robertson, J.
Browne, H. J.	Kirkpatrick, G. B.	Ross, G.
Browne, W. A.	Mackenzie, W. I., Jr.	Sankey, V.
Burke, W. R.	McAree, J.	Smith, H.
Butler, M. J.	McCulloch, A. L.	Speight, T. B.
Campbell, D. S.	McDoweli, R.	Stewart, E.
Chipman, W.	McEvoy, H. R.	Stewart, L. B.
De Morest, W.	McMullen, W. E.	Tyrrell, J. W.
Ellis, H. D.	McNabb, J. C.	Unwin, C.
Esten, H. L.	Murphy, C. J.	VanNostrand, A. J.
Fawcett, T.	Niven, A.	Walker, A. P.
Foster, F. L.	Ogilvie, W.	Whitson, J. F.—48.

RESULT OF ELECTIONS.

President.....E. Stewart .....(by acclamation).
Vice-President .....M. J. Butler .....(by acclamation).
Secretary-Treasurer ....A. J. VanNostrand.....(by acclamation).

Councillors—J. McAree, M. Gaviller, P. S. Gibson.

I hereby declare the abovenamed Councillors elected.

A. J. VANNOSTRAND,
Secretary-Treasurer.

Certified correct.

(Signed) F. L. FOSTER,
A. J. BROWNE,
Scrutineers of Ballots.

REPORT OF SECRETARY-TREASURER.

MR. PRESIDENT,—The following report is herewith submitted as the business of the Association from 10th March, 1891, to 22nd February, 1892 :—

The number of paid-up members on the list for the current year now stands at 107, being ten members more than at the annual meeting of last year. In addition to this number there are nine members in arrear for less than the twelve months specified in the Constitution as the limit allowed.

Death has claimed another member in the person of Mr. A. C. Webb, a prominent member of the Board of Examiners, and an active member of this Association since its inception. As his death occurred before the publication of the "Proceedings of the Sixth Annual Meeting," notice thereof was appended to the "Proceedings."

It is with regret that I have to announce that illness causes the absence of several of our active brethren from this meeting. Among this number is our venerable friend Mr. Kirk, of Stratford, who has been obliged through ill health to abandon active practice.

Owing to the distances separating the various members of the Executive and Standing Committees, meetings in some cases have not been practicable, and it has been found necessary to transact a considerable amount of the business by mail, but this has been done in a satisfactory manner.

The following circulars have been issued to all the members by direction of the Executive Committee during the past year :—

No. 35—Ballot for Officers, 1891-92.
No. 36—Explanation respecting Ballot.
No. 37—Requesting Papers for Seventh Annual Meeting.
No. 38—Programme for Seventh Annual Meeting.

The exchanges with the various sister societies have been the same as last year, with the exception of the Arkansas Society of Engineers, Architects and Surveyors, which did not this year publish a report A careful perusal of the exchange reports received will well repay the reader. It is unfortunate that a modification of railway rules in respect to reduced rates for conventions has placed those benefits beyond the reach of the members of our Association.

Much work has been done in the matter of incorporation, but this will be spoken of in the report of the Committee on Incorporation at another portion of this meeting.

The Secretary takes this opportunity to thank the members of the various Standing Committees for the able assistance rendered him in the matters relating to their several departments.

Accompanying this report is a statement of the financial transactions of the Association from 10th March, 1891, to 22nd February, 1892.

All of which is respectfully submitted.

A. J. VANNOSTRAND.
Secretary-Treasurer.

STATEMENT OF RECEIPTS AND EXPENDITURES OF THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO FROM MARCH 10TH, 1891, TO FEBRUARY 22ND, 1892.

1891. RECEIPTS.

To Balance on hand 10th March, 1891		$89 40
" Fees, 1 Active Member for 1890 at $3	$3 00	
" " 98 Active Members for 1891 at $3	294 00	
" " 1 Active Member for 1892 at $3	3 00	
		300 00
" Advertisements for 1890	$6 00	
" Advertisements for 1892	27 00	
		33 00
" Proceedings sold		4 50
Total		$426 90

1891. EXPENDITURES.

By Postage	$27 00
" Telegrams	50
" Stationery and Printing Circulars	6 50
" Printing Proceedings and Engraving for same	160 35
" Express, Freight, Cartage and Packing in Exchanges	10 43
" Duties paid	2 25
" Customs, Brokerage and Bank Exchange	75
" Rental of Rooms for Sixth Annual Meeting	12 00
" Amount granted R. Currie for Compass	10 00
" Amount granted Stenographer for Sixth Annual Meeting	35 00
" Amount granted Secretary-Treasurer for 1890-91	40 00
" 4 Copies of Quebec Act of Incorporation	1 00
" Typewriting re Incorporation Act	5 90
" Balance	115 22
Total	$426 90

1892. RECEIPTS.

To Balance from 1890		$115 22
" Fees, 1 Active Member for 1890 at $3	$3 00	
" " 6 Active Members for 1891 at $3	18 00	
" " 3 Active Members for 1892 at $3	9 00	
		30 00
" Advertisements for 1891		33 50
Total		$178 72

1892. EXPENDITURES.

By Postage	$4 75
" Balance	173 97
Total	$178 72

A. J. VANNOSTRAND,
Secretary-Treasurer.

TORONTO, 22nd February, 1892.

REPORT OF THE AUDITORS.

We hereby certify that we have examined the above accounts of Receipts and Expenditures, together with the vouchers therefor, and find them correct in all particulars.

M. GAVILLER,
H. D. ELLIS,
Auditors.

February, 25th 1892.

Received and adopted.

VILLIERS SANKEY,
President.

REPORT OF COMMITTEE ON LAND SURVEYING.

MR. PRESIDENT,—The Committee on Land Surveying beg to report as follows:—.

1. Several questions of survey have been submitted to your Committee, which questions and the answers of the Committee are hereto annexed.

2. As the Surveyors' Incorporation Act is now before the Legislature, your Committee do not deem it advisable to make any suggestions as to alterations in the Survey Act at the present time.

Respectfully submitted.

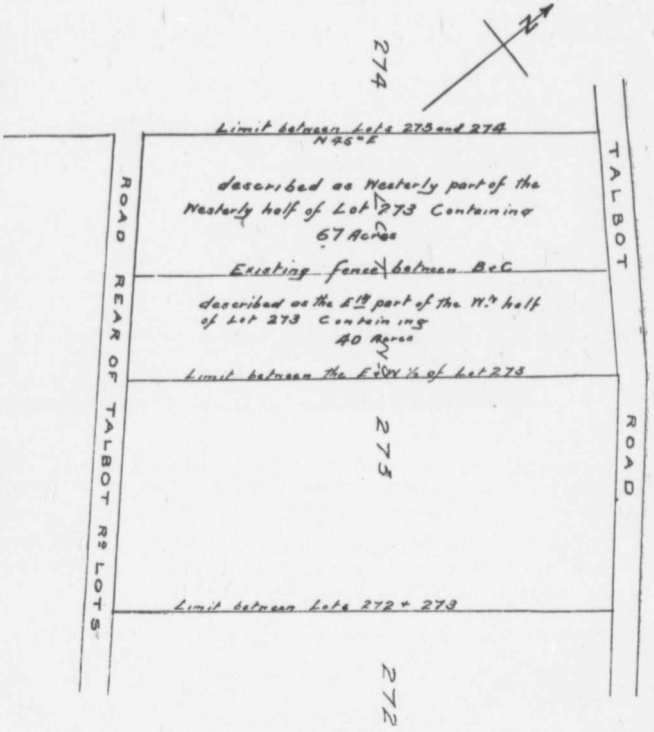
A. NIVEN,
Chairman.

February 23rd, 1892.

QUESTION DRAWER.

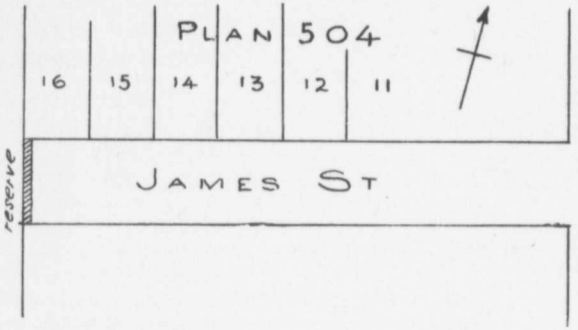
Question 1.—A sold to B, January, 1884, 40 acres of land, described as the easterly part of the westerly half of Lot No. 273, and in 1885 he sold to C 67 acres, described as the westerly part of the westerly half of Lot 273. Now B built a fence the whole depth of the lot, and

according to measurements he possesses 43⅓ acres, while C has practically 67 acres (66$\frac{99}{100}$ acres). Can C compel B to move his fence so as to give C the whole or his just proportion of the surplus?

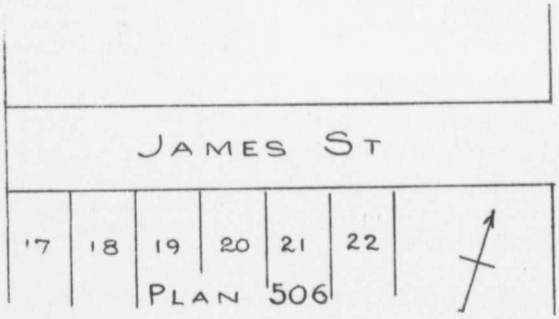


Answer.—Divide lot into east and west halves; then lay off 40 acres on easterly side of westerly half of lot; then lay off the westerly 67 acres of the westerly half of lot. The remaining 3⅓ acres is not conveyed by either of the descriptions.

Question 2.—An owner, A. B., registers a plan, No. 504, showing a foot reserve on the west end of James Street, thus:

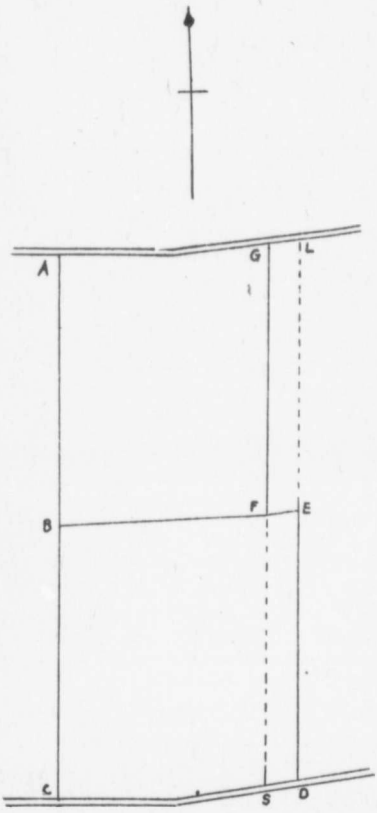


A month later he registers a new plan, No. 506, without any reserve, thus:



Is the foot reserved removed by the filing of the second plan?

Question 3.—In the re-survey of lots in double-front concessions, shall the division-lines between lots be run to the centre of the concession, as per section 56, Survey Act, irrespective of the frontage of the half lots, or does section 43 apply, giving to each patented half lot exactly half the area of the whole lot?



Answer.—Section 56 governs.

DISCUSSION.

Question 1.

Mr. J. A. Paterson—It was no doubt the intention to convey the whole of it to these two men; it is described as the west half, generally speaking.

The President—I think in a case of that kind, if there was a special description as to the 40 acres, and that in each case there were metes and bounds following the statement that it was the easterly 40 acres and the westerly 67 acres, metes and bounds in which the boundaries would show that the owner did intend to convey it all, then I think there might be some force in the question as to whether the surplus should be proportionately divided. It is a question as to whether an accurate description by metes and bounds after a general statement in a deed has not some effect.

Mr. Niven—I think if those are the only descriptions given that they are bad.

The President—If the two do not agree I think the metes and bounds play a considerable part in the final decision.

Mr. Gaviller—You mean to say when metes and bounds are given?

The President—Oh yes. It is to be presumed the information sent was all the surveyor had when he sent the question.

Question 2.

Mr. Foster—It seems to me he entirely does away with that reservation when he registers the new plan.

Mr. Niven—It is a question of law, I presume.

The President—The question is, what does one foot reserved mean when it is put on the plan; is it part of the plan at all?

Mr. Jones—I don't consider it is; I think it still belongs to the man that owns the land.

Mr. Gaviller—Supposing James street only extended halfway through, surely you are not going to say that that first plan governs.

The President—In the absence of any special information on the plans, I believe James street is first dedicated by plan 504 as far as the foot reserved, and the second plan dedicates the one foot as well in addition to that, so that when the second plan is registered the original owner owns nothing in connection with James street at all, and he cannot now raise a claim.

Mr. Niven—In other words, the filing of the plan 506 did away with the plan 504. That is the decision of the committee.

Mr. Stewart—It is quite likely it was a mistake.

The President—Then the poor surveyor would come in for the blame.

Mr. Aylsworth—No, I think not. I think when the owner signs a plan he relieves the surveyor of any responsibility.

Mr. DeMorest submitted a question to the meeting (with diagram on blackboard) in relation to the present system of subdividing lots in Nipissing. He was asked to lay out the south half of the north half of the east half of lot 11. AB has not been finished, and the production comes 1 chain and 40 links from where the post is planted; B is an original post, and A and C also.

Mr. Kirkpatrick—How can A be a governing post in the rear of a single front concession? B is the front, and that post at A has no reference to it.

Mr. Butler—A surveyor on the ground might run a line from A, although the line started from B——

Mr. DeMorest—It is an original line.

Mr. Aylsworth—Was it authorized in the original instructions?

Mr. DeMorest—The plan has been filed.

Mr. Stewart—The question is how you are to connect B with the line AB.

Mr. DeMorest—The first thing I thought of doing was to divide the lot into east and west halves.

Mr. Stewart—You will have to connect A with B some way. AB is a governing line.

Mr. Butler—Take one-eighth of the whole area.

Mr. Jones—Did you connect A and B to find the area?

Mr. DeMorest—Yes; I joined B to the end of the line, and calculated.

Question 3.

Mr. Niven—The gentleman who submitted this question stated that he had passed his examination before the Board recently, and that there was a divergence of opinion between the members of the Board themselves as to that question. For that reason he thought it would be of interest to submit it to this meeting.

Mr. Aylsworth—Supposing there was a jog of about forty rods at the south side-line, then how would you do it?

Mr. Niven—I suppose it would be as good a way as any to take half the distance through here and also there. You mean that BF and BFE would not be in the same straight line?

Mr. Aylsworth—Yes. I had a case like that.

The President—Does not BF govern first?

Mr. Niven—In discussing that this morning, I think Mr. Gaviller, one of the Committee, said something about cutting off the north-east quarter of the lot. It might be profitable to the Association to discuss how that would be done, whether it is half of the north half of the lot, or is it one-quarter of the whole lot.

Mr. Butler—Suppose one man owns the whole lot, and he sells the north-west quarter of the whole lot?

The President—How would you divide the lot into east and west halves first?

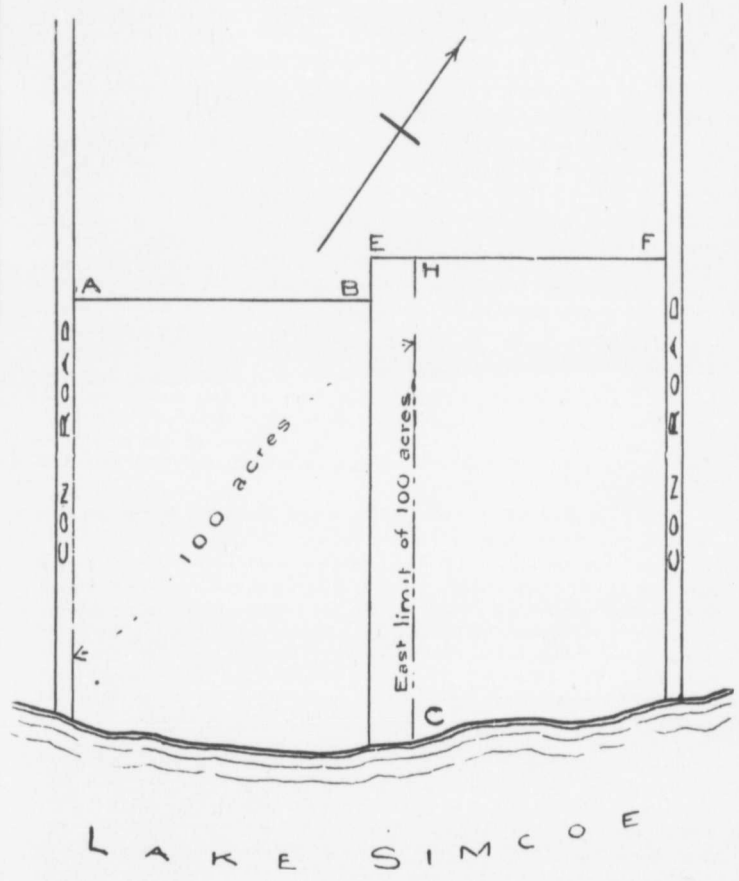
Mr. Niven—By an equal division of the distance along the two sides and drawing this line.

The President—That is, the north and south half; how about the east and west? The reason I ask is, I think there is a decision—I don't know the case—but I think it is held that lands referred to in that way shall be divided by the divisions of the half lots; that is, a line dividing the north from the south half would form the southerly boundaries of the two north quarters, and the line dividing the east from the west would define the other boundaries, and that area has practically little or nothing to say to the result of the work.

Mr. Niven—That is my idea. If I were called upon to survey out the north-east quarter of that lot I would give it half the north half of the lot by a line parallel with the side. That would be fixed by measurement. The north half of that lot is just as distinct and separate from the south half as if that were one concession, and this another.

Mr. Aylsworth—But supposing the deed called for the north-east quarter of Lot No. 4 in a certain concession, and nothing else about it? that is all the description there is in the deed?

Diagram illustrating the President's remarks referring to his Survey on Lake Simcoe.



Mr. Niven—I would divide the lot into north and south halves by measurement, connecting B and E by a straight line, then I would divide the four equally in area.

Mr. Gaviller—You would make a similar survey for the north-east quarter as you would for the east half of the north half? Both would be the same piece of land?

Mr. Niven—The same area—yes.

Mr. Abrey—How would you run DEFG, the line between the north and south halves?

Mr. Niven—What I say is that I would take half the distance. Establish the point E halfway between D and L, and F would be established halfway between G and S.

Mr. Abrey—Then EFB would have an angle in it of course at F.

Mr. Niven—There might or might not be an angle there. It is just one of those cases that often turns up on the ground, and BEF might be straight or there might be an angle there. If the distance from E to F was short the difference would be very little. But the point I wish to come at here is in laying out the north-east quarter of the lot that it meant the east half of the north half of the lot, instead of meaning one-quarter of the whole lot.

Mr. Abrey—I don't think you could cut into the south half to get the portion of the northern quarter.

Mr. Niven—Of course the question was whether that line should be drawn by division of the distance, or whether the area of the whole lot should be taken into account, and the answer of the committee was that this line BEF should be drawn equidistant between the concession lines.

The President—There was a case which came up in my practice once on this very section of the Act. It was on the north shore of Lake Simcoe. The part of the lot was supposed to contain 100 acres, and on the face of the deed it said "containing 100 acres." Part of the lot had been deeded to one person, and the rest to some other person, containing what was apparently the balance of the lot. On a survey being made it was found that there was a very considerable jog in the middle and some seven chains surplus between the west and east boundaries of the lot. The parties who came into possession of the easterly portion of the lot, not the easterly half of the lot, claimed that the first man should have his survey made by drawing AB, and it should be continued on in a straight line in the way the description read until the fixed distance mentioned in the first patent was obtained, and then it should be run down to C, and from the fact that the distance given from east to west filled up what was said to be the total distance of the lot, that therefore he was to come into possession of all that was left. The first man, having got all that the Government intended to give him in the first place, the second thought that therefore his description gave him everything that was over. The case came into court, and I was employed by the parties who claimed under

the original title. I made the survey in this way, by running AB, EF. It was decided from the last sub-section of Section 56 "without respect to how the lots or parts of lots have been described in the original patent." It was held that the northerly boundary of the whole lot had first to be determined, and that the first description gave the man everything that lay to the west of H, C. It was decided entirely on the last clause of 56. You see in that case the patent was for a fixed area: it said "Being the piece of land containing 100 acres"; as a matter of fact it contained 117 acres, but a considerable portion of it came into the lake shore, and there was a surplus in that direction as well as between east and west. The other man on the east side of the lot got a surplus too, but not anything like what he hoped to get.

Mr. Aylsworth—And then it also said you had to measure along the north boundary?

The President—Yes, and that was where the discussion arose. The parties on the east side claimed, if you get the area of 100 acres by measuring it that way, then we take all the balance. There happened to be some valuable timber on the disputed part.

Mr. Jones—I have had one or two cases similar to that, with the exception of the lake front; and I did as you did, I followed up the jog and then along the north limit of the east half.

The President—The idea is that the boundary lines of lots are governed by survey, not by description. The survey has first to be made, and then you cut up the lot in either way the description directs.

REPORT OF COMMITTEE ON DRAINAGE.

MR. PRESIDENT,—Your Committee on Drainage beg to make the following report thereon:—

During the past year there has been such a disorganization in drainage matters that this report must partake more of the nature of a review of the causes leading thereto, rather than a record of the amount of work done and money expended, both of which have been light, as in the extreme western portion of the Province no large schemes have been carried out, and the work mainly consisted of the necessary repairs and the construction of small drains tributary to the outlets now in use. This also has been the experience in other localities. A radical change in the working of the Act has been brought into operation during the year, by the institution of the office of Referee, before whom appeals may be laid, and whose decisions thereon are final. This is, in the opinion of your Committee, a step in the right direction, tending as it does to simplify the machinery, lessen the expenditure and, most important of all, give the engineer

an opportunity to complete the work within reasonable time, and therefore extend to the ratepayer some hope of a return from his investment. Under the present Act the possibilities for vexatious litigation are extensive, as cases may be carried on up through all the costly intermediate steps to the highest court, necessitating a heavy outlay and great loss of time. As an instance of such we might cite Williams vs. Raleigh, now in the Supreme Court, which has been before the courts some four years, and which suit for damages, by reason of insufficient outlet, is one of those cases involving the assessment of uplands which now enjoy thorough drainage, and whose owners do not feel disposed to pay again for that which they consider they already possess. The case has been appealed every time a decision has been given against the township. This assessment of uplands for outlet has always been the bugbear of the present Act to the engineer employed on any work where the question enters. Up to within a recent date the engineers have relied upon the decisions of the courts as something tangible and a safe guide, but of late these decisions have been such as upset all preconceived notions as to the correct interpretation of the Act, and now the engineer is at sea. Nor is it easy for him to determine which horn of the dilemma is the least—the old decisions or the new. As a matter of fact they are so conflicting as to render the Act of no value, as it is unworkable, especially where large schemes are in contemplation; and as these large schemes are usually the backbone of the system of drainage in any township, it is easily seen how vital the fault is. To remedy this and any other defects that may be found in its working, a Commission has been appointed by the local Government, and it may be safe to predict that till the revision by this Commission has passed the Legislature and received assent, there will be a lull in drainage matters, which will in all likelihood extend over the years 1892 and 1893.

Much dissatisfaction has been expressed by members as to the working of the Ditches and Watercourses Act, and the Committee appointed for revision should be asked to provide a remedy.

Respectfully submitted,

JOHN C. MACNABB,
Chairman.

DISCUSSION.

Mr. President—I think it would be well to take some action on this letter from the Chairman of the Ontario Drainage Commission. We have been invited by the Commission to appear as an association, which I think is another evidence that the Association is doing the profession some good. When a Government Commission are willing to hear us as such, I think we ought to take advantage of it. About two years ago our Drainage Committee went to a very great deal of trouble in revising the existing Acts, and prepared a draft of those amendments which it was intended to submit to the Government, but, owing to some cause that I am unaware of just now, these proposals never were presented. Perhaps Mr. Burke could tell us something about it.

Mr. Burke—I know I was up there with several other gentlemen before the Commissioner of Crown Lands, and we discussed the matter fully. We proposed a great many changes, but they did not wish to adopt them, though they did make a few amendments to the Act at that time. There was one important thing that we wanted, and that was cases under the Ditches and Watercourses Act not to be taken up before a judge, because we thought sometimes a judge did not understand the matter properly, and the lawyers could make a drain appear to him a mountain, but our suggestion was not adopted though there were a few changes made.

Mr. Robertson—There are very many things in the Ditches and Watercourses Act that are unworkable to a very great extent, and also in the Municipal Drainage Act, there is so much that is in an unsatisfactory condition I think it would hardly be of interest to the Association to take it up as suggested in Mr. Rankin's letter. I think it would be better left in the hands of the committee to deal with at present. It would necessarily be a very long, tedious work to go through the whole Act.

(The committee was then appointed in compliance with Mr. Rankin's request.)

Mr. Gibson—I suppose you would leave it optional whether they would go to the trouble of meeting the Commission or not ; I suppose it is understood they are not compelled to go ?

The President—I think I would just let them represent the Association with unlimited powers. I fancy that this committee is as good a representative committee of the men interested in drainage as we are likely to get, and I think the matter will be quite safe in their hands. Personally I think it ought to be left to their own judgment. We would urge them, of course, to take such a stand in the matter so that it will be shown that this Association has the interests of the public at heart. I think, though, that before any of these appear before the Commission, it would be well to decide that they should go there with the opinions of the committee, and not merely give their own personal ideas. They should have some collective opinion which would be the opinion of this Association.

Mr. Bowman—It seems to me that the better way would be to submit to the Commission the names of the prominent drainage men in our Association, and have them summoned to attend in the regular way and give their evidence. It is a matter of dollars and cents. If they can go all round the country holding meetings, it would be much simpler to have the members go to any convenient place for the Commission.

Discussion on Drainage Act.

Mr. Gibson—The Act is unworkable in many respects. My practice has always been to take a book along and get the crowd together and take down all they have to say, and I never failed yet to get the

crowd to put their hands to a paper recommending me to make my award, although after the award is out they see things in a different light sometimes. The ditches and watercourses adjoining Toronto are very small and don't amount to much, but I had a case lately I thought was going to be quite a job. There was one man who was going to fight to the bitter end. The man above said he would not dig the ditch through this man's land. I told them all what I purposed to do and all about it. But no, he will never step on my land, he said. What are you going to do about it? I said. I will do it myself, he said. And before I left each one had agreed to do his own portion. Of course, when you get out West perhaps that style of arranging matters would not work, but that is the way I always try to do around the county of York. There is a great deal in joking, flattery, etc., in trying to get men to do what is right, and, as a rule, if you show men that it is to their advantage to settle they will settle.

Mr. Burke—It is all very well, as he says, to get the people together and get them to agree, but they cannot always agree. And there are a great many difficulties in the Act that it is almost impossible to get over, by which injustice is done (drawing diagram on blackboard to illustrate a case of that sort). Another thing under that Act is, we lay a great deal of tile drain now under the Act, where each man does his portion. The engineer may take all the pains he possibly can to have the levels and grade and everything right, but the man may do his part of the work very badly, and it is all covered up and you don't see it, and then the whole neighbourhood are down on you as being an ignoramus and don't know your business, through no fault of yours. At my own expense one time I took up about ten or fifteen rods of drain just to see the way it was put down, and it was something shameful. All these men thought that it was my bad levels and bad work. I say that the Act should so be amended that no drain should be covered up till it is inspected. Some of these tiles were four or five inches of being down in the drain. Another case; you may specify a curve at so much radius and they will run it off square and swear that it is all right. Then about the fees; a man will come up with an appeal against your award—I never had an award upset yet, but I have fought them pretty hard in order not to have them upset —I had to get an engineer from St. Thomas in one case and had to go to all that expense myself; the judge did not allow a thing, although he did not upset the award.

Mr. Bowman—Was this tile drain laid in accordance with the specifications in your award?

Mr. Burke—It was intended to be, but it was not done.

Mr. Gibson—An inspector should be appointed by the engineer to go over the drain.

Mr. Bowman—About giving grades for drains, I would like to ask some of the members what their system is of giving those grades. I know in sewer work the simplest and easiest way by which the ordinary workman can understand it is the system of boning rods. Every

300 or 400 feet a bridge is put up, simply two stakes stuck in the ground on each side and a plank nailed across at any height above the tile which you want to lay—for instance, ten feet. Then the boning rod is nothing more or less than a big T-square, and that is held up and a man sights from one sight to the other. It is so simple that any workman in half-an-hour's time can see how it is done, and the engineer any time he is going up can take a look over the sights and see that it is all right.

Mr. T. H. Jones—I have always adopted the system of putting down the chaining stakes for these municipal drains every 100 feet, planting the stakes right side to the ditch, and the level back six inches to the right of that. I have found the boning rod to work well. I have instructed the different contractors and they have adopted that in every system and found for themselves it is the easiest and simplest way. Of course the trouble is that the work is inspected after it has all been done. About the quickest way to inspect a drain is by using boning rods.

Mr. Gibson—There was a suggestion made once to this effect, that under the Ditches and Watercourses Act the most advisable way was to give them too short a time to do the work, and then you could let the contract and get it done properly.

Mr. C. A. Jones—One of the Drainage Commission was speaking to me about making a change in this way, that you assess the parties so much money and let the contract instead of each one doing his own work.

Mr. Gibson—That ought to be done too.

Mr. Ross—In a good many cases the farmers don't object to digging the ditch, but they do object to paying anything out for it. They think more of what fees they have to pay the engineer than making the whole ditch.

Mr. Tyrrell—In the case of small ditches where it would only take a few days to make the ditch, is there any objection to making the time for the completion of the ditch less than the time given for the appeal?

Mr. C. A. Jones—You could not do that.

Mr. Tyrrell—I cannot find anything in the Act that would limit you in the time that you give. Last year I had a case of that kind where I received a notice late in the fall, and they wanted it done that fall so that damage would not be caused by floods in the spring, and I gave the man only about a week to do the work.

Mr. Bowman—There is one matter that I think the Association might bring before the Commission. The way the Act stands at present the engineer employed may be a Provincial Land Surveyor or any other person. I think it should be confined to Provincial Land Surveyors or members of the Canadian Society of Civil Engineers.

Mr. C. A. Jones (Drawing diagram on blackboard)—"A" sent in a requisition for a drain through B C and D. When I went out there I found that there were two drains existing under an old Fence

Viewers' award, both open drains, one running south and the other west and north. That was the only outlet that A had through either one of those drains. I made out the award going through C and D, and they appealed against the award on the ground that I had no right to interfere with either of those Fence Viewers' awards. A could not ask to have the drain re-considered, he was not a party to the old drains. I may say that the old drains were not deep enough for A to drain through. The judge crawled out of it by finding a flaw in the requisition; he set the thing aside on that ground, so that he did not decide on the point at issue.

Mr. Burke—Do you think that these awards under the Fence Viewers' Act will hold water now?

Mr. C. A. Jones—A good many of the ditches do hold water now. But we did not get any decision on that point on account of the flaw. The question I intended to bring up was, Could I interfere with that old Fence Viewers' award?

Mr. Gibson—I had an opinion given by some lawyers that a ditch meant an open one and a drain meant a tile drain. That was the opinion of two or three lawyers in Toronto.

Mr. Jones—Would I be justified in changing the portions of that drain made under the Fence Viewers' award, or award it to be done just in the same proportion as it was done under the Fence Viewers' award, or not take that into consideration at all?

Mr. Ross—That is a point, I think, that should be cleared up in the Act.

Mr. Gibson—You will find if you looked up the papers about that Fence Viewers' award you could not produce evidence to prove anything.

Mr. Jones—They had the award. They had a big law-suit about it before, and they had a bundle of papers.

Mr. Gibson—I think the Act is very hard on the engineer. He is placed in a position in which no lawyer or other professional man would act.

Mr. Jones—It is my opinion that a good many of the judges don't understand a case thoroughly at the time of an appeal. I knew of a case where there were two drains under appeal at the same time, and the judge never got through his head who was appealing on each drain; and in making his decision he spoke of the appeal of one man against such and such a drain that was not his drain at all.

REPORT OF COMMITTEE ON ENGINEERING.

Mr. President,—Your Committee on Engineering beg to report that this year a fair proportion of the papers to be read at the Annual

Meeting are on general engineering questions closely connected with land surveying.

To secure better and fuller discussions on these important questions your Committee would recommend that in future advance proofs of all papers to be read, unless of an historical nature, be printed and distributed to the members with the programmes for the Annual Meeting, and in case members cannot attend, they be requested to prepare and forward to the Secretary written comments on their papers, as is now done in the Canadian Society of Civil Engineers.

Your Committee would congratulate the profession on its success in engineering pursuits, as witness the occupations of the members in the list of names, etc., in the proceedings.

G. B. ABREY,
Chairman of Committee on Engineering.

REPORT OF PUBLICATION COMMITTEE.

MR. PRESIDENT,—Your Committee have very little to report, and might very well discharge this function by transcribing the similar document presented last year, so little variety is there from year to year. The same firm has printed our "Proceedings" from the beginning, having always given good satisfaction.

Our exchange list is about the same as last year. Below is a statement showing the number of copies of our Report sent to the different engineering societies and the number received in return:—

	Copies sent.	*Copies received.*
Ohio	130	120
Illinois	100	120
Indiana	60	50
Iowa	50	120
Michigan	135	120
Eng. Soc. School Practical Science	150	120

Your Committee would again ask the co-operation of the members in the work of securing orders for our advertising columns, our only source of revenue that is capable of enlargement, but at the same time one that is worthy and capable of cultivation.

Respectfully submitted on behalf of the Committee,

JOHN MCAREE,
Chairman.

Toronto, February 25, 1892.

REPORT OF THE COMMITTEE ON ENTERTAINMENT.

MR. PRESIDENT,—The Entertainment Committee for 1891-2 have to report that the annual session of the Association of Provincial Land Surveyors of Ontario for 1892 was held, in accordance with the usual arrangement, in the library of the Canadian Institute.

Owing to unavoidable circumstances the date for the opening of the new Engineering Laboratory of the School of Practical Science was, by its managers, fixed for the 24th of February, 1892, the date on which it was proposed to hold our Sixth Annual Dinner.

It was considered, therefore, by your Committee, that, as invitations had been issued to all the members of our Association to attend the opening, insufficient time would be given in which to enjoy the usual social gathering on that evening, and that the business on our programme would be interfered with if held on any other evening of the session, and would be otherwise unacceptable to our members.

It was therefore reluctantly decided to forego the Dinner this season.

From the good attendance of our *confrères* at the School of Practical Science on that evening, and the close attention paid to the many embodiments of mechanical skill and power, and of advanced science, it was evident that the change in form of entertainment was, by many, highly appreciated.

We would wish, however, to recommend that the Annual Dinner be in future adhered to whenever practicable, as this appears to be, from the opinion so far expressed, the most popular way of closing our annual sessions

On behalf of the Committee,

FRED. L. FOSTER,
Chairman.

Toronto, February 26, 1892.

REPORT OF COMMITTEE ON INCORPORATION.

MR. PRESIDENT,—The Committee on Incorporation beg to report as follows :—

1. That shortly after the last annual meeting a deputation of the Committee waited upon the Commissioner of Crown Lands and explained the objects of Incorporation. After hearing the views of the deputation the Commissioner suggested that no action be taken until the Parliamentary Session of 1892.

2. The Committee again met in December, 1891, and in January, 1892, and had a Draft Bill of Incorporation prepared by Mr. W. J.

McWilliams, barrister-at-law, and submitted to the Commissioner of Crown Lands, who kindly consented to take charge of the Bill and bring it in as a public measure.

3. The Bill has been printed, and a copy is now being sent to every land surveyor in Ontario in accordance with the resolution passed at last meeting.

4. Your Committee suggest that at the present meeting of the Association a committee should be appointed to watch the Bill in committee, and be prepared to answer any objections that may be made to its passage.

Respectfully submitted,

A. NIVEN,
Chairman.

February 24, 1892.

DISCUSSION.

Mr. Niven—I may say that the committee that was appointed to take charge of this business went to a very great deal of trouble and pains in preparing the present Bill. They had meeting after meeting and went through the Bill, and I don't know how many drafts we had. We consulted members of the profession elsewhere. Mr. Klotz, who happened to be in the city, to my knowledge devoted a whole day to preparing some of the clauses of the Bill. All that he put in has not been left in it, but a good many of his suggestions were adopted, and every pains taken to get the best information that we could. To the best of their ability the committee did what they could, and I think the Bill before us is as perfect as that committee could get it, at all events. Latterly, Mr. Sankey took charge of it, and, in connection with Mr. McWilliams, got the Bill into its final shape, and he perhaps is better posted in its provisions than anybody else.

[The Bill was then read by the Secretary, Mr. VanNostrand, and discussed clause by clause.]

Mr. Stewart—The idea is not to have another meeting this year, but to send this notice to all the surveyors who, if they wish to vote, pay their fees and send in their ballots.

Mr. Tyrrell—Is there anything specifying who they shall vote for?

Mr. Stewart—I think the clause explains itself. In reading it over it seemed to me they could vote for any one they like at the first election.

Mr. Butler—There is no provision made for who are to be candidates though.

Mr. Stewart—No; I think not.

Mr. Kirkpatrick—How can the thing be organized until it be first started? and the only possible way to start it is by the surveyors themselves. I should think the matter could be got at very easily by this Association nominating any person they like, but the surveyors

may vote for anybody they like; but after the first election it provides that they shall vote for nobody but those that are nominated. There is nothing to hinder this Association giving them a list of candidates to choose from.

Mr. Gibson—I think that will be proper too. An informal nomination will suit this case.

Mr. Stewart—I would like to ask Mr. Kirkpatrick whether there is any way that we could get the address of all the surveyors in the Province?

Mr. Kirkpatrick—We have a list of all those that have passed, and it has always been a rule that I have made—and which has always been neglected by the candidates—to ask them to send me their post-office address as soon as they picked out a place of residence. Of course we always have their address at the time of passing, and we can get their present address as far as it is known. It would be a good thing if every surveyor here who knows of a change in the address of any other practicing surveyor would let the secretary know.

Mr. Stewart—We are perhaps getting ourselves into a little difficulty here by making it compulsory that each duly authorized land surveyor in the Province shall be notified. There may be some difficulty in finding his address. I suppose his last address, however, would answer that.

Mr. Chipman—Why is "secretary-treasurer" included in sub-sections 1 and 4 of section 8, while in section 4 on page 2 it is dropped? In section 4 we find,—"The council shall elect annually one of its members as its chairman, and shall appoint from amongst the members of the Association such other officers as may be necessary for the working of this Act, who shall hold office during the pleasure of the council." Then sub-section 1 (reads). The council does that; then page 6, sub-section 4, the members of the Association shall elect the same officers.

Mr. Kirkpatrick—The only way in that sub-section 4 is to strike out the words "secretary-treasurer" and the word "auditors." If these are elected by the council they won't be elected by the Association. I should think there is a misprint there. Sub-section 1 of 4 provides that the Association shall elect a secretary treasurer and the auditors. It is quite clear that the intention is that the council shall elect the secretary-treasurer and the auditors in the first place, but every subsequent election shall be made by the Association. It provides that expressly in sub-section 1 of 4.

Mr. Chipman—I think it would be better if that sub-section 4 were put somewhere else; I don't see any use in that there.

The President—I might say that that section was put in by the Commissioner of Crown Lands and the law officers of the Crown. In the original draft sent to them that was not in at all, and I was notified that the Commissioner of Crown Lands could not see his way to ask every surveyor in the Province to come to Toronto to vote,

and his idea of getting over the difficulty was this section 8, which he put in his own words and in its own place. This Bill has been revised by the law officers of the Crown, and the position and rotation of the different sections have got their places by the authority of the Department, so I hardly think we can very well criticise it. The general election in this Bill is exactly in the terms that were submitted.

Mr. Stewart—It seemed heretofore the only parties that the members of the Association could vote for were those nominated at the annual meeting. I think there is nothing provided for that in this case at the first election, that the members, by sending in their fees, would be permitted to vote for anyone, but it would be well to nominate someone.

Mr. Jones—According to section 4 on page 2 they might elect the secretary-treasurer to be chairman and preside over the president.

The President—The secretary-treasurer is not a member of the council.

Mr. Jones—Still, we will take any other member; according to that they might elect some other member. It is understood that the president of the Association shall be chairman——

The President—No, sir; it is not understood. This council of management has practically all the management of the whole Association on its shoulders, and it is unavoidably necessary that that council should be more or less located in Toronto. Now, we don't wish to confine the president of the Association to Toronto or to a person who could readily be in Toronto. But it appeared that the chairman of the council should be easily got at, and with the view of not confining the person of the president to Toronto and immediate surroundings, that was the means devised for having one chairman of the meetings, and so it was thought advisable that the council should elect a chairman annually to preside at the council meetings. There is no reason why the president should not be elected, but it might so happen that he might not always be convenient to get. The most convenient man and the most suitable is most likely to be elected.

[The matter of filling in the blanks as to dates was then discussed.]

The President—Then the way to fill in the blanks on page 2 would be just to fill in March and April and leave other dates the same.

Mr. Butler—Is it possible that the old well known title of "Provincial Land Surveyor" would be wiped out by this Bill; would it become "Ontario Land Surveyor"?

Mr. Aylsworth—I think so.

The President—That is the idea of the Bill.

Mr. Gibson—Take the Registry Act, we will have to get that changed.

The President—At the present time I don't think it would be wise to discuss it. I may say that if this Act goes through in the condition

it is in now, there is no reason in the world why we should not keep the old letters "P.L.S.," but it was in the event of possible changes being made in this Act that the other was suggested.

Mr. Kirkpatrick—Ontario is a province of the Dominion, and an Ontario Land Surveyor would be a Provincial Land Surveyor.

Mr. Niven—I think the intention of the committee was to do away with the word "Provincial." "Ontario Land Surveyor," to my mind, is better than "Provincial Land Surveyor." It just states exactly what it is.

The President—There is no question about it, with all due respect to the Dominion Land Surveyors present, that the term "Dominion Land Surveyor" is very misleading to the public. A great many people believe that any one who signs "D.L.S." can survey anywhere throughout the whole length and breadth of the Dominion, whereas, that is not the case.

Mr. Niven—Let it go, I say.

The President—Then we will call the annual general meeting the fourth Tuesday in February.

[The motion to adopt the report was then carried.]

Mr. Chipman—I think it would be wise for every member of the Association here present to express himself in as few words as possible as to whether he favours this Bill or not, and that it be put on record. It is very important that we have the co-operation of every member of this society. This Bill may not include everything that every one of us would like to see in it, but we had better take what we can get now and try to get the rest in future years. I am in favour of it.

Mr. Gibson—I did not see my way clear to endorse the Bill as it was introduced last year, as it was likely to do us an injury; but the Bill as proposed at the present time puts us in the same position as we always have been, and in that way it meets my approval. With regard to the letters "P.L.S." and "O.L.S.," I would prefer "P.L.S.," and I think that we should have "P.L.S." continued. There may be reasons for the change that I do not understand, as I have not examined the Bill very closely, but I am rather of a conservative turn of mind and I don't like changes. However, under the circumstances, if a majority of the Association go in for this matter, as I said last year, I go in with them. But it seems a little hard this trying to force old gentlemen out that won't join us. For instance, we say, if you don't register your name you are not allowed to practise, and if you do practise we will put you through. I think there will be some trouble in that way, but, taking the Bill as a whole, it is a good Bill and I think a majority of the Association approve of it, and if so, I am going to go in with it. But I would like all our profession throughout the Province pleased with it. Of course it is not any worse than all the other professions; we see the medical and legal men, the architects and all these professions try to get incorporated, and they form a kind of mutual admiration societies for their own benefit,

intellectually and otherwise. Even the hod-carriers in Toronto have their society. You can't employ a man on the public roads in the Township of York unless he has his ticket of membership in his society. It certainly gives a man standing, and the world is really coming to such a state now that a man has to have a standing in order to make a living at all. I have not very great faith that this Bill will pass, as there are a lot of these grey-haired old men that have a lot of pugnacity in them ; they don't want to give up their practice and don't care to join, but, as I say, if the crowd goes in for it, I go.

Mr. Niven—I need not say, Mr. President and gentlemen, that I am in favour of the Act. I have given the matter a good deal of consideration along with the other members of the committee, and I think that we have the Act now in as nearly perfect condition as we can get it. So far as the appellation of "P.L.S." or "O.L.S." is concerned, it was considered by the committee that "Ontario Land Surveyor" would be preferable to "Provincial Land Surveyor." It is a matter of taste however. I am in favour of the Act altogether as it stands.

Mr. Abrey—I am with Mr. Niven.

Mr. Brown—I am in favour of the Act. I would prefer that "P.L.S." be retained, but if there is good reason for the change, of course I am with you.

The President—The principal reason was that the alternative was "Registered Surveyor," and "Ontario Land Survevor" was a compromise between "Registered Surveyor" and "Provincial Land Surveyor."

Mr. A. L. McCulloch—I see no good reason for opposing the Act. I think if it is going to give a standing to the profession in any possible way that we ought to be in favour of it. As for myself, I see no particular reason for retaining the title "Provincial Land Surveyor." It might possibly be that it would mean a land surveyor in other provinces besides Ontario, while "Ontario Land Surveyor" must mean a surveyor for the Province of Ontario.

Mr. Bowman—I think that Mr. Gibson has forgotten that there has been a change before. The old plans are all signed "D.P.S.," and I think it would be well to have something mentioned in that Bill of the right to use those letters. As far as I am concerned, with regard to the Bill, I feel that I have not been able to give it sufficient consideration to pass judgment on it, although I think that the desire of the whole profession is to raise it to a higher standard, and so far I support the Bill. But at the same time I think that there will be some difficulty in regard to the other Acts; the Registry Act still exists even though the "O.L.S." stands. If we wish to sign plans we will have to sign them "P.L.S.," and unless these Acts are changed the new candidates who receive their certificates will have to sign "P.L.S.," which they will not be able to do until the Acts are changed, though required to do it by the old Act. The officers of the

crown are not likely to see an Act passed which will be inconsistent with other Acts.

Mr. Burke—I may say that I am very strongly in favour of the Act, and I think it has already taken a very desirable shape. I think the report in last year's proceedings where Mr. Casgrain spoke so strongly about the Quebec Incorporation ought to have a great deal of weight with us. As regards the question of the use of "O.L.S." and "P.L.S.," I think if any of us were to go to the States or be spoken of in the States, that using the word "Ontario"—as Ontario is at least one of the greatest provinces in this Dominion—cannot possibly affect us in any way injuriously. And as regards bringing in outside members who have not joined this Association and who might object to register, I don't think they could have any very strong excuse for not doing so. The fee is a very small one, $1.00 for registering and a very small annual fee, and I know one or two surveyors who have not come in simply because we have not been incorporated.

Mr. Roberts—I may say I am in favour of the Act right through. It seems to be the only way of raising the standard of the profession.

Mr. Butler—I am in favour of the Act.

Mr. Tyrrell—I am in favour of the Act as it stands.

Mr. Stewart—I don't think this Act takes away the title "P.L.S."

Mr. Jones—I have no objection to it at all; I think there is nothing to be lost and a good deal to be gained.

Mr. Paterson—If there are any defects about it now, they can be remedied at some time again. I am in favour of it.

Mr. Aylsworth—I am in favour of the Act. After all these men have expressed themselves in favour of it, I think I would be rather in the wrong if I did not express myself in favour of it too; I think they have had more experience than I have had. Although I spoke against it yesterday afternoon, I can only express myself now as heartily in favour of the Act.

Mr. Robertson—I am in favour of the Act.

Mr. Fawcett—I have always been in favour of Incorporation. I have talked with a good many surveyors down in Quebec and surveyors in Manitoba, and they all claim that through Incorporation they have a great many advantages which they would not have without. What is good for them I think would be good for us.

Mr. McDowall—I am strongly in favour of the Act. I am also in favour of the "O.L.S." It would carry more prestige in the States and outside provinces.

Mr. Speight—I bear my testimony like the rest of them here in favour of the Act.

Mr. Abrey—In the event of opposition from outside members to this Bill, what then? I think that ought to be spoken of here.

The President—I think the simplest way to do it is to appoint a committee with instructions to act in whatever might be considered its interests, whether any proposed changes are of vital importance.

Mr. Ross—I think, so far as I have looked over it, I see no objection to it.

Mr. McAvoy—I am in favour of the Bill.

Mr. Rainboth—I think it would be of the greatest benefit to us. I have gone over the Bill and I do not see that it can be improved on in any way, and I am altogether in favour of it. I might mention that I am a member of the Quebec Association, and the Incorporation there has been a great success in every way. It has added to our numbers there and improved our standing. Of course the tariff may be a secondary consideration with some, but it has been a great success in that line with us in preventing any disputes.

(The committee to wait upon the Attorney General and Commissioner of Crown Lands *re* Incorporation was then appointed.)

Discussion on Incorporation.

The President—The inception of Incorporation took place about two years ago, and last year we had a good deal of discussion about it. We know that the Provincial Land Surveyors of both Quebec and Manitoba are incorporated, and their experience has been decidedly satisfactory. They find that the profession is decidedly improved, and the members of the profession at large take a more earnest interest in it than before. After the discussion we had last year a committee was appointed, and it was moved that the committee should bring the matter before the Commissioner of Crown Lands and have a Bill prepared in order to carry out the ideas of Incorporation. Some of our members last year, you may remember, thought that inasmuch as the surveyors of Ontario were appointed by the Government, the examiners appointed by the Government, and our certificates issued by the Government, that if Incorporation took the form of an ordinary incorporated society we would be under certain circumstances cutting ourselves away from the Government patronage and Government protection that we at present enjoy. For this reason, when the committee met and discussed the form that our Bill should take, it was decided that the principle that we wish to try and carry out was to procure if possible such powers as would not be inconsistent with our connection with the Government. In other words, it was thought that the profession would gain greatly by each surveyor having an active interest in the management and government of his own profession. The Bill now before us is drafted with that view. You will notice that the Bill does not profess to do away with the existing Land Surveyors' Act, but merely to amend such sections of the Act as become necessary, and to define the regulation and government of the Association by means of a governing body

elected by all the members in Ontario, by officers and a council elected by them. The principal point of the Bill now before us is simply as to its government, how the election shall be held, what the powers of the council shall be, the appointment of the Board of Examiners, and matters of that kind, also of the fees payable to the Incorporation by members of the profession. It certainly will enlarge our ideas; it will bring us more together, and all matters of interest in the profession will receive the attention of the council. There will be somebody to bring these matters before us. Take, for instance, a surveyor out in a distant part of the Province where persons who are practising may be unlicensed surveyors, he may not have the time or means to prosecute these men. I know this is occurring, and perhaps has occurred in the past, a little more than it does just now, but that man, as we now stand, has himself to look to for the protection of his own practice; whereas, with the Incorporation and council it will be the council's duty to appoint some committee or person whose business it will be to look after this on receiving proper notice.

You will see on the first page of the Bill the various powers that the by-laws will have,—"For the government, discipline and honour of its members," and so on.

Now, it occurs to me that there is a matter in which Incorporation would do a great deal of good, if we have properly established fees for the work in connection with surveying. A surveyor is not so much then at the mercy of the public as to what they feel like giving him for his work. If there is an established tariff he knows that he will be backed up by the profession at large in the charging of fees that may be established by that tariff, and he also has the assistance of every member of the profession in the province. Being united, we can all help each other, but, being as we are now, practically disunited, we are each one standing very much on his own merits. Until this Association was established, we were practically alone.

There are other members of the profession who, I think, are better able to describe the various improvements that are sure to come from Incorporation; but I know we would all like to hear any one that foresees any trouble or difficulty in the way in order that we may know what we are doing.

Mr. Stewart—There was a remark made some time ago which may cause some misunderstanding about these fees. Now, this Bill, as I understand it, does not impose any fees for our services. We don't attempt by this Bill any new fees for our services to the public. The fees mentioned here are the fees charged for admission and apprenticeship and becoming members of the profession. We don't wish it understood that we are attempting to force any higher fees on the public at large.

Mr. Butler—I might just mention a little thing I saw the other day. I went out in the township of Marmora to examine some reported trespasses. When I went into the woods I found a line blazed out and posts set and I naturally concluded they had a surveyor. After examining around a while I found the line had been

run by Mr. Bolger, and it was between that line and this new one that the trespasses were supposed to have been made, and I was informed that the work had been done by a wood ranger employed in the neighbourhood. Now, there is a case where, if we were incorporated, I think I would have sent a notice to the proper officer here in Toronto and he would have notified some local man to have that man brought before a magistrate and fined. Personally I could not do it on account of the connection that exists between that man and a friend of mine, and at present it is a very disagreeable place for a surveyor to put himself in, to appear to be prosecuting a man who is earning his living as a wood ranger for instance. But in this case he is planting posts and perhaps ten or fifteen years from now some young surveyor will find one of these posts there, and some man will swear he has known that post there for twenty-five or thirty years and it will pass off as an original post. I took them up and threw them in the swamp and warned the fellow that I would have him fined. It was only to frighten him a little, but at the same time it is a disagreeable place to be in.

The President—The public should certainly be protected. He may have started from some point that he had taken no means of ascertaining whether it was right or not. He is not authorized to administer an oath to find out where the true post was planted.

Mr. Stewart—It seems to me that if any body of men are capable of conducting the examinations and looking after the interests of the profession, certainly the members of that profession are the ones who should do it. Heretofore the examinations may have been conducted all right—I believe they have been—but that is no guarantee that they will always be in the future, and I think with this Incorporation it will be our fault at least if they are not conducted properly. I cannot see any objection to it, and I think the principal thing is this, that we take into our own hands the conducting of the examinations and the regulation and the working of our profession the same as other professions. The Law Society became incorporated, the Medical Society became incorporated, and I think it is just as necessary for us as for them.

The President—This Bill does not propose to do away with any of the powers of the existing Surveyors' Act; it simply adds something to them. The Government may either throw out the whole of this Bill or part of it, but in no case can I conceive our being worse off than we are now; on the other hand, I think we must necessarily be better off.

Mr. Butler—Who are so competent as the surveyors themselves to decide as to the efficiency of the examinations to determine the qualifications of the men who are going to carry on that work? Certainly there is no question at all about past Boards being men of exceptional ability, but it is a political appointment after all and one that may be made not wholly from the point of view of the capability of the examiner, it may be for political reasons, and therefore it would be better to do away with the possibility of any such appointment.

Mr. Stewart—As far as I can see in this Bill there is no attempt to enlarge the field of the operations of surveyors. What I mean by that is that there is no attempt, as far as I can see, in this Bill to encroach on any other profession, engineering or any other. There has been some little uneasiness felt, I understand, in certain quarters, that perhaps surveyors might take advantage in the passing of this Act to restrict to themselves certain works which are now performed by engineers and perhaps others.

Mr. McAree—It does not seem to be too much that the Association shall have full power to control all the members. Does the first clause of Section 10 prevent a man from practising who is not a member?

The President—It does as an Ontario land surveyor.

Mr. McAree—That, then, gives the council power to control the licensing and making of all regulations of the Association?

The President—Certainly. The Association under this Act has the power of passing such by-laws not inconsistent with the provisions of the Act, and the principal things that, under the provisions of the Act, the by-laws of the Association will not have power to alter will be the various fees that are mentioned in Section 7. The by-laws of the Association would have no power to increase, they might have power to reduce but certainly not to increase, any fees that are mentioned in Section 7. So that it is not intended that the Association shall have the arbitrary power of increasing the annual fee or registration fee or anything of that kind.

It appears to me that the sum and substance of any objection amounts to this, whether a surveyor thinks he would get value for what he is compelled to pay—the sum of $1 for registration, which is paid once and for all, and afterwards an annual membership fee of $4. That really seems to be the whole point that is worth while discussing in the matter. Do surveyors think that their practice will not stand that fee of $4, or, on the other hand, will they get corresponding value for their money?

Mr. Stewart—Well, at present our fees are $3; it is only $1 more.

Mr. Butler—I don't think that is worthy of consideration.

The President—I cannot see how any surveyor could reasonably believe that we are not going to get advantages. I have been told personally that there are surveyors in certain portions of the Province who thought at one time of joining our Association, but when they found that we had no power to stop improper or illicit practice, they said it is not worth our while to join; we can read books at home perhaps just as good and more useful than the Association reports; it is no good to us; it is not worth our while paying $3 to the Association. And I think many of them would be very glad to pay $4 to an incorporation that has the power to do what all competent men should have, take care of themselves. With regard to real estate or property, the Quebec Surveyors' Incorporation, I believe, have the sum of $2,500 in the bank. In the State of Ohio, where they have not got

Incorporation, they have some kind of general association, and they are now trying to get a Bill passed outlined very much on the Ontario Land Surveyors Bill. They propose to have a library and corresponding secretary, so that the profession shall have communication with the secretary and reference library in the State town, and every question of doubt or trouble submitted to a council and answers made, so that the whole profession all over the State will benefit by it, and I don't see but something like that would work very well in Ontario.

DISCUSSION ON MR. GAVILLER'S PAPER ON "DESCRIPTIONS."

The President—On the first page this statement is made, "The description of a property should be so drawn that any qualified person could lay it out on the ground without doubt or dispute as to the position or content."

I think we all agree in the general fact, but with regard to whether a surveyor is able to write the description in that way is another question. He may be controlled by circumstances that he cannot very well obviate. There may be matters connected with the ownership of the land which a surveyor is bound to respect. I mean the surveyor who is acting for the seller is bound to write the best description he can as a surveyor for the man who is selling the land, and yet, at the same time, he may not be able to write the very best description he would like himself. In a case of that kind, is the surveyor bound to give way, or is he bound to write the very best description he can and put the seller to perhaps a great deal of trouble and expense in explaining away the difficulties in title or matters of that kind?

Mr. Gaviller—I think that comes under the same heading with a great many other difficulties. There are a great many occasions in which a thing should be done but in which it is impossible to do it. It is not a question of what is best, but what can be done under the circumstances.

PRESIDENT'S ADDRESS, 1892.

GENTLEMEN OF THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO:—

It is with great pleasure that I again welcome you to our Annual Meeting, and trust that having been spared to enter on this, our seventh, year, we may be guided through its days with health and strength to carry out the work that may fall to our lot to undertake.

In my last address, I referred to the death of the Late Mr. Hugh Wilson, and before our Annual Report was issued we lost another of our members, and the profession one of its prominent men, by the death of Lt.-Col. Webb, of Brighton, Ont. His obituary was published in our report, which you have no doubt all read.

Quite recently our profession has lost another prominent and esteemed member—one who was, I think, personally known to most of us. I refer to the late F. F. Passmore; he died in Toronto, where he had practised for nearly half a century. He was the oldest member of the Board of Examiners, and enjoyed a reputation in the community, and particularly with the legal profession, which we may all look up to. There is no doubt that his retiring disposition alone kept Mr. Passmore from filling some of the most important positions.

Last year I drew your attention to what I thought was the most important subject we had before us, "Incorporation." It again comes up in a stronger and more forcible light, but I shall not go into details as it will be the subject of a Special Report from the Committee appointed to look after it. I would strongly impress upon you all to give it not only your passive assistance, but a live, earnest helping hand, for if we do not believe in ourselves and help ourselves, we cannot expect the public to have faith in us or even those of our own profession not among our members. I can assure you that the Committee has done all in its power to carry out the instructions, and a Bill is now before the House, so that it rests with the members of the Association and profession whether we succeed in obtaining what we ask—a reasonable share in the government of our profession. The Government has put no unreasonable difficulties in our way, and I feel it my duty to express my thanks to the Hon. Mr. Hardy, Commissioner of Crown Lands, for his courtesy on all occasions when I had interviews as your representative in this connection.

A new departure is being made this year in the discussing of some of the papers of last year. This is undoubtedly a good move. Many of the papers presented are so carefully prepared and so concisely written that it is not possible to discuss them properly or do justice to the writer, merely on hearing them for the first time. I hope, therefore, that you have all brought your Reports of last year, as requested by the Secretary.

On this year's programme are papers treating of most interesting subjects, which are written by gentlemen whose experience and knowledge are a guarantee of the accuracy of the statements and of the results deduced.

While on the subject of papers, let me urge upon the members the great good derived by us all from writing and reading papers such as those which appear in our Annual Reports. The writer of a paper derives the greatest good; he takes up a subject in which he has some special interest or with which, in the course of his practice, he has had to make himself familiar, but before he gets his paper finished he finds there are many points on which he requires more information, and he at once sets to work to get the information necessary. When his paper is finished and ready to be presented, he stands in the position of having one more subject added to his store of knowledge in a clear and workmanlike condition. The readers of a paper benefit in a degree proportionate to the information they already possess or the interest they take in the particular subject. Do not think from what I have just said that it is only the very clever brother or the one who has a big practice who can write papers which will be useful or interesting. There is no surveyor in the country who has not some information of interest to his brethren, or who cannot learn from others; it is by bringing these points out, and our brethren together to discuss them, that our Association is doing much good.

Let me, in conclusion, ask you to join in making this, our seventh, year, the most important of all that have preceded it, by uniting to forward and improve all that is for the good of our profession and for our usefulness to the public.

PRESIDENT SANKEY'S RETIRING ADDRESS.

MR. CHAIRMAN AND GENTLEMEN,—You have put me in rather an awkward position, and it is not the first time you have done it. It is not the first vote of thanks you have proposed to me. I think the first time you did it I explained to you in the most convincing manner that what I did was for the love of the profession, and on account of the hearty good-will and co-operation I have always received from every member of the profession. At the same time, I don't want to say that I am not very much flattered and very much pleased that you should have passed this vote of thanks to me. It is a kind of reward that one does not get simply by hard work. I feel personally that there is something more than the fact that I have done something for you and you want to give me a return for it; I think there is something in the fellowship and good-feeling between us all. And if there is one thing that pleases me it is this, that this Association has fostered a feeling of good-fellowship amongst the surveyors of this Province, a feeling that we never had an opportunity of cultivating until the Association existed. I am not a native of Canada. I have not been a very great many years in the Province, and yet, through the good graces of this Association—for I am comparatively a young man both in the profession and in the country—I have now the honour of being the retiring President, having held the office for two years. Now, if it had not been for the Association this thing could never have occurred. There are very few here to-day who would have known me personally. They might have seen my name in connection with that of the city or something of that kind, but that would be all. Now, if the Association has done so much for the profession in Ontario, there is no doubt in my mind that Incorporation is going to do a great deal more. (Applause.) We are all going to feel that we are members of one Association; we are going to feel that we are members of one profession, and our individual exertions will be to the furthering of the interests of that profession. Are there any people in the Province more interested in the well-being and high standing of the profession than ourselves—than we, the practising surveyors of Ontario? I cannot see for one moment how any person could ask the question, What good is Incorporation going to do?

I again thank you for the very kind feeling you have exhibited towards me personally, and I can assure you that my feelings are exactly the same way towards each and all of you; and I hope that if there is anything more I can do or may have an opportunity of doing, as I said, the fact of my being President or not will not have anything to do with whatever I may do for the furtherance of the Incorporation of the Association in whatever direction it may take.

CONVENTION OF CANADIAN LAND SURVEYORS.

MINUTES OF THE PROCEEDINGS OF THE CONVENTION OF CANADIAN LAND SURVEYORS, AT THE FIRST MEETING, HELD IN OTTAWA, TUESDAY, FEBRUARY 16TH, 1892.

The Convention was held in the Lecture Room of the Literary and Scientific Society, Sparks Street.

At 2 p.m. the Chairman, Mr. J. S. Dennis (being Chairman of the Delegation representing the Association of Dominion Land Surveyors), took the Chair.

Mr. W. S. Drewry, Secretary of the Delegation representing the Association of Dominion Land Surveyors, acted as Secretary of the Convention.

The following delegates, representing the affiliated Associations, were present:—

Representing the Association of Dominion Land Surveyors.

J. S. Dennis,	A. H. Witcher,	John Sullivan.
W. S. Drewry,	D. C. Morency,	

Representing the Association of Provincial Land Surveyors for Ontario.

O. J. Klotz,	William Ogilvie,	J. B. Lewis.

The following members of the Association of Dominion Land Surveyors were also present:—

J. I. Dufresne,	P. B. Symes,	J. B. Dowling,
J. J. McArthur,	Jacob Smith,	John Vicars,
James Gibbons,	T. D. Green,	R. Rauscher,
S. L. Brabazon,	W. F. King,	William Pearce,
P. T. C. Dumais,	Prof. Macoun,	John Nelson,
J. E. Woods,	Dr. Bell,	Samuel Bray.
H. Irwin,	Comdr. Boulton,	

The rules and regulations adopted by the affiliated Associations to govern the Convention meetings were then read.

The Chairman read letters from the President of the Ontario Association and others expressing regret at being unable to attend the Convention.

The Chairman stated that the Association of Provincial Land Surveyors in British Columbia had adopted the scheme of affiliation too late to appoint delegates for this meeting.

The credentials and proxys of delegates were received and filed.

The Chairman then presented the list of questions presented to the Convention for discussion and action as follows. The Chairman suggested that these questions be taken up seriatim and disposed of by resolution, which was agreed to.

QUESTION I.—After discussion it was *Resolved*, That in those Provinces where a penal clause exists in the law for illegal practice of surveying, an officer should be appointed to prosecute parties so practising; and that where no such penal clause exists, an endeavour should be made to have such a clause inserted in the law governing surveys and surveyors.

QUESTION II.—After discussion it was *Resolved*, That while it is considered by this Convention that an amalgamation of all the Associations of Surveyors is desirable, it is not thought that any scheme, other than that of the affiliation now in force between the Associations of Provincial Land Surveyors in Ontario and British Columbia and the Association of Dominion Land Surveyors, can at present be carried out.

QUESTION III.—A report of a Committee of the Association of Dominion Land Surveyors on Geoditic and Topographical Surveying was presented and read, and after a lengthy discussion it was *Resolved*, That the report on Trigonometrical Survey of the Dominion submitted be adopted by this Convention and incorporated in the Report of Proceedings, and that each of the affiliated Associations are requested to submit this matter to their respective Governments, adding such further remarks thereto as may be deemed necessary.

QUESTION IV.—After discussion it was *Resolved*, That in the opinion of this Convention the length of apprenticeship for pupils, consisting of three years' service under articles, one of which is spent in the field, is satisfactory, and does not require amendment.

QUESTION V.—This question gave rise to a lengthy discussion, and it was finally *Resolved*, 1st, That this Convention is of opinion that Surveyors are not paid in proportion to the services rendered. 2nd, That as the requirements of Surveyors have materially increased, the minimum remuneration per day should be ten dollars. 3rd, That each of the affiliated Associations should take steps to legalize such minimum pay.

QUESTION VI.—After a lengthy discussion it was *Resolved*, That this Convention is of opinion that graduates of engineering schools or colleges should not be granted any further privileges regarding service

of time under articles, but, on the contrary, the service of such graduates should be lengthened to two years.

This closed the consideration of subjects submitted for consideration and action.

The following papers were submitted to the Convention:—

Paper—"Are the Great Lakes Retaining their Ancient Level?"—Staff Commander J. G. Boulton, R.N.

Lecture—"Phototopographical Surveying."—J. J. McArthur, D.L.S.

Paper—"Irrigation Legislation: its Primary Principles"—William Pearce, D.L.S., Superintendent of Mines.

Paper—W. F. King, D.L.S., Chief Astronomer, Department of Interior.

Paper—"Latitude by Elongation."—O. J. Klotz, D.L.S.

Paper—"Exploratory Surveys."—William Ogilvie, D.L.S.

Paper—"The History and Use of the Arithometer."—J. I. Dufresne, D.L.S.

Paper—"Geographical Nomenclature."—A. H. Witcher, D.L.S.

Paper—"A Latitude Attachment for the Transit."—William T. Thompson, D.L.S.

Paper—"Notes on Maps and Map Making."—Jacob Smith.

Paper—"The Process of Photolithography."—H. N. Topley.

Paper—"Amber."—O. J. Klotz, D.L.S.

The Convention then adjourned to meet in Toronto, in 1893, during Annual Meeting of the Association of Provincial Land Surveyors for Ontario.

W. S. DREWRY,
Secretary.

J. S. DENNIS,
Chairman.

PAPERS.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

EXPLORATORY SURVEYS.

By WILLIAM OGILVIE, D.L.S., P.L.S.,
Ottawa.

In presenting a few remarks on exploratory surveys, I intend as far as possible to avoid all reference to technicalities; such as description and use of instruments, methods of reducing observations, or any other information which can be readily and fully got from works prepared by competent men for the use of surveyors generally.

I will confine myself to what might be called the executive part of such expeditions, and merely present what experience has shown me is the most difficult part for a beginner to contend with.

Let it be granted that we are about to conduct an exploratory survey which involves an instrumental traverse of a stream or streams —which may be more or less dangerous of descent—and at the end of such survey have to determine by accurate observations the latitude and longitude of our terminal point, or some important point in our line of march.

We will first consider equipment. To conduct such a survey you will require two canoes and a party of four men: if you have only three men and anything goes wrong with one of them, you are at a standstill while he is incapacitated; or, if he is lost, may have to abandon the enterprise altogether—as one man is wholly unfit, except in very smooth water, to handle a canoe of the requisite capacity; and even in smooth water he will not make much headway propelling her. Those four men should all be hearty, lusty fellows, possessed of infinite fortitude and patience, capable of carrying on their back at least one hundred pounds over rough ground and through the woods for a period of at least ten minutes without halting. Your canoes should not be less than 18 feet in length, upwards of 40 inches in width (half a dozen more would be better still), and at least 20 inches deep. Such a canoe will give you satisfaction in every way. Whatever you are disposed to yield in, be firm in this. A small canoe will be lighter, of course, but will give you infinite trouble and delay. Your outfit will crowd it and sink it so much that you will have very little freeboard; besides, thus loaded, it will actually draw more water than a larger one. Thus cramped you will often find it impossible to

proceed through rough water, or in shallow, when a larger canoe would allow advance with ease and safety. Such a canoe, when ready for delivery from the shop, will weigh about 170 pounds, and after a few weeks' use will weigh about 190 to 200 pounds. Two men will soon learn to carry it without much trouble, and it would take two to handle a canoe that would not carry more than half its load. Each canoe should be furnished with not less than four good stiff paddles. The ordinary sporting paddle is much too light for such work as we put them to. Giving them a coat of paint before using them adds much to their life, by preventing warping and splitting in hot weather when exposed to the sun.

As on every such survey more or less portaging has to be done, it is essential to provide a set of pack-straps for each man, and two or three extra sets for use by extra help when it is available. The old-fashioned tump-line, by which the load is supported principally by the neck, is simple and convenient, but requires a lot of practice to develop the necessary stiff-neckedness. Pack-straps which put the whole weight of the load on the shoulders are objectionable, in that they produce paralysis of the arms in beginners and do not permit of the load being readily put down, as with the tump-line. Besides, the load works down into the small of the back and becomes very fatiguing. I have seen a combination of the tump-line and pack-strap devised by an old trapper on the upper Ottawa River. It is made by a shoemaker in Mattawa Village, and seems to me just what is required. Tarpaulins long enough and wide enough to cover the canoe completely should be provided against rain storms, and also to cover the stuff at night.

The amount of provisions necessary to start with is, of course, entirely dependent on local circumstances, and will have to be determined by the surveyor taking into consideration all known local facilities for obtaining supplies on the way; but carefully avoid risk by depending too much on such local aid. It is better to have too much with you than to find yourself at some point without food, and unable to get any. I will add as a warning which I cannot repeat too solemnly: "don't depend on your gun or fishing-rod for anything." If you do you will very likely repent it bitterly. By all means take along a gun, or guns, and plenty of ammunition for them, and some fishing tackle, and whatever they bring you is so much gained; but you will probably find at the end of the season that it has cost you more than it is worth. Still, the sport it affords some of us is not to be valued by dollars and cents. You cannot, however, do two things at once; and hunting and surveying are two distinct callings; and, of the two, I think hunting requires the most tact and experience. True, large game once in a while does stumble on to you; but such cases are not frequent, and not at all to be depended on.

Your instrumental outfit will consist of a small transit—or, if you can take two along, it insures you against accident—and some form of micrometer to measure small angles with; the angle, subtended by a constant base, being what you deduce your distances from. The best form of micrometer for this purpose is, I am convinced, the Lugeol

—or a modification of it—which has been approved by the Surveys Office, and issued by it for use in this way. I don't think a description of it is necessary here, as it must be familiar to nearly all of you. The results obtained by this instrument, under good conditions, with a 20-link base in distances not exceeding 60 or 80 chains, are very satisfactory. I would define good conditions thus: atmosphere temperature, 50° to 60° Fahr.; sky clouded; a clear, grey light, and gentle breeze blowing. Under those conditions, distances less than a mile can generally be determined within one five-hundredth of the true distance, and often much less. With a higher temperature and strong light, the error averages much more, and the distances deduced are short; with lower temperatures the distances are long. The error in the distances deduced increases out of all proportion to the distances themselves; so that it does not follow that because we find an error of 10 or 20 links in a mile, that we will find twice that error in a two-mile distance. You will probably find the error increase in the ratio of the third or even fourth power of the ratio of increase in the distance. Why that is need not be discussed just now, as it would exceed the limits of a reasonable paper itself, and besides I am not quite clear as to why it is myself. If you have one of the ordinary forms of transit it will be well, as a check to the work of the micrometer, to have a micrometer head put on the tangent screw of the telescope, so that small vertical angles can be measured in that way. I had my four-inch D. L. pattern transit fitted that way at a very small cost, and, when using that instrument, always checked the micrometer work with it, and found the agreement between the two entirely independent methods very close. In practice it sometimes (owing to unfavourable background and the division of light in the Lugeol Micrometer) happens that the angle cannot be satisfactorily read with the latter instrument; in many of such cases the other arrangement enabled me to get over the difficulty, as with its single image there was no blending of unfavourable conditions. Whenever I could not satisfactorily, by one or the other instrument, determine the angle subtended by the base, I always left a base behind me from which I could deduce the distance from the succeeding station. This was done by setting up, in addition to the picket at the station, another one to the right or left of it, at right angles to the course to be measured and distant from the station 30, 40 or more links, as the ground would permit. From the succeeding station the angle subtended by this base was measured, and the distance deduced from it. Occasionally it would happen that there was no room for such a base; I would then, by a pre-arranged signal, let the base men know that I wanted them to erect such a base where they were, and I would measure the angle subtended by it from my station. On my arrival at the following station I would measure the inclination of this base to the course it was intended to measure, and if found not at right angles to its length was reduced to its tangential length. It was sometimes found necessary to do this in the case of leaving a base behind. In order to facilitate as much as possible such cases, it is

necessary that you have a good flag to signal with, and your base men have a good field-glass, or telescope, to see distinctly what you do signal. For a flag I used a piece of bleached cotton a yard wide and two yards long. It very seldom occurred that the signals made with this could not be distinctly seen. It is necessary that this be kept clean, or renewed occasionally, as a dirty one is not much use. Your base men should be thoroughly drilled in your code of signals before starting; otherwise you may have annoying misunderstandings and delay.

An amusing instance of this occurred the first day of my first micrometer survey. My flag was a small piece of red cloth, which worked all right the first four or five courses, none of which were a mile; then came one of a mile and three-fourths, in which I was in the shade of some large spruce. Do what I might, I could not make the base men understand I was through with them there. At last, in desperation, I pulled the cover off the canoe and waved it with all my might. This answered. In the evening I asked them what was the matter, and they innocently told me they could see nothing until I waved my white pocket-handkerchief. Imagine their surprise when I told them the white handkerchief was the canoe-cover, a piece of cotton duck 17 feet long and 6 feet wide.

Each one can devise for himself his code, but I found the following work well:—The flag-pole held horizontally to the right, with the flag hanging perpendicularly from it, signified that I was ready for the base to be erected; when I was through, it was signalled by waving the flag across the line of sight high above the head. If the conditions for seeing and making a satisfactory measurement were not favourable, it was shown by waving the flag low in front of the observer; and, if I wished them to put up a base for me at their point, I immediately followed this by quickly waving the flag vertically on the left side of the signal man. Of course it was necessary for one of the men at the base to be on the look-out all the time they were at a station, for some time after the survey commenced; but experience soon taught them just what to expect and when to expect it.

My experience is that, with courses averaging a mile, on a down-stream survey about 20 miles per day can be made, and on an up-stream from 15 to 20. The greatest number of stations I set up in one day was 37, but that was an exceptionally long day. The greatest distance I have made in one day was $23\frac{3}{4}$ miles, and strangely enough that was on an up-stream work (on the Mackenzie). There were only twelve stations in it. The next greatest was going down the Athabasca, 23 miles, with, I think, about 18 stations in it. Had I plenty of time to do my work in, I would instruct my base men to confine themselves to distances of about a mile, as far as practicable; but when you have a long distance to go and a short time to do it in, with the certainty of a tiresome snowshoe tramp of perhaps hundreds of miles if you are frozen in, they are very apt to think they have gone only a mile when they have gone upwards of two; and, though you expostulate with them, you are not very emphatic about it.

It should always be made a point to take along an instrument with which latitudes can be simply determined, and, during the course of the survey, as many latitudes as the weather will permit should be taken. If your transit is not fitted with a vertical arc of the requisite precision, a small reflecting circle and false horizon is convenient and simple ; and, by combining meridian altitudes of north and south stars, close and reliable results can be obtained.

To determine the latitude and longitude accurately of your principal point, you will require an astronomical transit. To determine latitudes with it, it will have to be set up in the "prime vertical"; or, better still, have a fine level attached to it on the principle of the zenith telescope. The stand for this instrument, in order to give it the necessary firmness, has to be made very heavy. This is a serious item for us. In order to overcome this, I had brass Y's made for the telescope I used, which are only a few pounds weight and answer just as well as the stand. A stump of a tree of the requisite size is selected, the middle portion cut out of it in the direction of the meridian, the Y's I have mentioned are then firmly screwed to the sides of the stump in such a position that the telescope when placed on them will revolve nearly in the meridian. It is finally adjusted in inclination and azimuth by the attachments to the Y's. When a suitable stump was not available, I have made a good stand by combining a couple of pieces of timber, 7 or 8 inches square and 8 or 10 feet long, in the form of the letter X ; but with one part of it made much longer than the other. This was carefully and firmly planted in the ground in the proper direction, the Y's firmly screwed to the top of the timber and the final adjustment made as before. With this arrangement I am confident I have got as good results as with the regulation stand, and saved the transport of upwards of 200 pounds of rather bulky outfit. Before beginning to observe, a platform should be built around the stump or stand, above the ground, to prevent any vibration of the telescope in making the necessary movements around it.

In compiling your returns of survey, the latitude observations will show the errors of the micrometer work, and if a record is kept of the atmospheric conditions for each day, you can, with this data and the lengths of the courses, apportion the error in the intervals, so that there will be very little error in the final plot.

If you have only to make a track survey—that is, one in which the azimuths are taken with a compass and the distances inferred from the time taken to travel over them—your instrumental equipment need only be a reflecting circle or sextant, and a false horizon with a chronometer, or more than one if convenient. In conducting such a survey you should, as often as is possible, determine the magnetic inclination of the compass used, and as often as possible test the rate at which you travel. On such a survey it is essential that you observe, as often as possible, for latitude, by meridian altitudes of north and south stars ; or, better still, circum-meridian altitudes of the same stars. For time and longitude, observe altitudes of stars

east and west of the meridian, when near the prime vertical, and if possible not less than 30° above the horizon. By observing stars on both sides of your zenith, you eliminate the results of index error in your instrument. My experience is, you never know just what the index error of a sextant is; as I found it different in different atmospheric conditions. The reflecting circle I used last season, in ordinary summer temperature, was eccentric about 40″; but in the winter, in low temperatures, I found it nearly 3′.

Before starting on your survey, provide yourself with as many different maps of the district you are to pass through as you can. Very probably many of them are mere guesses based on hearsay, but they are valuable in that they show you what you may expect to find somewhere in your route. By combining them you can generally, though not always, map out your route and make your plans accordingly. You will generally find, however, that you have to go it blind, so to speak, until you enter the confines of your work; here you can learn from the natives the general character of your route, and the number and nature of obstacles in it. In this, however, as in every other human attribute, you will find many kinds and degrees of intelligence. Here, as in civilization, the greatest curse—to use a strong term—is the man who knows everything. You have but to ask him about a place or thing, and he immediately begins a tedious description of it, which generally has some truth in it, but in the main is imaginary. Get him to make a map and then note his remarks upon it, and you will be disgusted with the general result. Possess your soul in patience; don't get prejudiced; get as many different maps from as many different men as you can, and in the end you can build a tolerably good one out of them all. You will also likely find that some one of them embodies the main features of all the rest. You can rely on the man who made that one. One striking feature of Indian maps is the general absence of all idea of scale; no two of them will delineate the same stream, for instance, anywhere nearly alike except by accident. It seems to me their conception of distance on their sketch is based on the time it has taken them to travel over the different parts; but I have found so many glaring exceptions to this that I do not give it as general. The best way—in fact the only way—to get an idea of distance from them, is to find the time it has taken them to travel over it, taking all possible care to learn the conditions at the time of travel; such as the time of the year, the state of the weather; whether they were travelling light or loaded; whether game was plenty or scarce; whether they had plenty to eat or were hungry—in fact, anything that would be likely to hurry or retard them on their march. Right in the way of the acquisition of this information comes in the general repugnance of the Indian to being questioned. If you could converse with him and had lots of time and means to entertain him sumptuously, you could get all the knowledge he is possessed of—probably more; but to start in cold blood and draw it out of him by a series of short, pointed questions, is contrary to his ideas of the nature of things. The probabilities are that if you

attempt to question him too much he will shut up altogether. Above all, avoid pointing out to him what you think is absurd or contradictory in his statement. Such is not "received with thanks" by him; and, if you do, you have very likely incurred his pity, if not his contempt. "What does a poor, ignorant white man know about these things?" Swallow all he gives you, and digest and assimilate all you can of it; but don't refuse anything or he will likely cut short the supply.

I have heard many amusing anecdotes of their contempt for whites who don't believe what they tell them; but they are too lengthy, and would be out of place here.

Another discordant feature in their map-making is the want of agreement as to the position of the general features in it with reference to the cardinal points of the compass. Very seldom will two of them independently agree on the direction of any distant point. Often I have marked the terminal points of a route I wished them to sketch in on a piece of paper, and held it in its proper position with reference to the meridian; but very seldom could they do it without turning the paper around to suit their idea of direction. It will be found that though they know the country well, they have not much capacity for conveying an intelligent description of it to a stranger, whatever they may do among themselves or with friends. If you employ any of them as guides, don't ask them too many questions about what is ahead if you wish to retain their good will and confidence; they seem to infer from it that you doubt their competence to guide you, and grow sulky. Don't be surprised if you find your guide, though he knows the route well, make many mistakes as to the time of arrival at different points on your route. It seems to me they generally build their time-tables on the time or times it has taken them to go over the ground, and they don't realize for some time that they are travelling under different conditions. Don't be surprised if you find many guides among them like the Irish pilot who declared he knew every rock in the bay, and when the ship struck one exclaimed, "An' be jabers that's one of 'em!" Very retentive memories are not more common with them than others; and I have seen many of them who, to use a common phrase, got lost, and did not know as much about where they were as I did at the time—though very unwilling to admit it.

I would say to you emphatically: don't depend too much on them. Exercise all possible care and keep just as sharp a look-out as if you were without them; but be just as careful that they don't see that you distrust them. By consulting the officer in charge of the post or posts nearest to your route, you will generally be referred to some one fairly reliable, to whom you can apply for information or secure as a guide; but you will very often find that, just when you want them, the best men are engaged by the traders or missionaries. In obtaining information from them concerning country beyond your route, it is important to interview them several times, as very rarely do they give you all they know at one sitting, and it would be unreasonable

to expect them to do so. Also, as far as you can, have such information confirmed or corrected by as many others as you can.

In getting names of places, it is important to learn from them why the names were given, and whether or not the name is merely local, or general. You will find many places have names which are merely local, and were given for some absurd or childish reason by some local character, and are only known as such by himself and a few others.

In descending streams, if you are making a micrometer survey, the rate of the current can be fairly well determined by sending your canoe into mid-stream in a calm day, putting your paddle two or three feet vertically into the water, with the blade across current, and timing yourself over the courses. By repeating this in different rates of currents, at frequent intervals, you soon learn to rate a current fairly well by looking at it. The same rate of current, however, has a different appearance in different depths of water, and with different bottom formations.

In descending rapids, even if you have a guide, it is well to take a good look at them before running them. This can be best done by getting as high above the river as possible; do this at several points so close together that you can have a good, clear view of the whole rapid on the side you intend to run on. From a height you can see better the whole surface of the water than when standing on shore; but you must always bear in mind that you will find the water much rougher when you are in it than it appears to be when looked down upon. When you are making this examination, if any place appears to you to be shallow, you can, if not too far out, sound it by throwing a three or four pound stone in such a way that it will descend vertically on the place you are doubtful about. If you hear distinctly the sharp blow of the stone on the bottom, it is unsafe—unless it is at the end of the rapid; if so, you can slow up on approaching it by holding your paddles or, better still, good, stiff poles firmly against the bottom, and then taking a safe time to cross the shallow. It is very important to know just where to enter bad places. To do this you have to know the set of the current. This you can ascertain, if it is not too far from you, by throwing in sticks and watching their drift and entry into the bad spot; a few trials will show you just where to drift and how to steer. When in very rough water, unless it is absolutely necessary to avoid danger, don't drive your canoe fast; if you do, she will ship water. If she were simply drifting with the current, she will go safely through places in which she might be swamped if driven at speed. When she is running she cuts into waves instead of riding them. Never turn sharply out of a swift current into an eddy; you are very apt to be upset if you do.

Don't forget, before you start on such an expedition, to provide every man in the party with a good life-preserver, capable of supporting at least 17 pounds, and as much more as you can get. The most convenient kind is made of india-rubber cloth, which you fill with air by blowing; but, as generally made, they are much too small, and

only the largest size possess 17 pounds buoyancy. One of this buoyancy will keep a man, weighing about 180 pounds, head and neck out of the water without any exertion on his part; but when exerting himself he is much higher out of water. It is not enough, though, to enable him to help a companion or save property with safety. The confidence which it gives a party, in any place into which they will venture, is worth much; they feel perfectly safe about themselves and don't lose their heads, as they otherwise might.

In ascending streams of more than three miles per hour current, the quickest and easiest way is tracking; that is, one of the party walking along the bank and hauling the canoe with a line. This line should be so attached that the canoe will keep out from the bank by the mere act of being hauled. The line need not be heavy: in ordinary current a good, strong fishing line is strong enough, but in rapids you want a hard spun-line of at least one-eighth of an inch in diameter. One unaccustomed to it could hardly believe what steep inclines in a rapid such a line will haul a canoe up. If your line is heavy in easy water it curves and sinks in the water, thereby keeping the boat too close to the shore; it also catches on sunken sticks and stones, causing trouble and delay. In ascending a rapid in this way, there are only two ways in which accidents can happen: one is, the line breaking in a bad spot; the other is, putting the canoe into a rushing current out of an eddy too square with the current—to do so is to invite disaster. Your line may break, your canoe upset, or the water rush over her side and fill her. Enter her as nearly parallel with the current as you can, and keep your line tight while doing so, that there may be no undue strain on it when it does tighten.

To enable you to make your report as complete as possible, you should provide yourself with a good, self-registering thermometer, and the minimum temperature of every day should be noted; also the temperature at mid-day, or soon after. Also the temperature of the river water should be frequently noted. The latter is important to yourself in the fall, as indicating in a general way how much longer you will have open water. In clear open water a large stream cools very slowly, so that, if the temperature of the water is about 40 degrees, you may look forward to eight and ten days without ice; but if a heavy snow-fall comes on, start at once for the nearest post.

Also provide yourself with an aneroid barometer of good size, and before starting adjust it by a good mercurial to the proper reading; note its reading at least once a day. As soon as possible after your return, compare it again with a mercurial; if there is much difference, your knowledge of what it has gone through on the journey will help you to adjust the difference properly. In running down a river, if there is much fall you can, by reading it at frequent intervals—say every quarter or half hour, or at the head and foot of every steep part—arrive at a very fair estimate of the ascent in that part of the river; but in ordinary currents it is practically useless. The use of the daily record is obvious. In the interest of science you should collect as many specimens of the fauna, flora and geology of the region you pass

through as you can. Some of the specimens may have more than a scientific interest, for they may help to determine the general character of the country, or its general metecrological conditions. I must say, however, if a surveyor attends to his own professional duties properly and fully, he has not very much time to attend to those matters; and very often when he sees some specimens that he would like to acquire, he is so situated and engaged that it is practically impossible for him to do so; yet, it is not out of his power to do something. All information you may get should be noted at once, with the date, place and name of party giving it, and any comments you may have to make on it, or conclusions to draw from it.

In conclusion I would say, aim at collecting all possible information, even if it is not pertinent to the object of your expedition, nor of a nature to be inserted in your report; you will probably find use for it some day, or it may be useful to someone else.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

ARE THE GREAT LAKES RETAINING THEIR ANCIENT LEVEL?

By STAFF COMMANDER J. G. BOULTON, R.N.,
Ottawa.

THIS question is not easy to answer definitely from past experience, because, as far as I am aware, there are no continuous records of the movements of lake waters, further back than thirty years. During this period, careful records have been kept, and the question would have been better put in the shape of—"Are the great lakes likely to maintain the mean level of the last thirty years?"—or it might have been put—"Have we any reason to fear the lakes are being slowly but surely drained?" I was led to make a few remarks on this subject because of the unprecedentedly low stage of water at the present time on all the lakes excepting Lake Superior. I have no theory to propound as to the future movement of the lake waters; my object has been simply to collect and give the Association what information I can upon the present and past condition of the inland seas, and invite opinion on the likelihood of their future movements.

Many of the members here present have read of the anxiety of ship-owners and vessel captains about the low stage of water last year, and there is little wonder at their alarm, when official records kept by the United States Government show that before the close of last navigation the water in Lake Huron was three and a-half feet lower than the level in June, 1886.

What no doubt increases the alarm is that this is not a sudden dip, but a steady fall of half a foot a year since 1886. All members of this Association know sufficient of marine matters to understand how seriously this action of the water may have effected the earnings of some of the splendid 3,000 ton steamers belonging to the States, trading from Lake Erie to Lake Superior, built in 1886, when the water had stood at a high and apparently permanent level for four years; vessels which when loaded were drawing all the water the canals and artificial channels could give them in the high stage of 1882 to 1886, all finding on their last trips in the fall of last year three and a-half feet less water; that is, if they made the trips at all, which they could only do with half cargo. To these men, Canadian ship-owners, and to lake commerce generally, the question of the maintenance of the lake level is a very important matter.

From records of the rain and snow fall kindly furnished me by Charles Carpmael, Esq., it appears that the diminished quantities of

precipitation since 1886 is nearly equivalent to the amount the water has fallen below the mean level since that date. In Lake Superior the rain fall has been normal, and the level has not lowered like that of the other lakes.

Those well up on the subject of forestry will be able to say whether the clearing of the forests by fire and axe is likely to cause a permanent diminution of rain and snow.

Evaporation plays an important part in the lowering of the level of the lakes, no doubt, not merely from the sun's rays (which in the course of the survey my officers and myself have reason to feel hot enough at times), but by the dry westerly winds accompanying a bright sky and blowing with great force and evaporating effect when forming the dry rear semicircle of the revolving storms which pass over the lakes.

An alteration in the meteorological conditions to cause a preponderance of these winds in duration and force would no doubt have a marked effect on the water of the lakes.

The Welland Canal is an additional outlet for Lake Erie, the Sault Canal for Lake Superior, lower canals for River St. Lawrence, and the deepening of St. Clair River for Lake Huron. But I leave to hydraulic engineers to calculate the additional quantity of water carried off in this artificial way.

Another interesting calculation would be the wearing effect of continual running water at the various rapid outlets. It is *possible* that the rocky spots of these lakes are wearing deeper by this natural means.

It is not necessary to say much about the reported sub-aqueous and subterranean passage from Lake Huron to the Gulf of St. Lawrence, because it is probably of very ancient origin, and may be considered a constant factor affecting equally both sides of the equation —the future and the past. Should any member of the society have made a survey of this passage at any time a few words about it might be interesting. This tradition has some value, however, on account of its being handed down by seamen whose veracity on all matters maritime, we all know, has never yet been impugned.

In 1838, there seems to have been the highest stage of which we have any authentic record.

This high water has been used by the United States authorities as the plane of reference for their soundings on their charts and for the records of the oscillations to which I have alluded.

From 1859 to 1887 the mean water surface of Lake Ontario was two feet four inches below the high water of 1838; there has been on the whole a gradual fall from 1859 to 1872, and a similar rise to 1888. I have not the records from 1888 to date, but have reason to believe the fall has been similar to that on Lakes Huron and Michigan, for which there are records to end of last year. In Lake Ontario during this period of twenty eight years the water has fluctuated from eighteen inches above to the same distance below the mean level for that period. The relationship between the rain fall and stage of water in this lake, however, is not very apparent. The yearly rise and fall

ranges greater in this than in any other lake, as much as four feet in 1867, the highest water taking place in May, and the lowest in mid-winter.

In Lake Erie the mean level from 1859 to 1887 is 2.1 feet below the high water of 1838; though the records are not printed to date there is every reason to believe that the water since 1887 has fallen similarly to that of Lake Huron, for which we have records. There has been a gradual fall from 1859 to 1872, and a corresponding rise to 1887, but not so marked as in Lake Ontario. The fluctuations on either side of the mean line have not been so great as on Lake Ontario, nor has the yearly range exceeded one and three-quarters feet, excepting twice.

For Lakes Huron and Michigan the mean level from 1859 to 1887 is 2.8 below the high water of 1838. There was a period of low water from 1864 to 1869, again in 1872-3, also in 1879 and 1880. The water then rose steadily to 1886, and has fallen over three feet since, or to one and a-half feet below the mean level of 1859 to 1889. The average yearly fluctuation is about fifteen inches. In these two lakes the periods of high water have been attended by copious rain-falls, and vice versa.

For Lake Superior the mean level from 1859 to 1887 is given as three feet below the high water of 1838, and this level it has maintained to the present time very steadily; the relationship of the level to the rain-fall is not very evident here. The yearly rise and fall is about one foot.

On all the lakes, excepting Lake Superior, the period from 1881 to 1886 was attended by high water, it being during the principal summer months one foot higher than the mean from 1859 to 1887. This period was sufficiently long for men who had not studied the previously recorded movements of the waters to conclude that this stage of water was the normal condition, and quite accounts for the alarm of the ship-owners and masters who have had unpleasant reminders by the grounding of their vessels that the water has been steadily falling nearly half a foot yearly since 1886.

The water in Lake Ontario attains its maximum in May; Lake Erie, in June; Huron and Michigan, July and August; Lake Superior, in August and September.

The sudden fall of the water since 1886 was very noticeable on the steep shores of the vicinity of Parry Sound last year, the rocks being stained black and void of vegetation for two to two and a-half feet above the level of the present water. Admiral Bayfield in 1820 shows these as clean granite rocks just level with the water in that year. In 1887 these two rocks were in the same condition.

General Poe, U.S.A., the best authority, probably, on the hydrography of the inland seas, says in a letter to me:—"I cannot believe that the unprecedentedly low water in Lake Huron will continue, but I think the level will come up again as soon as the precipitation becomes normal. For four or five years in succession the precipitation in the basins below Lake Superior has been below the mean, a fact which sufficiently explains the low stage we now have. Still, I

am further of the opinion that the surface of the lakes has been at some time at a considerable lower level than that of which we have any record, and it is possible that the subsidence may continue until that lower stage is reached. That is, evidence exists to show that we are now in the highest stage of a series of fluctuations which have long periods, probably a century or two."

Mr. Carpmael, the Director of the Observatory at Toronto, says:— "As to whether the recent deficiency in rainfall is likely to be permanent, this is a question of great difficulty; it seems not unlikely, to a limited extent, it may be, owing to the diminution of the forests."

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

CEMENTS AND CEMENT MORTARS.

By M. J. BUTLER, P.L.S., C.E.,
Napanee.

Taking into consideration the many valuable papers, reports, etc., pertaining to this subject that have appeared in recent years, it must be considered a mark of the importance of the subject.

Cement has been aptly defined as being the "soul of masonry." With most engineering works masonry is the all-important part.

What is cement? The following definition is taken from Brandt and Cox's Dictionary of Science and Art: "In building, a mixture of carbonate of lime and silicate of alumina, in the proportions of 16 to 64 per cent. of the latter to 84 to 36 per cent. of the former, which possesses the faculty of setting rapidly under water, and of increasing in hardness with time. There are two descriptions of cements, the *natural* and the *artificial*. The former is obtained by calcining natural stone; the latter is obtained by the calcination of a mixture of chalk and clay. The Roman cements are a type of the first class, and Portland cement of the second, these names having reference to some supposed resemblance to Roman mortar and to Portland stone."

It is almost needless to remark that the foregoing definition is one of no value, from the fact that it fails to lay down the exact composition and properties of either natural or Portland cement. Having, however, been roughly divided into two classes, it may be advisable to retain this form while we proceed to give the distinguishing characteristics of each.

Natural cement is a cement made from magnesian limestone, by burning the stone in suitable kilns and grinding the burnt rocks as finely as possible, and should have, as nearly as may be, the following composition:—

Silicic Acid	32.00
Alumina and Iron Oxide	8.00
Lime Ca. O.	54.00
Magnesia Mg. O.	6.00
	100.00

A small quantity of the alkalies, soda and potash, are also frequently present.

TABLE OF TENSILE STRENGTH—NATURAL CEMENTS.

NAME.	1 Day.	1 Week.	1 Month.	6 Months.	1 Year.	2 Years.
	Sq. in.					
Louisville	72	.....	.....	150	.....	.....
Rosendale	49	73	156	286	.....	.....
Average of 25,000 E. C. Clark, Boston, Mass., drainage tests	71	92	145	282	290	.....
Napanee average 1,000 sample	50	90	140	280	300	315

Portland cement is an artificial mixture of carbonate of lime and clay in proper proportions, which are brought by suitable means into close mechanical contact, formed into bricks, dried, burned into a hard lava-like clinker, and afterwards ground as *finely* as possible. The chemical composition of which should be :—

Lime Ca. O	60.05
Magnesia Mg. O	1.17
Alumina and Iron Oxide	11.30
Silicia Si. O^2	21.11
Alkalies (Soda and Potash)	.1 to 2 per cent.

" Artificial cement was manufactured in England several years prior to 1824, and if by accident a portion of a kiln was over-burned, producing clinker, this portion was thrown out as worthless. During the year named a Mr. Aspdin, of Leeds, England, thought to experiment with some of this waste clinker, and after pulverizing and wetting it up into cakes or blocks he was surprised at its colour and hardness. It resembled in colour a limestone that was being quarried for building purposes on the Island of Portland, in Dorsetshire, and in taking out a patent for the new product he named it ' Portland ' cement. Had the Portland building stone been light coloured, we should never have heard the word in connection with hydraulic cement. From this small beginning the word has grown to be a power in the public mind."

The writer feels constrained to give the above a place, from the fact that he has so often found rather erroneous ideas among engineers as to the meaning and origin of the word " Portland."

When about to use a cement the important question is to draw up a specification that will secure a suitable quality for the purpose in view. Too often we find some such specifications as the following :— " The cement shall be the best English Portland." No analysis, no tests for setting, fineness nor tensile strength. Now, of course, every manufacturer in England thinks his cement the best. It is an absurd and unfair specification. Germany, France, Belgium, Switzerland, the United States and Canada all produce cements quite as good as England. There is no magic in the word " Portland," nor in the combination of *English* with it.

Another, having heard that *fineness* is a good quality, the finer the better, therefore specifies that not more than 10 per cent. shall be left on a sieve of 10,000 meshes to the square inch. Also learning that heaviness is a desirable quality, therefore specifies in conjunction with the above fineness that the cement shall weigh not less than 130 pounds to the struck bushel. Now it so happens that these two properties are incompatible; a very fine cement cannot be a very heavy one, from the fact that the finer the material is ground the more bulky it becomes.

At the present time the tendency is to call for too high a tensile strength with *neat cement*, in short period tests. A coarsely ground, over-clayed cement, when tested neat, will show the highest test on a period of one or seven days.

The following are the recommendations of a committee of the American Society of Civil Engineers to bring about a uniform system for testing cements:—

"It is recommended that tests for hydraulic cement be confined to methods for determining fineness, liability to checking or cracking, and tensile strength; and for the latter, for tests of seven days and upward; that a mixture of 1 part of cement to 1 part of sand for natural cements, and 3 parts of sand for Portland cements, be used in addition to trials of the neat cement. The quantities used in the mixture should be determined by weight.

"The tests should be applied to the cements as offered for sale. If satisfactory results are obtained with a full dose of sand, the trials need go no further. If not, the coarser particles should first be excluded by using a No. 100 sieve, in order to determine approximately the grade the cement would take if ground fine, for fineness is always attainable, while inherent merit may not be.

"*Mixing, etc.*—The proportions of cement, sand and water should be carefully determined by weight, the sand and cement mixed dry, and all the water added at once. The mixing must be rapid and thorough, and the mortar, which should be stiff and plastic, should be firmly pressed into the moulds with the trowel, without ramming, and struck off level; the moulds in each instance, while being charged and manipulated, to be laid directly on glass, slate or some other non-absorbent material. The moulding must be completed before incipient setting begins. As soon as the briquettes are hard enough to bear it, they should be taken from the moulds, and be kept covered with a damp cloth until they are immersed. For the sake of uniformity the briquettes, both of neat cement and those containing sand, should be immersed in water at the end of twenty-four hours, except in the case of one day tests. Ordinary, fresh, clean water, having a temperature between 60 and 70 degrees F., should be used for the water of mixture and immersion of samples.

"The proportion of water required varies with the fineness, age or other conditions of the cement, and the temperature of the air, but is approximately as follows:—

For briquettes of neat cement, Portland, about 25 per cent.; natural, about 30 per cent.

For briquettes of 1 part cement, 1 part sand, about 15 per cent. of total weight of sand and cement.

For briquettes of part 1 part cement, 3 parts sand, about 12 per cent. of total weight of sand and cement.

The object is to produce the plasticity of rather stiff plasterer's mortar. An average of five briquettes may be made for each test, only those breaking at the smallest section to be taken. The briquettes should always be put in the testing machine and broken immediately after being taken out of the water, and the temperature of the briquettes and of the testing room should be constant between 60 and 70 degrees F."

For ascertaining the fineness of cement it will be convenient to use three sieves, viz.:—

No. 50 (2,500 meshes to the sq. in.) wire to be No. 35 Stubbs' gauge.
No. 74 (5,476 " " ") " " 37 " "
No. 100 (10,000 " " ") " " 40 " "

For sand two sieves are recommended, viz.:—

No. 20 (400 meshes to the sq. in.) wire to be No. 28, Stubbs' gauge.
No. 30 (900 " " ") " " 31 " "

Reject the material retained on No. 20, and retain material retained on No. 30.

To determine if a cement will "blow," as it is called, that is, to find if free lime is present, mix up some small pats with thin edges, expose them to the air until set, put, say, one or two into warm water, and note if any cracks appear; if none, it is certainly safe to use at once.

In the absence of proper testing machines, it is often desirable to make a quick examination of a cement, and the writer submits the following:—

1st. Fineness. Test with 10,000 mesh sieve. There should not be more than 15 per cent. retained on this sieve.

2nd. Test for "blowing" as above outlined. If in warm, moist air, the defect will be at once apparent, and shows the cement is insufficiently seasoned.

3rd. Note how long it takes to set hard enough to resist an impression with the finger nail. It should set up in thirty minutes, when mixed neat, so as to resist the finger nail.

Mortar.—The cement and sand should be mixed dry in relative proportion thoroughly. Then add sufficient water at once to make a stiff, plastic mortar. If for brick-work, a little excess of water will be less liable to do harm; if for concrete, to be rammed to place, less water should be used. It cannot be too strongly insisted on that in

the case of natural cement mortars a very slight excess of water will utterly ruin the mortar. Portland cement mortars admit of more abuse, yet it is important that the same rules be applied in order that we may get the best results.

DISCUSSION.

Mr. Alan Macdougal—I would like to say in connection with this that the great difficulty in getting a reliable cement test is really to find out the way in which the briquette has been prepared, because, as Mr. Butler says—and I suppose he has had as much experience in that as any of us—some engineers when they make their tests press the briquette down, they ram the cement in hard, and in that way they try to put the cement into the conditions under which it will be placed when put in the work. A man I met last summer told me that his cement test ran from about 700 pounds. Well, I said, if you have got a thing of this kind it will knock the spots off everything. I said: Do you ram your cement? Yes, he said, I do; I ram it as hard as I can. That would be almost on the same principle as compressed brick. I think the safest and fairest way is always to refer to the American Society of Civil Engineers' tests, then we all get a basis on which we can work.

There is one point I should like to ask the speaker on, and that is, why it was that Napanee cement went off so much. At one time there was some very good Napanee cement, and then after that it seemed to vary so much that it went out of the market altogether. The cement, as far as I know it, is a slow-setting cement, and I think if you take it at the end of a year you find that it will give a very good result in your work. If you use it in concrete work you will find it will set hard and solid. I know one example I had of it where it gave as good concrete as another that was made from Portland cement. I think one fault we are rather disposed to run into in Portland cements is we want them all quick-setting, to have a cement that will set almost immediately, and when it does that, I think that you will find it will deteriorate and will lose a large amount of its binding and staying qualities. I was always brought up on the principle of slow-setting cements, and I have never altered my views on that point. I think investigations should be made, and the only way it could be done would be by keeping some of these briquettes a period of one or two years. I was in Newfoundland about a year ago where we used the Alson cement, a German cement, in some work, and we used also some of White's Victor, an English cement. In the eight-day test the English cement gave much better results than the Alson; but from twenty-eight days and over the results were all in favour of the Alson's, showing that if the slow-setting cement takes a longer time to set, it binds and has greater strength than other cements. In a paper prepared by Vernon Harcourt, he shows that after a certain time deterioration sets in in these quick-setting cements. It is a question that we will do well to consider and to give to each other any experience we have of those points.

Mr. Butler spoke of the preparation of these. Are these quantities by bulk or by weight?

Mr. Butler—By weight always. In all the new works on the Cornwall canal they have used about 50,000 barrels of concrete, and 50,000 barrels have been ordered for the new "Soo" canal, so that puts it beyond any question as to the advantages of using a natural cement when you want a cheap cement, as Portland costs nearly three times as much as natural. That was made to set under water, but it is given a certain time in air before being put under water; it is generally given about a month or two months. This will run two or three years probably. During the construction of the work there will be no water admitted, but after it is completed then of course it will be under water.

Mr. Chipman—Although this is a surveyors' meeting, I see here a good many engineers who are more or less interested in this subject of cements. I cannot altogether agree with the previous speakers as to the advisability of using a slow-setting cement, especially in works that we, as municipal engineers, have to deal with. I think for an ordinary municipal engineer, who is unable to spend a year or a good part of a year in conducting tests, that a quick-setting cement is safer than a slow-setting one. In the works with which I am connected we specify a strain of 125 pounds to the square inch after immersion for twenty-four hours. We had great difficulty in getting Portland cement up to that standard, but, after once attaining it, we have had less difficulty in maintaining it at that. I have tried the natural cements and have found them quite satisfactory for engine foundations, foundations of buildings, etc., but for any troublesome work, or work that when once done must be covered up to remain covered up, I prefer the quick-setting Portland; in fact, in some cases, I use Roman cement.

Mr. Butler—Do you mean a quick-setting as against a slow-setting Portland?

Mr. Chipman—Yes; slow-setting Portland for some of the work we had would not answer.

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DOES THE PASSING OF AN ACT OF PARLIAMENT ALWAYS DO JUSTICE?

By A. NIVEN, P.L.S.,
Haliburton.

In the paper which I am about to read I beg leave to submit for your consideration the question whether or not a certain Act of Parliament has done justice or otherwise to the land owners in the 4th concession of the township of Etobicoke, in the county of York.

In our Survey Act you will find a list of local Acts relating to surveys in Ontario, and to one of these I wish to direct your attention, viz., "An Act to establish the true location of a road allowance between the township of Etobicoke and the township of the Gore of Toronto." (22 Vic., c. 59, passed A.D. 1858.)

Having been engaged in making a survey of the front and rear angles of all the lots in this 4th concession of Etobicoke, the question naturally enough arose at that time whether or not there was any road allowance between the said townships and the Gore of Toronto, and if there was, which township was to contribute the land for such road?

I think I have a sufficiently clear recollection of all the facts connected with the case to lay them fairly and impartially before you, and having done so, with a few remarks of my own, I shall leave the subject to you for discussion as to whether or not justice has been done to the township of Etobicoke, and also to the townships of Vaughan and King.

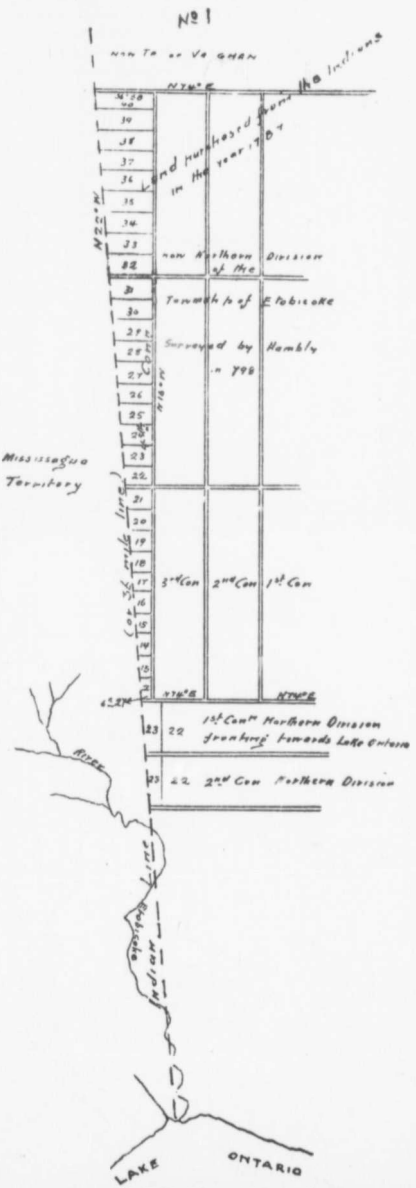
The division line between the township of Etobicoke and the township of the Gore of Toronto was originally a territorial line, sometimes called the "Indian Line,"—a line which commenced at the mouth of the River Etobicoke, and ran a course N. 22° W. for a distance of 36 miles, the land to the east of it being land recently purchased from the Indians. To the west of it the land was as yet Indian territory. I will give you the facts as they occurred in historical order, so that you may better comprehend the subject.

In the year 1798 instructions were issued to William Hambly, Deputy Surveyor, to subdivide the northern part of Etobicoke. It was a single front concession township. For as yet the double front system was not introduced. The width of the lots was to be 20 chains by a depth of 50 chains where it was possible to give that depth. The 4th concession, which abuts against the "Indian line," is a gore, its southernmost lot having a depth of only 6.27 chains, but

lengthening out therefrom as we go north until the last lot has a length of 56 chains 58 links. Hambly's "Field Notes" make no mention of his having left an allowance for road in the rear of this concession abutting on the Indian line. His plan, drawn by himself from his own field notes, shews only a *single line* in rear of this 4th concession, and no evidence could be procured from the oldest settler of any stake having ever been seen anywhere for a distance of $7\frac{1}{4}$ miles from lot 12 to lot 40 inclusive.

It has been said that in other parts of this plan of Hambly's there was only a *single line* drawn where it was well known that between two concessions there must of necessity have been a road, and that the same error or omission might have occurred when he drew the Indian line. But in those other places there were stakes marked, and sometimes trees in line of stakes marked with the letter R, which undoubtedly indicated a road allowance, and it was also a way of necessity, but in the rear of the 4th concession of Etobicoke, in the year 1798, there was no necessity for a road, as the land to the west was Indian territory.

The first patent, which was issued on the 5th of August, 1799, was for lot 20, described as follows: Commencing in front of the 4th concession, at the south-east angle of the lot, then S. 74°



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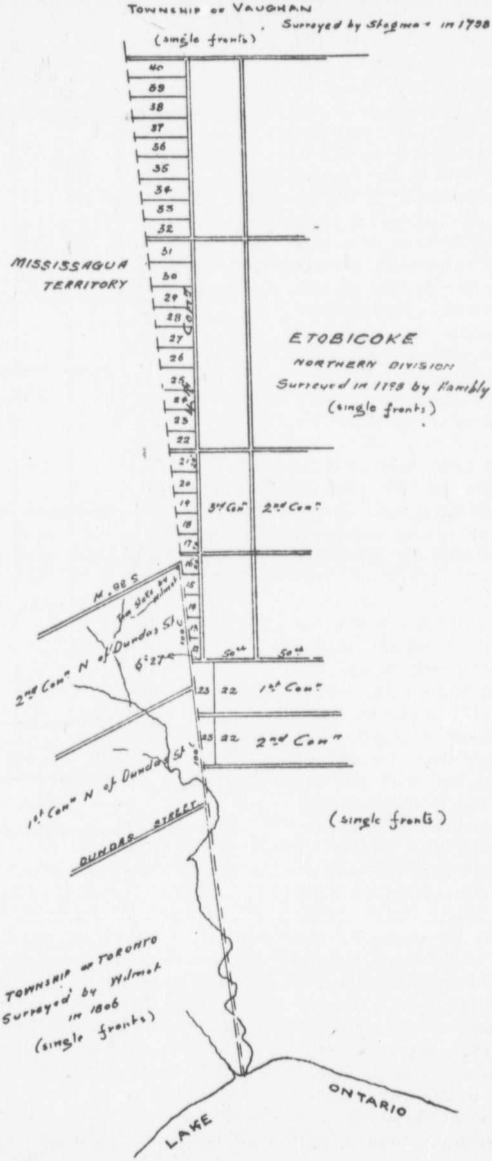
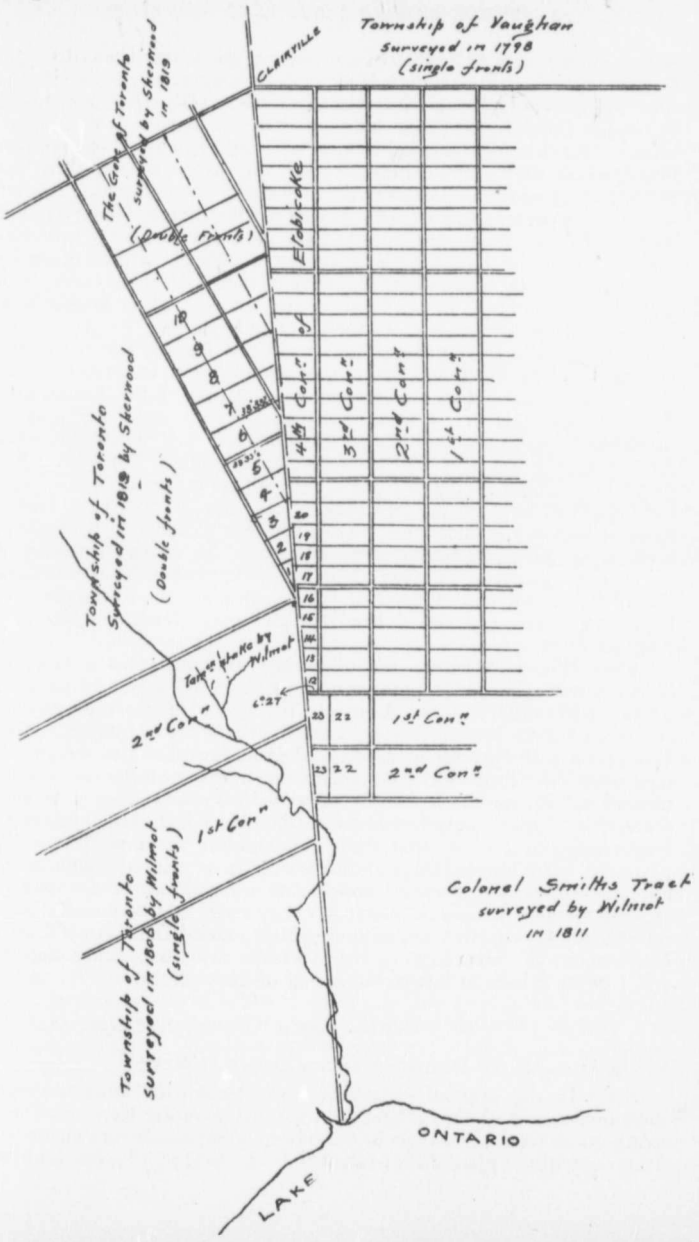

TOWNSHIP OF VAUGHAN
Surveyed by Stegman in 1798
(single fronts)
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21½
20
19
18
17½
16½
15
14
13
MISSISSAGUA
TERRITORY
ETOBICOKE
NORTHERN DIVISION
Surveyed in 1793 by Hambly
(single fronts)
3rd Con.
2nd Con.
50 ch.
50 ch.
N. 88 S.
2nd Con. N of Dundas St.
6° 27'
23 22 1st Con.
23 22 2nd Con.
1st Con. N of Dundas St.
DUNDAS STREET
(single fronts)
TOWNSHIP OF TORONTO
Surveyed by Wilmot
in 1806
(single fronts)
LAKE
ONTARIO

No 3


Township of Vaughan
Surveyed in 1798
(single fronts)
CLAIRVILLE
The Gore of Toronto
surveyed by Sherwood
in 1819
(Double Fronts)
Township of Toronto
Surveyed in 1818 by Sherwood
(Double fronts)
Lake Shore
4th Con.
3rd Con.
2nd Con.
1st Con.
Taken up Lots by Wilmot
2nd Con.
1st Con.
Township of Toronto
surveyed in 1806 by Wilmot
(single fronts)
Colonel Smiths Tract
surveyed by Wilmot
in 1811
ONTARIO
LAKE

W. 20 chains more or less *to the westernmost boundary of the township*, then along said boundary line N. 22° W. 20 chains more or less to the limit between lots 20 and 21, then N. 74° E. to the front of the said concession, then S. 16° E. 20 chains more or less to the place of beginning. This lot was granted the year after Hambly's survey was made, when all matters connected with the survey were fresh in the Surveyor General's Department.

The next patent was issued on the 15th May, 1800, for lot 21, and described thus: Commencing at a post, etc., in front of the 4th concession, at the north-east angle of the lot, thence S. 74° W. 23 chains more or less *to the easternmost boundary of the Mississagua lands*, then along said boundary S. 22° E. 20 chains more or less to the limit between lots 20 and 21, etc., to the place of beginning.

Although the next patent issued was not for any lot in the 4th concession, I cannot refrain from here alluding to it, because it shows that no road allowance was left on the east side of the Indian line. The lots described were a little below the 4th concession, and may be included as having a bearing on the question now before you, viz., lots 23 in the 1st and 2nd concessions, Northern Division. (See diagram.) Commencing in front of the said concessions, at the south-east angle of each of the said broken lots, then N. 16° W. 50 chains more or less to the allowance for road in rear of the said concession, then S. 74° W. 15.00 chains more or less *to the western boundary of the Toronto purchase in 1787*, then along said boundary S. 22° E. to the allowance for road in front of the concession, etc., to the place of beginning. This was issued from the Surveyor General's office 11th August, 1807.

After this, and before the adjoining township of the Gore of Toronto was surveyed, a number of patents issued, viz., Lot 12, Con. 4, on 24th January, 1810; Lots 15, 17, 27 and 30 in the 4th concession, on 26th January, 1810; Lot 18, on the 25th January, 1810; Lot 24, on 30th November, 1816; and probably other lots. All these lots were described thus: Commencing in front of the concession, then S. 74° W. *more or less to the allowance for road in rear of the said concession*. You who are familiar with the books of the Land Granting Department are aware that often descriptions are most frequently prepared by filling bearings and distances in a printed blank form, and consequently the words, *more or less to the allowance for road in rear of the said concession* occur in every issue, and may really have no effect. It was this expression which caused the Crown Lands Department to obtain legal opinion as to its value in another district, and I quote it here as having a bearing on this question.

CROWN LANDS OFFICE, *11th May, 1846.*

To the Hon. W. H. Draper, Attorney General (West).

SIR,—In the original survey of the township of Moore no road allowance was made in the rear of lots fronting on the River St. Clair, owing to a road allowance having been erroneously drawn on an office copy of the plan of that township. Several of the lots, both in

the concession fronting on the St. Clair and in those in rear thereof, have been erroneously described for patent as being bounded by such road allowance. The descriptions framed from the surveyor's original plan are correct. I have therefore the honour to submit for your consideration the questions, Does the expression in the description for patent, *to the allowance for road*, create such road allowance, when it was not intended nor laid out in the original survey? If it does not, should the grantees of the lots so described surrender their letters patent in order to have the description corrected, or should the deeds issue in their favour for the supposed road allowance?

(Signed) T. B.

(REPLY.)

MONTREAL, *12th June, 1846.*

To the Hon. the Commissioner of Crown Lands.

SIR,—In reply to your letter of the 11th ult., I have the honour to state my opinion that the erroneous statement in a land patent of a lot being bounded by a road allowance, where there was none reserved in the original survey, or directed to be made by competent authority, will not in itself create an allowance for road. . . .

I have, etc.,

(Signed) W. H. DRAPER.

In the present case now before you an office copy of this part of the township of Etobicoke had been prepared, and it shewed a double line in the rear of the 4th concession, and from this office copy the later patents were framed, and erroneously so in describing lots therein to a road allowance in rear of the concession, when we have seen that by one survey on the ground, original field notes and original plan, and the *earliest patents* no road was made or intended to be made on the east side of the Indian line. The descriptions then in the later patents, on which considerable effort was made by the people of the Gore of Toronto to prove a road allowance, did not in reality sustain their contention.

In course of time the land to the west of the 36 mile line was purchased from the Indians. The exact date of this transaction is for the present unimportant, but we next observe that on the 14th of February, 1806, instructions were issued to Samuel Wilmot to survey a part of Toronto Township on the old system of single fronts. This survey was outside or to the west of the Indian line, and overlapped the 4th concession of Etobicoke for upwards of 80 chains. (See diagram No. 3.) The instructions were to the effect, You are hereby authorized and directed to survey the tract of land lately agreed to be purchased from the Mississagua Indians, etc.

Commencing at the mouth of the River Etobicoke, then run N. 22° W. 6 miles, being the western boundary of the Toronto purchase in 1787, which line you will follow, etc. Wilmot's field notes say he

ran the six miles up to a cypress swamp, where he *planted the necessary posts and references*. Then *from the purchase line*, or 3rd concession north of Dundas Street, *he turned on a course S. 38° W.* and planted a post *one chain west of the Indian line*, and said in his field notes "Road." Here then it is evident that no road had been made previously on the east side of the line in Etobicoke for a distance of six miles up from the Lake, but that Wilmot *made a road west of the line* in his township, and I would here again call your attention to the patents which were issued for Lots 23 in the 1st and 2nd concessions, Northern Division, adjoining on the south Lot 12 in the 4th concession, which described those lots as 15 chains more or less *to the western boundary of the Toronto purchase in 1787*. Wilmot, we see now in the year 1806 makes a road allowance outside those lots on the west side of the Indian line. In his field notes, at this north-east corner of his township he *planted a stake one chain west of the Indian line* for the width of a road allowance. No one disputed its position, and although planted in the year 1806 the part of it which was driven into the swampy ground was apparently as sound in the fall of the year 1856 as when it was first planted. I pulled it up and examined it. The part above ground, however, was at the top decaying downwards. Possibly the foot of the same stake is there at this day.

The Highway Act, 50 Geo. 3, c. 1, was passed on 12th March, 1810. This Act was repealed long since excepting the 12th section of it. That section has always been retained, and imported into all the Consolidated and Revised Statutes and Municipal Manuals which have been framed. You will find it in Section 524 of the Municipal Act, or page 92 of our latest manual.

It confirmed all roads which in the first survey of a township had been laid out by surveyors under Government inspection to be public highways. If, then, Hambly, when surveying the northern part of Etobicoke had left a road in rear of this 4th concession, the Highway Act would have confirmed it, but as yet it does not appear that any such road was laid out or created, except the descriptions contained in the patents for Lots 12, 15, 17, 18, 27 and 30, which were issued before the Highway Act was passed. The Attorney General, the late Chief Justice Draper, gave it as his opinion that the words *to an allowance for road* did not in *itself* create a road. Well, if it did not, there was no collateral circumstance which helped to create a road in the 4th concession of Etobicoke, but every event to the contrary.

In order to put you in possession of all matters bearing on this subject, both for your present discussion and future consideration, I must call your attention to the case of "Field vs. Kemp," which occurred in the township of Niagara. You will find it in Vol. 3, Old Series U.C Reports, page 374.

At the present day we have the idea tolerably well planted in our minds that the work on the ground governs and overrides all plans, field notes and patents. Well that idea is correct now, and has been so since the Survey Act passed, 27th November, 1818, but it was not so before that date. Under the old Quebec Act land was surveyed in accordance with the language used in the patent. Division lines

between lots were not then run parallel to governing lines or proof lines, or at a certain angle with the concession, but each and every surveyor would run division lines by his compass needle, after allowing for annual variation, and 40 or 50 years ago the slur might often have been heard that you never could get any two surveyors to agree in running a line. And why? Because according to their difference of education and reading some surveyors would allow one minute, some two minutes, and some three minutes or more for annual variation, and then compasses were just as divergent as thermometers or watches—no two alike,—and as to chaining, chains would vary from one to five inches or more in length.

I am glad to say we do not hear those slurs at the present day. The lines have fallen to us in more intelligent times. There is, however, even yet room for improvement and unanimity. The statute of 1818 for the first time laid down the rule for running parallel to governing lines, and the Act of 1849 introduced standard measures.

Well, but to return to the case of "Field vs. Kemp." It was a question of where a side-road should be located between lots. The township of Niagara was surveyed and staked out with a side-road between every two lots. There was an odd number of lots in the township. The plan, however, through some mismanagement was drawn the reverse way, the plan shewing the side-roads to be between different lots from what the actual survey and the stakes on the ground shewed. Patents had been issued in accordance with the plan. Roads had been opened in accordance with the stakes. Which was to govern? At the present day we should no doubt adopt the stakes as the controlling feature in the matter, but the Court decided otherwise and held that the patents, having been issued before the passing of the Highway Act of 1810, must be considered as most correct.

To apply this ruling, then, to the 4th concession of Etobicoke, we should say that the earliest patents issued before the year 1810 established the fact that there was no road left or intended to be in the rear of that concession, and then, taking up Attorney General Draper's opinion that the language used in subsequent grants could not of itself create such a road, it must follow that there could not by any possibility be a road there.

Instructions were issued to Reuben Sherwood on the 25th of January, 1819, to commence at the north-east angle of the 2nd concession north of Dundas Street, in the township of Toronto, *where posts placed by Deputy Surveyor Wilmot, and the allowance for road with the necessary references, will be found to point out the allowance for road in rear of that concession on a course S. 38° W. between the townships of Toronto and Etobicoke* on a course N. 22° W. It is well known to this day, and was always known, where Wilmot's stakes were in the cypress swamp.

Sherwood was to commence at the stake planted by Wilmot in this swamp, four rods west of the Indian line. There is not the least doubt but what he did so. Sherwood's township was to be surveyed under the new system with double fronts, now for the first time in the

year 1819 come into operation. As a matter of necessity he would require a road allowance on and west of the Indian line. Wilmot had already in 1806 made a road for six miles in length in the old survey of Toronto township, and who could undertake to say but that it was evident from the instructions that Sherwood was to take it up from where Wilmot left it, and carry the road through his township on the west side of the Indian line. Yet the Municipality of the Gore of Toronto opposed the making of such road in their township, saying that it should be taken from the 4th concession of Etobicoke.

In the year 1851 Mr. David Gibson was appointed by the township of Etobicoke, and Mr. Stoughton Dennis by the township of the Gore of Toronto to enquire into this matter. Those gentlemen, as the result of their investigation, reported it as their opinion that there was no road in the rear of the 4th concession of Etobicoke, but could not agree whether or not there should be a road on the west side of the Indian line to come off the Gore of Toronto. A different decision might have been arrived at if instead of those gentlemen having been appointed separately by the townships they had been appointed jointly, and the expenses jointly paid by the townships. As it was, however, it was decided that no road allowance was to be taken off Etobicoke.

In the year 1856 instructions were issued to Mr. F. F. Passmore to survey and to plant stone monuments at the front and *at the rear* angles of all the lots in the 4th concession of Etobicoke. It was on this survey I was engaged, and to plant monuments at the rear angles of all the lots again brought up the whole question, going back as far as the Indian purchase.

The report of this survey, the evidence taken of old settlers, the documents examined, with other matters can be seen amongst the records of the Crown Lands Department. The Township Council of the Gore of Toronto entered a protest against this survey and report, but what right they had to interfere with any matter on the east side of the Indian line I never could understand. The report was that there was no road on the rear of the 4th concession of Etobicoke, and the stone monuments were planted for the rear angles of the lots *on* the Indian line. This was no more than Mr. Gibson and Mr. Dennis had concurred in, but the Gore of Toronto would not have it so, and insisted upon having a road taken off Etobicoke.

Now comes the question of right and wrong. The Gore of Toronto applied to the Legislature for an Act to take a road off Etobicoke. Members from Lower Canada were canvassed and lobbied. De-la-Haye, the French master of Upper Canada College, owned and lived on Lot 15 in the 7th concession of the Gore of Toronto, and the Lower House, by a large majority, declared in favour of passing an Act to take the road off Etobicoke, but in the Upper House the Bill was passed by a bare majority. The Deputy Reeve of Etobicoke told me the majority was only *one*. The Commissioner of Crown Lands, Mr. Sicotte, in the Upper House said this last survey of 1856 was correct. Mr. Vankoughnet (Chancellor) said the courts of law was the proper place to settle this question. Many other eminent members

spoke also to the same effect, but the Bill passed with a majority of *one* or at the utmost *two*.

The Governor General was then petitioned to withhold his assent to this Bill. His Excellency referred the matter to the Commissioner of Crown Lands for his opinion. Unfortunately for Etobicoke the Commissioner was not at his office that day, and the following day, with some slight hesitation, assent was given, and the Bill passed into law.

You will see it amongst the list of local private Acts in our Survey Act. But the mischief did not stop here, for the townships further north petitioned to have the road extended to King and Albion. Passed 34 Vic., c. 60, A.D. 1870.

I think that the passing of the Act of Parliament in question certainly did an injustice to the township of Etobicoke.

DISCUSSION.

Mr. Kirkpatrick—Mr. Niven alluded to the Township of Moore, the road allowance in rear of the front concession there. Now, it is only a very few years since there was a petition to have that road allowance established. The trouble is going on yet, although Mr. Niven says in 1846 it was decided by the late Chief Justice Draper that there was no road there. It is just as Mr. Niven says, there is a road allowance on the office plan and a good many of the lots run back to this road allowance. A good deal of trouble devolved upon me in hunting up this case. They asked that the road allowance be laid out. There was no road allowance in the original survey; there was no mention of a road allowance in any of the lines that struck this line, but there was the road allowance on the plan, as Chief Justice Armour would call it, a purchase plan, and in nearly every case the lots ran back to the road allowance. The municipality asked to have a surveyor sent to establish the road allowance. Mr. Coad established the line, planted the posts to establish the line, and then there was a good deal of ill-feeling among the council. They said they did not want the line established, they wanted the road allowance established; but it has never been established, and my belief is that if they want a road allowance they will buy it from the property owners on either side.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

HINTS TO SURVEYORS ABOUT TO SURVEY A TOWNSHIP FOR THE ONTARIO GOVERNMENT.

By W. R. BURKE, P.L.S.,
Ingersoll, Ont.

Before commencing this paper I might mention that the mode of making a survey, which I intend to explain, is merely written as a help for those who have not had any previous experience in this kind of work.

I know that there are many members of this Association who have had much more experience than I have, and if they wished could write a paper on this subject of much more interest and value than this will be.

However, having been asked to write something, I am anxious to do what little I can to aid the Association in making their meeting as interesting as possible.

We will suppose that instructions have been received to survey a township of six miles square, somewhere in the Algoma or Nipissing district, and the work is to be done during the summer months, and that you intend to survey it with one party.

These surveys are made under contract, that is, you are paid so much per acre for the faithful performance of the work; from this sum allowed, every expense connected with the work has to be paid, and also you are to furnish the Department with a plan and field notes, etc., so it will be necessary to run the survey as economically as you can.

The party may consist of the surveyor, his assistant, a cook, and five axemen, one of the latter to be used as head chainman. It is well to get a good assistant with you, one who understands something of surveying, and a person who is willing to work and assist you in every way that he can. A good cook is also very essential, and one should be very careful to try to secure a man that is capable and willing to make things in his line as comfortable as he can for the party.

In selecting the other men it will also require some care and judgment in order to secure the best you can. A poor cook with a party of lazy men will give no end of trouble and annoyance to the surveyor, and it may end in your being obliged to discharge part of the staff and get in others, which causes great delay in the work and loss to yourself.

If it be possible, when engaging men, hire them to remain until the work is completed, at so much per day. Explain to them fully that if they wish to come they must engage in this way. That should they work a little while and wish to leave, that you will not pay them at all, unless in the case of sickness or accidents, but when the survey is completed they will be paid in full. It often happens that men, after working a short time, will get dissatisfied without any apparent cause and wish to leave you; this will cause delay and annoyance, as everyone is aware that it is very difficult at times to replace men when one is far in the woods. It is frequently the case that one disagreeable and cranky individual will create discord and dissatisfaction among the whole of the men, and with such a person it is necessary to be firm and severe.

It might be well for those who are inexperienced to mention the complete outfit necessary. For a survey and party such as I have mentioned I would take the following:

Five tents, all moderately small and light, made of drill, one for yourself and assistant, one for the cook and another man, one to hold four men, one for provisions, etc., at camp, and another for the storage of the bulk of your supplies at a point perhaps where you enter the township; eight pairs of double blankets; three or four rubber sheets are very comfortable and useful to take along; one light tarpaulin; eight leather packing straps, with head pieces to rest on head when carrying; six axes, weighing about 3¼ pounds each; one small axe with leather cover for head chainman; two brush hooks; one small grinding-stone; some small whetstones; one ball of strong twine; ten common table knives; ten common table forks; one large carving-knife; one large iron fork; one large iron spoon; ten small tin spoons; one frying-pan, small size; one dozen tin plates; one iron shovel, called an Irish shovel, without handle (handle can be made at each camping place); one tin dipper; a scribe, or marking iron, for marking posts with; five or six pounds of pitch for canoes; two tin pails, holding about three quarts each; two tin pans to hold bread, etc., when cut up; two wash dishes, one dozen tin tea dishes; one large tin bake dish; three bake kettles, made of heavy tin, made to fit one inside the other. If you take a reflector with you, which is a very convenient article, one or two bake kettles would do. Three oval-shaped tin kettles, made to fit one inside the other, for boiling pork, making tea in, etc., etc.; towelling; some extra cotton bags; one dozen axe handles; red flannel for chain pins; two steel band chains; one compass, with Vernier plate for laying off variation of needle.

One transit (a light one is preferable); a solar compass, if you have one; one micrometer and discs for the survey of lakes, etc.; about one dozen pairs of shoe packs or beef-skin moccasins, different sizes without legs.

Regarding the provisions required, it will be necessary to calculate about how long you are likely to be out. You will be enabled to see how many miles are required to be run when the instructions are received, allowing a little time for the survey of the lakes, bad

weather, etc., also time getting into and out from the work. It will not be difficult then to form some idea of how much work can be done each day, and then calculate about how long it will take you to finish the contract.

Allowing about three-quarters of a pound of pork and about one and three quarter lbs. of flour to each man per day, I think this will be sufficient.

The list of provisions needed to live well, provided you have a good cook, would be as follows:

Flour; bacon (long, clear bacon done up in sacks, about fifty lbs. in each sack); dried apples (take plenty, say three bushels); beans; currants; raisins; rice; sugar; tea; fine salt; pepper; mustard; yeast cakes; some pain killer, and Fowler's extract of wild strawberry to be used in case of sickness, such as dysentery, etc.

If you are going into the survey by water, or partly by water and partly by portages, you will require a few bark canoes, perhaps, for the party and outfit mentioned, two moderately large canoes and two very small ones would do nicely.

It is always well to bring a small light canoe or two along, as you will perhaps require to carry them here and there throughout the work, in order to survey lakes, etc.

Try to purchase your provisions, etc., at some place as near your work as possible. The party you deal with will always try to help you to secure the men, canoes, and everything that will be necessary.

It is not a good policy to take men from a distance, if you can avoid it; you are obliged as a rule to pay their fares going and coming, etc., which adds to the expense.

The only person required to accompany you the whole distance is your assistant.

I have now given a tabulated list of everything that is absolutely necessary to mention in this short paper. Upon some of these articles I might make a few remarks.

Regarding the tents, some might prefer larger ones in order to accomodate more sleepers, but I think a number of small light tents are preferable, as the men are more comfortable; and again, the light tents are more easily folded and conveyed from place to place.

The tarpaulin mentioned is very necessary, when travelling with your outfit, etc., and perhaps having to leave your supplies out all night deposited here and there on some portage. Should a heavy rain come on, the tarpaulin and rubber sheets come in very useful indeed. I have found that they add greatly to one's comfort in the camp at night.

I said you should take two band chains, that in case one breaks, of course a chain can be mended if broken, but if you have not all the necessary appliances along with you, it is not an easy matter to mend it properly, but with a little care there is very little danger of one being broken. Band chains are much better to work with than the common iron link chains, they always keep their proper length, are light and easily held up, and drawn tightly over logs, rocks, etc.,

and they do not catch in twigs and sticks nearly so readily as the other chains do.

It is well to use a light mountain transit with extension tripod, if you can. A light instrument of good make will do just as good work as a heavier one; and in running a line over perhaps a rough and rocky country, and carrying it day after day, you will find the benefit of a light instrument, and when one is moving camp, carrying the light instrument is not a difficult matter, packed in a light box and furnished with straps for packing. The extension tripod when closed being only three feet long, it can be packed away with your blanket and tent. So the surveyor can carry his instrument, tripod, small tent, blanket, clothes, etc., while the assistant can carry his blanket, clothes, and something more of the outfit.

In subdividing a township, if one has a good solar compass, it will not be necessary to use the transit very much, if at all, excepting in the triangulation of a lake, or should you experience cloudy weather and be unable to see the sun for some time, then you might be obliged to resort to the transit. In my work I have found the solar compass a very convenient instrument indeed. Surveys can be more rapidly made with it than with the transit, or perhaps with the ordinary needle instrument, there being no time consumed in waiting for the needle to settle, or in avoiding the errors of local attraction.

The most favorable time to use the solar is, of course, in the summer, when the days are long and more generally fair. It is not best to take the sun at morning and evening when it is within half an hour of the horizon, nor at noon, for about the same interval before and after it passes the meridian.

When the sun is obscured the line can be run by the needle alone, it being always kept at o on the arc, and thus indicating the direction of the true meridian. The sun must be regarded as the most reliable guide, and should, if possible, be taken at every station. Some may think it difficult to work in a thick bush with this instrument, on account of the sun being shut out by the branches and leaves of trees overhead, but this is not the case; one will have little trouble in getting the sun's image to appear on the silver plate; it might be necessary to move a little forward or backwards along the line. It is necessary to turn off the latitude and declination upon their respective arcs with care. The latitude can be taken each day with the solar at noon. If the sun is visible, it is little trouble and can be taken during the dinner or lunch hour.

Be sure and take a nautical almanac along with you.

When surveying lakes with a Rochon micrometer use a ten link base wherever possible. I find with my instrument that all sights taken at about twenty chains away and under, produce the best results. Never measure a distance when the sun is shining in your face; you cannot see the discs properly; try to work with the sun at your back. A dull or moderately cloudy day I find preferable for making a survey with the micrometer.

As to the shoepacks or moccasins I mention, it is wise to take them along. Men as a rule never come into the woods with proper

footwear. After a little time, they will likely complain, and perhaps find it difficult to get along with the boots or shoes they may have; so you can sell them a pair of shoe packs, which are always comfortable in the woods. Should you not use all that are taken in, the party you purchased from will allow you to return those that have not been used.

Before leaving on your trip into the township it may be necessary to provide yourself with some bread, as the cook cannot make bread travelling in this way, as the stoppages will likely be very short.

On arrival at your work for the first day it is wise to take things quietly. Get everything settled around camp, provisions put carefully in one tent, axes helved and ground. If you are camped near the boundary of your township, which, perhaps, has been run before, get some of it opened out again. Pick out one of the men to act as head chainman, get him to go along with the assistant, have them chain a half-mile, and watch them go over the operation again, until you are satisfied that they can chain correctly. This is desirable at the commencement of the work; and the men should be instructed fully —if a pin is lost not to guess, but have them chain from the last tally; that the posts are to be well made, nicely marked, and if the scribe should not mark well, to cut the figures or letters over again with a knife; and when a post cannot be driven into the ground carry stones and place around it.

Before commencing to run a line yourself, if using a transit or solar compass, select the most active and intelligent man of the party as picketman. He should be able to choose the points for stations in the production of the line, and for a transit line to make pickets straight and of a uniform size. With a little practice he will soon get into this if he is willing and anxious to learn.

In running a line with the solar compass it is not necessary to be so particular about straight and uniform pickets.

Instruct the men as to the blazing of the trees; be particular and see that they do it. If they miss trees frequently call some of them back, and they will soon learn that it has to be done.

Tell the cook that each morning during breakfast time he has to prepare the dinner for the party in the woods during the day. Get a clean cotton bag, into which put some bread, bacon, and tea, with tin cups and a small tin pail in lieu of a tea pot. It will be necessary to put a cloth or something around the pail, as it will soon become so black, being held over the fire, as to discolour everything inside the bag. The tea should be put in a little bag, and the pork also. The head chainman carries this with a packing strap on his back. This is a better way, and more comfortable, than having each man carry his own lunch.

When moving camp start as early in the morning as possible. See that each person takes a good load. Go around among the men and see that none of them are trying to get away with as light a pack as they can. Take all you can the first trip, and when arriving at the new camping place get one of the men to help the cook in getting things arranged; the others may be putting up their tents. Have an

early dinner, and get out to work again on the line. There may be some things left at the former camping place; take one of the men from the party, the best suited for packing, and keep him at this work until everything necessary is brought along, and enough provisions to last several days. A tent with the main supply of provisions is left at your first camping place in the township, and when anything is wanted you send this man for it. Sometimes, if he has far to go, and you are in a hurry for supplies, let the head chainman and assistant give him a helping hand. In this way you will have always three men on the line, and can keep the work going on continually. It will not be necessary to stop work and allow the whole party to go portaging.

The chaining for a man is very light work, as there are so few posts on these surveys to make. Tell the chainman that when he is up to the choppers and has nothing else to do, to take his axe and turn in and help on the line, going back after a little to chain up again. Start to work early in the morning, and get back to camp in good time in the evening—this is the best plan.

Instruct your men to grind their axes in the evenings; that you wish no time wasted in the morning at this work.

Move camp frequently, so as not to have too much walking to and from the work.

It is advisable, if you can, to have a few good Indians, or half-breeds, in your party, as they are, as a rule, good packers, and will keep the canoes in good order for you.

Have a large note-book with you, properly ruled and settled beforehand with an index map of the township. Enter the field notes taken during the day each evening See that everything is entered up properly, and mark off each day's work on the diagram of the township kept for that purpose.

If one is surveying a township with two parties, of course more assistants will be necessary, and things arranged a little differently.

I might mention that it is wise to take some fly oil with you in a can, and some small bottles, so as to give each man a bottle to carry with him, as the flies and mosquitos are always troublesome in the summer.

Order, regularity, patience, and perseverance, good in all pursuits, are especially necessary for a surveyor. His work is often trying, and requires much foresight and sagacity. He should discourage all profanity and intemperance. The surveyor should set an example himself of upright conduct, and will find this often the best means of influencing those under his charge to a right and faithful performance of their several duties.

I offer the foregoing remarks with diffidence, but trust they may not be unacceptable to my professional brethren, and while I ask indulgence for defects, my paper will, I trust, show a sincere interest in the success and advancement of our profession.

DISCUSSION.

Mr. Butler—There is one thing: be sure and take some yeast cake along. It one time cost me about $20 to find that you could not grow yeast cake spontaneously in the bush.

The President—I would like to ask if any gentleman has ever tried the ordinary fly powder. I have tried it, but I used it by burning it. In the evenings, when surveyors generally look after their field notes, I found the burning of that powder in the tent answered very well, and is far preferable to anointing yourself with oil. It is known as insect powder.

Mr. Ellis—In reference to the amount of provisions to be allowed, I found in eighteen months that my men averaged two pounds per day of all kinds of provisions.

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COMPASS LINES.

By JOHN McAREE, D.T.S., P.L.S.,
Toronto.

I was down for a paper on this subject last year, but from some cause it was not forthcoming; and, upon further reflection, I was not altogether sorry, and was hoping that the secretary had forgotten it—the subject being so trite, and not of much interest to the majority of the rising generation of our surveyors and engineers, while the elder ones already know all about it. On receiving the programme, however, I found that the paper was down for this year again, so I must take hold of it and do the best I can.

As a surveying instrument, the compass has quite fallen into the background in our Province; the transit having superseded it in city, town and most farm surveying; and, even in the survey of our new townships it occupies, as a rule, quite a subordinate position—being employed only as an auxiliary to the transit, or solar compass.

And yet, while there remains in our Province so much bush country to be surveyed, where lines have to be run through heavy timber, considerations of economy will cause the compass still to be used—and it is pretty safe to say that, so long as there are lines to be run in the bush, there will be a compass to run them. The great price of the solar compass, and the heavy customs duty, is a great drawback to its general introduction.

The original surveys in the older townships of Ontario—in what might be called agricultural Ontario—were made with the compass, chiefly; and most of the division lines between the lots, as the land became settled upon, were run by the same instrument; and for the various errors and the general lack of precision of these primitive surveys, the compass has been too generally held responsible. Now, the art of instrument-making has received great development in recent years, and the compass itself has received improvements since those early days. Yet, with due allowance for all this, the greater share of the errors in the surveys in question is, in my humble judgment, to be attributed to the humble qualifications of the surveyors of those times, and to careless chaining—including the uncertain and varying length of the chain—coupled with the inexpensive rate at which the work had to be done; involving, as it did, a sort of hunter-and-trapper mode of life for the surveyor and his party. While, as an aggravation of the evil, and giving it its full effect, was the imperfect method of keeping field-notes and the omissions from plans—through which important, and even vital, information relating to a

given survey was lost for want of being recorded—bequeathing a legacy of contention to the succeeding generation ; as they might dispute over the interpretation of the meagre records, and find out, as best they might, what was done or what not done in the original survey, or intended to have been done or not.

With a good compass, such as is made at the present day, and the old link-chain, with the magnetic declination ascertained and the chain tested from time to time, the older portions of Ontario—being for the most part a comparatively level country, underlaid by Silurian rocks and free from any notable amount of local attraction—could have been laid out with a degree of accuracy sufficient for all practical requirements, and that would have left a minimum of work for lawyers and courts. I would be very sorry, indeed, to cast a slur upon the memory of these brave and hardy pioneers in our profession, remembering the many and great disadvantages under which they laboured ; and persuaded, as I am, that the majority of them did the best they could, as we are trying to do now in our generation, under our more favourable circumstances. It is easy to indulge in disparaging criticism from the vantage ground of our increased knowledge, derived from the experience of our predecessors ; but we, in turn, may not appear to any better advantage when compared with those who shall come after us. Again, if the settlers on the township lots had kept their boundaries and corners from being lost, the worse effects of the errors in the original surveys would have been avoided ; it was when re-surveys became necessary that trouble began, so that the farmers themselves are largely to blame for the litigation and the attendant evils that have ensued.

By the time the advancing surveys had reached the more rocky portions of our province, the use of the theodolite or transit had become general, and was used to run the principal lines, at least, of a new township—the compass being reserved for cutting up the blocks that were laid out by the superior instrument ; and this is the practice at the present time. A compass line is checked every mile or two by closing on the transit work.

The needle works fairly well over the Laurentian rocks, generally —except near bodies of magnetic iron oxide ; but in the Huronian the compass is very little use ; nor in the trap region, west and southwest of Thunder Bay, Lake Superior. It will, no doubt, be employed in the Silurian and Devonian areas around James' Bay when that region comes to be opened up.

Those who have never had much practice with the compass are apt unduly to despise it, and think there is nothing to be learned about it ; they are ignorant of the fact that it has adjustments that are worth while attending to, and they treat it as being altogether beneath the notice of the educated surveyor of these days ; whereas there is great scope for the exercise of much skill and care in its use, and a longer apprenticeship is required to become an expert with it than with the ordinary transit. I would not employ it in city, town, or even in farm, surveying—except in the back townships, where land is not as yet very valuable—although, as an old P.L.S. once observed

to me, "a good compass line is hard to beat." But on the survey of new townships, and on much topographical work, it is the instrument for making a rapid, and therefore inexpensive, survey. For working in the open, as traversing on the ice or along an open beach, the transit is more rapid besides being more accurate; but along our northern lakes and streams the brush comes down to the water's edge, leaving no beach at all, and here the compass and the micrometer must be the surveyor's outfit.

"Always have a backsight" is the great maxim in using the compass. This does not imply that you are always to have a back *picket:* a boulder, a bunch of grass, a peculiar bough, a point of rock—on or near the line—will be utilized for such a purpose by the practised compass-man. Ordinarily the blazed trees along the line, or the opening made for the line through the brush, where there are no large trees, will be all that is needed to give a backsight that will furnish a check upon the needle. In running lines in the survey of a new township the brush and smaller trees should be cleared away, leaving only the larger centre trees standing, which will then act as pickets to show the line. Where the centre trees are far apart, or where the brushwood is very dense, it will be economy to keep pickets set up as a guide to the axemen; especially until they become used to the work, and able to keep the line. The worst case is where there is local attraction and the surface is broken with heavy timber, so that the line cannot be seen for any distance back; all that can be done is to be content with short sights, and work along carefully until better ground is reached.

In surveying with the compass it is generally necessary to know the magnetic declination, for which course resort must, of course, be had to astronomical observation when working away from lines of known azimuth; and the more frequent these observations, the better —since the declination changes from point to point. In township surveys there is always a line to start from, viz., the boundary, or else some of the interior lines run by the transit.

In a region where there is local attraction, as in our own northern territory, it is sometimes troublesome to obtain the true declination. In this case the line should be followed for some distance, taking sights and readings at short intervals, the needle all the while showing the same bearing, which may then be adopted with reasonable confidence as the true magnetic bearing free from the effect of local attraction. The bearing of a line should never be adopted from a single "sight," nor from the readings of another compass, as there will generally be a difference in the bearing of a line when taken with different instruments: the bearing for a given line that is to be run should be taken by the compass that is to run it.

The great drawback in the employment of the compass is, of course, the occurrence of local attraction; and the surveyor must be on the look-out for it, not only where the rock is exposed and the ground high, but in other places as well. He may meet it in a swamp, or in crossing a belt of sand or sandy soil. The only way to be safe against its surprises is to keep up the backsights all the time.

Besides the ordinary local attraction arising from substances in the soil, there are other causes of it which must be guarded against. For instance, the operator must take care that no articles of iron or steel about his person are allowed to come close to the needle. The writer on one occasion inadvertently replaced one of the supports of the brass plate that raises the needle off the pivot by a piece of a common pin, which turned out to be galvanized iron; the result being that the needle was deflected more than a degree, and the mile of line run had to be re-surveyed. Another surveyor traced a disturbance of the needle to a steel buckle in his hat-band, that was brought down near the needle while he was taking a reading. And Mr. Abrey, P.L.S., informs me that the ordinary ebonite hand magnifier will attract the needle. Sometimes the glass cover becomes electrified by friction against the clothing when carrying the compass upon the arm, while under a hot sun the magnetic intensity is greatly weakened. In these cases the glass should be "discharged" by cooling off with water, bringing the wet fingers down upon it, etc.

Sometimes, from some cause that is not apparent, the needle behaves badly, vibrating violently about its axis, but otherwise seeming to be fixed to the compass box; this is probably due in some way to the electric condition of the inside of the glass. At other times again the needle will be sluggish and inert, as if it had lost its directive force, experiencing what might be called a sulky fit. At such times the needle would better repeatedly be raised off its pivot and lowered again, while the moistened fingers are rubbed over the glass and the Jacob-staff tapped with the hand until the needle comes to itself again.

When running by the needle alone without backsights the presence of local attraction is detected by the strange behaviour of the needle, which then shows a peculiar agitation, coming to rest in a reluctant, hesitating manner, and resuming its vibrations on the slightest provocation When the instrument is set up at a station and the sights put in line, the needle, when let down, oscillates about its mean position, yet settles down to it with a promptitude and decisiveness that is generally unmistakeable when it is in its best mood and free from any alien force. A single reading should never be relied upon however. The needle should be disturbed from its position of rest and allowed to settle again several times before the reading is finally accepted.

Care must be taken when the needle is working that it is quite disengaged from the lifter, and that there is no dirt on the inside of the glass or around the circle anywhere, which might cause the needle to stick. It may be necessary occasionally to remove the glass cover and wipe its under surface, as well as the graduated circle, and even the needle itself. When the instrument is not in use the brass cap should be kept on.

In reading the eye should be vertically over the end of the needle to avoid parallax and the effect of refraction by the glass. A magnifying glass may be used to aid the eye. The glass cover should have its faces parallel, and the glass smooth and clean, at least around the circumference, and be smooth and clean and free from flaws.

The needle should be an "edge bar," sharp at both ends to permit of fine adjustment, and no shorter than is necessary for its just swinging clear of the face of the compass box. When level its ends should project the slightest amount above the circle, the graduation marks of which should extend down the face, as in the Gurley instruments.

The adjustments of the compass must not be neglected. It is the general practice, I believe, to send it to the instrument maker's before going out on a lengthened trip, to have the needle recharged and the instrument overhauled generally, and give the adjustments no further attention. But the surveyor should test the adjustments of the needle himself, and see to it that the ends of the needle and the pivot on which it turns are precisely in line at the same time that the pivot is at the centre of the graduated circle. The test for this is to reverse the instrument in each of two positions at right angles to each other, and observe whether the difference of the readings of the two ends of the needle in each of the four positions is exactly 180°; if this is the case the adjustment is all right and there is no eccentricity. It would be worth while for any one to submit his compass to this test if he has not done so already.

The plane of the sights should pass through a diameter of the graduated circle, and should be a vertical plane when the instrument is level. Sometimes the compass plate becomes twisted, so that the lines of the slits of the two sights lose their parallelism, which then will give differing alignments as different portions of these slits are used. Error from this cause being more certain to occur where sights have to be taken up and down hill.

The ball and socket joint of the Jacob-staff should be kept smooth and clean and properly oiled, so as to give a steady, even motion without any jerking, and the ledge or projection on which the socket of the compass rests, and on which the whole instrument revolves, should be lubricated and kept smooth and clean so that the needle may be set with as great precision as possible.

The instrument should have a Vernier reading to single minutes.

About the size of the instrument there appears to be a difference of opinion. The writer has used a six-inch needle and considers this size of instrument the best, as there is a greater distance between the sights and the divisions of the circle are wider; on the other hand the instrument is heavier to carry, which is a consideration sometimes.

Among smaller compasses the prismatic is the best, being the most portable and the most precise; readings can be taken to half a degree or even less, and the "sight" and the reading of the circle are taken simultaneously.

DISCUSSION.

The President—I think Mr. McAree's paper is of great practical value. There is no doubt about it that although the compass is going somewhat into disuse there is still a good field for the compass in many parts of Ontario.

Mr. Gibson—I have often used the compass in running a certain class of lines, as there are certain degrees of accuracy required in

different classes of surveys. Where it is only an approximate survey, and it is not absolutely necessary to run the line exactly, you can accomplish the work with the compass with a great deal less exertion than in any other way; but of course when you come down to fine work the compass is not the thing.

Mr. Abrey—I would like to ask Mr. McAree if, in using the microscope, he ever noticed that it had the effect of attracting the needle to one side. My experience is that you never get one of these microscopes near the compass without moving the needle somewhat. In reference to taking back sights, on account of local attraction, I suppose he has observed in running a line two or three miles long that there is a very gradual declination, perhaps too small to take up with a back sight; he has perhaps found that he has made a bend in it of perhaps a degree, but it has been very gradual all the way through. In surveying in one place in Manitoulin most of the lines were run with the transit, one being run with the compass, but after I got through I was a long way out, and in going over it with the transit I found it was just a gradual bow all the way through. I presume that is one of the reasons why our streets, Dundas and some of the roads out west, have taken a bow; and I presume it was for the same reason that it was too small to observe by the ordinary way of taking back sights.

The President—In your observations, does the curve you speak of move in the same direction?

Mr. Abrey—I think Queen Street does; and I know in the County of Halton the lines there all take a bow in one direction, and that bow is of course too small to observe by taking back sights.

Mr. Stewart—How do you account for that swing?

Mr. Abrey—The lines are run that way, and these lines are run in several days; it has taken more than one day to run them. In one case in particular in Manitoulin I ran two or three chains out one day by the time I got the line two or three miles long, and it was simply owing to the gradual change.

Mr. Ellis—Some years ago I ran a line for a piece of railway on the north shore of Lake Huron—a trial line. We started on a very high rock and then went down in the valley about five miles. There was no local attraction whatever, and we got back sights every time; and on going back about two days afterwards, when we got up on the top of the hill, we could see the chopping completely through the bush, and it was just as Mr. Abrey said, there was a complete swing on the whole line from one end to the other. It was not very much, only about one and a-half degrees on the whole length of the line, but you could distinctly see it looking from the hill, though in going along you could not notice it anywhere. It was a gradual drawing towards the end on the same bearing.

Mr. Gibson—In regard to this solar compass work, there is a variation, of course, from about 8 o'clock in the morning to about 2 in the afternoon from five to fifteen minutes, and the old compasses

always have vernier plates to correct this. In making your survey you start at 8 o'clock with the needle due north, the proper bearing would be laid off on the plates, and then the plate has to be moved gradually between 8 and 2. At 2 o'clock we are at the extreme variation of the needle, and from that time the needle begins to retrace its course toward 8 o'clock in the morning. If you don't make allowance for that change you will have a beautiful scallop. An old surveyor once said, "Any fellow can run with a transit, but it takes a pretty smart man to run with the compass."

Mr. Ellis—I think it took us two and a-half days to run this line that I was speaking of, and my impression of the way in which the swing was caused was that, in making our sights through the slits, it was our personal error,—you are inclined to put your picket to one side or the other.

Mr. Gibson—I always make a note of what time of day I take my bearings. But of course we don't propose at the present time to use the needle for anything like fine work. It is used, I understand, away in Muskoka by some surveyors who want to make quick work.

The President—I was going to ask what kind of sights they used on their compasses?

Mr. Abrey—The sights I was using at the time I spoke of were ordinary slit sights placed about 16 inches apart. It could not be accounted for by what Mr. Ellis says in my case, about making that bow, and neither was it accounted for by doing it at different times of the day, because these lines were run over considerable periods.

The President—Probably one side of the slit was brighter than the other.

Mr. Abrey—It could not possibly be from that.

Mr. Gibson—I have always been trained to use the hair slits.

Mr. Ellis—The compass I am speaking about was one of these 5½-inch face instruments with very large surface. It was a very difficult instrument to use.

Mr. Paterson—I would like to mention a case I had once in running a long line, about eighty miles. This line was not a straight line, and when we came to plot the line we found there was a variation of some six or seven degrees. I found that this had been gradually accumulating, so that it brings out the idea of the bow in the same way as the other cases spoken of. I often wondered how it was, and I asked friends and they never could explain it. The line was east and west, and I suppose if we had gone on farther it would have increased very largely.

Mr. Stewart—It was swinging over as you went west I suppose?

Mr. Burke—In Mr. McAree's remarks he says you should always use a six inch needle. I have always used a four-inch needle, and I think I can run equally as good a line with it as I can with the six.

Mr. McAree—I have never used anything but a six. I think that the six inch needle does not settle down quite so soon to the bearing as the four inch; the longer the needle the longer it takes to settle down.

Mr. Stewart—I would like to ask, if any one ever noticed the difference between long and short needles with regard to local attraction? I have heard that the shorter needle was not affected to the extent the long one was; or the reverse, I forget which. I would like to know which was the least liable to magnetic attraction.

Mr. Abrey—I cannot see where the difference would come in. Of course the advantage with a long needle simply is getting a larger division. With a six-inch needle you could set it 33⅓ per cent. closer than you could with a four-inch needle. On the solar compass needle the long end is about 2½ inches, and I must say I never had a needle equal to the needle I have on the solar compass. The other end is made blunt and heavy.

The President—Is it not probable that the magnetic intensity of the needle would be the governing quality of the needle as to whether it would be affected by the local attraction? There is a difference in magnetic intensity.

Mr. Gibson—I should think the more delicate the needle the better.

Mr. Burke—I think these little compasses they have now are excellent; in any case I would not go back to the Jacob staff for any one.

Mr. Gibson—I never would think of not having the vertical motion as well as the horizontal motion.

Mr. Ogilvie—My experience is that the shorter needle gives just as good results as the longer one. The magnetic force may be just the same but the friction is less. I think a four or five-inch needle is all that you want.

Mr. Abrey—The only variation would be in the size of the graduation of the circle.

Mr. Fawcett—I remember once at home using a compass of rather elaborate construction. The needle was very short and it had a non-magnetic metal pointer. The needle was below the pointer and the pointer was apparently fixed on some white metal, evidently non-magnetic metal, and this point looked like a little piece of straw sticking out from each end of the little short dumpy needle. It had long graduations with a short needle. They were referring a short needle to a lar· circle.

Mr. Ogilvie—I was supplied with a declination instrument here from the Observatory. It read to less than a minute, and the magnet, as I recollect it, was about 3½ inches long. There were three magnets supplied with the instrument and that was the length of the whole of them.

Mr. McAree spoke of approaching the needle with iron or steel about your person. I made a series of experiments as to that; I had

a four-inch needle suspended just about as delicately as they can be suspended, and by taking an ordinary jack-knife I found I had to bring it within two feet before I could notice any movement at all. If the knife were magnetized if I brought it within six feet I could notice motion; when I brought it within a foot there were several degrees. In reading, you have got to read the needle several times, and of course the readings are not all the same. I did the thing just to see what error you might expect in carrying a jack-knife about it. Of course when they are very close to the needle I agree with anybody that they will displace it. As far as my experience goes, I should say that it takes quite a lot of metallic substance about you to deflect the needle very much. Then as to these curves, one explanation to me would be what you might call the personal error in not properly dividing the slit or putting your picket to one side of the true line. In making surveys on the prairies we have found the same deflection and we discovered it was due to the illumination of the picket.

Mr. Burke—I have found that if you put a sod on the top of the picket it does not affect it so much.

Mr. Ogilvie—The last time I ran any transit line on the prairie I employed a very small picket and I found the error much less than before.

Mr. Stewart—I think it is a capital idea where they divide down the side instead of just on the top. I think it would be a great improvement if the compasses were all made in the same way, that is, the graduation extended down along the side.

Mr. Campbell—There is one point that has not been brought out, and I think it would be rather in favour of having a long and heavy needle. It depends a great deal on what the attracting force is where there is local attraction. Supposing you bring a jack-knife near a small needle, you would deflect the needle much easier than a large needle. I think it would deflect the smaller body more than it would the larger. I have taken my knife near a small needle and it would fly around with the knife, but with a large needle it would move very slowly. The little one was attracted more by the attracting force than the larger one.

Mr. Ogilvie—That depends altogether on the intensity in the body attracted. If the needle was not magnetized or the knife magnetized there would be no deflection at all.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

OLD RECORDS IN RELATION TO MUNICIPAL SURVEYS.

By GEORGE B. KIRKPATRICK, P.L.S.,
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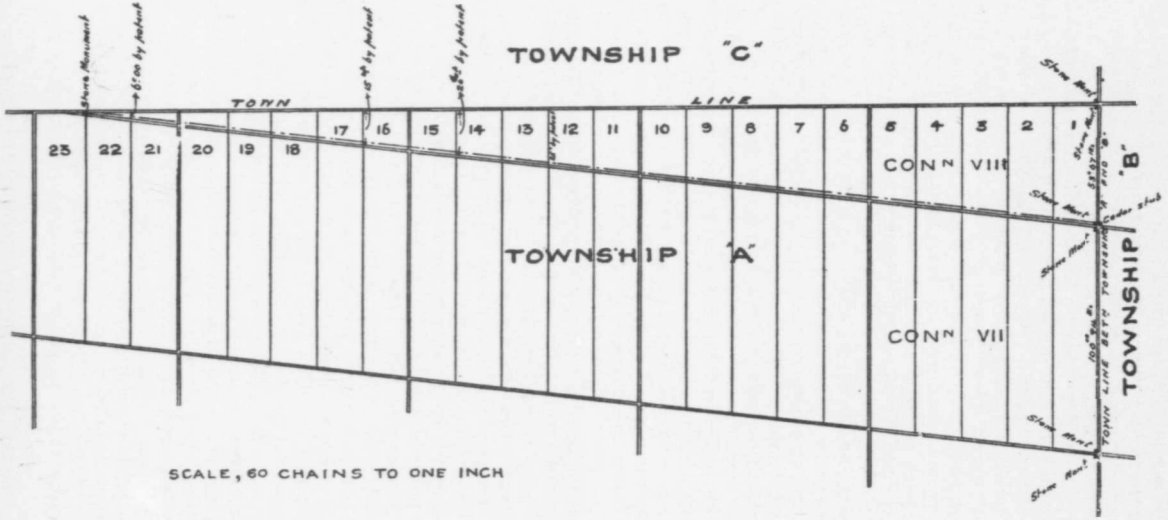
This subject has often suggested itself to my mind when examining Returns of Surveys performed under instructions from the Commissioner of Crown Lands on the petition of the Municipal Councils of Corporations of counties or townships in the Province of Ontario. If the land surveyors of one hundred years ago had been able to take a peep into futurity, and to see the great importance to generations yet unborn, of not only accurate work in the field, but of clear and methodical entry in the pages of their field-books of the course of their proceedings, and of the nature of the monuments set up to mark their operations, methinks the farmers of this Province would have been the richer by many hundreds of thousands of dollars. Our present system, infinitely superior as it is, both in theory and practice is still, I venture to think, capable of much improvement in one important particular, and the reason for it is not difficult to discover. The old saying "familiarity breeds contempt" is responsible for it to a great degree. When a surveyor has been for several months employed in the survey of townships, baselines, meridian lines, road lines, etc., etc., his work becomes, as it were, second nature to him. He understands himself all about it, the details seem self-evident, and when he comes to write the report of his operations, he is very apt to omit as superfluous some of the most important items of detail, and to make his report as brief as possible, so far as these are concerned, contenting himself by stating "I have the honour to inform you that I have performed the survey as per instructions; the nature of the country is rolling, in some places almost mountainous, in others intersected with swamps." Of course I do not mean that such meagre reports are general now, but I contend they should be wholly things of the past. I have read reports otherwise very good, where the reader is left wholly in the dark as to the nature of the monuments planted by the surveyor, where the instructions went fully into the diameter of the iron to be used, the kind of piping, the length above ground, the marks to be cut thereon with a cold chisel, the exact mile at which iron was to be used, and where wooden posts might be substituted, and where a combination of both were to be used, all with the view of enabling the explorer or lumberman to locate himself without difficulty on coming across any of these monu-


TOWNSHIP "C"
TOWN LINE
TOWNSHIP "A"
TOWNSHIP "B"
CONN VIII
CONN VII
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Stone Monument
Stone Mon.
Cedar stake
SCALE, 60 CHAINS TO ONE INCH

ments. The ideal surveyor's report is one which states all the details in clear, concise sentences, capable of being clearly understood by non-professional people for whose benefit and information these reports have been for many years published in the annual report of the Commissioner of Crown Lands.

But if this is true of the end of the nineteenth century, how much more so is it of the records of the last century and the early part of the present, where the exception is to find a word to indicate that any monuments were planted, how wide the allowances for roads were left, or on which side of the allowance for road the line was actually run and marked in the field, and where the instructions themselves are at this date of reading very vague, in that they often refer to a projected plan sent, which was to be returned with the fair plan of survey, but which, alas, if returned, has long ceased to exist, or again the instructions refer to the knowledge possessed by the surveyor, which renders it quite superfluous to repeat to him what he is already well aware of from former surveys. Well, then, you will say, if this is the case, are the old records valueless? Is not time wasted in searching amongst rubbish for the chance of finding a precious pearl? By no means! It is to show how useful evidence can be extracted from these old documents that the present paper is penned. An example will perhaps make my meaning clear. For obvious reasons I withold the name of the township, actual dates, the surveyors employed, merely designating the townships by letters A and B, and the surveyors by letters A, B, C, D, E, F.

About ninety-two years ago, D.S. A—— received instructions to survey four concessions in the township of A——, the concessions to be 100 chains deep, leaving an allowance of one chain for a road between each concession. About three years later, D.S. B——, received instructions to "survey the remaining part of the township of A——, four concessions of which have been already run. . . . . You will proceed to the north-west angle of the fourth concession on the division line between townships A—— and B——, and continue the same on a course N. 74° E. until you intersect the Eastern boundary of the townships; you will then proceed to run the remaining concessions on a course of N. 9° W., laying off the lots and roads," etc.

The plans, field notes, etc., of both these surveys are of record in the Department of Crown Lands. About sixty years after the second survey, the Township Council of township A——, at the request of the landowners interested, petitioned the Governor-General in Council to have a survey made of part of the 8th concession line of township A——, and permanent posts planted to define the angles of the lots along the front of said concession, and praying that instructions be given to P.L.S. C——. An order-in-council authorizing said survey having been passed, instructions issued to the surveyor named in the petition. I have heard that a tradition has existed in the township, that this portion of the concession, lying as it did in a dense cedar swamp, had not been originally surveyed by D.S. B——. Be that as it may, when P.L.S. C—— went on the ground he could find no marks from lot 16 to lot 35 on the town-line;

at lot 16 he found the old post marking the north-west angle of the lot, and drew a random line across the lots northerly to the town-line. Here he found a cedar tree or stump marked for the north-west angle of lot 35 in 8th concession, with the marks clearly indicated, viz: R on north side, lot 35 on south side, concession 8 on east side. He stated in his report that the markings were so clearly defined that he did not require to take any evidence, having known it himself for some years. He then offset back from his random line and planted his posts to define the angles of the lots. His survey was confirmed by the Department the same year it was made. The following year the County Council of the county in which the townships A—— and B—— are situate, on the petition of the parties interested, sent in a petition to the Governor-General in Council to have stone monuments planted at the angles of the concessions upon the south boundary of the township of B——, the same being the governing line for that township. (I may say that this line is the boundary between the townships of A—— and B——, and was run by D S. B—— in 18—, on the south side of town-line.) The necessary order-in-council having been passed, instructions issued to P.L.S. D——, the surveyor named in the petition. He performed the survey and I find in his report, the following extract as to the corners between the 7th and 8th concession line: "Here I found a cedar stump with the sides slabbed off marking the north-east angle of lot number 35 in the 7th concession of the township of B——, and displaying the following marks, inscribed with a marking iron, on the west 7th concession, on the east side 8th concession, and R on the north side, the blazes on the old original town-line could also be easily traced, and from this data I established the corners and planted the monuments."

P.L.S. D—— sent in his returns of survey about four years after receiving his instructions, and his survey was then confirmed.

I may explain here that the two last named surveyors found the same cedar stump but each took it to mark different points and made their surveys on this assumption; the one taking it to mark the north-west angle of lot 35 in 8th concession, the other the north-east angle of lot 35 in 7th concession, the two points being one chain apart.

About ten years after this survey, the County Council petitioned the Lieutenant-Governor in Council, at the instance of the parties interested, to have the 8th concession line of the township of B—— run out, the same not having been surveyed in the original survey of the township The necessary order-in-council having been passed, instructions were issued to P.L.S. E——, the surveyor named in the petition, to define the 8th concession line and to plant stone monuments therein. He performed the survey, and in his plan and field notes showed the stone monument planted by P.L.S D——, apparently defining the front of the 8th concession; on this assumption the survey was confirmed.

About six years after this it was represented that the survey had not been acted upon, so far as opening the road allowance, and that doubts existed as to which side of the line the road should be opened.

It was not easy to see how any difference of opinion could exist on this point, but at last, by patiently investigating the old records in the Department of Crown Lands, the error was located.

The original field notes show that D.S. A—— ran the boundary between township A and township B——, along four concessions on the south side of the road allowances, and the concession lines on the east side of the concession road allowances, the same being the front of the concessions and the lines on which the lot posts were planted. From the quotation from the instructions given to D.S. B—— it is clear that the north-west angle of the 4th concession was believed to have been defined by D.S. A——. This would be the north-west angle of lot 35, 4th concession, township A——. On examining the diary of D.S. B—— the record is found that on Saturday, January 28th, 18—, he set out early in the morning and got to No. 35 on said line and camped late in the evening; on Sunday opened the line between township A—— and township B—— and continued it through cedar and spruce swamps, Monday, Jan. 30th, continued the line, and at 101 chains planted the 5th concession stake. From this entry it is clear that he planted the stake on the east side of the allowance for road. After enumerating a number of days' work, this entry occurs: "Saturday, Feb. 4th, then 101 chains to the front of the 8th concession, marked a cedar picket, then through to the eastern town-line 55 chains." The cedar picket here described is the site of the cedar stump variously described by P.L.S. C—— and P.L.S. D—— as above mentioned.

It now became necessary to investigate on the ground the cause of the trouble, and to see how matters could be set right. P.L.S. F—— having notified the Reeve of the township that he would be on the ground a certain day, and after the parties interested had been notified to be present, proceded under instructions from the Commissioner of Crown Lands to make the necessary examination. He chained the depth of the 7th and 8th concessions along the town-line to ascertain the exact depth between the stone monuments set by P.L.S. D——

The 7th concession measured	101 ch., 94 lks.
" 8th " "	52 " 67 "
Total depth exclusive of road.....	154 ch., 61 lks.
Depth given in original field notes.	155 " 00

The stone monuments stood exactly one chain apart and by the letter R indicated that a road allowance lay between them, the Western one stood exactly one chain North of the site of the old cedar stump before alluded to. The concession road in township A—— has been opened out and travelled for many years to the west of this cedar stump, and thus the stone monuments as found indicated a jog to the east of the road allowance of one chain. It is well to explain here that the two townships were surveyed at the same time originally, and in every other case the concession lines were continuous.

On enquiring if any old resident knew of the existence of the original monument, an old man was found who had given evidence as to its position before P.L.S. E——. On visiting him and asking what he knew of the matter, he at once clearly described the position of the cedar stump as marking the north-west angle of lot 35 in 8th concession, stating that he had known it now upwards of thirty years, and that it was marked with an R on the west side in the same way as another old monument in the 7th concession was marked to define the front, and that he had known both of them for over thirty years. He also clearly described the operations of P.L.S. C——, whom he had assisted to make the survey in the 8th concession of township A——, and described his running the random line, his coming out west of this cedar stump before mentioned and his offsetting his posts for the front of the lots—a remarkable instance of memory of a transaction which had taken place nearly thirty years before. This man's evidence proved conclusively that an error was committed by P.L.S. D——, in assuming the cedar stump to mark the north-east angle of lot 35 in the 7th concession, instead of the north-west angle of lot 35 in 8th concession, and that this error was made from two causes: (a) not examining the old records, whereby he could have ascertained the fact that the concession lines had been run on the east side of the road allowance and the posts planted on this line; (b) not adopting in this concession the municipal survey made the year before by P.L.S. C—— and confirmed the same year.

On P.L.S. F—— reporting to the Commissioner of Crown Lands the result of his investigation, the Commissioner held and found that it was established that the position of the cedar tree as the original monument marking the north-west angle of lot 35 in 8th concession of township A—— was clearly defined by P.L.S. C——'s survey as confirmed by the Department of Crown Lands. That any subsequent survey purporting to establish the position of the same cedar tree as marking the site of another point was inoperative so far as this point was concerned. That by the removal of the two stone monuments so planted in error by P.L.S. D—— to points which would bring them in accord with P.L.S. C——'s survey, the error so made would be rectified. He therefore directed P.L.S. E—— to amend his survey so as to cover this point, and the stone monuments were moved each one chain west, thus bringing the road allowance in direct continuation with the travelled road to the south, and as this concession line had never been run in the original survey, the Commissioner of Crown Lands directed that it be treated as an original survey, and be paid for by the Department of Crown Lands.

Moral—Whenever you get instructions for a municipal survey, make it a point to examine the original records before commencing the survey.

DISCUSSION.

Mr. Gibson—There seems to be an impression amongst surveyors that if they make a survey under instructions from the Commissioner of Crown Lands and they get it confirmed that the thing must be all

right; but if, as in this case, it is shown afterwards that there has been a mistake made it upsets the whole thing. I remember discussing the matter with Judge Osler one time, and he cited a number of cases where they had been set aside. As to the old notes mentioned by Mr. Kirkpatrick, there is no question but that the instructions were rather indefinite and the returns were sometimes worse; and I have understood that some of these men actually did not make any returns at all.

Mr. Niven—I think that the remarks made by Mr. Kirkpatrick about furnishing reports were very good. Most of us in writing our reports, being familiar with the ground and the nature of the surface, often omit details,—I know I have omitted details which I have been convinced since would have been useful. I think that is a point that has been well taken, and most of us could benefit by bearing in mind when we are writing our reports that the parties for whom this work is intended are not familiar with everything as we are and it is for their information we are giving it. I am satisfied that we often overlook the point in that way.

Mr. Gibson—Don't you think the difficulty arises by the surveyor on the ground taking rather a small field book with him? I have a satchel and a good big book and I take everything down—and get paid for it too. Besides, you can write down affidavits and everything; and if they get into a row I take their names and what the trouble is, and if it comes to a court of law, there I have it.

Mr. Gaviller—Did I understand you to book your affidavits in the field book?

Mr. Gibson—Yes; the Act speaks about taking evidence. Now, when I was a young fellow I remember being on a case and was asked if I took any affidavits. I said "No." "Why didn't you?" they asked. "Why," I said, "there they are, swear them yourself." But I made up my mind that if I was doing a survey afterwards I would take affidavits just to protect myself. The statute says you must, so I take them and file them away in the office; then I refer to them by number. I use an indelible pencil and then apply a damp blotting paper; it is much handier than ink to use. These affidavits are a great protection to the surveyor.

The President—Yes, but some of the members of the legal profession seem to think that a surveyor does not know how to take an affidavit, and I am afraid there is some truth in it. I have seen affidavits that the very last clause knocks the whole thing out. I know a case where, after swearing all about a certain stump, the very last clause was that he had no reason to doubt that it was the right one. The moment the lawyer got his eyes on it he said it was no good at all, the man wasn't sure.

Mr. Stewart—Did you ever take negative evidence? That is, when a man has lived in a place a great number of years and has not seen a post?

Mr. Gibson—It is just a question; some say that you have no right to take negative evidence. I would not pay much attention to

it if it was from an interested party; but I think it is as well to take his evidence anyway.

Mr. Ogilvie--Suppose you took an affidavit and went to court with it, and the witness gave materially different evidence in court from that affidavit, and the witnesses who heard it read and subscribed their names as witnesses were there and swore to it, what would you think the judge would be justified in doing in such a case?

The President—The case happens every day in ordinary courts. A man, after being examined by the preliminary examiner, goes to court and gives a different version of the case.

Mr. Ogilvie—I remember one time I examined a man on the ground and gave him three days to think over it, and told him if he was then convinced he was right to come back, and he came and made it stronger. I drew up an affidavit very carefully and read it over to him and was particular to see that he understood it thoroughly. He came in court, and under stress of cross-examination and a little whiskey he gave entirely different evidence, and the judge threw the affidavit aside and said it was not what he swore to last week or last year, it was what he gave there. Afterwards the man asked me how that case came to go the way it did. I told him it was no wonder it went the way it did after the evidence he gave, and I told him what he said. He said it was a lie, that he had never sworn to that. The man did not actually know what evidence he did give in court, and right there he corroborated in full the affidavit. That case was lost because the man did not tell the truth and because the judge took the evidence given to him and rejected the affidavit, and rapped me severely over the knuckles for taking the affidavit when my motives were just as pure as his were.

Mr. Stewart—I think you will all find a great many men in the country who are willing to make affidavit to almost anything, and we have to look out for them.

Mr. Ogilvie—But how are we to protect ourselves against these men?

The President—I know in matters of that kind a surveyor very often lays himself open to improper imputations. The first time I ever took an affidavit, after examining four or five, I concluded that only two of them really had sufficient knowledge to make it worth while taking their affidavits, and rejected the other three. Well, it was immediately imputed to me that was dealing unjustly. I was brought in under the pay of both parties to settle the matter, and through over-carefulness I got the imputation of being a partisan.

Mr. Gaviller—We all know that the person who is most likely to have some knowledge about the corner of a lot is the owner, but then would not his evidence be looked upon in court as the evidence of an interested party?

Mr. Gibson—From an experience I had some years ago I made a rule that I would swear every man. It was a case concerning a certain stake that had been planted, and they all swore it had been

planted by such and such a man. I wrote affidavits all day long. Now, said I, are you men all through swearing? Then I pulled out my old field book and showed them that they were wrong. Oh, they said, they must have been mistaken. But they would have been very angry if I had refused to swear them.

Mr. McAree—Then there is not much use in taking an affidavit.

Mr. Gibson—You have to; the law says you must. My practice is this: If I get an individual to swear against his own interests his affidavit is a good one, but if his evidence is in his own favour it is not much use. I think it is a good plan to take affidavits right along; I always take the whole batch of them.

Mr. Ogilvie—I might mention a case I had near Ottawa. There were seven men, all Protestants, swore a post occupied a certain position; but there was one man, an Irish Roman Catholic, came along and contradicted them flatly, said the post did not stand there, it stood forty-seven feet from where they said it stood. Two of these witnesses had established it in court and surveys were governed by their evidence. There was likely to be a law-suit and I did not know what to do. I was three days driving around making inquiries, and at last I found one old man, bed-ridden with rheumatism, who gave me a clue, and from that I demonstrated that the Irishman was right, and so completely that the seven men came along and apologized about it.

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SEWERAGE FOR TOWNS AND VILLAGES.

By HERBERT J. BOWMAN,
Town Engineer, Berlin.

In Ontario, all of the cities, most of the towns, and some of the villages have now systems of water-works, but only a few of the larger places are as yet provided with sewers. Thus a large proportion of our people are living in communities that have within the last few years greatly increased the consumption of water for domestic and manufacturing purposes; and this water after being fouled is poured upon back-yards, or into street gutters, or, worse still, run into cess-pools, polluting the ground surrounding dwellings, causing rapid increase in deaths from typhoid and diphtheria, and surrounding the inhabitants with the worst conditions under which to fight an epidemic of Asiatic cholera, should it again sweep over the country. The necessities of our Province require that the people living in its towns and villages be aroused to their danger, and in this good work the members of this Association are fitted by their professional attainments to not only point out the danger, but to suggest the remedy.

In small villages where there is no public water supply, and wells are entirely depended upon for drinking water, it is in the highest degree important that the soil should be kept free from pollution. Removal by public scavengers of all dangerous matter at least once a week should be encouraged. This will of course prohibit the use of that abomination of abominations the privy pit, and necessitate the adoption of some form of the pail system, or the dry earth closet. This will, however, not suffice in larger places possessing ample public water supplies, and containing factories, tanneries, large hotels, and other public buildings, from which the liquid waste is considerable. Experience has shown that under these conditions removal by water carriage through underground conduits is the only satisfactory method. In designing a system of these conduits or sewers, the first question that presents itself is the disposal of the fouled water or sewage, and on this depends also to a great extent the question whether it is expedient to carry the rainfall in the same conduit with the sewage proper, or to provide two separate conduits.

The "combined" system is in use in nearly all of the cities in this Province already provided with sewers, but this does not say that in the majority of cases it is the best. There is no doubt, however, but that it will prove satisfactory in large cities, with their many miles of

paved streets, and in a climate with frequent falls of rain to flush the sewers, but in case the sewage must be pumped, or treated either chemically or by application to the soil, these sudden additions to the flow will of course be very troublesome.

The "separate" system when carried out in its entirety, namely, the construction of two separate conduits, one for sewage proper and the other for storm water, possesses all the advantages of the combined system even for the largest cities, and the cost has been found not to exceed the old method, while sewer gas is almost unknown, and cellars are never flooded with foul matter as is frequently the case in the "combined" system. However, the great advantage of the separate system is that the small conduit for the sewage proper, sometimes called the sanitary sewer, may be built at a comparatively small cost, long before the storm water conduit becomes a necessity, and in fact there are many towns with porous soil and good natural drainage into some regular watercourse, where it will never be required.

In designing the sanitary sewers of the separate system, the quantity of sewage to be carried is usually determined from the probable quantity of water that will be delivered to the inhabitants when the estimated limit of population is reached. In case this estimate does not exceed about 50,000 inhabitants, the daily quantity of water consumed will probably be not more than 75 gallons per capita, and it is usually estimated that half of this will be carried off in eight hours. The capacity of the sewers should be such that this assumed maximum flow will never more than half fill the pipe, except, perhaps, in the case of a main outfall sewer with no private drains connecting, where it may run nearly full without detriment. For most of our towns, unless the available fall is very little, it will be found that even for the outfall sewer no larger diameter than 18 inches will be required; and for this and all smaller sizes the best practice is to use vitrified salt-glazed clay sewer-pipe. It is to be regretted that we have in Ontario no deposits of fire-clay, so necessary for the manufacture of a good sewer-pipe, so that the raw clay must be imported. However, good sewer-pipe—Canadian, Scotch and American—can be bought here at very little, if any, advance over the prices paid by our more fortunate cousins over the border; and as labour is cheaper sewers can be constructed at as low cost here as in the United States. In fact the average cost of sanitary sewers for any of our towns should not exceed one dollar per foot, exclusive of the cost of private drain connections across the streets to the property lines. In most cases brick manholes are now built every four or five hundred feet at least, and at all changes of direction and grade, to facilitate inspection and the removal of obstructions, as well as to assist in ventilation. To overcome any tendency to deposit, particularly at the upper ends of the lateral branches of the system, some method of flushing is required. This may be accomplished by admitting along these upper ends the rain-water from roofs of houses or by systematic flushing from the nearest water-works hydrant. However, the most effectual method is obtained by the use of automatic flush-tanks discharging their con-

tents, about two hundred gallons, with a rush. In some cases, where the water supply is very limited, these tanks are supplied by connecting with them the drains from some of the houses, but the most reliable way is to have a service-pipe from the nearest water-main, admitting constantly a small quantity of water sufficient to have the tank discharge once or twice a day. In towns having a gravity water supply the cost of operating these flush-tanks will be reduced to a minimum; and even where water must be pumped the cost per tank should be very small.

As mentioned before, the question of the disposal of the sewage is in reality the most important, and happily are those towns situated that have some large body of water—like the mighty St. Lawrence—into which the sewage may be discharged without danger. All inland towns, however, and perhaps eventually those now discharging into the great lakes, will have to provide some means of purification of their sewage, and the Provincial Board of Health, whose approval must first be obtained in every sewerage system, is looking well to the future by requiring municipalities to make provision for sewage farms, even when the sewage may be in the meantime run into a river or other body of water not now used as a water supply. Chemical treatment of sewage has been found very expensive to obtain satisfactory results, and purification of sewage by application to the soil has been found to be the best method, either by broad irrigation where sufficient suitable land can be obtained, or by intermittent downward filtration through specially prepared filter-beds.

DISCUSSION.

[With samples of sewer pipe.]

Mr. Butler—From my experience I have yet to find a salt glazed pipe that will remain watertight under pressure.

Mr. Bowman—In our work we use all kinds. I don't like to run down any manufacturer's pipe. I know in Toronto it has been very hard for these St. Johns people to sell any pipe, because if you take up the report of the city engineer you find it has been run down for a number of years, not allowing any to be used at all, but this year they have got the contract. It may be because of the economy wave that has struck the city, but at the same time they are beginning to use it. I think they can make just as good a pipe in St. Johns as in Buffalo.

Mr. Gibson—Where do they get the fire clay for this?

Mr. Bowman—They bring the clay by train from New Jersey. Pure fire clay does not make the best sewer pipe.

Mr. Butler—In regard to the separate system, it seems to me to multiply the cost about 75 per cent. by putting in separate conduits.

Mr. Bowman—If you look into the thing, it will not be necessary to put in a large brick sewer for storm water at anything like the depth of the other.

Mr. Butler—What about the cellar drainage? That is a very important matter.

Mr. Bowman—That is a matter, of course, that has got to be looked into, but you find some very eminent men in the Canadian Society of Civil engineers endorse the separate system. In every place the work has to be done on its own merits. For instance, it may be found, in a town, necessary to take the sewage several miles out into a sewage farm, whereas the storm water will not be required to be taken any length at all.

Mr. Butler—I would like to get the opinion of Mr. Chipman as well as the writer of this paper as to how we are to provide for the discharge into these inland bays, where there are no particular currents, but just simply a large body of water; for instance, the Bay of Quinte. How would you provide for that?

Mr. Bowman—Where is the difficulty you have anticipated?

Mr. Butler—In disposing of the sewage along the shore. And I anticipate that if you discharge the sewage close to the shore that it will remain there.

Mr. Bowman—Would it make any difference how far out you deposit it?

Mr. Butler—I should think so.

Mr. Bowman—With an iron pipe it could be carried out as far as you like. Either in cast iron or wrought iron or steel it can be laid at much less cost than is usually figured on; and I know it stands the ice of Lake Huron with very little protection. I had charge of the laying of a pipe into Lake Huron at Kincardine, put 430 feet into the lake. We put it all together at once, and towed it out of the harbour and up along the shore with a team of horses, and then cut away the floats and let it sink. It was this cast iron pipe with flexible joints. But you cannot make any flexible joint tight unless it is gone over and caulked after it is put in its position. If you got it perfectly tight it would not be flexible.

Mr. Chipman—This paper is worth discussing and is interesting to a good many of us, though there are some points upon which probably we might take issue. I cannot see why the combined system of sewers should flood cellars more than any other system if it is properly constructed. If the writer had said that in constructing the combined system more errors have been made than in the separate system, perhaps it would have been the better way of expressing it. Again, where falls of rain are depended upon to flush the sewers, we find here in Toronto to-day it does not work satisfactorily; it is impossible for a rain-fall to flush a sewer system such as we have in this city. The only proper way to do it is by means of flush tanks. In this climate we may not have a rain for two or three weeks, and that two or three weeks is quite time enough for the sewer to become perfectly foul. Three days will make a very foul sewer; and when you have a rainfall only once in two or three weeks you have during a great portion of this

time a foul sewer. As to the question of laying pipe, etc., which has been mentioned, during the last year I have laid six of these pipes, and in all cases but one—and that one we could not fix, it was down so low—we found it quite tight after it was laid. When I put in a submerged pipe I specify that that shall be made watertight, and we make it watertight. We use very few flexible joints. We laid one in Brockville 900 feet long and next day that was dry; we laid two in Barrie this year and they were tight. There is no trouble about making them tight. As to what we shall put in in the towns mentioned by Mr. Butler, of course it all depends upon the town, but in these towns, Kingston and Picton, they have first polluted their harbour and then they take the water from this polluted basin. They get the water from the wrong place; they started wrong.

Mr. Gibson—I am interested in sanitary matters for some of these inland towns, and the greatest difficulty is that people will not allow you to put in any kind of a sewer; they run off their sewage into the creeks, and the great trouble is to get rid of it. Take East Toronto; in the first place I know they have got to use dry earth closets, and then all they have to do is to dig six or eight feet into the gravel below, and all the storm water will disappear. West Toronto Junction, however, has quicksand under it, and it is in a worse position. With reference to the separate system, a point is made in this way, that in the separate system you can take the sewage away and leave the storm water. Why, the first thing in any new town is to get rid of that water. For my part, I don't see how you can run a large town under the separate system. I have made investigations as to the town of North Toronto, and I have found that it would take miles of sewers to take it to the bay. All I can see for these villages is to have dry earth closets and to take the slops, etc., into the creeks.

Mr. Chipman—In some of our inland cities and towns it is altogether out of the question to build combined sewers. In the city of Brantford we carried the sewage over two miles, but to convey all the storm water and dirt, etc., for two miles would be a ruinous enterprise for the city. As to the pipes breaking and being found broken, it depends upon the pipes themselves, the maker, and upon the factory, and upon how they are laid. Now, I will venture to say in the fifteen or twenty miles of sewers that I have laid within the last two or three years you will not find 100 feet that is broken.

Mr. Gibson—They are just as careful in Toronto as they are any place else.

Mr. Chipman—No, sir; they are not as careful in Toronto as they are in other places.

Mr. Roberts—With regard to the pipe in Toronto, I might say in the work in Barrie last year the contractor shipped up pipe the same as he had used in Toronto. I went down to his yard and culled the pipe roughly before they were shipped, and I found a good 75 per cent. of culls that were not fit to use at all. And I found on reaching Barrie that I had to cull 25 per cent. of the quantity delivered. These were the pipes he had used in the city of Toronto.

Mr. Bowman—In writing this paper I did not attempt to treat it in a technical way, simply in a popular style for the information of those members who have not paid any attention to this question at all, and not with the idea that there would be so many sewer constructors in the meeting. My object was more to interest the outside places, where this question has not been taken up at all, and I did not go into details of construction, so I would like to have any questions answered by members of the Association who are looking into this question.

Mr. Butler—I question very much indeed the tightness of all pipe sewers. I think that at times they are liable to run under pressure, and I think if they do they fail.

Mr. T. H. Jones—As regards the question of the separate and combined systems, I think, as Mr. Bowman says, that each place must be considered in itself. In Brantford, as Mr. Chipman says, under the combined system we would require the main sewer to be two miles long. There was a great deal of newspaper discussion there, and I made an estimate and I found that it would take a sewer six feet in diameter to discharge the rainfall which would be required to start, and as the pipe would have to increase in size as it went down, it would take a pipe nearly as large as a house at the bottom. In Brantford the separate system is plainly the system. We have the Grand River there and the creeks and little depressions running into the river which provide for the rainfall. As regards the cost, it struck me that Mr. Bowman's estimate was rather low, judging from our experience in Brantford. The Scotch pipe has been used altogether for sewers over nine inches in diameter.

Mr. Bowman—Fault has been found with my saying that the combined system necessarily flooded cellars; and it was said that that was caused in these cases by the combined system not being designed properly. That is no doubt correct, but was there ever a combined system designed properly? The combined systems are designed to carry a certain amount of storm water, but I don't think there ever was, as far as I could find, a combined system that at all times carried the surface water. If so, it was at a very great expense. For instance, from half an inch to an inch of rainfall per hour is usually taken to base calculations on, but there have been storms as high as three and four inches of rainfall per hour, so that you can hardly expect a sewer to carry that exceptional rainfall. Mr. Rust, who has had charge of the Toronto sewers for a number of years past, read a paper on the construction of the Toronto sewers before the Canadian Society, and he speaks of that question and gives the basis on which they figure out the capacity for these sewers. At all events they never attempt to provide for the heaviest rains, and that is why the cellars are flooded. Last summer there was a storm here that filled the sewers so completely that it washed off the cast-iron tops of man-holes on Jarvis Street. It would bankrupt any city to put in a combined system that would carry off every rainfall. Then Mr. Gibson says the first thing in his experience has been to provide for the storm-water.

Mr. Gibson—That is the creeks.

Mr. Bowman—That may be in muddy York, but when we get out to these high, sandy ridges where there is perhaps a stream running through the middle of the town, the storm water looks after itself. It may never be required to be carried in the sewers. Then about the tightness of the pipe sewers, I don't think it is fair to expect that a sewer will stand a forty-foot head or even a ten-foot head. Sewers are not supposed, especially the separate system, to be filled full at any time.

Mr. Butler—The flush tank is ten feet above the sewer.

Mr. Bowman—I don't think any flush tanks, or very few, put ten feet head on the sewer; in fact they don't more than fill the sewer in a very short distance. If it did it would be perhaps all the better. If you take the combined system on that basis—because they are made of porous brick—they allow the foul water to percolate through them. And about running outlets into bays, the first question would be, Would the Provincial Board of Health allow you to run your sewer into the bay? They have authority to prevent it. All sewerage plans have to be submitted to the Provincial Board of Health, and it would be very unwise, if they had to use that as a source of drinking water, to run it into the bay. The engineering difficulty of laying the pipe to carry it is very simple, especially in a protected bay where there is no surf to beat the pipe. It is a very difficult matter to get a flexible joint water-tight.

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GEORGETOWN WATER-WORKS.

By JAMES WARREN, P.L.S., A.M. Can. Soc. C.E.
Kincardine.

Early last year I was employed by the Corporation of Georgetown to examine into a scheme proposed for the supply of water, both for fire and domestic use. The proposition was to bring the water from a stream known as Silver Creek, from a point about 2¾ miles away from the village, which would give sufficient pressure for fire purposes. On taking levels I found there was a fall of nearly 200 feet from a favourable location for a reservoir to the centre of the business part of the village. The route was also very favourable indeed, as there were only two places where there was any rise—or rather any depression—that would in any way obstruct the flow. We had to cross the line of the G. T. R., where there is a cutting of 23 feet, but, fortunately, just after crossing the line there was a steep incline, so that by digging our trench deep and tunneling, 17 feet could be taken off this rise, so that it practically would not interfere with the flow of the water.

The location of the reservoir is very favourable indeed, as the ravine through which the creek runs at this point narrows, so that a dam was easily constructed, and can at any time be raised higher if required; and also at this place there are several springs flowing out of the bank that of themselves give enough water for domestic supply. The reservoir is 96 feet across, or wide, on the dam, and 10 feet deep, but runs out at 150 feet as you go up the stream. The ground was nearly all clay, so that it would hold water, except in a small portion of the bottom which was puddled. The whole bottom and sides are cobbled with small stones, so as to give the bottom a nice appearance —also will give facilities for cleaning out the reservoir at any time. On the north side we came on one or two beds of quicksand which caused us to change our location a little, but we overcame the diffi- by building a strong retaining wall, as there was danger, if the quicksand began to run, that part of a steep bank would be undermined and run into the reservoir. There is a six-inch main laid down at the lowest point of the reservoir and through the dam, so as to quite drain the whole of the water out in case of cleaning out the reservoir at any time.

There is a small dam built at the head of the reservoir, and is so arranged that the whole or part of the stream that comes by the creek can be turned off and flow past in a channel cut for the purpose; by

this means the water collected in the reservoir is entirely spring water; or, in case the springs do not give sufficient supply, part of the stream may be turned in. The quality of the water, as taken from the creek last September and submitted for analysis to Dr. Bryce, Secretary of the Provincial Board of Health, gave the following analysis per million parts: Chlorine, 3 2; free ammonia, 0.2; albumenoid ammonia, 0.09; oxygen absorbed in 15 minutes, .72; absorbed in 4 hours, 1.60; total solids, 246; loss by ignition, 128. By comparing this statement with a table on page 33 of the reports of the Engineering Society, 1890–91, it will be seen that the water is "exceptionally pure," as remarked by Dr. Bryce at one of the meetings of the Board of Health, "and falls easily within the first class."

The water is brought in a ten-inch main from the reservoir into a point in the village, from which it is distributed by eight and six-inch mains as required. The mains are:—

10-inch	14,540	feet.
8 "	1,374	"
6 "	7,825	"
4 "	11,632	"
Or a total of	35,371	"

—nearly 6 7-10 miles. This is divided into 24 sections by valves, so that any portion between these points can be shut off in case of any damage and repairs being needed, and is also arranged that in the important points, if one section is shut off, water can be supplied by the mains from other sides. The Ludlow Hydrant is the one used, and gives good satisfaction. There are 36 of them in all, and in the centre of the village are placed about 200 to 400 feet apart so as to give good fire protection on all sides.

To overcome any reaction that would arise on a heavy draw on the mains, four relief valves are placed, which blow off at a pressure of 120 pounds per square inch. Also at the highest points on the line where there are no hydrants there are air valves placed, so as to allow any air that would accumulate in the mains to escape, which, if not allowed to escape, would, in a very serious manner, interfere with the flow of the water.

The pressure in the centre of the village is 85 pounds per square inch, but allowance must be made for friction, which, after allowing for a discharge of 750 gallons per minute, gives a working pressure of 60 pounds, which is sufficient to throw an inch stream 90 feet in the air through 100 feet of 2½-inch hose. On some of the tests water was thrown from 160 to 175 feet horizontally from one of the hydrants where the working pressure was about 80 pounds per square inch.

The pipes used were tested to stand a pressure of 300 pounds per square inch, and one section required a test of 400 pounds. The pipes all stood the pressure of the system without any flaw being found in any. The main from the reservoir is 10-inch, and is divided into three sections by valves so that the water can be shut off at any time in case of any accident. On this section there are four hydrants,

furnished with secondary gates, which allows the hydrant to be shut off or entirely removed without the flow of water being interfered with. The system is also furnished with vacuum valves to allow the air to enter the pipes in case of the water having to be drawn off. The 10-inch main extends from the reservoir into the village, the whole distance being 14,540 feet. For the first mile they weigh 50 pounds per foot, this being quite heavy enough to stand the pressure in that part of the system. The weights required for each size of pipe are:—

10-inch	light 10-inch	8-inch	6-inch	4 inch
60 lbs.	50 lbs.	45 lbs.	30 lbs.	20 lbs.

per foot. The mains were all coated with the usual waterproof coating. From the extra quality of the water there will be a great many water-takers, as the water will be supplied at reasonable rates, which will be a great boon to many parts of the village, as water from wells is hard to be got, and is also not good for domestic use; and as the G. T. R. and the H. & N. W. railways cross here, no doubt the railway company will take water also, as they can get an abundant and never-failing supply for their engines. This makes Georgetown an important point of supply, as it is at the beginning of the heavy grades on the line going west.

The advantage of the gravity system will be easily seen, as after the first cost of the work there is no further cost for any outlay in the shape of pumping, fuel, or any other expense; and, also, there is a direct pressure on the mains at all times, and no risk to run of the pumps getting out of order.

DISCUSSION.

Mr. Bowman—This paper, I think, is one of the most interesting we have ever had read before this Association, and gives a case where one of our members has had entire charge of the building of a very economic system of water works, looking at it from every point of view. He does not mention the cost of the works, but I think it is somewhere in the neighbourhood of $30,000. This includes a system of nearly seven miles of pipe and a small reservoir which did not cost very much to construct. The pressure they get should be ample for a town of Georgetown's size, where, I suppose, there are no buildings more than two or three storeys at the most, so that a pressure of eighty-six pounds would be ample, and with two or three streams going, the pressure still remains sixty pounds. Mr. Warren does not give the biological examination of the water. Now the Provincial Board of Health are examining all waters and giving the number of bacteria per cubic centimeter; this, perhaps, is more an indication of the quality of the water than the chemical analysis. Mr. Warren told me about this reservoir. He said it was at one side where they can turn this creek in if they require, but at present it is fed from springs along the side of the reservoir; just one pipe, a ten-inch main, about three miles out in the country.

Mr. McCulloch—Why is it necessary to have a pressure test of 400 pounds per foot on part of the pipe? Three hundred pounds is the pressure he has for most of the pipe, and is probably larger than is required by the standard of the American Society of Civil Engineers. In this connection, too, I would like to ask the experience of any of the members present as to an actual test of this pipe. In Galt during the summer we had some tested that was sent to us. The pipe was poor in quality and we discarded a great deal of it. The manufacturers asked us if we would accept a pipe if it stood a proper test. They went on with the test, and it stood the 300-pound hammer test with two and a-half inch hammer and fifteen inch handle, sharp blows. But on one occasion while unloading the pipe one of them that had stood that test broke in the unloading. I was almost satisfied from that that this 300-pound hammer test was not a satisfactory one.

Mr. Butler—There is no doubt that the pressure test is a very equally and uniformly distributed test; in the other case it is a jar.

Mr. McCulloch—For a length of probably two or three feet they were full of blow holes. It could not possibly be expected to stand any pressure at all, and this man that was testing them, I know, hit them very sharply. We had to condemn the whole batch of pipe after that.

Mr. Butler—Have any of you used Stewart's of Glasgow? I have thought seriously of using it soon. I know in India and South Africa, where the difficulty is to get proper caulking materials, that they used a great deal of that pipe. I think it was in the Hong Kong works that they used it and found it perfectly water-tight under good high pressure. I know in the West, in hydraulic mining, that the pipes there under heads of 2,000 or 3,000 feet are simply forced in; they are not rivetted or coupled in any way, just simply forced in one length inside of another. Of course in that case it is wrought iron pipe.

Mr. Chipman—I fear that the return joint would not answer in this country, one reason being the extreme climate here, where the earth freezes to a considerable depth. I am not prepared to give a statement as to what extent the soil temperature varies from the atmospheric temperature. At McGill University some experiments have been made, but unfortunately they don't take the temperature at a great enough depth to be of much use. I have made some examinations myself on this subject, but they are not in a condition yet to be of much use to the Association or to the public. At a future time perhaps I will be able to give the result of my investigations.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

THE HAMILTON AND BARTON INCLINE RAILWAY.

By J. W. TYRRELL, C.E.,
Hamilton.

In selecting this subject for my paper I am perhaps a little ahead of time, as the railway is not yet completed; however, as the character of the work is something new in this country, a general description of the road, will perhaps not prove uninteresting.

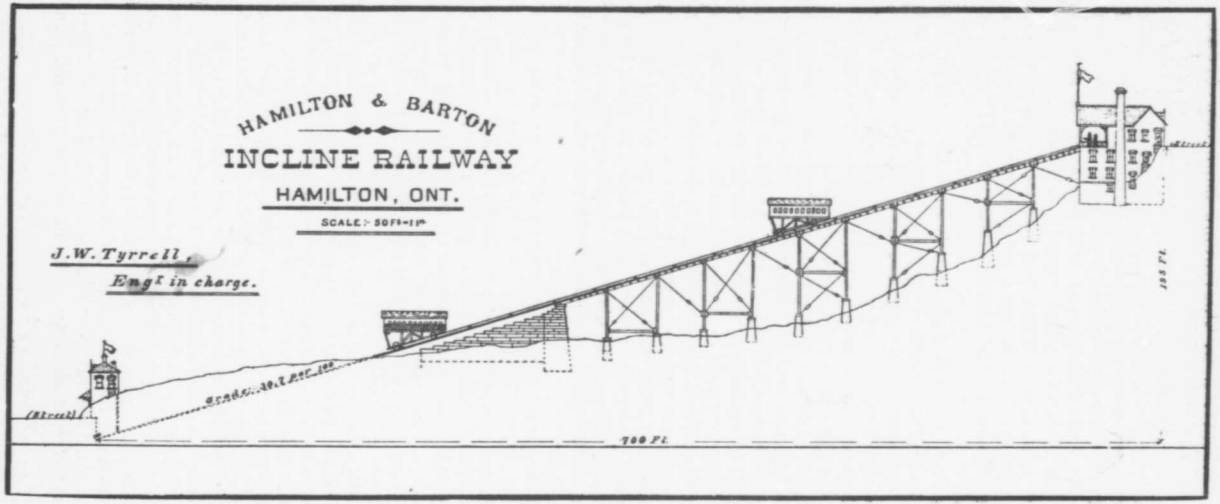
I will not attempt to go into details of construction or the calculation of strains; but will endeavour to convey a general idea of the appearance of the work and its mode of operation.

Those who are familiar with the city of Hamilton relatively to to the back-lying country will readily understand the object and great necessity of some means of facilitating traffic between the city and the rural districts to the south. All along the south side of the city, and extending for miles in either direction, stretches a bold, steep escarpment, commonly called the Hamilton mountain.

The city is built on what has been the beach of Lake Ontario—a strip of land about two miles wide—while the elevation of all the back country is from two to four hundred feet higher. This high table land, which has been cut away in part by the action of the lake, forms the escarpment, which is a very serious barrier to traffic, and though a number of roads have been constructed, and some of them in use for a great many years, leading up the mountain, their grades are so steep—varying from 10 to 15 feet per 100—that ordinary loads cannot be taken up with one team of horses, and light vehicles only with difficulty. The natural result of this inaccessability of the table land from the city has been that, though the most valuable resident property in Hamilton lies along the foot of this escarpment, the property on top, only a few hundred feet distant, is valued at little more than farm land and is very little built upon.

In consideration of these facts and with the object of making our southern suburbs more accessible, a local company, styling themselves the Hamilton and Barton Incline Railway Company, was formed, and secured an Act of Incorporation, which was passed on the 7th of April, 1890.

The greater part of the right of way was secured from the township of Barton over an original side-road allowance. The boundaries of this not being defined upon the ground, our recently departed and


HAMILTON & BARTON
INCLINE RAILWAY
HAMILTON, ONT.
SCALE: 50 Ft = 1 In
J.W. Tyrrell,
Engr in charge.
700 Ft.
185 Ft.

highly esteemed brother, F. F. Passmore, was instructed by "the department" to locate them, which instructions he carried out.

Next, the services of an engineer were required, and M. D. Burke, who had built several inclined railways in the United States, was engaged. He visited the ground and prepared the general plans for the road; but not being able to remain in the country the writer was employed to take charge of the construction. His proposition was to construct a straight cable road of uniform grade from a point at the commencement of the rapidly rising ground to the top of the escarpment.

The distance between these two points along the line of location was found to be about 700 feet, and the rise 195 feet. Of this rise 125 feet occur within the southerly 200 feet—that is, nearest the face of the hill; consequently, it was found that by adopting a uniform grade the central portion of the track would be at an elevation of about 50 feet above the surface of the ground.

The design of the company being to provide for the carriage of heavy loads of coal, electric cars, etc., as well as passengers, it would at once seem advisable that the road should be built in a substantial manner, and of materials which would require as few repairs as possible. After a good deal of discussion in order to meet these demands it was decided to adopt stone and steel as far as possible.

Whilst these preliminary, but essential matters were being considered, the writer was engaged in making the right of way surveys, cross-sectioning the ground, etc.; and these all having been arranged and completed, the general plan was prepared which in the main has been adopted, though a great many more or less important changes have been made.

I will now proceed with a description of the road as it is being built:—

It consists of a double track inclined railway. The lower portion of the road-bed is built upon the ground, partly through a cutting and partly upon an embankment formed by the material taken from the cut. The road-bed at the lower end commences in a pit 13 feet deep—that is, 13 feet below the level of the approach to the track.

This pit is formed to receive the peculiar-shaped cars of the road, which are built with level platforms and consequently, to suit the steep grade which is 30.7 per cent., require to be 13 feet high at the one end, the other being as close to the track as possible.

The cutting, which commences with a depth as mentioned, within a very short distance attains a depth of 30 feet. The width of road-bed being 34 feet the amount of material requiring to be excavated was therefore very considerable; and as much of this as could be used with economy was graded up to form an embankment. However, on account of the character of the material—it passing from a stiff clay near the surface to a soft, red rock at the bottom—and the heavy grade of the road, this work was very expensive.

The company having only acquired the right to occupy 48 feet of the side-road, it was necessary to build retaining walls, both to sup-

port the sides of the cutting and those of the embankment, which reaches a height of 25 feet.

The upper end of the embankment is terminated by a heavy stone abutment, built to receive the lower ends of four girders forming part of a steel trestle viaduct.

This abutment is built with large, heavy stone, and provided with wing walls turning back to meet the retaining walls, or rather the retaining walls are extensions of the wings. Some difficulty was experienced in obtaining a good foundation for this stone work, as the ground to a depth of about 20 feet was found to be loose made earth consisting of old boots, ashes, etc. A ravine had crossed at this place, but for years an untiring old squatter had been at work improving this scrap of a road allowance, only to have it taken from him when his task was about completed. In addition to the fact of the ground being loose, a large brick sewer cut through the foundation. This, however, was stepped over with large, flat stones, care being taken to leave plenty of room over the sewer to allow for settlement; and the former difficulty was overcome by excavating until a hard, stiff clay bottom was obtained.

These difficulties were met with again at other points higher up the bank in obtaining foundations for piers to support the steel trestle, which extends over about two-thirds of the length of the railway.

It would take up too much time and space to go into a very full description of this viaduct, but briefly it consists of eleven 30-feet spans and one of 37 feet.

Most of the bents, which are of steel, supported by two stone piers or pedestals, are from 30 to 50 feet in height. They carry four parallel track girders two feet in depth and spread eight feet from centre to centre. The whole structure is designed so that a moving load of 60,000 pounds will not produce a greater strain than 10,000 pounds per square inch of section on any member.

Across each pair of these inclined girders the ties are placed, and upon them, directly over the centre of the girders, the track rails, which are bolted to the girders.

There are then two parallel tracks eight feet from centre to centre of rails and eight feet apart. Upon the bank, below the trestle, the tracks are laid in the ordinary way, except that the ties are supported on the lower side by stout stakes to prevent them from working down hill; and the grade of the whole is as before mentioned, 30.7 feet per 100 feet.

On either track runs a single car 36 feet in length by 14 feet in breadth. The cars, as already intimated, are constructed with level platforms, being supported by wedge-shaped frameworks, which raise the platforms toward the lower end about 13 feet above the tracks.

The cars are combination affairs, being arranged to carry passengers and teams at the same time.

About five feet along one side of each car is covered in to form an apartment, the inside of which resembles the interior of a street car, while the remaining nine feet space is open, being enclosed only by

iron lattice walls on the sides and iron folding gates at the ends, which are opened alternately at top and bottom of the plane to admit of the entrance and exit of teams.

Attached to two heavy timbers, braced by heavy iron knees, in the lower framework of each car, are two steel wire cables, each having a tensile strength of 125,000 pounds by actual test. From the cars the cables are carried up the centre of the tracks on small carrier wheels 14 inches in diameter. To prevent noise and wear of the cables these are made so that they can be packed with leather or rubber.

At the head of the plane the cables pass over large cast iron sheave wheels, 10 feet in diameter (these being strongly supported by iron girders and columns). Thence the draught cable passes down to a winding drum 10 feet in diameter, about 30 feet below, situated in the basement of the depôt at the head of the plane; but the safety cable passes from the sheave wheels onto another large cast-iron wheel of about equal size, which is set in a heavy iron frame-work and securely anchored to the solid rock, so that in case of the possibility of an accident happening to the draught cable the cars would be held securely by the safety. Powerful brakes are attached at either side of the drum and to the safety wheel, and these may be applied by the engineer from the pilot house.

The foundations of the drum—which itself weighs about 10 tons—are strongly anchored down to the solid rock by 16 two-inch iron bolts.

The drum is controlled, and from it the road operated, by a pair of Wheelock engines of about 125 indicated horse-power.

The depôt, situated at the head of the plane, and which contains all the machinery, is a four storey stone and brick building. The basement is occupied by the engines and drum, the boilers and fuel room, and also contains a large room to be used as a workshop. The second and third flats are designed to be used as a dwelling for the engineer and his family, and the upper flat, which is only on a level with the top of the hill, contains the driving platform, a waiting room, a board room, and a large covered balcony looking out over the city. In the centre of the driving platform and opposite the centre of the tracks is situated the little 4 x 8 feet pilot house. This is built with large glass windows on all sides and commands a view of the whole road. Within it stands the engineer, who has within arm's reach the means of controlling every part of the machinery.

At the lower end of the plane there is another small but neat brick depôt, and dwelling above it for a caretaker. The entrance to this depôt is guarded by sliding gates, which are opened when a car is down. Into the face of the car pit are built four large iron air buffers—two for each car to strike against. These consist simply of 18-inch iron cylinders provided with pistons which are drawn out by wire sash-cords hung with weights and working over pulleys. I have here the general plan of the railway, and a few other plans of various parts of the work for the examination of any who may care to see them.

And now, in concluding this brief description, which I am afraid I have not made as clear as I would like to have, I may add that I will be pleased to give any further information or explanation to any who may desire it.

The road was completed and opened for traffic on the 11th of June, 1892.

DISCUSSION.

Mr. Butler—There are incline platforms similar in principle to the one Mr. Tyrrell describes so well, but none of anything like the size in this country. The idea of transporting a team of horses from the level of the lake up to the top of the mountain is a novel scheme. In the city of Quebec where they have about 300 to 400 feet to rise there is an elevator on the same principle, I think. Supposing something should go wrong with the machinery or both cables give way. I presume the drum is driven by gear wheels. I know of a case where a drum driven in that way stripped, the gear stripped through a flaw in the casting, and the drum ran away and the car dropped from the top to the bottom. In all such cases where you have incline railways it is necessary to provide against that contingency in constructing the drum or by putting some form of governor brake on the drum itself, and I have designed an arrangement which by fixing band brakes on both sides of the drum and governor balls driven at a definite speed, so that if anything went wrong that band brake would set and retain the car in its place. Something of that kind should be on all such incline railways.

Mr. Tyrrell—We have a powerful brake, but it could only be applied in this case by the engineer or some one in charge. It is on the drum, one on each side of the drum. They are belt brakes lapping around the drum, and by applying the foot to a lever the brake is applied.

Mr. Butler—Instead of leaving it under the control of the engineer, it ought to be perfectly automatic, driven with governor balls.

Mr. Tyrrell—The safety cable would come into play anyway, and would keep the car in equilibrium.

Mr. Butler—There was an accident of that kind in Kansas City, where a cable car dashed across through a passenger station and killed ten or twelve people. It has about thirty per cent. grade, and since then they have introduced a kind of grip brake; a grip driven by governor-balls regulated by the speed of the car, so that if the car gets a certain speed these grips clutch the centre rail and hold the car still.

Mr. Bowman—I suppose this cable is made of different strands. A case happened on the cable railway in St. Paul, I think, where one strand became broken and the grip was caught in the strands, so that they could not release it when they wanted to stop, and from that there was a very bad collision, killing four people.

Mr. Tyrrell—In this case the cable is attached permanently to the car and the cars balance each other.

The President—Is there any provision in case the cable should stretch at all?

Mr. Tyrrell—Yes; cables will stretch, especially when they are new. That will perhaps stretch a foot the first day. They are fastened by means of clamps turned over, put through a heavy eye and clavises put around the double cable, and these can be loosened. That is on the cars themselves. After cables have been in use for a short time they vary very little in length.

The President—I presume the cable on a road of that kind would last much longer than on the ordinary cable road?

Mr. Tyrrell—Yes; probably it would.

Mr. Bowman—Is this railway being built by a company by day labour, by letting the different contracts for the different iron works and looking after the work themselves, or by letting it all to one contractor?

Mr. Tyrrell—No; the different parts of the work have been let to different contractors, the steel and iron work. This trestle viaduct was built and put in place by the Hamilton & Barton Company. The engines and drum machinery are being built by Goldie & McCullough of Galt, and different contractors in that way are doing parts of the work. The earth work was done by contract as well. The different parts of the work have all been done by contractors.

Mr. McCulloch—What is the estimated cost of the road?

Mr. Tyrrell—Between $35,000 and $40,000, and the length is 700 feet.

Mr. Abrey—That is the cost irrespective of land damages, I suppose?

Mr. Tyrrell—Yes.

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EXPLORING FOR NICKEL.

By CHARLES E. FITTON, P.L.S.,
Orillia.

It would have been better, perhaps, if I had added the words "in the vicinity of Sudbury" to my title, but in the haste of replying to a request from the Executive Committee to prepare a paper I sent in the above rather indefinite heading.

It occurred to me that now our wealth in that particular ore is becoming a matter of general interest, and that there is seemingly an inexhaustible supply in the above mentioned district, extending for miles in a part of the country that was considered until lately a barren waste of little or no value to man or beast when stripped of its timber, it might be a benefit to some, and interest to others, if I endeavoured to reduce to writing the experience and knowledge gained in portions of three summers spent in that section exploring and locating mines.

The best season of the year for the work is undoubtedly the spring, beginning directly the snow goes off the ground or rocks, as the case may be, and the rivers and lakes open up, which generally takes place in the district mentioned between the 1st and 10th of May. You can then remain out with comparative comfort until about the middle of June, when the flies and mosquitoes take full possession and warn you off.

The outfit may be elastic, and depends on the depth of one's pocket, but you must have at least one good tent, a good Peterboro' canoe, one large and one small axe, a coarse whetstone or small grindstone, prospectors' hammers in number according to party, one or two magnifying glasses, and a magnet for each member of the party; drills (half a dozen or so), and small anvil to keep same in order, and two heavy hammers. A few pounds of blasting powder, and a limited quantity of dynamite should also be taken.

The next requirement is a knowledge of what to look for and how to look for it. I have known of parties camping for days on and near what afterwards turned out to be a rich deposit, and be quite innocent of the proximity of minerals; and I might say it is not always the most scientific man of the party who is the most successful, but rather the old bushman or trapper, who cannot tell one mineral from another, but whose sharp eye, trained to note every change, can at once discern any rock (decomposed or otherwise as the case may be) differing slightly from the surrounding formations. Sometimes it may be the colouring of the rock or earthy matter that first attracts

his attention which, followed up, leads to the exposure of a rich vein or bed of mineral.

A great help to the inexperienced, and which will amply repay the time spent, is a careful examination of the mines already discovered and working, as the surface indications are all very similar. Circumstances alter cases, so that it would be next to impossible to give any cast-iron rule for the best method of directing the efforts of a party without being on the ground.

I hope that readers will take the will for the deed in this my first contribution to the Association, as my forte evidently does not lie in an editorial direction.

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RAILWAY SURVEYS.

By HENRY K. WICKSTEED, P.L.S., C.E.,
Cobourg.

LAST year I had the honour of reading before you a paper containing a few notes on the "Theory of Railway Location," as at present accepted. I propose, on the present occasion, to follow this up by an equally brief discussion of the most modern "practice" in the same art; and in doing so I address myself more to the younger members of the Society, who will look in vain, as I have, for a description in the text books of the operations I am about to describe, and their proper sequence. Of the older, there will scarcely be one who has not his own way, and his own order of performing the necessary operations. To them I would say that I wish to compare notes with them rather than to dictate; and feeling that their ideas would be of interest and value to me as a student, and not a master, of my art, I feel the less diffidence in giving them the benefit of mine, and asking for an exchange in subsequent discussion. Without further apology for its shortcomings, I beg to submit the following description of my *modus operandi.*

Being asked to locate a line between two given points, and from a given point, in some definite direction, we shall first obtain the best map of the district which we can lay hands on, showing the natural drainage of the country, the travelled roads, villages, towns, and municipal boundaries, and studying this with due regard for the purpose and object of the railway, about which our letter of instructions will give us more or less information, we shall probably soon form some idea as to the approximate position of one or more desirable lines. Armed with this map, an aneroid barometer, a compass, and a note-book, we shall, if we are in a civilized country, proceed to the nearest livery stable and hire a strong, steady-going horse, and a buggy or other vehicle to match, and proceed to drive across country as near as may be to the likely-looking lines. If we can pick up a man to accompany us who knows the roads and the people, and who can give us information of the kind we ask when we ask it, and hold his tongue when we do not, we may do well to take him along to do the driving, and look after the horse. But beware of the garrulous creature who has lived in the country all his life, and longer, and knows every square inch of it—who will show you a beautiful line all ready for the ties and rails, and who will introduce you to every loafer around the village inn, as the "Surveyor come to lay out the new railroad," and

therefore a fit subject for "treatment" at the bar. Such a man is a nuisance, and will give you five times as much trouble as he is worth.

Few men whose eyes are not specially trained can detect a rise of 25, 50, or even 75 feet per mile, and so long as the ascent or descent is uniform and smooth they will call it "level" ground, and be much puzzled and disappointed when it is not found so satisfactory as rougher ground affording easier gradients.

They will talk *sotto voce* to their chums of your wish to favour Smith or Brown, who have friends upon the directorate and a seat on the County Council, and otherwise make themselves an intolerable nuisance.

My own preference is for a solitary drive, stopping occasionally for a closer inspection of some ravine or notch in the hills, or at a farmhouse or inn for straightforward answers to explicit questions as to the flood level of a creek, the value of land, the output of a mill, or the price of railway ties—such questions, in fact, as the average countryman can answer offhand, and without drawing on an imagination unduly excited by the knowledge that you are a railroad man.

Barometric readings should be taken frequently and entered fully in the note-book opposite the date, time of day, and an index number or letter, referring to a similar one on the plan, showing the point at which it was taken. When a stop is made for a meal, or overnight, take two or more readings at the same point; the differences, divided by that of the times, will give you a rate of rise or fall due to atmospheric changes independent of the altitude, and this rate will generally be found tolerably constant for the next and the preceding two or three hours, and multiplied by the proper interval of time will give a correction to be applied to other readings in order to obtain the relative altitudes.

When returning to the same point in the evening be especially careful to compare the reading with that of the morning, and so obtain an average rate for the whole day. This rating and correction is of the utmost importance. The results are at best reliable only as a rough guide, and without correction they are often utterly worthless and even misleading.

This preliminary skirmish or reconnoissance will sometimes occupy a long time, sometimes a short one, varying with the nature of the country, and the distance of our objective point. If not more than 10 miles away we can do much in a single day, but if 20—and other things are equal—there is really four times the amount of ground to be looked over, it is an area we are examining, not a line, and similar figures are as the squares of their similar parts—but often, as in the approach to terminals, the ground is so confined, and choice of route so limited, that there is little to be done in this way. Let us be careful, however, to examine all reasonable possibilities before making a more detailed survey, and consider the time well spent if we feel satisfied that we have examined a considerable area where there is *no* line to be had.

If the country is very wild and unexplored, a couple of Indians and a canoe will be substituted for the horse and buggy, or we may

have to travel on foot. But generally it may be said that it is better to follow the main arteries of travel in the first place from end to end before examining in detail, and that we should guard carefully against prejudice in favour of any one route until we have examined all from end to end.

The last few miles will very often prove quite impracticable a route which for the balance of the distance is incomparably the best. It is better, therefore, to take the line of travel which affords the most extended view of the country generally, rather than to attempt to follow closely some tempting lead or valley.

If we drive over the main roads and the hill tops, or travel over a canoe route well out in the lakes, we shall notice many small gaps and passes which would be quite unsuspected if we followed the valleys, or tramped through the woods *on* the route which we fancy the railway will take; and again there will generally be some governing points, crossings of rivers, or summits, which will fix the route and gradients for miles on either side, and it is these points which we wish to establish first and with least possible delay.

This is the true aim of the reconnoissance—not to examine or compare in detail one or more routes, but to find all possible routes, and by a process of elimination to weed out those which are impracticable, and gradually narrow the choice down to one, two, or three worthy of examination and comparison by the more precise methods which we will now go on to describe. In unsettled countries we shall probably now have to make a preliminary survey, mapping out the country on either side of the proposed route with sufficient nearness to determine distance and direction, and obtaining levels of summits and valleys with sufficient precision to establish the gradients.

A few years ago the only instruments in common use for such purposes were the transit or compass, the spirit level and the chain; and on the early C. P. R. surveys, for instance, hundreds of miles of line were laboriously cut through the wilderness, and carefully traversed, levelled, and chained, which were never afterwards used or seen.

Their main object was, I have said, to lay down on the map the main features of the country, and establish the levels of plains, swamps, lakes, rivers, and divides, and to form a base from which exploratory trips could be made on either hand with barometer and compass.

These objects, however, were generally lost sight of, and the party confined themselves to making an elaborate profile of the ground actually passed over, and a plan of the line actually run—represented by a very narrow red line on a very wide sheet of white paper, with daubs of brown colour and Prussian blue, representing such fragments of the topography as were visible from the immediate neighbourhood of the line, which in the case of our dense forests of spruce, tamarac, and pine, were very fragmentary indeed.

Later the objects of these surveys has come to be better understood, and the micrometer, Locke's hand-level, even the plane table, have been brought into use as affording means of getting much more extended information with quite sufficient accuracy, and in very much

less time. Four men in two canoes will make a survey of a canoe route with a light transit, provided with a gradienter or micrometer attachment, at the rate of several miles per day, and will be able to lay down *en route* by compass bearings or plane table, a large amount of detailed topography. Arrived at a portage one pair of men take over the horizontal measurements and the other the vertical. To do half this amount of work under the old method of running through the woods with transit, chain, level, and axe, would necessitate a party of ten or twelve men, with at least six or eight more to move camp outfit and supplies. With a fifth man attached to the little party, and a third canoe, the engineer in charge can make side excursions with barometer on either side of the micrometric survey as a base, and lay down the levels of a great number of points on either hand, with their approximate positions, and virtually carry on reconnoissance and preliminary survey at the same time.

In more settled and surveyed districts the preliminary survey is greatly simplified, and the work is reduced pretty much to more precise levelling in order to establish the gradients necessary, distances being obtained with sufficient accuracy from the township plans, but a more or less detailed survey of some portions may be necessary, especially in heavily wooded districts where limited field of view, and feeble definition of original survey lines, render the position of levels uncertain. By the time the preliminary survey is complete some one route will in all probability be proved the best, or at most, there will be alternative routes over only a portion of the distance. The length of the line, maximum gradient necessary, and even the approximate cost, and minimum radius of curvature, can be fixed with considerable precision by an experienced hand, and there is sufficient material to form the basis of a preliminary report to gladden or sadden the hearts of the directors. But whatever may be his private convictions the careful engineer will be extremely cautious about keeping on the safe side, and not raising hopes which subsequent location may prove to be groundless. Having prepared a small scale plan embodying all the information so far obtained in not too cumbrous shape, and having definitely decided upon our maximum gradients, we will proceed to run the trial line, or trial location, or, as I generally call it, the "traverse," or "location traverse." This in my own practice is a line carefully run with precise instruments and methods, and approximating as closely as the eye and the preliminary plan will enable us to run, the actual location, or centre line of the railway. Over the rougher portions it should be staked and levelled every 100 feet, and as the extra work entailed is small, it is as well to do so throughout. The extra stakes and hubs needed can often be used again on location, saving time and work, and the extra points (centred by the instrument), are often of great assistance in obtaining intersections and angles. A full party will, therefore, be needed, comprising transitman, leveller, two chainmen, picketman, rodman, and from two to five axemen. A "back-picketman" is sometimes added, but after trial of different methods, I have found that not only can he be dis-

pensed with, to the saving of one man's wages, but that more accurate work can be done, and annoyance avoided, by allowing the transit-man to set a small picket himself immediately behind the eyepiece of his instrument, the level of which is marked by a chip nailed or wedged across near the top of the picket. The punishment for touching this picket, or shoving it out of perpendicular is never clearly specified, but threats, though vague, are forcible, and generally entirely effective in protecting the point from desecration.

On rocky ground a back-picketman is often indispensable, but rocky ground is generally clear, and one of the axemen can usually be spared. He should be provided with a plumb-bob to enable him to plumb his picket.

Some engineers dispense with the transit altogether and run a picket line, taking angles with the compass. More line may certainly be run in a day in this way, and with a slightly smaller force, but the subsequent location is rendered more laborious and the checks upon its accuracy less certain, and balancing one thing against another I believe that it is time and money saved to run the trial line as elaborately and perfectly as may be, and to line in all chain stakes with the transit, so that each one is a transit point, and we may start a location tangent or loopline from any point without going backwards or forwards to finds hubs from which to locate the exact line at intersection.

On the other hand, while the instrumental work should be careful and reference points numerous, extreme nicety and precision is so much time wasted. We must project our location on a plotted plan and work from protracted angles, rarely from calculated ones; and the eyes and hands of few engineers are sufficiently keen and steady to take these angles off much more precisely than the nearest five minutes of angle.

If cumulative errors and mistakes in reading are guarded against by keeping the instrument in fair adjustment and by repeating all angular measurements right and left face the small errors will be found to fairly balance one another, and hence a small light transit which can be rapidly set up and handled is the best for the purpose, and will give in good hands excellent results, and much better than a large and heavy instrument carelessly handled. Young transitmen especially are far too prone to believe that it is the instrument which does the work and not the man, or perhaps I should say that when the work is good the man is generally credited, and when bad the instrument is held responsible.

My favourite graduation is from 0 to 180 on each side of the centre, with one double Vernier to limb. The telescope should be furnished with a tolerably sensitive bubble of its own and a clamp and tangent movement to its axis; but a vertical arc is a redundancy of no use except for an occasional latitude, which can be better determined with a box sextant.

A most useful attachment, the gradienter, has been already mentioned; it enables small angles of elevation or depression to be measured with extreme nicety, so that the transit may be used in con-

junction with an ordinary levelling-rod as a micrometer for measuring distances or for inclined levelling. The almost universal practice is to measure and book angles to right or left of the produced line; bearings should be promptly worked out and compared every few courses with the readings of the magnetic needle as a check against errors in reading, and an observation of polaris every ten or fifteen miles is little trouble and gives a great sense of security. Similarly in levelling, it is correctness and rapidity which are desirable, and not extreme precision. If care is taken to equalize back and foresights, and to manipulate the rod properly and wave on turning points, remarkably close work can be done with a very light instrument, and more rapidly and with less effort than with a large instrument with extremely sensitive bubble taking time to set up and adjust. A point not generally realized among instrument men is that the accuracy of a traverse, especially a very crooked one, is dependent on the excellence of the chaining quite as much as on the angular measurements, and ordinary chaining over rough ground can hardly be considered precise measurement. If chainmen can be trained to measure 400 or 500 feet across a ravine to within an inch of the actual distance then it may be of some use to approximate in reading angles to less than the nearest minute, otherwise it is time wasted. Similarly, if the rod is held on a nailhead at each turn, and the graduations are all exactly equal for its entire length and painted on the wood itself, if there is no play about the joints and the greatest care is taken to hold it exactly plumb, then, and only then, will it be consistent to use a 24-inch Y in place of a 10-inch dumpy.

As these auxiliaries are usually handled, however, on railway surveys, the only advantage a large and expensive level has over a small one is the more powerful telescope with which it is fitted, enabling longer sights to be taken in open country. In ordinary woodland or mixed country, however, this is seldom of much consequence, as the leveller can generally get along faster than the line can be cleared and staked, and has ample time on his hands, and on rough, broken ground rapidity in handling and setting up is of much more consequence than great power or range.

Common practice is to run the traverse completely through from one terminal point to another before starting to locate. If we are going to compare two distinct lines there is something to be said in favour of this, but not much, for the preliminary survey will give us a fair basis for approximate comparison, and if this is not decisive the traverse rarely will be, and a fairly close location is the only reliable basis for a determination of approximate quantities and cost. American engineers are going more and more into elaborate contour surveying over a considerable area enabling a location to be laid down on paper in the office, and a profile to be made and quantities taken out without the planting of a single location stake. If this is all that is wanted, well and good; and the contour plans are certainly very interesting to compile and very beautiful studies when completed; but while all this field work and office work is being done (and it takes considerable time) the first stakes and hubs are being dis-

turbed and ploughed out by the farmers. And the extremely delicate personal knowledge of the ground which is acquired by working over a limited amount of it all day with the instruments is dulled by time and subsequent work; and if the object is to lay down the actual centre line as quickly and accurately as possible, I prefer to run only so much traverse ahead as will determine two arbitrary points on location, and then locate at once, and work over the same ground again and again until we are satisfied no improvement can be made. This procedure economizes time in moving the party from point to point, and a great deal can be left to the memory from day to day, which would otherwise have to be noted at extreme length on plan or profile, adding to labour, and serving often rather to confuse than to give information.

Locating in this way, long maximum grades should always be run from the top downwards, as the summit is generally fixed in position and the lower end free; the length of the location and the necessary "slack" to compensate for curvature can not be determined with certainty beforehand, or only with considerable labour, and if we run upwards we are apt to find ourselves a foot or two lower in our summit cutting than we intended, or on the other hand, that we could have lessened the height of our stream crossings considerably lower down.

This running of a maximum gradient for a long distance is one of the prettiest, most interesting, and at the same time most tedious operations which the locating engineer has to perform, and any one who has the patience and ability to make a success of it may safely be trusted to find his own way out of any other situation in which he is likely to find himself placed. The traverse being run for a mile or two ahead, it is cross-sectioned with more or less exactness and detail. The grade elevations proposed are entered in the level book opposite the respective stations and their surface elevations as just determined, and the leveller can tell at a glance whether it is higher or lower ground which is required, and how much of either, and will regulate his work accordingly. Often, however, it is impossible without excessive curvature to approximate even as closely to the proper level as the traverse does, and then the problem is to balance the cuts and fills, with a leaning towards an excess of the latter. If the traverse has been well run a few shots with the hand-level will often be sufficient, the cross-sections being entered in the book opposite the stations in the form of a fraction, the numerator representing the distance at right angles to centre line from the latter, and the denominator the difference in elevation, thus:

$$\frac{40\ R}{+5} \quad \frac{70\ R}{+10.}$$

the signs representing higher or lower. The frequency of the cross-sections depends altogether upon the nature of the ground; 200 feet apart is generally near enough, provided that the highest points in cutting and the lowest in filling be among them. The object being to determine the greatest number of points on the inclined contour, the best run

traverse is that which is alternately a trifle too high and too low, and crosses it oftenest. With a line so placed on a tolerably regular slope, very little cross-sectioning is necessary. Stretching a sheet of manilla paper upon our camp drawing-board, we proceed to plot the line in pencil; I prefer to do this just as it is run by angles right or left from the preceding line produced. If the lines are long enough to warrant it the protracting is done by co-ordinates, one of which is assumed and the other taken out by inspection from a table of natural tangents, but usually a brass protractor of four or five inches radius, a boxwood scale, and a two-foot straight-edge, are all the instruments I care for.

If several miles are to be plotted on end on the same sheet accumulated errors will be avoided by plotting the bearings or by making out a table of latitudes and departures, but as in the side hill case we are considering a closure or check will be made between the traverse and the location at least every day, I keep only a mile or two, or say four feet on a scale of 200 feet to an inch plotted ahead, and then start afresh on a new sheet of paper from the end of the location as far as run. In this way I have seldom to plot more than 20 or 30 angles at most, and producing first and last courses to meet and comparing the angle with the calculated differences in bearing, I seldom find the error greater than 10 or 15 minutes, which means that the probable mean is not more than five minutes. With ordinary camp appliances it is hard to get much better results by any other method even if considerable time is spent. Having plotted plan in pencil, the lines and chainage should be inked in in fine black, and each chain stake ticked off. Then on the profile we lay the projected grade line, allowing enough "slack" to compensate for the necessary curvature which must be estimated. As the necessary flattening amounts to only about 17 feet per mile for a continuous 10° curve, a little error in the estimated quantity and pitch will not amount to a great deal in a mile or two. With this profile before us we proceed to tick off on the plan, with the aid of the cross-section notes, as many points as possible on the inclined contour or ideal location by offsets from the traverse, and then, commencing with the more crooked portions, to project a line intersecting this location at as many points as possible, consistent with a moderate radius of curvature, and a reasonable amount of tangent between the curves of contrary flexure. The curves must be sketched in first and the tangents drawn to them. A set of cardboard or hard rubber curves, cut to represent every 15 or 20 minutes of curvature on a scale of 400 feet to one inch from 0° to 2° and every half degree, from 2° to 4° will be found almost indispensable for scheming the lines rapidly and easily. Sharper curves can be drawn with the help of a table of radii with a pair of pencil dividers. It is well to commit the radii of all the even degree curves to memory as quickly as possible. The curves being schemed and their connecting tangents drawn in and produced to intersections with one another, the intersection angles are protracted and pencilled in, and the points of curvature and tangents, or B C's or E C's, are established. In the case of the flatter curves this is best done by taking out the subtangents

from Menck's invaluable table, and setting these off by scale on either side of the intersection point. With the sharper curves whose centres fall on the paper, it is often quicker and equally accurate to draw the terminal radius, which is of course perpendicular to the tangents, by means of a set-square slid along a straight-edge. The P C C's, or points of compound curvature, are found by drawing the common radius connecting the centres. Having schemed out sufficient work for the following day, we have next to give the transitman some notes by which to start and run it from the points he has on the traverse or previous location, the end of which (generally at end of a curve) will be shown on the plot. Connecting this existing location with that just projected, we shall be able to dictate to the transitman somewhat as follows: "Produce last curve to 1,072 + 50, or 2° 30′. Run tangent 1,055 feet, then 3° 20′ curve to right for 54° 10′; then tangent 550 feet, then 2° curve left for 15°. Run tangent to intersect with traverse, and 240 feet back from intersection start 1° 40′ curve to right for 24°."

These three curves will probably fetch us nearly a mile ahead, and unavoidable errors in plotting and scaling will be very apt to throw us considerably off our intended course if we run much further. To make things safe and fetch us back to our projected position, we may lay the next tangent down before the curve is run, by intersection with the traverse at some point to be determined from the plan. Our notes will then read thus: "At 1,224 + 30 on traverse, turn off angle 6° 30′ to R and run back to intersection with tangent of last curve, insert 4° curve, and at point 125 feet east of intersection with traverse put in B C of 2° curve for 10° 15′."

This is equivalent to taking a fresh start from the traverse and eliminating all previous errors in both lines, so far as their effect on the subsequent work is concerned, but it is often, nearly always, a tedious and tiresome operation, and I avoid it whenever possible by tieing to the traverse at the end of each day's work, and plotting the remainder as a continuation of location on a fresh sheet of paper. If the last curve or two are not exactly where we want them, we can run them over again in the morning in probably less time than the intersection process would have demanded, and the second running will bring us nearer to the true location than we could hope to get in any other way except by accident. There are so many indeterminate quantities which influence the proper location, and the minute graphic representation of the ground would consume such a large amount of time, that in my experience the true line is obtained more satisfactorily on extremely rough and difficult ground, by a series of approximations rather than by any attempt to lay the line down once for all on the plan and run it by a series of intersections on the ground. But there are some who locate every tangent directly from the traverse, run them out to intersection and put the curves in by the methods in the field books. In this method extreme or even moderate accuracy in the traverse and plotting are unnecessary, but the location operations are tedious, and it will generally be found that considerable subsequent revision is necessary. It is claimed again that the intersections are a

valuable and necessary check on the accuracy with which the curve is run. I prefer, myself, to check with a closely run traverse running over the same ground, and consequently more likely to agree in chainage than long sub-tangents whose intersections may be away off in the next township, and often altogether inaccessible.

Arrived at the end of our traverse, a new one is started as a continuation of the location with the same chainage carried on, and a new sheet of plan is started on in plotting, avoiding the handling of huge rolls of paper and confusion in grade heights owing to difference in length between the two lines.

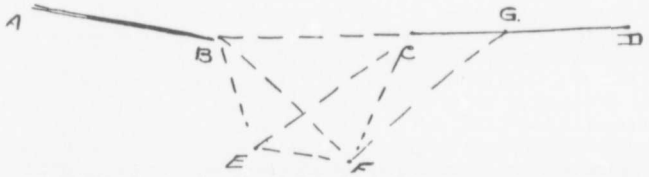
The bearings of location tangents should be kept worked up just as in the case of the traverse and discrepancies looked for at each closure. The actual running of curves and tangents, and the marking of stakes and lines has been too often described in books to make repetition necessary; there are numbers of tricks in handling instruments which can be learned only in practice.

In thick woods it is a laborious process to run in every stake with the transit on a long curve, and there are a number of methods of avoiding the necessity. The most common is to break the curve up into a number of chords, and run it as a series of straight lines off-setting the individual stakes into position as we go. The great trouble is that having started a chord we must run it to the end, and if this end is on an inaccessible point we have no recourse but to return to its beginning and lay off a fresh angle which may bring us out at an equally undesirable point. My own method, which I have never seen described or used by anyone else, is to run a series of short tangents to the curve which enables us to pick and choose our transit points. If we take care that the angle between any two tangents shall not exceed 4° or 5° on the flatter curves, and double this on the sharper, the difference in length between the tangents and the curve is small, and may often be neglected. For instance, we have a long 3° curve, starting from a given point on a given tangent; we put this point in as we come up, but, instead of setting on it, run straight on for, say, 100 feet further; and the tangent being 100 feet, the intersection angle will be 6°, which we lay off at the end. From the angle 100 ft. will fetch us to a point on the curve, which we again put in, but do not set over, running, say, 75 ft. further to a convenient transit point; the angle will now be 4° 30′, and so on —the sum of all the angles is the total angle of the curve—and the offset to the curve at any point is found by the formula $O = \frac{7}{8} ND^2$. Where O is the offset in feet, N the degree of curvature, and D the distance from the tangential point, or P. C., in hundreds of feet. We have the option at any time of setting on the P. C. and running the balance of the curve in the ordinary way.

There are numbers of beautiful problems in almost everyday occurrence in difficult country, many of which are described in the text-books and field-books, and many which are not and must be solved by individual ingenuity. One occurs to me which is unique in my own experience, and, I think, may be interesting to some of my

hearers, as the solution was so uncommon and simple and at the same time so entirely satisfactory.

A B represents a piece of located line running on a talus slope of broken rock at the foot of a precipice on the one hand and a deep lake on the other. C D is another precisely similar piece. Between B and C was a piece of the original rock wall which had resisted desintegration and jutted out from the rest of the cliff, descending almost perpendicularly 400 feet into deep water at its base, necessitating a tunnel some 500 feet in length. It was required to lay out and drive this tunnel from each end, at once—in other words to find the deflection angles at B and C—and the bearing of these points one from another. To run over the top was impossible, for the tunnel faces were as sheer as the lake side of the bluff, and the precipice not being exactly perpendicular the line B C could be seen to fall outside the face at the top. To offset a parallel line was equally impossible, as there were precipices on one hand and deep water on the other; but luckily two small islands existed about a quarter of a mile distant, on which we placed the stations E and F. Measuring



off a distance, C G as a base, the triangle C G F was solved, and from it E C F, and from these again B E F, B C F, and B E C. The angles F B C and B C F being known, the laying off of the tunnel line and the adjustment of the short curves at either end became a simple matter, and it is worthy of remark that after the heading was run through, the line laid off from C struck the hub at B within half an inch of the nail—a very fair result, considering that the instruments used read only to single minutes, and that B and C were 100 feet above E and F. A point which has puzzled me in connection with this problem is that while the angles F B C and B C F were all we wanted, and while we could protract these angles from a plotted plan without knowing anything except the angles at E and F, yet in order to calculate them we were obliged to at any rate assume a value for the base E F. Cannot some of our mathematicians solve this problem geometrically in some way, and work out the angles B C F, F B C with no other data, real or assumed, than the angles B E C, B E F, E F C, and B F C, which are all that are really necessary for the solution of the problem.

Having started out to give others information as to modern practice in location surveying I have wound up by asking the best solution of a geometrical question; and I feel so much more at home in the position of a student asking information than that of an

instructor in a very complicated and complex science, that I think I had better stop where I am and conclude this already very long paper with a reiteration of the principle I have already laid down, that if we are pushed for time, as we usually are, we can use light instruments and approximate rules and do very practically good work, but if you want good rest at nights take every precaution against blunders and mistakes. Small errors may be annoying, especially in the case of a bench mark which has two different elevations, one for the traverse and one for location, but they cannot be felt by the locomotive or the passengers. An error in feet or degrees will cause an amount of worry and expense, which must be experienced to be realized. I have said nothing about the modern practice of tapering curves by a gradual transition into the straight line, or one of greater or less radius, because it deserves a treatise in itself, and I have already read one before the Canadian Society of Civil Engineers and which is now bound up as part of the transactions of that body. Another treatise will be found in one of our last batches of exchanges. I think it is the Michigan Society's proceedings, and is well worth perusal. Further, this refinement of curve-running belongs rather to the subsequent operation of setting or laying out the work for construction, when a number of other small changes and improvements will usually be noticed.

But the theory and practice of running these transition curves will be found to repay study, even by those who may never have occasion to use them, and if there is anything more beautiful in art than a perfectly true circular curve on a railway track, with super-elevation exactly uniform and no elbows at the rail joints, it is the end of the same curve where it melts by imperceptible gradations into the tangent and the super-elevation is gradually reduced to zero. Would that there were more track artists, and that the argument that our road is as good as somebody else's, and therefore good enough, were made a crime to utter. Nothing is good enough, if at the same cost it can be made better. And nothing has been so well done that it cannot be improved. This is especially true in location, and it is well to remember that all locations and re-locations are merely successive approximations to perfection, and that there is always a chance to improve until the line is built, and not much afterwards.

DISCUSSION.

Mr. Butler—There is one little thing that Mr. Wicksteed draws attention to. He says: "American engineers are doing more and more to economize time." I think that no general rule of that kind should be laid down. There are cases where it is absolutely a necessity to lay down a contour plan, and there is no occasion for making the contour minutely accurate. I have a case in point somewhat similar to this. (Draws diagram and explains on blackboard.) In that way I was able to make my contour plan in the afternoon and go on with the location next morning.

Mr. Paterson—There are so many different circumstances. The case shown by Mr. Butler appears very clear on the board, but there are more difficult cases where the side hill is irregular, turning round in such a way that it may be very sharp curves. When you are running, not only for quantities but for gradient, and where you are bound down to 1 in 100, you will find after great care that you have shortened your line considerably, and the result is of necessity going over the ground again. So that you cannot make a rule in those difficult cases. Through a rough country, where there are rocks interfering with the sights, these contours are necessary. In the States they have a great deal of rough country—in Mexico and those places—and every place has rules of its own, and I think there should be great care in laying down a rule that such and such a thing must be done; because, as a rule, circumstances alter cases. And I think even in Canada we have rough ground necessitating the custom of the American engineers.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

ROCK EXCAVATION OF TRENCHES FOR WATER-WORKS PURPOSES.

By A. L. McCULLOCH, A.M., Can. Soc. C.E.,
Galt.

The object of my paper is to outline in as simple a way as possible the method adopted in the rock excavation required on the construction of the distribution system of the Galt water-works during the year 1891.

Galt is situated on the banks of the Grand River, which at that point runs almost due south, the town occupying the river valley, about 2,000 feet wide and a plateau about 60 or 70 feet higher on either side of the valley.

In the river valley the silurian rocks of the Guelph formation of some geologists, by others recognized as the upper series of the Niagara, outcrop in many places, and for the most part are within one and a half to two feet of the surface, there being above the rock from six inches to one foot of loose stone, and a surface covering of one foot of loam. The Guelph formation, as most of you know, is a highly fossiliferous dolomite limestone of a semi-crystalline texture of generally horizontal strata, from a few inches to four feet in thickness. In some places the strata is disturbed and wrinkled and in many ways shows signs of disturbance, particularly on the west side of the river.

The distribution system of the water-works comprised about 55,000 feet of four to twelve-inch cast-iron pipe, of which about 25,000 feet was in rock trench. The specifications for rock trench required that "all trenches shall be excavated to such depth as will give a covering of not less than five feet above the upper surface of the pipe;" that "No extra price will be paid for rock excavation in any part of the works. The contractor must satisfy himself as to the quantity and quality of the rock to be excavated. In rock trenches the rock must be excavated so that at no point shall any part of any pipe be within three inches of any rock, and the rock trench shall be at least 12 inches wider than the exterior diameter of the pipe laid."

"In rock trenches the pipes shall be bedded in sand, fine earth, cinders, ashes, or sawdust, as the engineer may direct; and shall be covered to a depth of two feet above top of pipe with sawdust, fine wood shavings, sand, gravel, or good earth." "No rock of greater weight than 50 pounds shall be returned to the trench." "The top six inches of filling shall be of finely broken stone."

Messrs. Garson & Purcer, of St. Catharines, were the contractors for all work on the distribution system, binding themselves to complete the work by December 1st, 1891.

They deserve great credit for the manner in which this work was done. It can easily be seen that in a work of such magnitude, the systematic handling of the men and plant, the use of all modern improvements in the method of working are great factors in successful contracting, and I do not think that the rock trenching on the work could have been more economically or more efficiently done. It certainly was done to the entire satisfaction of the engineer and to the people of Galt.

The method adopted in drilling was that of the percussion steam drill, but in many cases, such as in deep water drilling for the river crossings, or in an occasional hydrant run, and in cases where the first blast was not effective enough, hand-drilling for economic reasons had to be resorted to.

Both methods of hand-drilling, churn-drilling, and the jumper-drilling were tried, the former being probably the best in thick bedded strata, but the latter proved much more effective in the thin bedded, shaley rock that we were dealing with, and for this reason was most used, and requires two strikers, each with hammers weighing about five pounds, hitting the drill alternately and regularly; another man sitting down holds the drill, turning it slightly during the interval between the blows. The sitter's duty it is to keep the drill hole partially filled with water to prevent the powdered rock from accumulating under the bit and to sponge out the hole when necessary. In order to prevent this water from splashing on the sitter it is necessary to wind a piece of gasket or other similar substance around the drill at the rock surface.

If the work is of any magnitude and the time in which it is to be done limited, the hand-drill method would prove much too ineffectual to grapple with it. In such cases the method employed must have economy of time, convenience and efficiency completely under control, and a mechanical plan must be used. That used at Galt consisted of two Rand percussion steam drills and a traction steam-engine of about 15 horse-power and its connections. A traction steam-engine for trenching purposes is a necessity, as it can be moved at any moment into any desirable positon, whereas with the ordinary wheeled engine there would be constant inconveniences and delays by not having the moving power when desired. For this work an ordinary stationary engine would be entirely unsuited.

In almost all progressive farming localities traction engines for threshing purposes are used, so that one can readily be obtained, and even if it cannot be so obtained, may be brought by rail at a not very great expense.

The steam percussion drills work in the same manner as the "jumper" in hand-drilling, the motive power being steam. The principle of the drill is that of the direct acting steam-engine, the steam cylinder being vertical, the drill bars being connected directly with the piston.

The cylinder is supported on a tripod made of steel, on each leg of which is an arrangement for hanging heavy cast-iron weights of 250 pounds, which steady the machine against the upward reaction of the blows. The rotation of the piston, and hence of the drill bit, is effected by a spirally-grooved steel bar and a ratchet wheel, and so arranged that the rotation is effected in the upward stroke. As the drill bit does its work, the cylinder is lowered by means of a feed screw which is turned by the operator, who needs to have some skill, as he must operate this feed, regulate the supply of steam, and loosen the drill bar when it becomes wedged, as it frequently does in shaley rock

The drill bars used vary in length from two feet to eight feet, the latter being the maximum depth for the machine in use. The short one being used first is replaced by longer ones, as the hole deepens. The form of bit used is that of the x-shaped cutting surface, and requires re-sharpening every half-hour.

The steam, which is used at about 70 pounds, is conducted to the drill through inch and a half extra heavy wire-bound steam hose, and the machine may be worked fast or slow as the operator desires by means of the steam cock, which he works at his pleasure. Each drill requires an operator, and an assistant to help move the drill and to pour water into the drill hole to permit the effective working of the bit, and to keep the hole flushed out. After the hole is drilled it is stopped with a wooden plug to prevent dirt getting in until the blasting gang come up.

These machines set complete weigh about 850 pounds, including the three weights of 250 pounds for the tripod legs. The machine is so constructed that it can be taken apart when moved, or can be packed in a convenient form for shipment.

Some distance in the rear of the drilling gang come the blasting gang, who first sand-pump from each drilled hole any dirt accumulation, and then sponge out with a long wooden bar about one inch thick, usually of balsam or some evergreen wood with the bark peeled off; the bar also serves as a tamping bar. The sponging finished, the hole is then filled with the explosive. Judgment must be exercised in the kind, the strength, and in the form of an explosive needed in the different classes of work.

There can be no difference of opinion in the results required in trenching operations such as I am here describing; the rock must be so shattered that it can be handled with pick and shovel.

In thick-bedded rock a strong explosive is necessary, but in the thin-bedded rock, such as is met with in Galt, an explosive with 30 to 35% nitroglycerine proved sufficient for all purposes and did its work well. I do not think, though, that an easier rock for blasting than here met with is often found, nor would it be wise to use dualin or dynamite with less than 30% of nitroglycerine in its composition. The explosive used was dualin, made by the Hamilton Powder Co., put up in cylindrical paper-covered cartridges about 10 inches long and $1\frac{1}{4}$ inches in diameter, but are furnished to order in any required size.

Dualin or "False Dynamite" is a mixture of nitroglycerine with some granular absorbent of explosive substance. True dynamite has inert granular absorbent.

The nitro-glycerine undergoes no chemical change by this absorption, but retains all its characteristics—it freezes, burns, explodes, etc., under the same conditions as when in the liquid form. The absorbent minimizing the danger of explosion in transportation and handling by acting as a cushion to the nitroglycerine. The Dualin cartridges, or "sticks," as they are always called by the men on the work, are packed in sawdust in wooden boxes containing 25 or 50 pounds each.

Its transportation is very expensive, some of the railway companies refusing to carry nitro-glycerine in any form, while with those that do it is with the following restrictions: "That each car must be labelled 'dangerous explosive' in large letters. That cartridges must be packed in sawdust, as must also the boxes containing them. That a man must accompany each car to its destination." The company, I believe, do not ship in smaller quantities than in lots of 56 cases. For these reasons, "dynamite" is rarely used on small undertakings unless there happens to be a quantity stored in the locality. When bought in large quantities it costs about twenty-five cents per pound. After being brought to the place of destination, as a guarantee to the security of property, the dynamite must be stored in some isolated place; usually it will pay best to put a temporary storehouse with stove for heating, and shelving for spreading out the dynamite when thawing. Dynamite freezes at about 45° Fah. and when frozen is very difficult to explode, so that before use they must be thawed, which should be done gradually by spreading the cartridges out on some shelving in a warm room some distance from the fire. The dynamite cartridges are exploded by the use of a fulminating cap and safety fuse, with a Siemens magneto-electric blasting apparatus.

The cap or exploder used with ordinary safety fuse is a hollow copper cylinder about one-fourth inch in diameter, and an inch or two in length, containing 15 to 20% or more of fulminate of mercury mixed with some other ingredient into a cement, the mouth of the cap is closed with a sulphur cement through which pass two fine wires about one-eighth inch apart, connected in the fulminate with a fine platinum wire which is heated to redness with the current of electricity, ignites the fulminate and explodes the cap.

These exploders called platinum caps are sold in bunches of fifty, are always kept separate from the dynamite until wanted for use, when they are fastened into the cartridge. The electrical machine consists of a wooden box about the size of a small transit box, in the side of which are two openings for attaching the two leading wires to the exploders. From the top of the box projects a handle on a vertical bar, which is toothed and gears with a small pinion inside the box. When a blast is to be fired this handle is raised as far as it will come, and then pressed down quickly, putting into operation by means of the pinion the magneto-electric apparatus inside the box, generating the electricity, which is liberated the moment the handle in its downward

motion strikes a spring near the bottom of the box. The electrical machine is usually placed about 60 to 100 feet or more, as the necessity of the case requires, from the blast, and is connected thereto by two cotton-covered copper "leading wires."

It is always better in trenching work to fire a number of holes simultaneously, thereby getting the maximum effect from each charge. The number so fired being only limited by the length of the blasting shield and of the capacity of the electrical machine. Where this is done each hole has a platinum cap inserted into its charge, and one of the short wires attached to each cap is joined to one of those of the next cap, so that at each end of the series there is one free end of a short wire; to one of each a leading wire is fastened, thus producing a circuit from the electrical machine.

The electrical machine, size No. 3, weighs about 16 lbs., and costs about $25, while the next size costs about double that.

After each hole is sponged out it is loaded with the dynamite. The paper covering to the cartridges, or "sticks," as the men call them, should be slit open the whole length with a sharp knife, thereby allowing the dynamite to get free and to thoroughly fill the hole when pressed down with the wooden tamping bar; this operation should be repeated with each stick. When within two feet of the surface a half stick with the exploder attached is put in with another stick on top of that, the top of the hole is then filled with sand, tamped solid when the hole is ready for the charge, and such a charge will let daylight into any rock: a half-dozen of these holes charged simultaneously will break the rock almost as fine as macadam for a length of fifteen to twenty feet, so that the men can handle it entirely with pick and shovel.

The results may be better illustrated when I explain that, according to the specification, no rock greater in weight than 50 pounds is to be returned to the trench, and we had no trouble in enforcing it, for the simple reason that there were rarely any left to go back. With such a blast, then, as this, in order to prevent injury to person and property on the public streets from scattering stones and debris, it was necessary to cover the blast. The method of covering with loose timbers, with brush, etc., might possibly do with an exceedingly light blast, or with work in the open country, but on public streets, lined with houses, with people constantly passing and repassing, some method more economical of time, more satisfactory and secure in its results was necessary.

For the purpose the contractors used a shield made on the following simple principles: 5 oak timbers, 12 x 12 and 20 feet long, placed side by side and thoroughly bolted together, forming a platform 5 feet wide, sheeted on the bottom and sides with $\frac{3}{8}$ inch boiler plate, rivetted into one piece, and with the timbers thoroughly bolted together.

The shield weighed about 5 tons, and did its work most effectively. By its use the contractors could load each hole to the surface without fear of results. I have yet to hear of any person who was injured in any way during the construction of the works, and probably not more than a half-dozen window lights were broken after the first week's

use. Notwithstanding the immense weight of this shield it was on a number of occasions thrown high enough into the air to come down reverse side up; it will be readily understood, then, how a blast with such lifting power would shatter the rock fine enough to be shovelled, and that too with very little use of the pick. The width of trench so shattered was seldom more than four feet, and never wider than the five feet to prevent the use of the shield.

From its weight and form this shield was very difficult to handle, but by the use of two pairs of wheels that could be readily detached and removed from danger when firing a blast, there was very little loss of time in moving it forward its own length into position for the next blast.

These wheels were 60 inches in diameter, made on the same principle as the ordinary cart-wheel; the wheel rim was two and one-quarter inches thick, four inches wide, covered with a tire one-half inch thick. The axles were of machinery steel three inches square, five feet in length between inside of hubs, and seven feet four inches in length over all.

At its centre for a length of sixteen inches this axle was widened to six inches, and had an opening four inches by two and one-half inches through which passed a square threaded screw one and one-half inches in diameter and three feet long, with a swivel link attached to the lower end of the screw for linking into a hook in the shield.

This screw has no direct connection with the axle, but passes through a nut with bearings on both ends working on the axle, with journal caps bolted to the axle to keep it in position, thus giving it a side swing motion, the axle giving the forward and back motion.

When brought into use the wheels are run into position at the front and rear end of the shield, and each screw is linked to the hook on the shield, which, by means of a hand wheel eighteen inches in diameter at the upper end of the screw, is screwed up from the ground until suspended from the axle by means of these two screws.

The whole is then moved forward, the wheels running on planks on either side of the trench. When over its new position the shield is lowered over the trench by the screws, the wheels detached and removed until wanted to again move the shield forward after the blast. By means of this shield five men could blast in about two-thirds of a day what the two drills would cover in one day, so that it was not kept continuously in use.

It was easily moved in continuous trench blasting, but when moved any distance to a new street, was troublesome enough; for as each set of wheels was entirely independent of one another, they could not be guided when drawn by a team, for the wheels would persist in going any way but the right way in just about as helpless a fashion as a man without a backbone. In moving the shield, then, to a distance it was necessary to do so by hand, laying down planks for the wheels to run on, with a man at each wheel—a rather slow operation, but it was so seldom required that it did not prove a great inconvenience. But this difficulty might be overcome if it was often necessary to move the shield any distance at a time, as it seldom was on the work.

Drilling operations commenced about the middle of April, and were carried on continuously thereafter with two steam drills until the middle of August, in doing about 25,000 lineal feet of trenching, with a probable average of about five feet in depth of rock.

Part of this time for a few weeks, when running day and night, there was drilled, blasted, excavated, with pipe laid complete, about an average of 400 feet per day.

With trench well opened ahead, so as not to delay pipe-laying, the biggest day's laying of twelve-inch pipe in a rock trench was about 380 feet; of six-inch pipe, about 720 feet, including hydrant setting, etc. The biggest day's pipe laying of eight-inch was 710 feet without any hydrant settings.

It was impossible, however, to keep a pipe-laying gang continuously at work using only two drills, so that the average day's pipe-laying on each sized pipe was much smaller than the above. Usually when the pipe gang caught up to the blasting gang, they were shifted to some contiguous street in an earth trench, and kept there for some days, allowing them to have a good clear run in the rock trench before commencing again.

OBITUARY.

It is again our sad duty to record the death of a member of this Association in the person of Mr. David Suter Campbell, of Mitchell, who was called hence on February 28th, 1892.

Mr. Campbell was born in the city of Aberdeen in 1841. His father, the Rev. James Campbell, was at that time a minister in the Baptist Church in that city, but shortly afterward removed with his family to Canada and took charge of what is now known as the Jarvis Street Baptist Church in Toronto. He subsequently removed to the county of Perth, where the boyhood and youth of his sons were spent in the difficult task of acquiring an education with the very limited facilities of that period.

Among the relatives of the late Mr. D. S. Campbell may be mentioned his uncle, William Greig, who was Provost of Perth (Scotland), and had the honour to present "the keys" to Her Majesty on the occasion of her first visit to that place. Another uncle, James, was editor of the Edinburgh *Scotsman*. And still another, Alexander, was Principal of Perth Academy.

Mr. D. S. Campbell passed his preliminary examination for Provincial Land Surveyor in 1852, and received his commission to practise four years later. He then entered into partnership with Mr. W. Rath, P.L.S., and upon the death of the latter he assumed the whole practice. His professional labours, with the exception of one year spent in the North-West Territories, were chiefly in the counties of Perth, Huron and Middlesex, and during the past few years embraced an extensive practice under the various Drainage Acts of Ontario.

In his religious views Mr. Campbell was a staunch Presbyterian, and for eighteen years he was a prominent adherent of Knox Church, in Mitchell, holding at various times the position of Elder and Clerk of Session.

Mr. Campbell was married in 1875 to Miss Murdie, of the township of McKillop, who survives him.

In 1887 Mr. Campbell became a member of our Association, and continued an active member up to the time of his death.

Those of our members who were present at the first session of the annual meeting in February last will remember that Mr. Campbell attended and was appointed an auditor. Before the afternoon session of that day he was taken ill and was unable to attend again. On the following Saturday he was taken to his home in Mitchell, and died on Sunday, February 28th, of aneurism, deeply regretted by a large circle of friends.

Toronto, July 1st, 1892.

APPENDIX.

CHAPTER 34.

An Act to incorporate the Association of Ontario Land Surveyors and to amend the Act respecting Land Surveyors and the Survey of Land.

Assented to 14th April, 1892.

HER MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

1. Section 2 of the *Act respecting Land Surveyors and the Survey of Land* is amended by inserting the words "and shall have become registered under the provisions of this Act" immediately after the word "force," in the last line thereof. Rev. Stat. c. 152, s. 2, amended.

2. Sections 3, 4 and 5 of the said Act are repealed. Rev. Stat. c. 152, ss. 3, 4, 5, repealed.

3. All persons duly authorized to practice as land surveyors, as provided by the said Act, and all such other persons as shall become hereafter duly authorized so to practice under the provisions of this Act, shall, upon becoming duly registered as hereinafter provided, form "The Association of Ontario Land Surveyors," and shall be and are hereby constituted a body corporate under the said name of "The Association of Ontario Land Surveyors," having perpetual succession and a common seal, with power to acquire and hold real estate not exceeding at any time an annual value of $5,000, and to alienate, exchange, mortgage, lease or otherwise charge or dispose of said real estate, or any part thereof, as occasion may require, and all fines and fees payable under this Act, or under any by-law which may be passed by the association under the powers hereby granted, shall belong to the association for the purpose of this Act, and with power to the said association to pass by-laws not inconsistent with the provisions of this Act for the— Incorporation of Association of Ontario Land Surveyors.

(*a*) Government, discipline and honour of its members.

(*b*) Management of its property.

(*c*) Examination and admission of candidates for the study or practice of the profession.

(*d*) And for all such other purposes as may be necessary for the working of the corporation.

(*e*) All by-laws shall be prepared by the council hereinafter named, and be ratified by the association at the annual general meeting, or at a special general meeting, to be called for the purpose.

Council of management.

4. There shall be a council of management of the association consisting of the Commissioner of Crown Lands, the president and vice-president of the association, and six other elective members, to be elected and hold office as hereinafter provided. The said council shall elect annually one of its members as its chairman, and shall appoint from amongst the members of the association such other officers as may be necessary for the working of this Act, who shall hold office during the pleasure of the council.

(1) After the first election provided for in section 8 of this Act, the members of the association shall elect annually from amongst their number a president, vice-president, secretary-treasurer, two auditors and two members of the council of management, and the secretary-treasurer of the association shall be the registrar of the association and secretary of the board of examiners.

(2) The said president, vice-president, secretary-treasurer, auditors and two members of the council may be elected at the annual general meeting in each year, providing their election be unanimous, but should the election of any of them not be unanimous and a ballot be demanded for the election of any of them by any member of the association entitled to vote at such election, then and in every such case the president, or in his absence, the vice-president, shall appoint two scrutineers to count the ballots, and the secretary-treasurer shall at such annual general meeting receive nominations of candidates for the office or offices in respect of which such ballot shall have been demanded, and the election shall take place in manner following, that is to say:—

(3) At least one week after the annual general meeting, when a ballot has been demanded, the secretary-treasurer, as registrar of the association, shall send by post, when his address is known, the form of voting paper in the schedule "B" to this Act, to each member of the association, with the list of names of all candidates nominated at the annual general meeting, and also a list of the retiring members, and the voting for officers and members of the council shall be limited to the persons who have been so nominated.

(4) The votes at an election by ballot for officers and members of the council of management shall be given by closed voting papers in the form in the schedule "B" to this Act, or to the like effect being delivered to the secretary-treasurer of the association at his office, between the hours of ten o'clock in the forenoon and four o'clock in the afternoon, on any day between the second Tuesday of March and the first Tuesday of April in each year in which an election by ballot is held, and any voting papers received by the secretary-treasurer by post during the time aforesaid shall be deemed as delivered to him for the purposes of the election.

(5) The voting papers shall upon the Thursday after the first Tuesday of April be opened by the secretary-treasurer of the association in the presence of the scrutineers appointed as above provided, who shall examine and count the votes, and keep a record thereof in a proper book to be provided by the council.

(6) The persons who have the highest number of votes for officers and members of the council, as the case may be, shall be declared elected.

(7) Any person entitled to vote at the election shall be entitled to be present at the opening of the voting papers.

(8) In case of an equality of votes between two or more persons which leaves the election of one or more officers or members of the council undecided, then the scrutineers shall forthwith put into a ballot box a number of papers with the names of the candidates respectively having such equality of votes written thereon, one for each candidate, and the secretary-treasurer of the association shall draw from the ballot box, in the presence of the scrutineers, one or more of the papers sufficient to make up the required number, and the person or persons whose name or names are upon the papers so drawn shall be the officer or officers or the member or members of the council, as the case may be.

(9) Upon the completion of the counting of the votes and of the scrutiny, the secretary-treasurer shall forthwith declare the result of the election, and shall as soon as conveniently may be, report the same in writing, signed by himself and by the scrutineers, to the president of the association.

(10) In the event of any elector placing more than the required number of names upon the voting paper for members of the council, the first names only, not exceeding the required number, shall be taken for the members of the council.

(11) The elective members of the council shall hold office for the following terms respectively: the two members receiving the greatest number of votes at the first election, for the term of three years, and until their successors shall have been elected; the two members receiving the next greatest number of votes at such election, for the term of two years, and until their successors shall have been elected; and the last two members for the term of one year.

(*a*) No person shall be entitled to vote as an elector at any election unless all his fees to the association have been paid.

(*b*) All elections under this Act shall be by ballot if demanded as may be provided by the by-laws of the association.

(12) No person shall be eligible for election to any office or to the council, or qualified to fill any vacancy thereon, or to appointment by the council to any office, unless his fees have been paid, and unless duly qualified under the provisions of this Act and the by-laws of the association.

(13) All members of the council, elected after the first election, shall hold office for the term of three years, and until their successors shall have been elected, except as hereinafter provided.

(*a*) In case of resignation, death or dismissal of any member or members of the council, the other members of the council shall have power to fill all vacancies so caused.

(14) In case of any doubt or dispute as to who has or have been elected to any office, or as a member or members of the council, or as to the legality of the election of any such officer or officers, member or members of the council, it shall be lawful for the other duly elected officers and members to be, and they are hereby constituted, a committee to hold an enquiry, and decide who, if any, is, or are, the legally elected officer or officers, or member or members of the council, and the person or persons, if any, whom they decide to have been elected, shall be and be deemed to be the officer or officers, or member or members legally elected, and if the election is found to have been illegal, the said committee shall have power to order a new election.

(15) The annual general meeting of the association shall be held in the city of Toronto, on Tuesday of such week and month in each year, and at such place as the council may elect. Due notice of such meeting shall be given by the secretary-treasurer, to each member of the association,

by circular letter, posted to his registered address, at least ten days before such meeting.

(16) (*a*) There shall be a board of examiners for the examination of candidates for admission to study, and also for such other examinations as the council may hereafter prescribe for candidates for admission to practise as land surveyors, which board shall consist of the chairman of the council, four other members of the association, to be appointed by the council, and two to be appointed by the Lieutenant Governor in Council.

(*b*) Of the four appointed members of the first board of examiners by the council, two shall hold office for three years and two for two years. After the second year, the council shall appoint two members of the association as examiners, who shall hold office for the ensuing three years as the terms of the appointees shall expire, and in the case of the resignation, or death, or inability to act of any member so appointed, his place may be filled by the council for the unexpired term by the appointment of some fit and proper person.

(*c*) Of the two members of the first board to be appointed by the Lieutenant-Governor in Council, one shall be appointed to hold office for a period of three years, and the other for a period of two years, and thereafter the appointment shall be made for a period of three years, unless when made to fill an unexpired portion of a term.

(*d*) The chairman of the council shall be the chairman of the board of examiners.

(*e*) Three members of the board of examiners shall form a quorum.

(*f*) The council may also appoint competent persons to assist the board of examiners in any of the subjects of examination.

(17) The council shall have the power to fix the expenses and fees to be paid to any of the examiners, as above appointed, subject as hereinafter provided.

(18) (*a*) Each member of the board shall take oath of office before a judge of any county court, or a justice of the peace.

(*b*) The following shall be the form of the oath of office:—

I, of having been appointed a member of the board of examiners for the admission of provincial land surveyors for the Province of Ontario, do sincerely promise and swear that I will faithfully discharge the duties of such office without favour, affection or partiality. So help me God.

Sworn before me at this day of 18

Rev. Stat. c. 152, s. repealed.

5. Section 23 of the said Act is hereby repealed and the following enacted in lieu thereof:—

Dismissal or suspension of members.

23—(1) The council may in their discretion suspend or dismiss from the association any land surveyor whom they find guilty of gross negligence or corruption in the execution of the duties of his office; but the council shall not take action until the complaint made under oath has been filed with the secretary, and a copy thereof forwarded to the party accused, nor shall the council suspend or dismiss such land surveyor without having previously summoned him to appear in order to be heard in his defence, nor without having heard the evidence offered either in support of the complaint or in behalf of the surveyor inculpated, and all such evidence shall be taken under oath, which oath the chairman of the said council, or person acting as such in his absence, or the secretary, is hereby authorized to administer, and all such evidence shall be taken down by a duly qualified stenographer, as in the case of procedure in the High Court of Judicature. Any surveyor so dismissed or suspended within fourteen days after the order of resolution of dismissal or suspension may appeal to a Judge of the High Court against such order or resolution by giving seven days' notice to the council, and may require the evidence taken to be filed with the Registrar of the Chancery Division, and the costs of such appeal shall be in the discretion of the judge; unless the order or resolution shall be set aside or the judge or council shall otherwise order, any surveyor so suspended or dismissed shall not have the right to practise as a surveyor after the appeal shall have been disposed of, except where the time for which he was so suspended shall have expired.

(2) If the council think fit in any case, they may direct the registrar to restore to the register any name or entry erased therefrom either without fee or on payment of such fee, not exceeding the registration fee, as the council may, from time to time, fix, and the registrar shall restore the same accordingly.

Rev. Stat. c. 152, s. 24, repealed.

6. Section 24 of the said Act is repealed and the following enacted in lieu thereof:—

Payment of examiners.

24. The council shall pay to each member of the board of examiners, and the secretary of the board, who attends any examinations, out of the funds of the association, such sum not less than $6 nor more than $8 as the council may by by-law determine, for each day's attendance, and their travelling expenses.

Rev. Stat. c. 152, s. 25, sub-ss. 1-4, repealed.

7. Sub-sections one to four, inclusive, of section 25 of the said Act are repealed and the following enacted in lieu thereof:—

(1) By every person duly authorized to practise as a land surveyor under the provisions of this Act on applying for registration under this Act, the sum of $1. Fees.

(2) By each member of this association an annual membership fee of $4.

(3) By each apprentice at the transmitting to the secretary the indenture or articles of such apprenticeship, $10.

(4) By each candidate for examination, with his notice thereof, $1.

(5) By each applicant obtaining a certificate as a fee thereon, $2.

(6) By each applicant receiving a certificate to practise as an admission fee, $30.

And such fees shall be payable to the secretary-treasurer for the use of the association under the provisions of this Act.

8.—(1) The first election of president, vice-president, secretary-treasurer, auditors and members of the council of management shall take place on the 2nd day of July, one thousand eight hundred and ninety-two, by such returning officer as the Commissioner of Crown Lands may appoint, and one month's notice thereof shall be given by the returning officer in the *Ontario Gazette*, and to each duly authorized provincial land surveyor practising in Ontario, by mailing the same to his usual post office address. And the persons entitled to vote at such first election shall be all persons who are at the time of the holding of the said meeting duly authorized to practise as land surveyors in the Province of Ontario whose names are on the list of Provincial land surveyors in the list thereof in the Crown Lands Department, or on the list thereof in the hands of the secretary of the board of examiners, and who are resident at the time of the election in the Province and pay to such returning officer for the association the registration fees authorized by this act. First election of officers and council.

(2) Such returning officer shall perform the like duties in respect of such election as the secretary-treasurer of the association may perform under section 4, and such election shall be by ballot as provided by said section 4, and the proceedings for transmission of ballots, voting by same, opening and counting the same, and otherwise as regards such first election shall as near as may be, be the same as provided by sub-section 3 of section 4 to sub-section 11 of said section 4, inclusive, except as to any proceedings to be taken at the annual general meeting or special general meeting.

(3) The Commissioner of Crown Lands may appoint for the purpose of the first election two scrutineers who shall perform all the duties to be performed by the scrutineers under section 4.

Subsequent elections.

(4) Every subsequent election of president, vice-president, secretary-treasurer, auditors and members of the council of management shall be held at the annual general meeting on the fourth Tuesday in February in each year, unless a ballot shall have been demanded, as herein elsewhere provided, and the persons qualified to vote at such election shall be such persons as are members of the association who have paid all fees due to the association from them under the provisions of this Act and of any by-law of the association.

Registrar of association.

9. It shall be the duty of the secretary-treasurer of the association to act as registrar of the association, and to make and keep a correct register in accordance with the provisions of this Act, as shown in schedule "A" hereto of all persons who shall be entitled to be registered under this Act, and to enter opposite the names of all registered persons who shall have died a statement of such fact, and from time to time make the necessary alterations in the addresses of persons registered.

Effect of omitting to register.

10.—(1) Any person entitled to be registered under this Act, but who neglects or omits to be so registered shall not be entitled to any of the rights or privileges conferred by registration under the provisions of this Act so long as such neglect or omission continues.

Removal of names from list.

(2) Any registered surveyor desiring to give up practice can have his name removed from the registered list of practitioners at any time upon giving written notice to the secretary of such desire, and paying up all fees due from him to the association to date, and thereafter shall not be liable to the association for annual or other fees, and may, upon like notice of his intention to resume practice and paying the annual fees for the year in which such notice is given, have his name re-registered.

Registrar not to admit improper entries.

(3) No name shall be entered in the register, except of persons authorized by this Act to be registered, nor unless the registrar be satisfied by proper evidence that the person claiming to be entitled to be registered is so entitled, and any appeal from the decision of the registrar shall be decided by the council of the said association, and any entry which shall be proved to the satisfaction of such council to have been fraudulently or incorrectly made, shall be erased from or amended in the register by order of such council.

(4) The association may by by-law provide that any surveyor who has been in the actual practice of his profession for a period of thirty-five years or more and has during the entire period being a duly qualified surveyor may be exempted from the operations of this Act.

Who shall be entitled to register.

11. Any person duly authorized to practice as a surveyor of lands, in the Province of Ontario, under the provisions of the said Act, or who had been so authorized before the passing thereof, according to the laws then in force, and who may not have become registered under the provisions of this Act, may become a member of the association of Ontario Land Surveyors, by causing his name to be registered with the registrar of the association within six months after the election of such registrar, and by paying to such registrar such fees as may by by-law or otherwise be made payable in that behalf.

Omission to register through absence, etc.

(2) In case any such person as aforesaid omits to be registered within said period of six months through absence, illness or inadvertence, such person may be admitted by the council to enrolment as an Ontario land surveyor upon payment of the arrears of fees or such part thereof as the council may direct.

Penalty for practising while unregistered.

(3) From and after the first day of January, 1891, no person, unless registered as above provided, shall be entitled to take or use the name or title of Ontario land surveyor, either alone or in combination with any other word or words, or any name, title or description implying that he is registered. Any person who, after the above date, not being registered under this Act, takes or uses such name, title or description as aforesaid, shall be liable on summary conviction to a fine not exceeding $20 for the first offence, and not exceeding $50 for each subsequent offence.

Register of practising surveyors.

12. The registrar of the association shall in every year cause to be printed, published and kept for inspection at his office, free of charge, under the direction of the council, a correct register of the names in alphabetical order, according to the surnames, with the respective residences, in the form set forth in schedule "C" to this Act or to the like effect, of all persons appearing on the general register, on the first day of January in every year, and such register will be called the "Surveyors' Register," and a copy of such register, for the time being, purporting to be so printed and published as aforesaid, shall be evidence in all courts, and before all justices of the peace and others, that the persons therein specified are registered according to the provisions of this Act, provided always that in case

of any persons whose name does not appear in such copy, a certified copy under the hand of the registrar of the association of the entry of the name of such person in the register, shall be evidence that such person is registered under the provisions of this Act.

Penalty for making improper entries.

(2) If the registrar shall wilfully make or cause or allow to be made any falsification, in any matters relating to the register, he said be deemed to be guilty of an offence, and shall be liable, upon summary conviction therefor, to a fine of not less than $20 and not more than $50, and in default of payment, to imprisonment for a period of six months, unless the fine and costs shall be sooner paid.

Penalty for procuring entry by fraud.

13. Any person who wilfully procures or attempts to procure registration under this Act, by making or producing or causing to be produced or made any false or fraudulent representation or declaration, either verbally or in writing, that he is entitled to such registration, shall be deemed guilty of an offence, and shall be liable, upon summary conviction thereof, to a fine of not less than $20 and not more than $50, and in default of payment, to imprisonment for a period of six months, unless the fine and costs be sooner paid, and the council may remove the name of the offender from the registry.

Recovery of fees and penalties.

14. All fees payable under this Act may be recovered as ordinary debts due the association, and all penalties under this Act may be recovered and enforced before one or more justices of the peace, in manner directed by the Revised Statutes of Canada, chapter 178, entitled *The Summary Convictions Act*, and any Act amending the same.

(2) Any sum or sums of money arising from convictions and recovery of penalties as aforesaid, shall be paid immediately upon the recovery thereof, by the convicting magistrate to the registrar of the association.

(3) Any person may be prosecutor or complainant under this Act, and the council may allot such portion of the penalties as may be expedient towards the payment of such prosecutor.

Services of notices, how effected.

15. Subject to the other provisions of this Act, all notices and documents required by, or for the purposes of this Act to be sent, may be sent by post by registered letter, and shall be deemed to have been received at the time when the letter containing the same would be delivered in the ordinary course of mail, and in proving such sending it shall be sufficient to prove that the letter containing the notice or document was prepared and properly addressed and put in the post. Such notices and documents may be in writing or in print, or partly in writing

and partly in print, and when sent to the council or other authorities, shall be deemed to be properly addressed if addressed to the said bodies or authorities, or to some officer of the council or authority at the principal place of business of the council or authority, and when sent to a person registered under this Act, shall be deemed to be properly addressed if addressed to him according to his address registered in the register of the association.

Application of fees.

16.—(1) All moneys arising from fees payable on registration, or the annual fees, or from sale of copies of the register or otherwise shall be paid to the registrar of the association to be applied in accordance with such regulations as may be made by the council for defraying the expenses of registration, and other expenses of the execution of this Act.

(2) The council shall have power to invest any sum not expended as above, in such securities as shall be approved of by the Government of the Dominion of Canada or of the Province of Ontario, in the name of any three of their number appointed as trustees, and any income derived from any such invested sums shall be added to and considered as part of the ordinary income of the association.

(3) The association may also use surplus funds or invested capital for the rental or purchase of land or premises, or for the building of premises to serve as offices, examination halls, lecture rooms, libraries, or for any other public purpose connected with land surveying.

Accounts to be kept.

17. The secretary-treasurer, registrar of the association, shall enter in books to be kept for that purpose a true account of all sums of money by him received and paid under this Act, and such account shall be audited by the auditors, and submitted to the council and association at such time or times as they may require, and it shall be the duty of the said secretary-treasurer, as registrar of the association to keep the register in accordance with the provisions of this Act, and by-laws of the association and the orders and regulations of the council.

Short title.

18.—(1) This Act may be cited as *The Ontario Land Surveyors Act*, and may be read with and as part of said chapter 152 of the Revised Statutes of Ontario, 1887.

(2) The words, "Ontario Land Surveyor" shall include the words, "Provincial Land Surveyor."

SCHEDULE "A."

(*Section 9.*)

NAME.	Residence. P.O. address.	Qualifications and additions.	When admitted.	When ceased to practise.	When died.

SCHEDULE "B."

(*Section 4.*)

FORM OF VOTING PAPER.

Association of Ontario Land Surveyors election, 18 .

I, of the
in the county of
member of the Association of Ontario Land Surveyors, do hereby declare,

(1) That the signature affixed hereto is my proper hand writing.

(2) I vote for A. B., of the of
in the county of , (as president, vice-president, secretary-treasurer, auditor *or* auditors, *as the case may be.*)

(3) That I vote for the following persons as members of the council of management of the association of Ontario Land Surveyors:—A. B., of the of in the county of C. D., of the of in the county of.

(4) That I have signed no other voting paper at this election.

(5) That this voting paper was executed on the day of the date thereof.

Witness my hand this day of A.D. 18 .

SCHEDULE "C."

(Section 12.)

"Surveyors' Register," 1st January, 18 .

NAME.	Residence. P. O. address.	Qualifications and additions.

LIST OF MEMBERS.

ACTIVE MEMBERS.

NAME. OCCUPATION. ADDRESS.

Abrey, George Brockitt ..... Toronto Junction.
Town Engineer.

Aylsworth, Wm. Robert ..... Deseronto.
Engineer for Napanee, Tamworth and Quebec Railway.

Aylsworth, Charles Fraser, Jr ..... Box 60, Madoc.
Engineer for Tps. of Sydney, Thurlow, Rawdon, Huntingdon, Hungerford, Madoc and Tyendinaga, also Villages of Madoc and Tweed.

Baird, Alexander ..... Box 195, Leamington.
Engineer for Tps. Romney, Tilbury W., Colchester S., and Malden, also Town of Leamington.

Beatty, David ..... Parry Sound.

Bell, James Anthony ..... St. Thomas.

Berryman, Edgar, M. Can. Soc. C.E. ..... Sherbrooke, Que.
Chief Engineer Quebec Central Railway.

Bolger, Francis ..... Penetanguishene.

Bolton, Jesse Nunn ..... Albion.

Bolton, Lewis ..... Listowel.
Engineer for Townships of Elma, Grey, Morris, Town of Listowel and Village of Drayton.

Booth, Charles Edward Stuart, A. M. Can. Soc. C.E., Radford, Virginia.

Bowman, A. M. ..... Berlin.

Bowman, Clemens Dersteine ..... West Montrose.
Engineer for five Townships.

Bowman, Herbert Joseph, Grad. S.P. Sc. (Toronto); A.M. Can. Soc. C.E. ..... Berlin.
Superintendent Berlin Water Works.

Browne, Harry John ..... 17 Toronto Street, Toronto.

Browne, Wm. Albert ..... 17 Toronto Street, Toronto.

Burke, Wm. Robert ..... Ingersoll.

NAME. OCCUPATION. ADDRESS.

Butler, Matthew Joseph, M. Am. Soc. C.E.; M. Can. Soc. C.E.; Asso. M. Inst. C.E.....Desoronto, Ontario.
Chief Engineer The Rathbun Co. System, Bay of Quinte Ry. & Nav. Co., Thousand Islands Ry., K. N. & W. Ry.

Caddy, C. F. .....Campbellford, Ontario.

Campbell, Archibald Wm., A. M. Can. Soc. C.E.....St. Thomas.

Casgrain, Joseph Philip Baby, A. M. Can. Soc. C.E...Morrisburgh.

Cavana, Allan George .....Orillia.
Land, Loan and Insurance Agent.

Cheesman, Thos .....Mitchell.

Chipman, Willis, B.A.Sc. (McGill); M. Am. Soc. C.E.; M. Can. Soc. C.E.....103 Bay Street, Toronto.
Branch Offices at Brantford, Galt, Barrie and Brockville.
Civil and Sanitary Engineer.

Coad, Richard .....Glencoe.

Cozens, Joseph .....Sault Ste. Marie.
Mem. Am. Soc. M.E., Pres. Sault Ste. Marie & Hudson Bay Ry.

Davidson, Walter Stanley.....16 Warren Ave., Petrolea.

DeMorest, Richard Watson.....Sudbury.

DeGursé, Joseph .....Windsor.
Chief Engineer, Lake Erie, Essex & Detroit River Railway.

Dickson, James .....Fenelon Falls.
Engineer for Tp. of Fenelon, Inspector Crown Lands Surveys.

Doupe, Joseph, C.E. (McGill)...190 Smith Street, Winnipeg, Man.

Drewry, William Stewart, D.T.S.....Dept. of Interior, Ottawa.
Triangulation Survey of part of Rocky Mountains, Topographical Survey of Canada.

Ellis, Henry Disney, C.E.....Toronto.
Assistant Engineer in charge of Roadways, City Engineer's Dept.

Esten, Henry Lionel.....157 Bay Street, Toronto.

Evans, John Dunlop, M. Can. Soc. C.E., Copper Cliff, near Sudbury, Ontario.
General Manager Canadian Copper Company, Chief Engineer Central Ontario Railway.

Fairbairn, Richard Purdom.....127 Major Street, Toronto.
Engineering Draughtsman, Public Works Dept., Ontario.

Farncomb, Frederick William .....Box 107, Exeter.
Engineer for Exeter, also Townships of Hay and Stephen.

NAME. OCCUPATION. ADDRESS.

Fawcett, Thomas, D.T.S. ..... Gravenhurst.
Dominion Government Surveys.

Fitton, Charles Edward ..... Drawer 31, Orillia.
Engineer Wahnapatæ Mining Company, Land and Insurance Agent.

Flater, Frederick William ..... Chatham.

Foster, Frederick Lucas ..... 157 Bay Street, Toronto.

Galbraith, John, M.A.; Asso. M. Inst. C.E., D.T.S. ..... Toronto.
Professor of Civil Engineering, School of Practical Science.

Galbraith, William ..... Bracebridge.

Gardiner, Edward ..... St. Catharines.
Engineer County of Lincoln.

Gaviller, Maurice, C.E. (McGill) ..... Barrie.

Gibbons, Joseph, Grad. S.P.S ..... Renfrew.
Triangulation Survey Ry. Belt, Rocky Mountains.

Gibson, Peter Silas, B.Sc.; C.E.; M.Sc. (Univ. of Mich.). . Willowdale.

Gilliland, Thos. B. ..... Eugenia.

Hart, Milner ..... 103 Bay Street, Toronto.

Henderson, E. E. ..... Henderson, Maine.

Howitt, Alfred ..... Gourock, Ontario.

Hutcheson, James ..... Nassagaweya.

Jephson, Richard Jeremy ..... Calgary, Alberta, N.-W.T.

Johnston, Robert Thornton ..... Sudbury.

Jones, Thomas Harry, B.A.Sc. (McGill) ..... Brantford.
City Engineer.

Jones, Charles Albert ..... 215 Dundas Street, London.

Keefer, Thos. Coltrin, C.M.G.; M. Inst. C.E.; Pres. A. Soc. C.E.; Can. Soc. C.E ..... Ottawa.

Kennedy, James H ..... Shedden.
Resident Eng. Pac. Ex. Great Northern Ry., Montana.

Kirk, Joseph ..... Box 373, Stratford.
Engineer for Townships of Mornington, South Easthope, North Easthope and Village of Milverton.

Kirkpatrick, George Brownly ..... 8 Coolmine Road, Toronto.
Chief Clerk Survey Branch, Department of Crown Lands.

NAME. OCCUPATION. ADDRESS.

Klotz, Otto Julius, D.T.S.; C.E. (Univ. of Mich.).....Preston.
Astronomer for Department of Interior.

Laird, James Steward .....Essex Centre.

Laird, Robert, Grad. S. P. Sc. (Toronto),
City Surveyor's Office, Toronto.

Lawe, Henry ....Hare Building, West Main St., Norfolk, Virginia.

Lendrum, Robert Watt .....VanKleek Hill.

Lewis, J. B ..... Brunswick House, Ottawa.

Livingston, T. Chisholm.....Hamilton.

Lumsden, Hugh David, M. Inst. C.E.; M. Can. Soc. C.E.,
7 Homewood Ave., Toronto.
Supervising Engineer Calgary and Edmonton, and Qu'Appelle, Long Lake and Saskatchewan Rys., and Engineer Can. Pac. Ry.

McAree, John, Grad. S.P.Sc.; D.T.S.....81 Rose Ave., Toronto.

McCulloch, Andrew Lake, Grad. S. P. Sc., Toronto.....Galt.
Engineer for Town of Galt, Townships of Beverley and North Dumfries.

McDowell, Robt., Grad. S.P.S., Assoc. M. Can. Soc. C.E.,
Owen Sound.
Engineer for Tps. Derby, Sydenham, Sullivan and Saugeen.

McEvoy, Henry Robertson .....St. Mary's.
Tourist's Guide, North Bay.

McFarlen, George Walter .....10 St. Vincent Street, Toronto.

McKay, Owen..... .....Windsor.
Assistant Engineer, L. E. E. & D. R. Ry.

McKenna, John Joseph .....Dublin.

McMullen, Wm. Ernest.....7 Murray Street, Toronto.
Eng. Dept. Can. Pac. Ry.

Macnabb, John Chisholm .....Chatham.
Engineer for Erie and Huron Ry. and Town of Chatham.

Manigault, W. M..... .....Strathroy.

Miles, Charles Falconer .....Walkerton.
Engineer Minto, Normanby, Carrick, Brant, Greenock, Bruce, Arain and Town of Wingham.

Moore, John McKenzie .....Albert Building, London.
Engineer for four Townships.

Morris, James Lewis, C.E. (Toronto University), A.M.
Soc. C.E.....Pembroke.
Engineer County of Renfrew.

NAME. OCCUPATION. ADDRESS.

Mountain, George Alphonso ..... Ottawa.
Chief Engineer Can. Atlantic Ry., and Chief Engineer Ottawa and Parry Sound Ry.

Murphy, Chas. Joseph ..... 157 Bay Street, Toronto.

Niven, Alexander ..... Haliburton.
Outline Surveys, Crown Lands Department.

Ogilvie, William ..... Ottawa.
Dominion Land Surveyor.

Patten, Thadeus James ..... Little Current.
Agent for Can. Perm. Loan and Savings Co.

Paterson, Jas. Allison, M. C. Soc. C.E.,
9 Masonic Chambers, Toronto St., Toronto.
Engineer for Toronto Belt Line Ry.

Proudfoot, Hume Blake, C.E. (University of Toronto) .... Toronto.

Purvis, Frank ..... Eganville.
Engineer for Townships of Bromley and Wilberforce.

Rainboth, E. J. ..... 48 Sparks St., Ottawa.

Roberts, Vaughan Maurice ..... 11 Peter St., Toronto.

Robertson, James, Grad. S. P. Sc. ..... Glencoe.

Rogers, Richard, Birdsall; B.A.Sc. (McGill) ..... Peterboro'.
Superintending Engineer Trent Canal.

Rorke, L. V. ..... Sudbury.

Ross, George, B.A.Sc. (McGill) ..... Welland.
Engineer for Towns of Welland and Niagara Falls, and six Townships.

Russell, Alexander Lord ..... Box 240, Port Arthur.
Mining Engineer.

Sankey, Villiers. ..... City Hall, Toronto.
City Surveyor.

Sanderson, Daniel Leavens ..... Enniskillen.

Saunders, Bryce Johnston, B.A.Sc. (McGill).... Box 114, Brockville.
Engineer for Counties Leeds and Grenville, Townships Augusta and Elizabethtown.

Scane, Thomas ..... Ridgetown.
Engineer for Townships of Orford and Done, and Town of Ridgetown.

Seager, Edmund ..... Rat Portage.

Sherman, Ruyter ..... Brantford.
Assistant City Engineer.

Smith, Henry ..... Crown Lands Dept., Toronto.
Supt. Colonization Roads.

NAME.	OCCUPATION.	ADDRESS.
Speight, Thomas Bailey		Arcade, Yonge Street, Toronto.
Steele, Edward Charles		Prince Albert, N.W.T.
Stewart, Elihu		Collingwood.
Stewart, Louis Beaufort, D.T.S.	Lecturer on Surveying.	Sch. of Practical Science, Toronto.
Tiernan, Joseph M	Engineer for three Townships.	Tilbury Centre.
Tyrrell, James Williams, C.E. (Toronto)	Engineer for County of Wentworth, Townships of Ancaster and Flamboro' West, Seneca, and Town of Burlington.	42 James St. N., Hamilton.
Unwin, Charles		157 Bay Street, Toronto.
Ure, Frederick J	Engineer for Town of Ingersoll and six Townships.	Woodstock.
VanNostrand, Arthur J		Arcade, Yonge Street, Toronto.
Vicars, John	Engineer for Village of Cannington.	Cannington.
Walker, A. P	Eng. Dept. Can. Pac. Ry.	Toronto.
Warren, James, Asso. Mem. Can. Soc. C.E.	Engineer for the Townships of Ashfield and Culross, Kincardine and Bruce, and Lucknow Water Works.	Kincardine.
Weatherald, Thomas		Box 116, Goderich.
Wheelock, Chas. Richard	Engineer for Counties of Wellington, Dufferin and Peel.	Orangeville.
Whitson, James Francis	Crown Lands Dept.	Toronto.
Wicksteed, Henry King, B.A.Sc. (McGill), M.C. Soc. C.E.		Cobourg.
Wiggins, T. H.		Brantford.
Wilkie, Edward Thomson		Carleton Place.
Yarnold, William Edward	Engineer for Townships of Brock, Reach, Scugog, Mariposa and Georgina.	Port Perry.

JUNIOR MEMBER.

Mackenzie, William Innes, Jr		Toronto.

HONORARY MEMBER.

Carpmael, Charles, M.A.	Superintendent Meteorological Service.	Toronto.