



Have the honor to be
Dear Sir

Your most Obed^t
humble Serv^t
W. Churwch

PROCEEDINGS

OF THE

ASSOCIATION OF

PROVINCIAL LAND SURVEYORS

OF ONTARIO

AT ITS FIFTH ANNUAL MEETING HELD AT TORONTO,
ON FEBRUARY 25TH, 26TH AND 27TH,

1890.

*The Sixth Annual Meeting will be held in Toronto, on Tuesday,
24th of February, 1891.*

PRINTED FOR THE ASSOCIATION

BY

C. BLACKETT ROBINSON, 3 JORDAN STREET,
TORONTO.



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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.

Each member is requested to add to his business card the following:
"Member of the Association of Provincial Land Surveyors of Ontario."

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

Copies of the Constitution 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 following Report of the Proceedings of the Association at its Fifth Annual Meeting, held in Toronto, in February, 1890, is now brought before you.

The Papers read were full of instruction, and we feel that the thanks of the Association are due to the writers for their selection and treatment of the various subjects presented. Many points of value to the profession were discussed in connection with the "Question Drawer," the Land Surveying Committee having paid much attention to this feature.

Owing chiefly to the epidemic that prevailed at the time of meeting, the attendance was not quite so large as at the meeting of 1889.

Several new members have joined the Association during the past year.

We would impress on the members of the Association that it is desirable to have as large an attendance as possible at the Annual Meetings, in order to have full discussion on each of the subjects presented.

Respectfully submitted on behalf of the Executive Committee.

A. J. VANNOSTRAND,
Secretary.

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ASSOCIATION OF
PROVINCIAL LAND SURVEYORS
OF ONTARIO.

ORGANIZED 23RD FEBRUARY, 1886.

Officers for 1890-91.

PRESIDENT.

Villiers Sankey, P.L.S., City Hall, Toronto.

VICE-PRESIDENT.

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

SECRETARY-TREASURER.

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

COUNCILLORS.

H. B. Proudfoot, Toronto.

Maurice Gaviller, Barrie.

T. Harry Jones, Brantford

BANKERS.

Imperial Bank of Canada.

STANDING COMMITTEES.

- LAND SURVEYING.—A. Niven (Chairman); C. F. Miles, G. B. Kirkpatrick, M. Gaviller, P. S. Gibson, J. P. B. Casgrain, R. Coad.
- DRAINAGE.—James Robertson (Chairman); A. W. Campbell, H. J. Bowman, J. C. McNabb, W. S. Davidson, H. W. Selby.
- ENGINEERING.—Willis Chipman (Chairman); R. B. Rogers, G. B. Abrey, H. D. Ellis, Joseph Kirk, H. K. Wicksteed.
- LEGISLATION.—W. R. Aylsworth (Chairman); James Dickson, G. B. Kirkpatrick, Lewis Bolton, J. F. Whitson, Isaac Traynor.
- ENTERTAINMENT.—F. L. Foster (Chairman); Chas. Murphy, H. D. Ellis, G. B. Abrey, T. B. Speight, H. B. Proudfoot, W. A. Browne.
- PUBLICATION.—John McAree (Chairman); H. L. Esten, H. J. Browne, F. L. Foster, Willis Chipman.
- INSTRUMENTS.—J. W. Tyrrell (Chairman); W. Ogilvie, B. J. Saunders, Thomas Fawcett.
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PROGRAMME OF THE
ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO

AT ITS FIFTH ANNUAL MEETING HELD IN TORONTO,
FEBRUARY 25TH, 26TH, AND 27TH, 1890.

PROGRAMME.

Tuesday, February 25th—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, M. Gaviller, P.L.S.,
Chairman.
Announcements by Entertainment Committee, A. J. VanNostrand,
P.L.S., Chairman.

Evening, 8 o'clock.

Paper—"Harbour and Coast Surveys in Hudson Bay and Strait,"
J. W. Tyrrell, P.L.S.
Paper—"Township Boundary Lines in the District of Nipissing,"
B. J. Saunders, P.L.S., Brockville.
Report of Committee on Boundary Commissioners, Villiers Sankey,
P.L.S., Chairman.
Report of Committee on Affiliation of the different Associations of
Land Surveyors in Canada.

Wednesday, February 26th—Morning, 10 o'clock.

Question Drawer—"Land Surveying and Legislation."
Report of Committee on Drainage, James Robertson, P.L.S.,
Chairman.

Paper—"Compiled Plans," P. S. Gibson, P.L.S.

Paper—"Tunnel Drain," J. C. McNabb, P.L.S.

Question Drawer—"Drainage and Engineering."

Paper—"Levelling," J. L. Morris, P.L.S.

Afternoon, 2 o'clock.

Report of Auditors.

Report of Committee on Engineering, W. M. Davis, P.L.S.,
Chairman.

Paper—"Practical Working of the Ditches and Water Courses
Act," Richard Coad, P.L.S.

Paper—"Draughting," F. L. Foster, P.L.S.

Paper—"Highway Bridges," A. W. Campbell, P.L.S.

Paper—"The Graphical Calculus," G. B. Abrey, P.L.S.

Paper—"Water Works for Towns and Villages," H. J. Bowman,
P.L.S.

Thursday, February 27th—Morning 10 o'clock.

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

Report of Committee on Publication, H. L. Esten, P.L.S.,
Chairman.

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

Report of Committee on Affiliation, President, Chairman.

Report of Committee on Decimal *vs.* Duodecimal Systems, T.
Fawcett, D.T.S., Chairman.

Paper—"Extra Strains in Structures," G. B. Abrey, P.L.S.

Paper— — R. B. Rogers, P.L.S.

Afternoon, 2 o'clock.

Report of Committee on Entertainment, A. J. VanNostrand,
P.L.S., Chairman.

Unfinished Business.

Election of Associate Members, Junior Members and Honorary
Members.

Nomination of Officers.

Appointment of Scrutineers—Ballot of 1890.

New Business.

Adjournment.

Full discussion after each Paper and each Report.

ASSOCIATION OF
PROVINCIAL LAND SURVEYORS
OF ONTARIO.

MINUTES OF THE FIFTH ANNUAL MEETING,

FEBRUARY 25TH, 26TH AND 27TH, 1890.

The Association met at 2 p.m., on February 25th, in the Library of the Canadian Institute, 46 Richmond Street East, Toronto.

The Association was called to order by the President, Alexander Niven, Esq.

Moved by Willis Chipman, seconded by H. B. Proudfoot: That the minutes of last meeting, as printed in the Proceedings, be confirmed as read. Carried.

The President read the resignation of Willis Chipman, Secretary-Treasurer.

Moved by James Dickson, seconded by W. R. Aylsworth: That the resignation of the Secretary-Treasurer be accepted. Carried.

Moved by E. Stewart, seconded by J. Dickson: That A. J. Van Nostrand, P.L.S., act as Secretary, *pro tem*. Carried.

The Secretary-Treasurer, Willis Chipman, then presented his Annual Report, which, upon motion, was received and adopted, and financial statement referred to the Auditors.

Moved by C. F. Miles, seconded by E. Stewart: That Messrs. D. S. Campbell and T. H. Jones be the Auditors for the current year. Carried.

The President then read his annual address. (See page 49.)

The Report of the Committee on Land Surveying was then presented by the Chairman, M. Gaviller, which, after discussion, was received and adopted. (See page 21.)

The Committee on Entertainment notified the meeting of the annual dinner, on Wednesday evening, at 8 o'clock.

Meeting adjourned at 5 p.m.

EVENING SESSION, 8 P. M.

President in the Chair.

J. W. Tyrrell read his paper on "Harbour and Coast Surveys in Hudson's Bay and Strait."

Moved by Mr. Kirkpatrick, seconded by Mr. Cozens: That a vote of thanks be tendered to Mr. Tyrrell for his excellent paper. Carried.

Committee on Boundary Commission presented their report, through Mr. Sankey, Chairman. (See page 44.)

Moved by Mr. Gaviller, seconded by Mr. Ellis: That the President name a Committee to make a draft of the proposed amendments, and they be submitted for the consideration of the Association on Thursday. Carried.

The President named as that committee Messrs G. B. Kirkpatrick, C. F. Miles, V. Sankey, M. Gaviller and E. Stewart.

The President read report of Committee on Affiliation of the Different Associations of Land Surveyors in Canada, which was laid on the table until the last day of the meeting.

Meeting adjourned at 10 p.m.

WEDNESDAY, FEBRUARY 26TH, 10 A.M.

The President in the chair.

The Report of the Committee on Drainage was read by Mr Chipman in the absence of the chairman, James Robertson, P.L.S.

Moved by Mr. Selby, seconded by Mr. Campbell, that the Report of the Committee on Drainage be received and adopted. Carried.

Moved by Willis Chipman, seconded by T. J. Patten, that the Committee on Drainage for the ensuing year prepare a circular, as recommended in the Report of the Drainage Committee, and send a copy to such of the township clerks as they may select, and that the Secretary send copies to the members of this Association. Carried.

The paper on "Tunnel Drain" was read by Mr. Chipman, in the absence of the writer, J. C. McNabb, P.L.S. A resolution of thanks was passed to the author.

The paper on "Levelling" was read by Mr. Chipman in the absence of the writer, J. L. Morris, P.L.S.

Moved by Mr. Aylsworth, seconded by Mr. McAre: That this paper be received and referred to the Publication Committee, and the thanks of this Association be given to the author. Carried.

Moved by H. D. Ellis, seconded by C. F. Miles: That the President name a committee to revise the tariff of charges, and report to the meeting Thursday morning. Carried.

The President named the following committee: Messrs. E. Stewart, M. Gaviller, H. J. Browne, H. B. Proudfoot, T. B. Speight, C. F. Miles and Lewis Bolton.

Adjourned at 12.20 p.m.

AFTERNOON SESSION, 2 P.M.

The Report of Auditors was then received and adopted.

The Engineering Committee made no report.

F. L. Foster, P.L.S., read his paper on "Draughting."

Moved by Mr. Stewart, seconded by Mr. Dickson: That a vote of thanks be tendered to Mr. Foster for his excellent paper on draughting. Carried.

Mr. H. J. Bowman read his paper on "Water-works for Towns and Villages."

A vote of thanks was tendered Mr. Bowman for his paper.

Mr. G. B. Abrey read his paper on "The Graphical Calculus."

The thanks of the meeting were tendered to Mr. Abrey for his paper, one which must have cost a great deal of time and thought in its preparation.

Prof. Galbraith suggested that, in papers of this description, abstracts should be printed previous to first reading, to enable discussion on it.

Meeting adjourned at 5.15 p.m.

THURSDAY, FEBRUARY 27TH, 10 A.M.

Report of Committee on Publication was then presented by the Secretary, in the absence of the Chairman, H. L. Esten, P.L.S.

Moved by Willis Chipman, seconded by A. J. Van Nostrand: That the report of the Publication Committee be received and adopted. Carried.

Report of Committee on Instruments was then presented by J. W. Tyrrell, P.L.S., Chairman.

Moved by Mr. T. H. Jones, seconded by R. B. Rogers: That the Report of Committee on Instruments be received and adopted. Carried.

The President, Chairman of the Committee on Affiliation, made the following remarks: This matter came up the first day, and I read all the correspondence, the matters submitted from the Dominion Association, and to the Committee appointed to report to the Execu-

tive, and the remarks of each member of the Executive. The whole thing was forwarded to the Dominion Association, in Ottawa, in time for their annual meeting, and although suggested that some of them should appear here and discuss the matter, we have not heard from them by letter or by any representative. I don't think there is any use of my saying anything more about it. The matter originated with them; they have our opinion and they have taken no action upon it. It might be proper under this head, if this meeting sees fit, to adopt the report of the Executive as the opinion of this meeting. That would dispose of it and the matter would stand.

Moved by John McAree, seconded by D. L. Sanderson: That the Report of the Special Committee on Affiliation be received and adopted. Carried.

P. S. Gibson then read his paper on "Compiled Plans."

Moved by Mr. Dickson, seconded by Mr. Abrey: That a vote of thanks be tendered to Mr. Gibson for his excellent paper. Carried.

AFTERNOON SESSION, 2 P.M.

G. B. Abrey read a paper on "Extra Strains in Structures."

Moved by M. Gaviller, seconded by Mr. Dickson: That a vote of thanks be tendered to Mr. Abrey. Carried.

Report of Committee on Entertainment was verbally presented by A. J. VanNostrand, Chairman, as follows: Prof. Galbraith mentioned last night at our dinner something about our taking quarters in his building at our next annual meeting. We have nothing to report but our dinner of last evening, but our written report will appear in the Proceedings.)

The President: As to Prof. Galbraith's suggestion, we had better leave that to the Executive to deal with as the next session approaches.

Moved by John McAree, seconded by F. L. Foster: That the Report of Committee on Entertainment be taken as read, and be printed in the Proceedings. Carried.

Mr. Sankey: I have the Report here of the sub-Committee appointed yesterday *re* Boundary Commissioners. I suppose the proper thing would be to hand it over to the Legislative Committee to carry the thing further. The Committee did not think it necessary to bring in the several clauses that were in the first draft relative to improper acting on the part of the members of the Board. That is all covered in other ways, both as surveyors or judges, as the case may be. The law of arbitration seems to be well understood in the country. It is clearly set forth in the existing Acts. What the Committee thought was, that by having a court of this kind the parties could bring it into operation of their own free will, and the results of which can be made binding; that it will lessen litigation and have justice done in a more

proper and business-like way than at present. We think if a court of this kind is established, and the public get to know the powers of such a court, that it will be the way more often chosen.

Moved by Villiers Sankey, seconded by Mr. Dickson: That the Report of Committee on Boundary Commissioners be referred to the Committee on Legislation. Carried.

Mr. Aylsworth: The Committee on Legislation have nothing to report.

Mr. Stewart: The Committee on Tariff have put their report in the form of a resolution, as follows:—Moved by Mr. Stewart, seconded by Mr. Miles: That the Executive Committee be empowered and instructed to take such means as they may deem advisable to prevent unqualified persons from practising as surveyors. Carried.

The President: The idea is that this should be left in the hands of the Executive, and any member feeling aggrieved by such men practising may communicate the facts to the Secretary of the Association, with the evidence, and that will be laid before the Executive. If the Executive feel that from the state of the case laid before them a conviction could be made, they would be expected to proceed with it. However, the matter is left entirely in the hands of the Executive.

Mr. Sankey: I think the Executive ought to do a little more. If a reasonable case is made out, they ought to be at liberty to employ somebody to examine into the facts. It is putting the onus on the surveyor. It is of general importance to the whole profession. The Executive ought to be empowered to assist the surveyor hunting up the facts.

The President: I think the meeting would be willing to leave that to the judgment of the Executive.

Mr. Dickson: We are all interested in this, and if there is a case of the kind comes up, there should be an understanding that we all put our hands into our pockets to fight it.

A communication was read from David Boyle, Esq., curator of the Canadian Institute, inviting the members of the Association to visit the Archæological Museum of the Institute.

Moved by Mr. Chipman, seconded by Mr. Sanderson: That the invitation be accepted after the close of this meeting. Carried.

Report of Committee appointed last session on Exploratory Surveys was then presented by E. Stewart, Chairman.

Mr. Stewart: It was also thought wise that some lands should not be surveyed but left as timber reserves. Also that a Mining Engineer be allowed to accompany the party in order to find out where the best mineral land was, and find out something of the geology of the country. We all know that the Geological Survey is, and has been, for a great many years engaged in topographical surveying, in fact they are interfering with the work properly belonging to surveyors. There is one matter that I think would be wise to bring before the

Commissioner of Crown Lands, that we should have a traverse of the Canadian Pacific Railway right through the Province as a base for future work.

Mr. Cozens: I helped to make surveys north of the Canadian Pacific line to which I could get no tie line at all. They were accepted by the Department because it was not possible to get further information.

Moved by Mr. Stewart, seconded by Mr. McAree: That the report of the Special Committee on Exploratory Surveys be received and adopted. Carried.

Moved by Willis Chipman, seconded by W. R. Aylsworth: That the meeting do now adjourn for an intermission of ten minutes. Carried.

(During intermission a photograph of the members present was taken by Mr. Chipman.)

Moved by Willis Chipman, seconded by John McAree: That in the opinion of this Association an Act of Incorporation similar to the acts incorporating the other professions in this Province is desirable; that the Executive Committee of the Association to be elected during the month of March (proximo) be and are hereby instructed to submit to this Association at its next annual meeting a draft of a bill to incorporate this Association. Carried.

Moved by A. J. VanNostrand, seconded by V. Sankey: That any omissions or clerical errors in the Record of the 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.

NOMINATIONS OF OFFICERS.

Mr. VanNostrand: I move that Mr. Villiers Sankey be appointed President. Carried.

Mr. Dickson: In this Association as in other public bodies, I think it is well to put members in positions of trust who are active working members of this Association. I have much pleasure in moving that Mr. E. Stewart be nominated as Vice-President of this Association.

Mr. McAree: I move that Mr. Aylsworth be nominated as Vice-President.

Mr. Aylsworth: My name has been proposed, but I hope the gentleman who proposed it will withdraw it. I could not consent to act as Vice-President. While I desire the Association to go on and prosper, I am too far removed from the centre of action, and I am not wholly occupied in land surveying and not so interested as I would have been twenty-five years ago.

Mr. Aylsworth's name is withdrawn and Mr. Stewart elected Vice-President.

Mr. Chipman: I beg to nominate Mr. A. J. VanNostrand as Secretary-Treasurer. I am certain we cannot get a man who will fill the

position better than Mr. VanNostrand. In proposing him I hope you will see your way to making it a unanimous nomination. Carried unanimously.

Mr. VanNostrand: If it is the desire of the Association that I take the position for a year, I will do my best, and if I can give anything like the satisfaction Mr. Chipman has given, I will feel highly rewarded.

The President: We want six Councillors.

Mr. Dickson nominates Mr. M. Gaviller, Mr. McAree nominates Mr. Jones, Mr. Gibson nominates Mr. Chipman (Mr. Chipman declines nomination), Mr. Sankey nominates J. W. Tyrrell, Mr. Gaviller nominates Mr. Proudfoot, Mr. Chipman nominates Mr. Robertson, Mr. Foster nominates Mr. Dickson, Mr. Cozens nominates Mr. Miles, Mr. VanNostrand nominates Mr. Gibson (Mr. Gibson declines).

Moved by Mr. Aylsworth, seconded by Mr. Selby: That Messrs. H. L. Esten and John McAree be scrutineers of ballots for the year 1890. Carried.

NEW BUSINESS.

Mr. Abrey: We have a good deal of bother here in the Registry Office about looking at plans, and paying a fee of ten cents. It creeps up every month or two that the Registrar wants sometimes \$1, and other prices. I would like to have the matter arranged. I think the surveyors ought to be entitled to see plans free. Half the people come to our office to look at plans, and we make no charge. I think a deputation should be appointed to wait on the Inspector of Registry Offices or other officer of the Government.

Mr. Cozens: In every Registry Office that I have gone to I have paid nothing whatever.

Mr. VanNostrand: Some years ago I wrote to the then Inspector of Registry Offices in the matter, and I received a short note from him to say that he had no authority to settle the fees; that they were all to be found in the Registry Act.

The President: I think it is perfectly right that a clear understanding should be had in this matter. The Registrar has a right to charge certain fees and no others. I think it would be a fit subject for the Executive to take up to wait on the Deputy-Attorney General or the Inspector.

Moved by A. J. VanNostrand, seconded by G. B. Abrey: That the Executive Committee be instructed to confer with the Attorney-General or such officer as they may deem fit in order to reach an understanding as to fees to be charged by Registrars for inspecting or copying filed plans. Carried.

Mr. Sankey: I take this opportunity of returning my thanks for the unanimous election of myself as President. When the Association was first started I never supposed you would confer this honour on me. Although I have endeavoured to do what I could to further the

interest of the Association I certainly don't feel the work I have done has merited such honour from you. I hope during the coming year the Association will go on and prosper; and I would ask of you all to assist the Association in whatever way you may. I also ask, if any member of this Association has anything to bring up, not to wait until our annual meeting to start the idea, but to write a letter to myself or the Secretary. A great many points come up at our annual meeting when members have hardly time to discuss them, and in that way don't get the discussion they would if we had some previous notice of it.

Mr. Stewart: I beg to return my thanks for the honour you have conferred on me in making me Vice-President. At the last meeting we passed a resolution that any question coming up on Land Surveying should be sent to the Chairman of the Land Surveying Committee, and they would sit on that, and they have carried it out this year, and brought it before the Association. If it was done with the Engineering and Drainage Committee it would have the same effect. I think if every member will try to get some one near him to join the Association we could do a great deal to swell the membership, and have a better meeting than this year.

Moved by Mr. Jones, seconded by Mr. Gaviller: That the sum of \$40 be paid to the retiring Secretary-Treasurer, Mr. Chipman, from the funds of this Association. Carried.

Mr. Chipman: I don't think the Association can stand that expense.

Moved by Mr. Dickson, seconded by Mr. Chipman: That the President do now leave the chair, and that Mr. Aylsworth take it. Carried.

Moved by Mr. Dickson, seconded by Mr. McAree: That a hearty vote of thanks be tendered to the retiring President, Mr. Niven. Carried.

The Chairman: Mr. Niven, I have much pleasure in tendering you the hearty vote of thanks of this Association for your services as President during the past year, for the courteous and affable manner in which you have treated us all and conducted the business of the Association during the past few days.

Mr. Niven: I thank you very much, gentlemen, for the vote of thanks you have just given me. All I can say is, I have endeavoured to the best of my ability to discharge the duties incumbent upon the occupant of that office. I shall have just as much pleasure in acting as a full private in years to come as I have had in sitting at the head of this Association. As I have said before, I think that our Association is fairly launched, and as years go on I hope that the purpose for which we have been organized will be more fully seen and felt.

Mr. Dickson: I move we now adjourn.

Mr. Niven: I declare the Fifth Annual Meeting of the Land Surveyors' Association of Ontario closed, 4.20 p.m.

MEMBERS IN ATTENDANCE AT THE TORONTO
ANNUAL MEETING.

| | | |
|------------------|--------------------|--------------------|
| Abrey, Geo. B. | Foster, F. L. | Proudfoot, H. B. |
| Aylsworth, W. R. | Galbraith, Jno. | Rogers, R. B. |
| Bolton, Lewis. | Gaviller, M. | Ross, Geo. |
| Bowman, C. D. | Gibson, P. S. | Sankey, Villiers. |
| Bowman, H. J. | Jones, T. Harry. | Sanderson, D. L. |
| Browne, H. J. | Kirkpatrick, G. B. | Selby, H. W. |
| Browne, W. A. | McAree, Jno. | Sherman, Ruyter. |
| Campbell, D. S. | McEvoy, H. R. | Speight, T. B. |
| Chipman, Willis. | McKay, Owen. | Stewart, Elihu. |
| Cozens, Jos. | Miles, C. F. | Stewart, L. B. |
| Dickson, Jas. | Murphy, Chas. J. | Tyrrell, J. W. |
| Ellis, H. D. | Niven, Alex. | VanNostrand, A. J. |
| Esten, H. L. | Patten, T. J. | Wheelock, C. R. |

RESULT OF ELECTIONS.

| | | |
|----------------------------------|-------------------------|-------------------|
| <i>President</i> | Villiers Sankey | (by acclamation). |
| <i>Vice-President</i> | Elihu Stewart | (by acclamation). |
| <i>Secretary-Treasurer</i> | A. J. VanNostrand | (by acclamation). |

Councillors.

| | | | |
|-----------------------|----|----------------------|----|
| H. B. Proudfoot | 29 | J. W. Tyrrell | 14 |
| M. Gaviller | 26 | Jas. Dickson | 8 |
| T. Harry Jones | 21 | Jas. Robertson | 8 |
| C. F. Miles | 18 | | |

I therefore declare the following Councillors elected:— H. B. Proudfoot, M. Gaviller and T. Harry Jones.

A. J. VANNOSTRAND,
Secretary-Treasurer.

Examined and found correct.

(Signed) JOHN McAREE,
H. L. ESTEN,
Scrutineers of Ballots.

REPORT OF THE SECRETARY-TREASURER.

MR. PRESIDENT,—The following report is herewith submitted as the business of the Association for the year ending with this meeting:

Our membership remains about the same as during 1887 and 1888, but I regret to say that several of our members have not as yet remitted their fees for 1889, notwithstanding that they have had several opportunities to do so.

A very full meeting of the Executive and Standing Committees was held in Toronto on the 27th of December last at which several matters of importance were discussed.

The following circulars were issued by the Executive up to the present date since my last report:—

- No. 18—Proposed amendments to Surveyors' Act.
- No. 19—Programme of Fourth Annual Meeting, 1889.
- No. 20—Respecting annual dues (6th March, 1889).
- No. 21—Respecting land surveyors in active practice.
- No. 22—Result of election of Executive Committee, 1889.
- No. 23—Addressed to those Provincial land surveyors who are in active practice, but who are not members of the Association.
- No. 24—Minimum tariff in 1889.

The proposed amendments to the Survey Act were discussed at the last meeting of the Association and were referred to the committee on legislation.

The replies to circular number twenty-three show that there are many Provincial Land Surveyors in active practice who are not members of this Association, of which the following is a list:—

- | | |
|-------------------------------|----------------------------------|
| Allan, Jas., Renfrew. | Fair, Jno., Brantford. |
| Bakie, J. D., St. Thomas. | Fitzgerald, J. W., Peterborough. |
| Beatty, W., Delta. | Fowlie, Albert, Orillia. |
| Burchill, Jno., Merrickville. | Gibson, Geo., St. Catharines. |
| Brown, D. R., Cornwall. | Gossage, B. W., St. Thomas. |
| Brown, D. B., Cornwall. | Hamilton, Robt., L'Orignal. |
| Brown, Jno. S., Heckston. | Hermon, R. W., Rednersville. |
| Burnet, H., Peterborough. | Hermon, Mr., Rednersville. |
| Bell, Wm., Pembroke. | Halford, A. J., Essex Centre. |
| Bell, Andrew, Almonte. | Howitt, Alfred, Gourock. |
| Byrne, Thos., Sarnia. | Hewson, T. R., Peterborough. |
| Carre, Henry, Belleville. | Jephson, R. J., Bracebridge. |
| Cotton, A. F., Ottawa. | James, Silas, Toronto. |
| Creswick, Henry, Barrie. | Johnston, W. O., Whitby. |
| Cromwell, J. M. O., Perth. | Jones, J. H., Sarnia. |
| Carroll, Cyrus, Hamilton. | Kennedy, R. O'Dowd, Caledonia. |
| Chadwick, F. J., Guelph. | Kennedy, J. H., St. Thomas. |
| DeCew, E., DeCewville. | Longhead, Aaron, Orillia. |

Ludgate, B. A., Peterborough.
 Laird, J. S., Essex Centre.
 Law, Henry, Dunnville.
 Malcolm, Sherman, Rondeau.
 Marshall, Jas., Kincardine.
 McDougall, A. H., Port Arthur.
 McLean, J. K., Elora.
 O'Flynn, Edward, Windsor.
 Passmore, F. F., Toronto.
 Reynolds, Samuel, St. Catharines.
 Rombough, M. B., Durham.

Reid, J. L., Port Hope.
 Smith, Geo., Beaverton.
 Smiley, Wm., Norwich.
 Sing, J. G., Meaford.
 Staunton, F. H. L., Hamilton.
 Strange, Henry, Rockwood.
 Seager, Edmund, Rat Portage.
 Ure, F. J., Woodstock.
 Wilkins, F. W., Norwood.
 VanBuskirk, W. F., Stratford.

In addition to these 57 there are a few surveyors in the Province who practise occasionally, and several men who have passed their final Provincial Land Surveyors' examination during the year.

It may be of interest to the members to have for reference a statement of the number of Provincial Land Surveyors appointed since 1857:—

| | | | |
|------|----|------|----|
| 1857 | 21 | 1873 | 7 |
| 1858 | 22 | 1874 | 5 |
| 1859 | 11 | 1875 | 11 |
| 1860 | 21 | 1876 | 17 |
| 1861 | 21 | 1878 | 19 |
| 1862 | 11 | 1879 | 12 |
| 1863 | 17 | 1880 | 10 |
| 1864 | 17 | 1881 | 10 |
| 1865 | 6 | 1882 | 14 |
| 1866 | 15 | 1883 | 8 |
| 1867 | 5 | 1884 | 8 |
| 1868 | 3 | 1885 | 9 |
| 1869 | 2 | 1886 | 13 |
| 1870 | 4 | 1887 | 12 |
| 1871 | 4 | 1889 | 10 |
| 1872 | 6 | | |

From 1856 to 1886—thirty years—341 surveyors were appointed, an average of over eleven per year, or nearly one new surveyor per month.

The Secretary again begs to acknowledge the great assistance rendered him by the members of the Committees on Entertainment and on Publication.

It is to be regretted that the railway companies have seen fit to so modify their regulations respecting reduced fares that members attending this meeting will secure little reduction.

The accompanying statement shows the financial condition of the Association. Although the expenditure has been less than last year, the cash balance at the end of 1889 was less than that at the end of 1888 by \$30 00, representing ten members in arrears.

All of which is respectfully submitted.

WILLIS CHIPMAN,
Secretary-Treasurer.

STATEMENT OF RECEIPTS AND EXPENDITURES OF THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO FOR THE YEAR 1889.

| 1889. | | RECEIPTS. | |
|--|--|-----------|-----------------|
| To Balance from 1888..... | | | \$55 00 |
| " Fees, 1 Active Member for 1888 at \$3..... | | \$3 00 | |
| " " 94 Active Members for 1889 at \$3..... | | 282 00 | |
| " " 2 Junior Members for 1889 at \$3..... | | 6 00 | |
| " " D. Beatty, Balance for 1888..... | | 1 00 | |
| | | <hr/> | 292 00 |
| " Advertisements, 1888..... | | 6 00 | |
| " " 1889..... | | 81 00 | |
| | | <hr/> | 87 00 |
| " Proceedings sold..... | | | 50 |
| Total..... | | | <u>\$434 50</u> |

| 1889. | | EXPENDITURES. | |
|--|--|---------------|-----------------|
| By Postage and Telegrams..... | | \$26 65 | |
| " Stationery, etc..... | | 11 15 | |
| " Rental of Rooms for Annual Meeting..... | | 12 00 | |
| " Printing Circulars, Programmes, etc..... | | 23 00 | |
| " " Proceedings..... | | 171 90 | |
| " " Azimuth Tables..... | | 19 50 | |
| " Engraving, etc..... | | 44 75 | |
| " Express, Cartage, Freight, etc., in Exchanges..... | | 16 55 | |
| " Amount granted to Stenographer..... | | 35 00 | |
| " " Secretary-Treasurer..... | | 40 00 | |
| " Balance, Dec. 31st, 1889..... | | 34 00 | |
| | | <hr/> | 34 00 |
| Total..... | | | <u>\$434 50</u> |

SUPPLEMENTAL STATEMENT, FROM JAN. 1ST, 1890, TO FEB. 20TH, 1890.

| 1890. | | RECEIPTS. | |
|---|--|-----------|---------|
| To Balance from 1889..... | | \$34 00 | |
| " Fees, 2 Active Members for 1889 at \$3..... | | 6 00 | |
| Total..... | | <hr/> | \$40 00 |

| 1890. | | EXPENDITURES. | |
|--|--|---------------|----------------|
| By Postage..... | | \$6 50 | |
| " Printing Programmes, 1890..... | | 5 00 | |
| " Express, etc., Ohio Reports, 1889..... | | 2 60 | |
| " Cartage, etc..... | | 90 | |
| " Balance..... | | 25 00 | |
| | | <hr/> | 25 00 |
| Total..... | | | <u>\$40 00</u> |

Feb. 25th, 1890.

WILLIS CHIPMAN,
Secretary-Treasurer

REPORT OF AUDITORS.

The undersigned Auditors beg to report as follows:—That we have examined the books and accounts of the Secretary-Treasurer, Willis Chipman, Esq., for the year 1889, and to date of this year, and have annexed to this report a statement showing the amount of Receipts and Expenditures, which shows a balance on hand of Twenty-five dollars (\$25). We find vouchers for all accounts paid excepting about Fifty dollars (\$50), this amount being principally for postage, duties, freight and express.

D. S. CAMPBELL,
T. HARRY JONES,
Auditors.

Toronto, Feb. 26th, 1890.

REPORT OF COMMITTEE ON LAND SURVEYING.

MR. PRESIDENT,—Your Committee beg leave to report as follows:—

At the last annual meeting of our Association some subjects for consideration were referred.

1. That a recast of the Act relative to Town and Village Surveys seems to be a necessity.

This your Committee heartily endorses, but on account of the date of meeting of the Local Legislature, and probability of this session being the last of this Parliament, it was considered advisable not to submit any recommended changes for legislation. Also from papers expected to be read, and discussion thereon, considerable new light may be thrown upon the subject.

2. As to adaption of Cadastral Survey in Ontario, as now in use in the Province of Quebec, your Committee consider that, from measurements not being given on the plans filed and from the different manner in which lots in original surveys are laid out and numbered in this Province—the Cadastral System, whilst most useful in the Province of Quebec, would not be found so to any such extent in Ontario.

3. The use of the term “more or less,” as to the length of lines, we consider to be necessary in some descriptions. We should recommend the use of this expression to be limited to the greatest possible extent.

Bearings of lines should be shown on a plan and defined as astronomical or present magnetic.

4. Actual staking out of a sub-division is not called for by the Act, as at present worded.

Your Committee consider steps should be taken to render this compulsory, and recommend its consideration to the Legislative Committee.

5. We cordially agree with the remarks of Mr. H. D. Ellis at the close of his paper on Right of Way Surveys (Dominion Act), read at our last annual meeting. We regret that legislation has been passed placing in the hands of others the power to certify plans, draw up descriptions and define boundaries of properties, which are specially the duty of a land surveyor.

6. From all reports the working of the minimum tariff, adopted at our last annual meeting, has been satisfactory.

Your Committee would recommend, in addition, the adoption of a tariff by the hour, which would, in many cases, avoid difficulties.

In accordance with the recommendation of our last annual meeting, several questions have been sent in for the consideration of your Committee.

The questions and diagrams submitted, with answers attached, are appended to this Report.

Your Committee consider that questions intended to be submitted are to be those relating to field work and application of Surveyors' Act.

M. GAVILLER,
Chairman of Committee.

DISCUSSION.

The President—I think the Chairman should read the queries, with the answers of the Committee, and let us deal with that before we pass on to anything else.

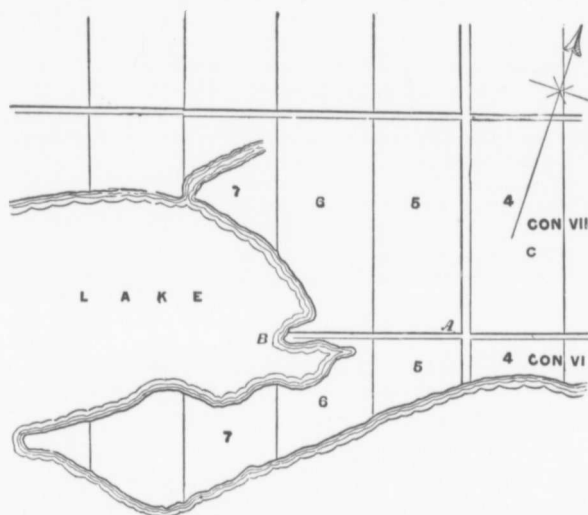
Question "A."—This diagram is part of a double-fronted township bordering on a lake. That part of the road allowance between the 6th and 7th concessions, extending from *a* to *b*, is entirely obliterated, not a blaze or mark is to be found of any description, and the corporation require it to be located and established to give access to the lake, and the parties owning the land on each side are bitterly opposed to it, and no evidence can be obtained as to any of the old trees or other marks. How can it be established; where is the law for such a case?

Answer by Committee.—Not sufficient data given. If broken distance is given between lots 5 and 6 from concession line vi. and vii. to lake, and width of con. vii.; on Government plan. Lay off cons. vii. and vi. by proportional division—if depth of con. vi. is not given as above, give con. vii. depth according to Government instructions for original survey of the township, and leave balance for con. vi. (less one chain for concession road allowance). Sec. 38, Survey Act.

Mr. Chipman—I have expressed my opinion before on questions similar to this, to this Association, but I repeat what I have said:

The object of a re-survey is to reproduce the old line, whether that is the wording of the Act or not. I am of the opinion, the proper way to re-produce that line *a* to *b*, as it was run in the first place, is to take your bearing on line *a* to the east, and start from *a* and produce to the lake. That will be the nearest to the original line. That is the best way that you can re-produce the old line, or the line run in that way will be nearer the original line than any other line you will run.

Mr. Aylsworth—The course that Mr. Chipman suggests is the best possible way to find if there were any marks. I am quite in accord with the finding of the Committee in that case, for the distance between lots 5 and 6 and con. vi. is not given.



Mr. Stewart—The variation, owing to local attraction, will be the same each year.

Mr. Chipman—The variation from one point to another will be the same.

Mr. Aylsworth—Two or more surveyors might go on the ground with their compasses, having the same opinion of the law and what they ought to do to run the line, as Mr. Chipman proposes, and run different lines, each of them. They take the variation and they run on the same magnetic course; they agree in the mind as to what should be done, but they get a different result on the ground; would that not be fatal? If we do as the Committee have found, they will all get the same line.

Mr. Chipman—That may be very true, but the difference between the different lines in that case would be slight as compared with the

difference of the line which would run from *a* to *b* by measuring the distance across con. vii. The line between may be ten chains in error—it may be 110 chains instead of 100. I have seen cases where the distance between the concessions was ten chains out. By the method I propose you may reasonably hope that your line will be within half a chain of the original line, whereas by the method proposed by measuring down on the line of 5 and 6, you will have perhaps the southern boundary of con. vii. a line at an angle of about seventy degrees, which would, of course, be absurd; which is not the original line at all.

Mr. Aylsworth—That is quite a reasonable ground. When the surveyor ran through to the lake on the magnetic course, he could not tell how much he had in any one lot, or where he was. The only point of difficulty is as to how the bearing is to be got at. Mr. Chipman proposes to pick up the line to the east and produce it on to the lake; if that line had been correctly run, that would be the best thing to do.

The President—I am rather inclined to agree with what Mr. Chipman has said. By taking the depth of this concession, it frequently happens that these concessions are short or long, and by measuring down there the depth you might be five chains either one side or the other. Now, the object that we have in view is to re-produce this line on the ground, and we want to get as near as we can where the original survey went.

Mr. Gaviller—I think the Committee, in giving its decision, has simply to look to the Statute, and if the Statute says so and so, we should so word our answer, no matter what our opinion is. I think, as far as my judgment is concerned, that the answer of the Committee is in accordance with the law laid down; that is, that where a concession line is obliterated, it is to be divided according to the intention of original survey—unless you can find a point at each of the ends to fill up that obliterated space. In this case this concession line is obliterated.

Question "B."—When Township A was originally surveyed, the north boundary was chained and posts planted 100 chains apart, leaving the concessions 100 chains deep and then one chain for road as shown on diagram. Afterwards Township B was surveyed and the posts on the north boundary of A were used for starting points, so that the roads in each township are opposite.

Some years ago the lots in Township A, in the 8th concession from lot 16 to the north-west angle of lot 35, were surveyed under the C. L. Dept., and the surveyor then found, at the north-west angle of lot 35, a cedar stump, the remains of the original monument, and marked all his posts, taking the road off to the west.

A short time after this survey was finished the south boundary of Township B was established under the C. L. Dept., and the monuments were all placed opposite those in Township A, with the exception of those between the 7th and 8th concessions, which were put down as shown in red marked 1 and 2, in this case making a jog and not corresponding with the line as previously surveyed in Township A, or as the cedar stump was marked.

TOWNSHIP

CON VII

ROAD BETWEEN VII & VIII CONS

3

2

1

Town

CEDAR POST

Line

100 CHAINS

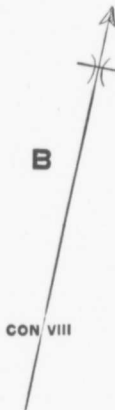
A

TOWNSHIP

CON VII

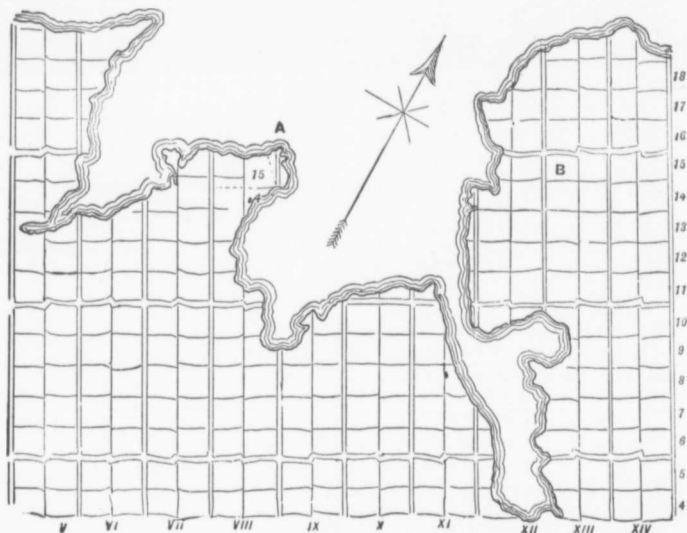
A

CON VIII



In Township B the line between the 7th and 8th concessions was not run or located at the time of the original survey, but a few years ago the County Council applied by petition to have it surveyed under instructions from the C. L. Dept. When the surveyor went on to the ground to begin his survey, the owners of lots in the 8th concession objected to his starting from monument 1, as they contended it was not in the right place, and that it should stand where monument 2 is, and the road be taken off to the west, and No. 2 be moved one chain west to No. 3. That in order to prove that they were correct in so contending, two disinterested witnesses were produced, and they gave positive testimony that they saw the cedar tree when it was green and had not been defaced by fire, and that it was marked with the letter R on the west and north sides. The question is, how can this matter be remedied so that the monument can be placed in the proper position, and was the surveyor justified in starting from monument No. 2, and locating the line for the front of the 8th concession therefrom.

Answer by Committee.—Ascertain from the Crown Lands Department the evidence upon which both the municipal surveys were made; also Government instructions issued for the same. If reliable evidence can be found showing either of the municipal surveys to be incorrect, ignore that survey. More data should be given in this question.



Question "C."—The original concession line, marked *a* in the accompanying sketch, is now obliterated, the timber having been cut and burnt, and is now thickly overgrown with small wood of all sorts.

The original field notes give lot 15 as thirty chains from shore to shore across the point. How would you establish the original concession line? I might mention: 1st. The concession line produced from across the bay strikes as shown by dotted line, and makes the distance across the point about sixty chains—just double that given in the notes; and a sub-division across the lake to concession line marked *b* comes out in the water altogether. 2nd. If you measure the neat width of the concession given in the notes (66 chains, 66 $\frac{3}{4}$ links) from the concession line to the west; easterly along the line between lots 14 and 15, produced and run northerly parallel to the original concession line between cons. 7 and 8, as found in the field, it agrees best with the original notes and will give lot 15 just about the thirty chains, as shown in the notes.

Answer by Committee.—Similar to Question "A." More data should be given. Answer same as to Question No. "A."

Question "D."—In case of Township where original sub-section made under order in Council dated March 27th, 1829—each alternate concession line run, and each alternate side road run. If original post can be found at blind line on original side road, should bearing be used from said post or from the whole length of side road?

Also, should unequal division of said base line affect rest of section?

Answer.—The bearing should be taken of full length of the side road, proof line, across the two concessions.

Only as regard to the two lots adjacent to the side road, the widths of others to be of equal lengths—Secs. 56-57, Surveyor's Act. (See also p. 96 Proceedings, 1888).

Mr. Dickson: When instructions are issued now we are instructed not to plant those posts. When a post has been planted by the surveyor, when he has had no instructions to do so, that should not govern. If he had instructions to do so I would use it as a governing post.

Mr. Abrey: I have received instructions to plant those posts like that from the Indian Department on the Manitoulin Island.

Mr. Stewart: I must say from looking over the Act that the finding of the Committee with regard to the bearings is the correct one.

The President: We all know as instructions are issued now we are told not to plant these posts. To go back to what was done some time ago, perhaps on the Huron tracts, I have seen posts planted at those places. I think if the surveyor was instructed to plant posts there and did so and returned them that would be all right. If he had no instructions in the matter as he did it and returned them I think that would bind. But if he had no instructions at all and did not return the posts, then I think we have no business to pay any attention to them further than simply as a centre tree, or a point indicating where the surveyor ran. As the instructions are issued nowadays, and as recent surveys have been made, a post planted there is manifestly wrong; it is planted there in defiance of the instructions and of

no account whatever. As regards the question of bearing I think it is imperative that it should be taken from end to end across the two concessions.

Question "E."—Should not some steps be taken to compel municipal corporations to have all governing lines established and to provide for the maintenance of original posts, etc. The law as it is at the present time is too easy, and leaves them to act as they like.

Answer.—Best to leave this to the discretion of each municipality. Query! This answer debatable.

Question "F."—If the boundary of Township from which the lots are numbered was not fully run in the original survey, and the boundary at the opposite end was fully run in said survey, which boundary should be used as governing line—in case of there being no other governing lines in said Township?

Answer.—Where boundary from which lots are numbered not fully run in the original survey extends across a full concession use it as governing line. For those concessions across which this boundary has not been run in the original survey use the boundary at the opposite end as governing line, if the east and west boundaries were intended to be parallel in the original.

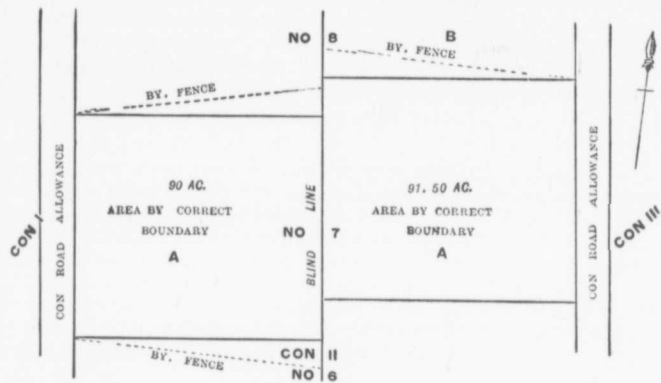
Question "G."—In case where the Government instructions for original survey of a Township showed that the concession lines should have been run wholly across the Township; making the concessions of equal width; and they are so shown on plan of original survey. On the ground the concession lines were only partly so run from one end of the Township but not completed up to the opposite boundary. Both boundaries being run in said original survey. What rule is there for completion of survey of said concession lines?

Answer.—Chain across from the concession lines nearest, on each side, run in original survey and divide proportionally for each side of each lot. Sec. 38, sub-sec. 2.

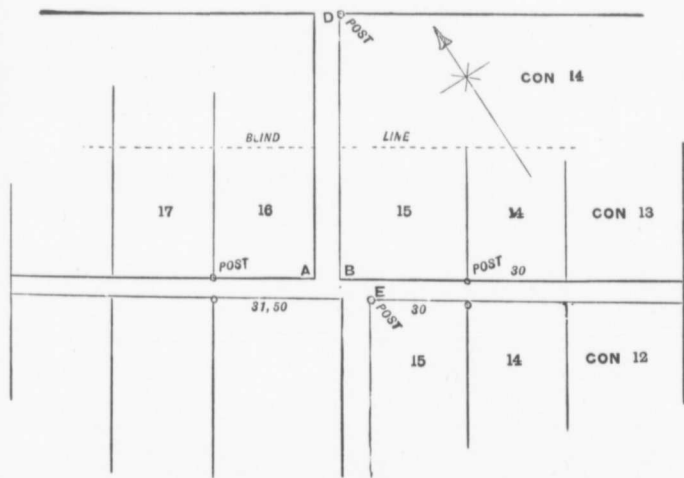
Question "H."—In a double front concession township, A sells to B part of a lot by following agreement:—The North-west quarter of Lot No. 7, Con. 11, containing 50 acres more or less, together with a right of way, two rods wide along the blind line from the East half of No. 8. At the time of sale A owns all Lot No. 7, and B the East half of Lot No. 8. The fences not on bearing of proper lot lines are established by possession. No dispute as to corners of the lot. The concession a narrow one. How would you lay out the sale?

Answer.—Use areas calculated from correct boundaries.

Question "K."—How would you establish the posts at A B? In this case there are posts where shown, but they are lost at A B. The frontages of the lots are 30 chains. In the original survey all the side



[SEE QUESTION "H."]



[SEE QUESTION "K."]

roads should run opposite each other, but in this case there is a jog—say of 1.50 from the old lines as blazed out; there is a post at 16 and 17, and 14 and 15. There is no doubt of the post E at 15; so there is no trouble in con. 12—but in con. 13 the posts are missing—and the side road B D is a governing side road, according to statute, and it is of great importance to establish the posts at A and B.

Answer.—If original blazed line can be located it must govern.

Question "L."—In some townships double fronts, alternate concession lines run, there were posts planted for the centre or blind line, but they seldom are in the centre, and of course are then not according to the Act; when the posts are there as on the sketch and the concessions measure—as noted—one concession being wider than the other by one chain. This post at A was not planted by authority or direct instruction—but was planted by the surveyor. Can that old post be taken to run the blind line from, or must the two concessions be equally divided B C? And how would you run the blind line if it has to be run from the old post A?

Answer.—If old post at blind line is not on record at C. L. Department it cannot be used for any purpose of survey. If on record in C. L. Department it (old post) governs blind line at the point where it is located. Blind line must be drawn from old post at S. Road to point of proportional division from concession line to concession line for blind line or lines between the other lots of the two adjacent sections. (See answer to Question D).

Question "M."—In laying off lands, show that in a rectangle of given perimeter, the area will be a maximum when the figure is a square (section).

Answer.—Let A B C D be a given rectilinear figure. $x, x - m$ = opposite sides.

Required to prove that the area is a maximum when square.

Perimeter = $2(x + x - m)$.

Side of square of equal perimeter = $\frac{2x - m}{2}$.

Area of given rectangle = $x^2 - m x$.

Square of equal perimeter = $\frac{4x^2 - 4m x + m^2}{4}$.

$\therefore \frac{4x^2 - 4m x + m^2}{4} > \frac{x^2 - m x}{4}$
by $\frac{m^2}{4}$

Which was to be proved.

Question "N."—Give an ideal plan for an inland city? What is intended to bring out specially in this is, the size of business and residence lots; the width of streets in various parts of the city, and of lanes; public squares; whether it is desirable to have all the streets

at right angles to each other, or some radiating or otherwise running obliquely, forming gore lots; whether business lots can be so laid out as to conform with subsequent numbering of the business houses; what system of naming of streets; where monuments to be placed for reference in future survey of any lot or street?

Answer.—1. For location where ground is sufficiently level so as not to cause heavy grades on straight streets. Streets to be at right angles to each other in all cases practicable. No street to be less than 66 ft. wide near centre of town plot have two streets at right angles to each other 99 ft. wide. Lanes to be avoided as much as possible—no lane to be less than 10 ft. wide. Streets to be ten lots, and 300 feet apart. Lots to be 60 x 150 feet in all cases. Numbering of houses to be independent of sub-division of blocks. Public squares 300 x 240 every fifth block on main 99 feet wide streets. Name streets—1st, 2nd, 3rd, and so on, that run in one direction, and 1st, 2nd, 3rd, 4th, etc., avenue, those running at right angles.

2. For location on hilly ground make careful topographical survey of location. Arrange streets so as to avoid heavy cuttings for grade to as great an extent possible. Subdivide lots so as to make nearly as possible even frontages and square corners. Locate public squares at highest elevations. Where navigable river runs through the town plot have streets not less than 66 feet wide on each side of said river following bends of same. If situated on a lake have 99 feet street along shore of the lake—and public squares every fifth block fronting on this street. If entrance of railways to river or lake fronts are required arrange to allow for docks, yard, freight and passenger depot accommodation. Adopt high level viaduct system—allow access by all streets possible to lake and river front by under crossing.

REPORT OF COMMITTEE ON DRAINAGE.

MR. PRESIDENT AND MEMBERS OF THE PROVINCIAL LAND SURVEYORS' ASSOCIATION OF ONTARIO,—Your Drainage Committee beg to submit the following report :—

In pursuance of a notice from the Secretary of the Association the Committee held a meeting at the Crown Lands office in Toronto on Friday the 27th day of December, 1889, the following members being present: Messrs Joseph Kirk, Stratford; D. S. Campbell, Mitchell; H. W. Selby, Stayner; and James Robertson, Chairman.

We have no statistics as to the amount of drainage having been done during the past year as none have been collected; but from general observation, and information obtained from coming in contact with those who are more or less interested in matters of drainage, and from the experience of your Committee, it is safe to say that the very

wet spring of last year, succeeding several successive dry seasons, has shown the farming community generally that their lands are not as yet all high and dry, and as a consequence gave a most marked impetus to the carrying out of drainage schemes both large and small, and the drainage work of the past season has been much in advance of that of several previous seasons.

We would suggest and would like to have the opinion of the Association as to the advisability of attempting to collect statistics from year to year as to the amount of draining being done throughout the Province. We are of opinion that could this be done with any degree of accuracy it would prove a source of much information and be of much interest to the profession generally. We made no attempt to collect any such statistics during the past year, preferring rather to bring the matter before the Association for an expression of opinion as to the advisability of doing so and as to the best method of carrying out the work.

We would suggest that a circular letter be sent to the clerk of each municipality in which drainage works are carried on asking for a statement as to the number of drains constructed in such municipality during the year, whether under the Municipal Act or the Ditches and Watercourses Act, with the length, acreage drained, estimated cost, etc. ; and he, as the officer in charge of the engineer's reports and awards on drains, will be most likely to comply and furnish the information which he could readily do with a small amount of trouble on his part. The information from these reports could readily be combined and presented to the Association at each meeting. Copies of this could again be sent to the different clerks when again asking for drainage information for the next year.

We would also bring before the notice of this Association the advisability of the preparation and adoption of some formulæ for the calculation of, and tables of sizes for drains of different lengths for the drainage of different areas of land under different circumstances which are met. We have now no recognized standard to which to refer, and each engineer of experience has probably adopted some table or means of his own for determining the size of a drain when called upon to lay it out, and frequently with unsatisfactory results.

The difference of opinion and results of calculation are sometimes forcibly shown in the case of lawsuits for damages by the flooding of land from a drain of insufficient size when there are often as many opinions as to the requisite size as there are engineers giving evidence. It is needless to say that this is not very creditable to the profession or satisfactory to the court ; while, if tables or formulæ adopted by the Association of Provincial Land Surveyors of Ontario and recognized by them as a standard from which to work could be pointed to, such differences would not exist between individual engineers, and their evidence would carry much more weight in such matters. This table if as at first adopted did not prove to give satisfactory results it might be amended as experience taught. We are of opinion that this matter should be taken up and something in this line for the general benefit of the profession.

We here give a list of important drainage cases under the Municipal Drainage Act decided in the years 1887, 1888 and 1889 :—

| NAME OF CASE. | WHERE REPORTED. | REMARKS. |
|---|---|---|
| Chrysler vs. Sarnia.... | 15 Ontario Reports.... | |
| Robertson vs. North Easthope..... | 15 Ontario Rep'ts, p. 423 | Reversed in appeal ; see 16 Appeal [Reports, p. 214. |
| Re Romney vs. Mersea. | 11 Appeal Rep'ts, p.712. | |
| Re Clark and Howard.. | 16 Appeal Reports, p.72. | |
| Dillon vs. Raleigh..... | 13 Appeal Reports, p. 53. | |
| Pratt vs. Stratford..... | 16 Appeal Reports, p. 5. | |
| Alexander vs. Howard.. | 14 Ontario Reports, p.22. | |
| Dover vs. Chatham..... | 11 Appeal Reports, p. 248 12 Supreme Court Rpts., p. 321..... | |
| Green vs. Orford..... | 15 Ontario Rpts., p. 506. | Reversed in appeal ; see 16 Appeal [Reports, p. 4. |
| Re Bryne vs. Rochester. | 17 Ontario Rpts., p. 354. | |
| Hodgson vs. Bosanquet. | 17 Ontario Rpts., p. 589. | |
| Nissouri vs. North Dor- chester..... | 14 Ontario Rpts., p. 294. | |
| Quantaince vs. Howard | 25 Law Journal, p. 545. | And subsequently tried, but judg- [ment not yet given. |
| Re McCormick vs. How- ard..... | 25 Can. Law J'rn'l, p.616 | |

We also give cases under the Ditches and Watercourses Act:—

| | | |
|--|---------------------------|---|
| In re Ditches and Water- courses Act..... | 25 Can. Law J'rn'l, p 64. | Deciding that it is the duty of the Clerk and Engineer to satisfy them- selves that proper notices, etc., were given in compliance with the Act. The Engineer need not adopt the course asked for. |
| Re Hilborn vs. Picker- ing..... | 23 Can. Law J'rn'l, p.194 | If interested parties not notified, award will be set aside. |
| Bryne vs. Campbell.... | 15 Ontario Rpts., p. 339. | As to right to sue the Engineer. |

We would suggest that when appeals are heard before the County Judge from the award of the Engineer under the Ditches and Watercourses Act, that the Engineer who made the award send to the Secretary of this Association a brief statement of the case with the decision of the judge, etc., so that the Engineers engaged in this class of work would the better know the opinions of the different judges, and would be able to govern themselves accordingly. These might be read along with the Report of the Drainage Committee at the annual meeting, and when new and important points were involved, the case

might be recorded in the printed Annual Report. These appeals are few and would not occupy much space, and would no doubt be of much service. We would also call your attention to the following sections of the Ditches and Watercourses Act, which we are of opinion might be simplified to some extent, improved and amended, and would ask the views of the Association in the matter.

In section 4 and succeeding sections where *ditch* and *drain* occurs throughout the Act, we would suggest that "ditch and" be omitted, and only the word "drain" used, as in our opinion it expresses all that is required.

We notice that Mr. Proudfoot, at the end of his paper on "Drainage," in the report of the meeting of 1886 (page 39), refers to these two terms, and asks the opinion of the Association with regard to the meaning of the words, but we do not notice that any discussion took place on the subject.

Sec. 4 also requires that such ditches or drains shall be kept and maintained so, opened, deepened, or widened by the said owners respectively and their successors in such ownership, *in such proportions as they have been so opened, deepened, or widened*, unless in consequence, etc.

This, we are of opinion, is not always just, and we think the Engineer should have power to say in his award by whom the drain should be maintained, instead of the statute fixing it upon the person opening, etc., any particular part.

Sec. 8, sub-sec. 3, we are of opinion, gives the Engineer power only when making his award to state therein that any portion of such ditch or drain *may* be constructed as a covered drain, but that the Engineer has no authority to say that any portion *shall* be constructed as a covered drain, and to have power to enforce such award. We believe, however, many Engineers claim they *have* power by this section to award that any portion of a drain shall be covered, and do award it so, but we think this meaning would not be upheld in case of appeal. We think, however, the Engineer should have such power, and that the section might be amended by inserting in the second line after the word "may," *or shall*; so as to read: "Any portion of such ditch or drain *may or shall* be constructed as a covered drain," etc.

Sec. 9, sub-sec. 2, we think would be somewhat difficult to put in operation in its present form, as it authorizes the Engineer by his award to determine the sum which shall be paid by each of the persons benefited by rock cutting, while the sum to be paid for rock cutting can only be determined by the letting of the work at some time subsequent to the making of the award, as required by a former part of the section. The Engineer might by his award determine *the proportion of the cost* of such rock cutting which shall be paid by each of such persons, etc., and we would recommend that this section be amended by inserting in the place of the word "sum" in the 6th line, "proportion of the cost of such rock cutting," etc.

Section 11 and sub-sections was dealt with at considerable length by the Drainage Committee of 1888, which Committee proposed, in

short, to have two courts of appeal; the first to the council of the municipality, and from them to three competent persons (one of whom is to be a provincial land surveyor) appointed by the judge of the County Court, whose award should be final.

While in the opinion of your Committee such amendment might serve some useful ends, yet we think that as this Act is designed only for small drainage schemes that one Court of Appeal should be final; and as the ruling in the case may depend as frequently upon some legal point—as shown by all the cases decided and mentioned previously in this report—as upon any injustice or seeming injustice done the appellant, we would, therefore, not at present recommend the changing of the Court of Appeal from the County Judge.

We might further say that the farmers generally, the Engineers and the judges, are all becoming better acquainted with the Act, and fewer appeals take place than formerly, and when such do take place more satisfactory (to the Engineer) decisions are given than in the earlier history of the Act. More particularly is this the case where the judge inspects the premises, which he is at liberty to do by subsection 4, and perhaps holds his court at some house in the locality. Some judges have been doing this, and were it done in each case where necessary, we are of opinion more general satisfaction would be given than by changing the Court of Appeal. Section 15 requires the Engineer to inspect the drain at the expiration of the time limited by the award for its completion, *if required in writing so to do by any of the parties interested.*

We think many of the drains under this Act are never completed in accordance with the Engineer's award, and the parties, or some of them, do not receive the full benefit intended by the award, and consequently an injustice is done, and frequently the Engineer is blamed for laying out an insufficient.

It is our opinion, therefore, that an inspection by the Engineer of the work should be compulsory, and if the work is complete he should certify so to the clerk, and if not, he should proceed to have it completed as provided by the Act.

This section might be amended by inserting in the first line after the word "shall," the words "within thirty days after," and by leaving out of the third and fourth lines: "if required in writing so to do by any of the parties interested."

Your Committee have not suggested any amendments to the Municipal Drainage Act, it being more perfect than the Ditches and Water-courses Act, but we are of opinion that a statutory form of petition, somewhat similar to that suggested by the Drainage Committee of 1888, would be of much service, and would facilitate the originating of drainage schemes by the farmers and others interested.

All of which is respectfully submitted.

Signed on behalf of the Committee by

JAMES ROBERTSON,
Chairman.

REPORT ON ENGINEERING.

MR. PRESIDENT,—I regret that beyond the papers on engineering subjects, which will be read before the Association, the Engineering Committee has nothing to show for work done during the year. I only learned of my appointment to the chairmanship of the Committee late last year, and since then my time and that of the other members of the Committee has been so occupied it has been impossible to have a meeting. I had hoped till the last moment to be with you at the annual meeting, but now find that impossible.

Trusting the meeting will be successful,

I remain very truly yours,

W. M. DAVIS,
Chairman of Committee.

REPORT OF SPECIAL COMMITTEE ON EXPLORATORY SURVEYS.

MR. PRESIDENT,—Your Committee beg to report that they carried out your instructions without delay by meeting the Commissioner of Crown Lands and urging on him the desirability of instituting a regular system of exploratory surveys in our new and unexplored territory. The honourable gentleman discussed the matter with the different members of the Committee present, and expressed himself as interested in the idea. Of course, it was not expected that any direct results would follow. It is our opinion that the matter should not be allowed to drop, but that the Committee be empowered to continue to further the object aimed at, by any legitimate means that they may see fit to use.

All of which is respectfully submitted,

E. STEWART.

REPORT OF COMMITTEE ON INSTRUMENTS.

MR. PRESIDENT AND GENTLEMEN,—As Chairman of your Committee on Instruments, I am sorry to have to say that I have very little to report.

Having been unable to convene a meeting of the Committee, I have not seen any of the members since last year at this time, and

have not received any communications. As I believe has been the custom in former years, I invited several prominent dealers of this city to make exhibits of instruments, stationery, etc., at our meetings, but none of them seem to have responded.

As Chairman of the Committee I wrote a letter to N. C. Wallace, Esq., M.P., with reference to securing a reduction in the import duty on mathematical instruments.

My letter was forwarded to the Minister of Customs, and the following is the reply which was received:—

OTTAWA, 4th Feb., 1890.

N. C. WALLACE, Esq., M.P.
House of Commons.

DEAR SIR,—Referring to the letter written you by Mr. J. W. Tyrrell, of Hamilton, respecting the duty on mathematical instruments, to which you called my attention: I will see that this matter is brought under the notice of my colleagues when tariff matters are considered.

Yours truly,

M. BOWELL.

It seems to me that an effort should now be made by this Association, before the tariff question is dealt with at Ottawa, to secure this very desirable change.

We have now to pay a duty of 30 per cent. on all our brass instruments, and considering that there are no instrument makers in Canada requiring protection by such a duty, this seems to be unreasonably high. I think if we could secure the co-operation of some of our sister associations, there is a strong probability that we would soon have cheaper and better instruments.

I would therefore strongly recommend that some steps be taken by this Association to secure the assistance of the sister associations in the Dominion, and the appointment of a deputation to wait on the Minister of Customs.

Feb. 27th, 1890.

J. W. TYRRELL,
Chairman.

DISCUSSION.

Mr. Gaviller—I think the suggestion that a deputation be appointed to wait on the Minister might be composed of some of our men, members of the Dominion Association resident in Ottawa, and we could avoid the double expense of travelling connected with it, and also have a proper representative on the spot.

Mr. Gibson—I go in for a revenue tariff, but you cannot make a revenue tariff out of one or two things. I think \$70 or \$80 on an instrument is rather too steep; still, at the same time, the surplus funds that the Government secured through its National Policy is laid

out to a very great extent for our special benefit, especially to railway engineers. See the money spent in public works. Let the duties stay where they are.

Mr. McAree—If we combine with the Dominion Association, the Quebec, the Manitoba, and the Engineering Association, I think we could get the tariff reduced. The duty should be taken off the larger instruments, and reduced on the others to about fifteen per cent. I don't think our instrument makers would feel aggrieved. They would sell more instruments and make more money.

Mr. Chipman—I read very carefully the report of the Committee on Instruments last year. I do not think there would be any prospect of getting the duty decreased by all the deputations we might send there. It will demand some energy to be put forth to do this work, to draft a proper petition to the Government. And I think our energies would be extended in securing for ourselves incorporation, as the other learned professions are incorporated, to deal with the examinations. I don't say that they should have controlling power altogether at first, but if we had a voice in the conducting of the examinations for Provincial Land Surveyors, and had the same powers as the other professional bodies have, we then may move in the direction suggested in the report.

Mr. Stewart—There is one objection. There are certain mathematical instrument makers in the Province, and they feel interested in having the duty kept on. If you take it off surveying instruments the telegraph operators would have just as good a chance of representing a grievance as we have. I do not think there is much chance to get the duty off surveying instruments unless taken off other instruments that are not manufactured in the Province.

REPORT OF THE PUBLICATION COMMITTEE.

MR. PRESIDENT,—We had printed 900 copies of the Report of Proceedings of the Fourth Annual Meeting. To the Michigan Society we sent 135 copies; Illinois, 100 copies; Iowa, 50 copies; Arkansas, 90 copies; Indiana, 75 copies; and Ohio, 110 copies.

We received in exchange from each of the above societies about 100 copies of each of their reports, except from Indiana, where the secretary, from severe illness, was not able last year to attend to the publication, but has informed us that they will print the reports of 1889 and 1890 in one volume, which will be sent us at an early date.

Copies of our Report were also sent to different libraries, editors of newspapers, and such persons or societies as take an interest in our proceedings or have given us their assistance.

We now have about 200 copies of the 1889 Report on hand. If any members have not received any of their exchange Reports, they will be at once forwarded, if supply is not exhausted, upon notifying the Secretary.

H. L. ESTEN.

Chairman.

REPORT OF COMMITTEE ON ENTERTAINMENT.

MR. PRESIDENT,—Your Committee on Entertainment for the Association, year 1889-90, beg to report as follows:—

Arrangements, similar to those of last year, were made with the Canadian Institute for the use of hall for the meeting this year, and the accommodation given us was everything that could be desired.

A kind invitation was tendered our Association by the Canadian Institute to inspect their collection of Indian and other relics, and was much appreciated by those who were enabled to accept it.

The annual dinner took place this year at Harry Webb's restaurant, and seemed to form a pleasant and attractive part of the annual programme. Among the guests of the Association present were Mr. Aubrey White, Assistant Commissioner of Crown Lands; Mr. Edmund Wragge, C. E.; Mr. W. T. Jennings, C. E.; Mr. Wm. Armstrong, C. E., and Mr. H. Neilson, manager Bell Telephone Co., Toronto. Due appreciation having been shown the toothsome substitutes for pork and beans, and the usual toasts having been proposed and responded to, an interesting programme followed. This consisted of vocal and instrumental music, recitations, etc., from members and guests, after which the party separated, apparently well satisfied with the result of our fourth annual dinner.

We, your Committee, beg to thank the Toronto surveyors for the interest and support they have given the Entertainment Committee when called upon.

All of which is respectfully submitted,

A. J. VANNOSTRAND,

Chairman.

REPORT OF COMMITTEE ON PROPOSED SCHEME FOR
AFFILIATION OF ASSOCIATIONS OF LAND SUR-
VEYORS IN THE DOMINION.

Your Committee begs to report as follows:—

1. That in the opinion of your Committee the scheme, as proposed, would not be a success; as very few surveyors would go to the expense of travelling, for instance, from Winnipeg to Montreal, or from Quebec, Montreal, Ottawa or Toronto, to Winnipeg, to attend an annual convention.

2. The time suggested (two days) would be too short to get through with the business of the different associations and also of the general convention; it having been found that the business of our Association usually occupies from two to three days.

3. During the limited time that the different associations would have for the transaction of their business, there would be no time for the discussion of topics in which members of these associations are most interested, and the result would be that many surveyors would see no object in belonging to an association that had not time to give special attention to the work in which they were particularly interested.

Your Committee would suggest, however, that affiliation might take place in some such way as the following:—

a. That one joint tri-ennial meeting of all the associations be held alternately in each of the Provinces of Ontario, Quebec and Manitoba, at say Toronto, Montreal and Winnipeg, to be called the Tri-ennial Convention of Canadian Land Surveyors.

b. That the different associations continue to hold their meetings annually, as at present, but that in every third year they meet where the tri-ennial convention is to be held, and on the day previous to said convention.

c. That the proceedings of the convention take some such form as suggested in the memorandum of Mr. Dennis.

Sgd. A. NIVEN,
FRED. L. FOSTER, } Committee.
H. B. PROUDFOOT. }

February 1, 1890.

OTTAWA, ONT., Nov. 26th, 1889.

WILLIS CHIPMAN, Esq., P.L.S.,

Sec. Asso. of P.L.S. of Ontario, Brockville, Ont.

DEAR SIR,—The Executive Committee of this Association have had under consideration a scheme for the affiliation of the different associations of land surveyors in the Dominion, which has been submitted by Mr. J. S. Dennis.

The outlines of the proposed scheme are set forth in the copy of the memorandum relating thereto, which is enclosed herewith.

At the last meeting of the Executive Committee it was resolved that the proposed scheme should be submitted to the Executive Committees of the different associations, so that their views regarding the possibility of carrying the proposed scheme into effect, might be obtained.

In submitting this scheme I am directed to say that our Executive are unanimous in thinking that the welfare of all the associations would be very materially advanced were some scheme of affiliation agreed upon.

The scheme submitted is of course a mere outline, and would have to be elaborated by a committee composed of representatives of all the associations.

The object in submitting this scheme is to obtain from the Executive Committees of all the associations their views on the subject, so that if the scheme receives favourable consideration, the necessary further steps may be taken to have the matter dealt with by the different associations.

Will you kindly submit this to your Executive Committee as soon as possible, and acquaint us with their views thereon.

Yours faithfully,

ARTHUR O. WHEELER,
Sec.-Treas.

Memorandum.

PROPOSED SCHEME FOR THE AFFILIATION OF THE DIFFERENT ASSOCIATIONS OF LAND SURVEYORS IN THE DOMINION.

At the present time there are four associations of land surveyors in Canada, viz : The provincial associations of the Provinces of Quebec, Ontario and Manitoba, and the Association of Dominion Land Surveyors.

Of these, two associations (those in Quebec and Manitoba) are incorporated societies, having power to control the examinations for admission to the profession, and generally to administer matters relating to surveying. The other two associations are simply societies governed by a constitution and by-laws, and have in view the advancement of professional knowledge and feeling, by holding annual meetings and publishing an annual report.

It has suggested itself to the undersigned that the general welfare of all the associations would be materially advanced by the adoption of a system of affiliation somewhat as follows :—

1st. That one joint annual meeting of all the associations should be held, instead of each association holding its own meeting, as at present, and that this joint meeting be called, "The Annual Convention of Canadian Land Surveyors."

2nd. That the annual convention be held alternately at a point in the different provinces most central for the members of the association of that province.

3rd. That each association maintain its own individuality, and issue its own annual report, containing papers contributed by its members, as at present; the report of each association containing only a short account of the proceedings of the annual convention.

4th. That the annual convention be conducted as follows:

a. The meeting to extend over two days, being ended by an annual dinner or some other social gathering.

b. A certain portion of the first day to be allotted to each association for the transaction of its individual business, appointments of committees, etc., or these sub-meetings might go on at the same time, as is the practice with the different sections of the Royal Society. The first evening and the second day (except the evening which is to be devoted to the social event above-mentioned) to be spent in the reading and discussion of such papers, from among all those submitted to the different associations, as may be selected by a committee composed of the presidents, secretary-treasurers, and two elected members of each association.

c. The joint annual convention to be presided over by the president of the different associations in turn.

If the aforementioned scheme meets with the approval of the different associations, arrangements for carrying it into effect could be made by the appointment of the president and two other members at their next annual meeting of the associations, who would act with a like committee from each of the other associations in drawing up the necessary and defined scheme of rules, etc., to give effect to the above. This joint meeting could meet at some point mutually agreed upon.

It is evident that if a joint convention of all the associations was held, the attendance would be large enough to ensure success in every way. Cheap railway fares could be obtained, and the holding of some social entertainment in connection with the meeting would be an inducement for members to bring their friends and families with them. The large attendance would make it an object for the city in which the convention was held to extend its hospitalities to the members, and there is no question that any action taken by all the associations at a joint convention would carry very much more weight than the individual actions or representations of associations now do.

Again, the bringing together of surveyors from all the provinces cannot but result in mutual benefit in many ways, and the undersigned feels confident that if the proposed scheme is carried into effect, the results will be an increased interest in our profession, not only by its numbers, but by the press and public generally.

(Sgd.) J. S. DENNIS,
Pres. Asso. D.L.S.

OTTAWA, Ont., Aug. 15th, 1889.

BROCKVILLE, Ont., 4th February, 1890.

I concur in Report of our sub-committee, but would extend an invitation to members of the Dominion Land Surveyors' Association who have given this matter consideration to attend our next meeting on the 25th, 26th and 27th instants.

WILLIS CHIPMAN.

TORONTO, February 5th, 1890.

I also concur in the opinion put forth in the Report of the sub-committee, that it would not be feasible to hold the meetings of the proposed Association of Canadian Land Surveyors *annually*; once in three years would, perhaps, be as often as a good attendance could be hoped for. In these years I think the suggestion contained in section *b* of the Report, that the provincial association should hold their annual meeting for that year at the place where the general meeting is held, and immediately antecedent to it in time, is a good one.

The question of the frequency of the meetings of the new association appears to be the only point in which the Report of our sub-committee differs from the memorandum of Mr. Dennis, and I beg most strongly to endorse Mr. Chipman's proposal that members of the Dominion Land Surveyors' Association who have given this subject consideration should be invited to our annual meeting about to be held in Toronto. It is most desirable that the subject should be discussed at a personal gathering of the members of the several associations concerned.

JOHN McAREE, P.L.S.

COLLINGWOOD, Feb'y 10th, 1890.

I think the proposal worthy of consideration, but amended as suggested by our sub-committee; and heartily agree with Mr. Chipman's proposal to invite members of the Dominion Association to attend our next annual meeting.

E. STEWART.

SURVEY DEPARTMENT, CITY HALL,
TORONTO, Feb. 5th, 1890.

I agree with Mr. Chipman's ideas.

VILLIERS SANKEY.

WILLOWDALE, 7th Feb'y, 1890.

I am of the same opinion as Mr. Chipman.

PETER S. GIBSON.

REPORT OF THE COMMITTEE ON BOUNDARY
COMMISSIONERS.

The Committee on Mr. Ogilvie's Boundary Commissioners' Bill beg to suggest the following amendments:—

1. Every Provincial Land Surveyor shall act as a "Boundary Commissioner" when called upon to do so.

2. Whenever the parties to any disputed boundary case shall so agree, they may refer the adjustment of such disputed boundary to a court of arbitrators composed of two Boundary Commissioners as above and the County Judge of the county in which the disputed boundary is situated or some legal practitioner appointed by him.

3. The arbitrators so chosen and appointed shall within days after receiving notice of their appointment to the said duty of arbitration give ample notice to the parties to such disputed boundary of their intention to proceed on the day set forth in such notice to the place of the boundary in dispute, and to adjudicate upon the case; and the arbitrators shall, on the day appointed, proceed to the scene of the disputed boundary, and shall then examine all witnesses in the matter on the ground to which their evidence relates, and shall perform any operations as surveyors which they may deem necessary to a proper understanding of the matter in hand.

4. Upon the completion of the examination of all evidence submitted to them in the case, and such measurements and operations as they may deem advisable, the arbitrators shall make their award in the case.

5. The court of arbitration which has tried any case of disputed boundary shall award the costs of such trial and the proportion to be paid by each of the disputants in a manner that shall be deemed just and equitable by the arbitrators.

6. Each arbitrator shall be entitled to the fees as at present provided by law, together with travelling and living expenses, while engaged in the trial of any disputed boundary case submitted to them as hereinbefore set forth; such fees and expenses to be a part of the costs of the trial.

7. Before proceeding to the trial of any suit or question submitted to them, the Commissioners, as above chosen, shall make an affidavit before the County Judge, or before some Justice of the Peace or commissioner for taking legal affidavits, that he has not any personal interest in the suit at issue, and that he has not in any way been engaged professionally as a surveyor on it. Such affidavits to be filed along with the rest of the documents connected with the case with the Clerk of the County Court of the county in which the dispute is located.

V. SANKEY,
Chairman.

DISCUSSION.

Mr. Sankey—(Explains the amendments by the Committee to the draft bill by Mr. Ogilvie). The question is, whether the surveyors of best practice, and men who are doing the largest amount of work in any particular county would likely take the position of Boundary Commissioner. These men would have the greatest amount of experience, and that being so, the fact of their being commissioners would interfere with their getting work. I think the question to decide is whether it would not be better to leave every surveyor eligible to be called upon, when required, to act as Boundary Commissioner. We should decide whether it would be necessary to make one surveyor in each county a commissioner. It would limit the choice of parties. The proposition of this Committee gives the choice to the parties of one out of twenty, assuming there are twenty counties. Why not leave it open? That is the most important point, except one, in the whole matter as to whether the first clause in Mr. Ogilvie's draft shall stand, or whether it should not be read, "that all surveyors shall be eligible to act when called upon to do so."

Mr. Dickson—Is it the cheapening the cost of those things suggested, or do you think justice might be got more readily? I think something should be done to cheapen the cost of these suits.

Mr. Sankey—A surveyor going on the ground to make a survey, evidence is tendered him; gets evidence on the ground—perhaps takes an affidavit—and the matter then comes before the Assize Court. In cases of back townships these men are brought down to the front and put into the witness box, and a clever lawyer gets hold of them, and the evidence that he gave him is knocked into a cocked hat, and the surveyor is blamed. Cases of this kind are appealed, and the Court of Appeal ask if so and so was done by the surveyor, and if not the court sends the case back.

It is supposed the expense of bringing a great number of witnesses many miles will be greatly lessened and justice will be more perfect, the chances of appeal will be less, and people will have their boundaries adjusted in a more professional and business-like way.

Mr. Cozens—Would the report of the commissioner be final?

Mr. Sankey—The Government would decide that themselves. The Court of Assize and the Divisional Court is not final. In this case it is, whenever any of the parties to the dispute in boundary cases shall agree. If two neighbours get fighting over a boundary line, and they take this way of settling it, that may be made final by agreement, on the idea that everything goes regularly and no impartiality or unfair dealing, the matter would be final, and might be made the award of a court of proper jurisdiction. If this Boundary Commission be established and one or two cases settled before them in a professional way, in a very short time we would have every case settled in that way.

Mr. Dickson—It is simply creating a board of arbitrators, if the people take advantage of it.

Mr. Sankey—Certainly. The first point is as to whether every surveyor should not be eligible. The one difficulty is, as I have suggested, about getting the best man in every township to act, owing to its interfering with their practice.

It was thought, generally speaking, that the clauses with reference to misconduct and that sort of thing might be left out of this Act. Surveyors are bound under oath as such to do their duty properly, and the Surveyors' Act lays down a rule whereby they can be deposed from their office. The Committee thought the one court would be sufficient to try a surveyor. That was the next alteration.

The third alteration was as to substituting the County Judge instead of one of the surveyors.

With those three alterations the Committee are of the opinion that this scheme might be brought before the attention of the Government, and they be urged to bring in such legislation as may be necessary to confirm it.

Mr. Speight—Is it intended to exclude lawyers ?

Mr. Sankey—At almost all of these courts it is usual for people to be represented by their legal advisers, and if it is going to be a court of final jurisdiction, it is right that lawyers should be there. The public at large do not feel they have had all the fair play they ought to have unless they have a lawyer to assist them. I do not think it would be advisable to exclude lawyers.

Mr. Speight—In adjusting the boundaries by the arbitrators it would make it more expensive, but of course might be more satisfactory—it is practically three judges.

Mr. Sankey—There would be the County Judge and two surveyors to pay. I don't suppose it would be much greater than the cost at an Assize Court. The trial would commence the day the court would sit, whereas at an Assize Court you sometimes have to wait for days until the case is reached.

Mr. Dickson—I think the only thing in favour of that scheme is by taking the court to the place, instead of taking the parties to the court.

Mr. Stewart—Speaking of the County Judge being appointed as one, I think it would be very difficult to get him to attend; for the draft bill provides that the surveyors should go on the ground and make such inquiries, and the County Court Judge would have to wait for several days before the real examination commenced. Then, as to the expense, you will have other surveyors besides the Commissioners—perhaps two or three. The difficulty with regard to the County Court Judge could be got over in this way, by saying, "the County Court Judge, or somebody deputed by him"—and it might be said that a legal gentleman would be best for that purpose. I think it should be final to save expense. In the one case you take the wit-

nesses to the court, and in the other you take the judge and surveyors away to try the one case. I certainly think it is moving in the right direction.

Mr. Sankey—With regard to the objection as to the County Court Judge, unquestionably some lawyer would be better than a surveyor. As to the expenses of the surveyors, they would be there in any case. No extra expense incurred in bringing the surveyors to the ground, than taking them to the court of trial.

Mr. Kirkpatrick—I think something in this direction is wanted. Something is needed to make a finality of these municipal surveys. A surveyor performs the municipal survey, and if there is a petition against that, there is great difficulty in confirming that survey. He may have done it right, but one or two parties petitioning against it, the Department does not like to take the initiative and say we will confirm the survey.

I think a Commissioner should be appointed, but not for life. I would have him appointed by the Lieutenant-Governor for that object alone, and his office would cease as soon as that was done.

Mr. Sankey—That is the view of the Committee.

Mr. Kirkpatrick—I would make it compulsory on the parties asking for this Commission, and I certainly would have the County Judge on it too. If parties want to go to the courts, let them go there first. In these petitions for municipal surveys the parties don't really know what they want. Each party thinks the surveyor is going to run it in his way; they want it on the road and he does not put it there, and because of that they petition that the Crown should not confirm it in any way, and it hangs on. There were the roads, but the line may be north or south of the road, and when everyone dies the stone monuments will remain, and what are these for?

If we could have a court which should be final, I would not make it compulsory. Let it be a voluntary choice. I think if there were a few good decisions by these Commissioners, the public would soon find and realize where their true safety lay. I believe this would be the greatest move in cheapening litigation.

Mr. Gaviller—Cannot the Crown Lands Department send out an inspector to inspect a municipal survey?

Mr. Kirkpatrick—The Department could easily send a man out, but why should the public have to pay him? In the proposed case the idea would be that the parties would agree to pay the expense.

The President—There would be no guarantee that the inspector sent out knew any more about it than the surveyor who made the survey—perhaps not as much. Upon the question of the Boundary Commission, I think it is a step in the right direction, and if we can get a court established it will be time well spent, even though it is extended from session to session. If we can accomplish something in the end that will cheapen these matters and make them final, I think it will be time well spent. With reference to the surveys made under

the authority of the Crown Lands Department, I can point you to two surveys that were made when I was an apprentice, the lines were run and the monuments are standing there yet, but the fences have never been moved; there is no finality to it. I think if there can be any way of having a tribunal to which parties may go and have it settled once for all, it would be far better. I think, at all events, that people should have the option of taking the natural way through the courts, or taking this.

Mr. Sankey—My idea would be to get the proposals, if the Association think the amendments in Mr. Ogilvie's scheme are advisable to adopt, brought before the Attorney-General asking him, if necessary, to get further information on the subject and take the thing up.

Mr. Browne—I fully agree that this is a move in the right direction, and I think Mr. Kirkpatrick's suggestion a good one; that it should be optional. If it was made final I know that a great many cases would be brought before the surveyors and settled in that way, speaking particularly of the city.

Mr. Gaviller—I think it would be advisable to go over this matter clause by clause, and if we determine to have it brought before the Attorney-General, to have a committee appointed or a person appointed to present it to the Attorney-General, and let it take its chances. Supposing the Committee make a draft of the proposed amendments and submit it to-morrow?

Mr. Sankey—I think it better to adopt Mr. Gaviller's suggestion to have a committee named to put this in workable shape, and bring it up to-morrow or next day and let it be discussed clause by clause, and then brought up before the Government.

PRESIDENT'S ADDRESS.

GENTLEMEN OF THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO,—I have much pleasure in extending to you a hearty welcome to our Fifth Annual Meeting.

We have reason for gratitude to the Giver of all good that our membership has suffered no loss by death since last we met together in this place.

We come together to-day to talk over the past, and to prepare for greater usefulness in the future.

It is now four years since we met in the Parliament Buildings for organization, and I think I can safely say that our society has been a success, and that the outlook is still very favourable.

The young surveyor of the present day has many advantages that were not enjoyed by those who came out 25 and 30 years ago. The benefit of organizations like ours can scarcely be estimated.

In those days there were no associations to which we could belong and have the privilege of acquiring information from his brother members, or by an exchange of reports with other societies gain a knowledge of what was going on in other parts of the continent.

All these advantages the members of our association now enjoy, and he will be a dull man indeed who does not profit by our meetings and discussion of matters pertaining to our profession, and who can derive no advantage from reading the many excellent papers published in our exchanges.

In no other way can a surveyor get the same information for five times the money that it costs him to belong to our Association.

A man may think he knows all that is necessary in his business, but when he comes in contact with others he finds that he has a great deal still to learn.

Associations like ours, in which practical men meet to discuss practical questions, form a necessary part of professional education, which no live man can afford to do without. It is surprising, therefore, that all members of our profession do not avail themselves of the advantages of belonging to our Association.

I trust we may be able during the present year to count among our members many who have hitherto not cast in their lot with us.

Our membership remains at about the same number as last year.

As to what we have been doing during the year, you are referred to the reports of the various committees.

A communication from the Association of Dominion Land Surveyors, regarding affiliation of the different associations of land surveyors in the Dominion, with the action taken thereon by the Executive, will be laid before you for consideration.

It appears to me that the tariff of charges framed at our last meeting should be amended in some respects. I think that a surveyor should get a dollar an hour for his services, or a minimum of \$8 per

day, and that the working of the tariff during the past year should be enquired into.

I have frequently been asked during the past year as to the best means of preventing unlicensed persons in many parts of the country practicing surveying; or, as it is generally termed, "running lines," and this matter should, I think, be dealt with by the Association.

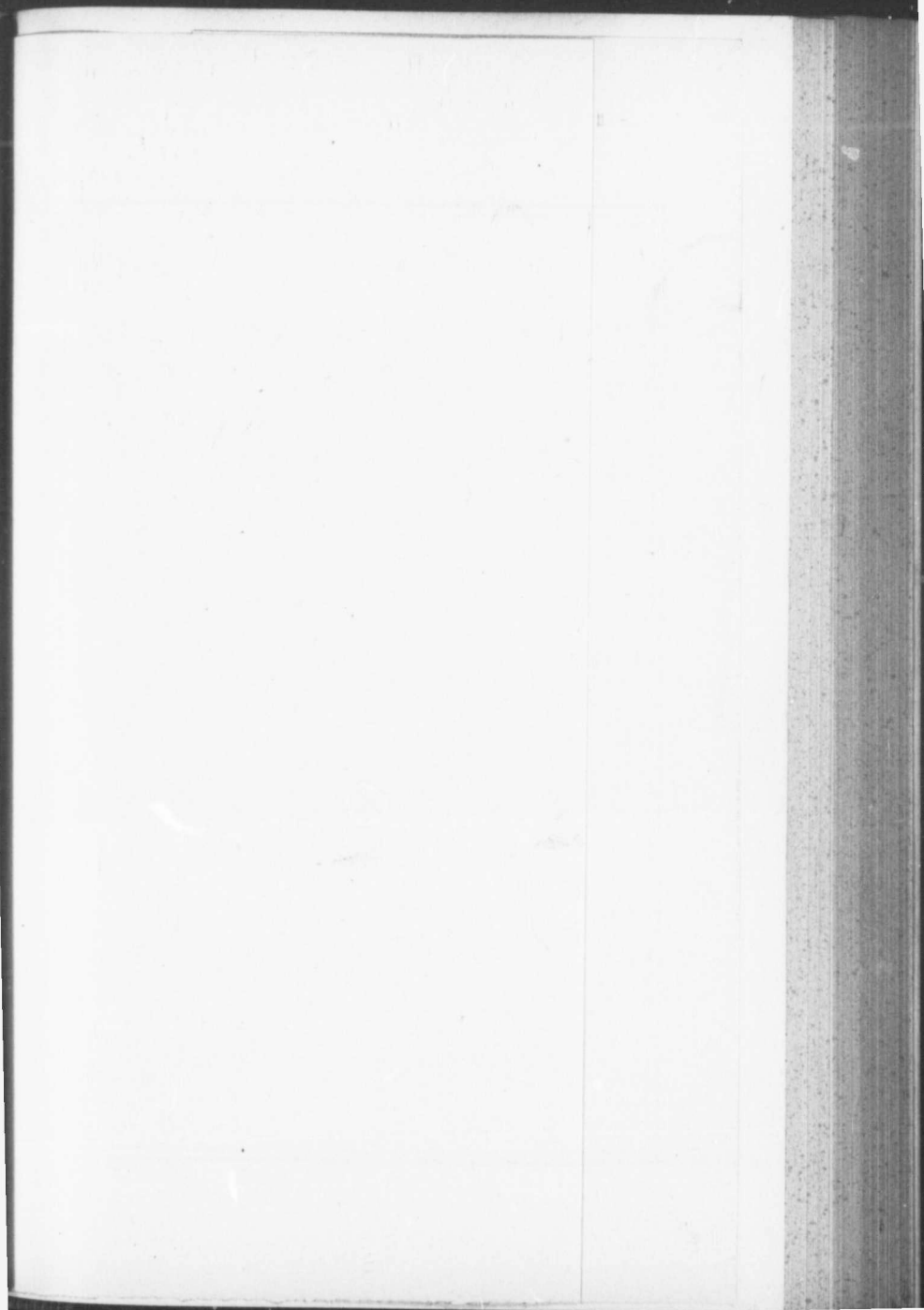
Other matters will, no doubt, come before you from the different Committees.

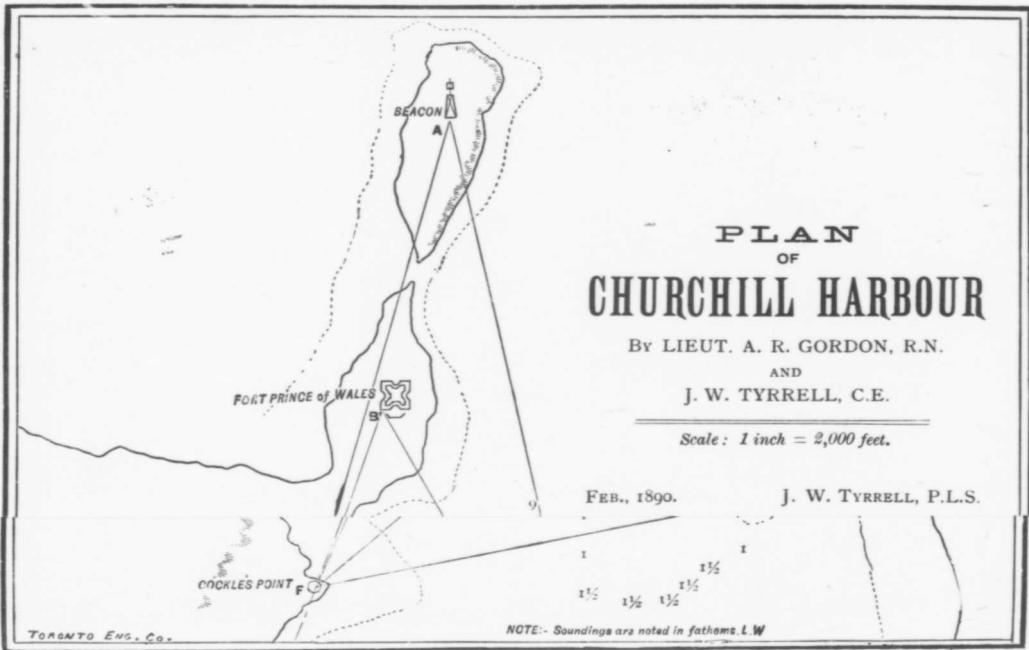
By reference to the programme it will be seen that a number of papers upon subjects of interest will be submitted to the meeting. A full discussion on each paper submitted is very desirable, and I trust that any one present will have no hesitation in expressing his views upon any matter coming before the meeting, and also that any member wishing information upon any matter in which he may be interested will not shrink from bringing it under the notice of the Association.

I now ask your consideration of the further business of the meeting.

A. NIVEN,
President.

February 25th, 1890.





PAPERS.

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

COAST AND HARBOUR SURVEYS IN HUDSON BAY AND STRAIT.

By J. W. TYRRELL, C E., P. L. S.

IN this paper I propose briefly to present an account of the principal surveys performed, by the recent Hudson's Bay expedition—of which the writer was a member—sent out under the command of Lieutenant A. R. Gordon, by the Dominion Government during the years 1884, 1885 and 1886.

Before taking up my subject proper, however, I think it will be interesting just to note the names of some of the early explorers who visited in years gone by the field of our observations.

Hudson Strait was first discovered in the year 1517 by Sebastian Cabot, who was sent out by Henry VIII. in charge of an expedition to search for a north-west passage to India. In the year 1610 Henry Hudson sailed in a barque called the *Discovery*, and re-discovered the strait now called by his name, passed through it, keeping along the south shore, and entered the bay, in the southern part of which he wintered. The next summer, becoming short of provisions, he had trouble with his crew, who finally mutinied, and one night bound Hudson, his son and several of his officers, and sent them adrift in an open boat. At this time they were supposed to be near the west end of the strait. The remainder of the crew, after undergoing great privations, reached home with the ship; but nothing was ever afterwards heard of the unfortunate navigator and his party.

In the year 1821 Captains Parry—afterwards Sir William E. Parry—and Lyon, in command of H.M. ships *Fury* and *Hecla*, conducted an expedition into Hudson Strait and Bay, and obtained some valuable information in the neighbourhood of the upper Savage Islands and elsewhere; and three years later Captain Lyon, in command of H.M. S. *Gripper*, again visited the same waters.

In 1836 and '37 Captain G. Black, in command of H.M.S. *Terror*, also made a voyage of discovery into Hudson Strait and Bay, and since the year 1847, when the ill-fated Franklin expedition was lost, several other exploring parties have gone to that region, but few of their searches extended into the fields of our labours.

PLAN OF CHURCHILL HARBOUR

By LIEUT. A. R. GORDON, R.N.

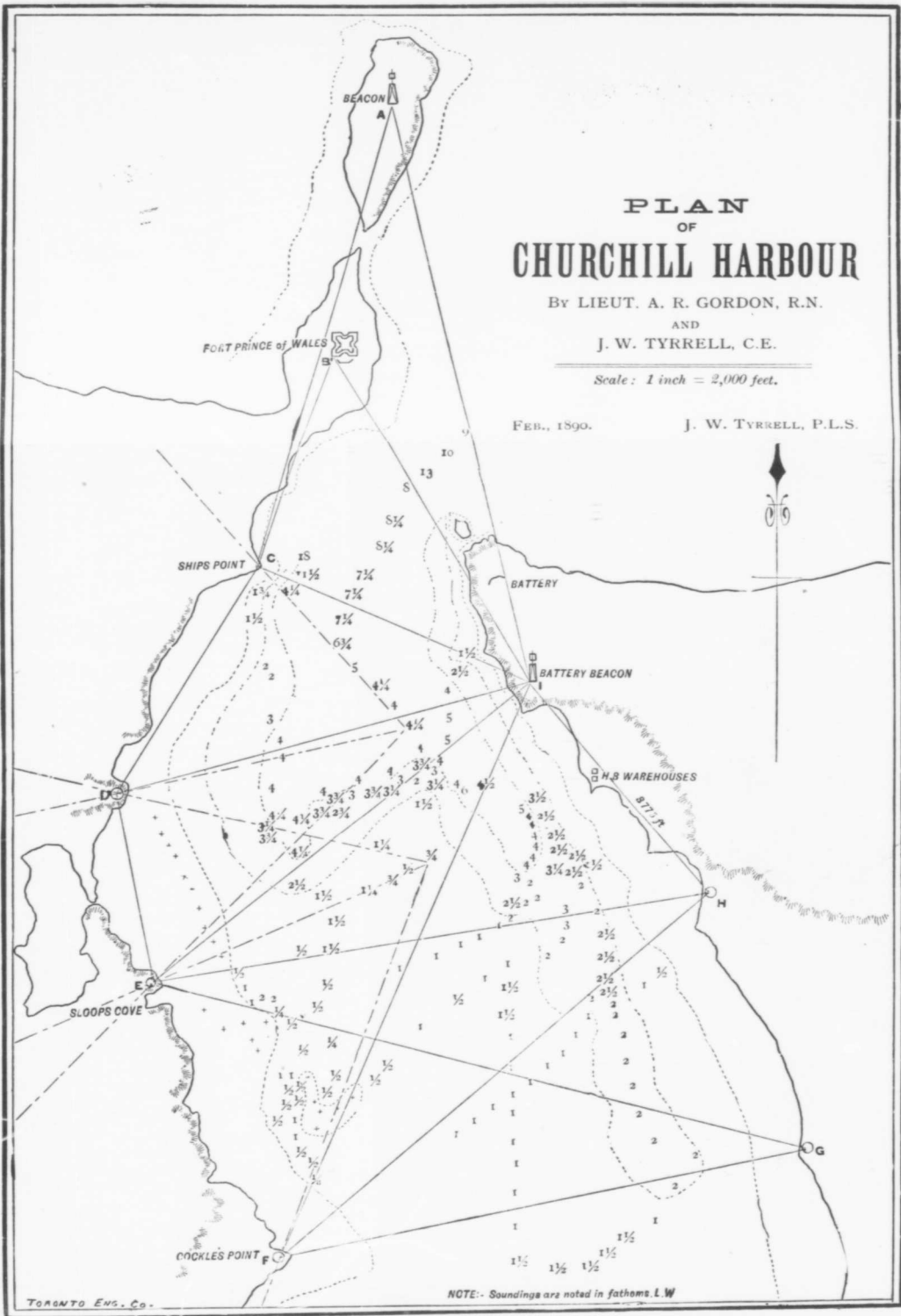
AND

J. W. TYRRELL, C.E.

Scale: 1 inch = 2,000 feet.

FEB., 1890.

J. W. TYRRELL, P.L.S.



However, notwithstanding all these expeditions (besides the annual voyages of the Hudson Bay Company's ships, which have for several centuries visited the shores of Hudson Strait and Bay) it was found a short time ago, when the question of the practicability of navigating Hudson Strait became a matter of discussion, that very little reliable information of any value was available, and in order to thoroughly look into the feasibility of the proposition to establish a steambot route between the Eastern world and our Canadian Northwest, the Dominion Government thought it well to send out an expedition to collect such information as might be required to determine the question.

Accordingly, in 1884 the steamer *Neptune*, and in 1885 and '86 the *Alert*, having been procured for the work, Lieutenant Gordon, R.N., under instructions from the Honourable Minister of Marine, proceeded to Hudson Strait to establish observing stations, and to collect as much valuable information as possible.

Naturally, surveying formed an important part of the work of the expedition, as it was very desirable to know something of the character of the coast, and to locate and survey harbours wherever they might be useful.

I have here a small map of Hudson Strait and Bay on which I have shown in red the portions of coast line added to the chart from our surveys.

The principal places where work was done are as follows:—First, at the entrance to the strait north of Cape Chidly, the Buttons, a group of eleven or twelve islands were surveyed. This work was done from the deck of the ship as she was steaming slowly past the islands, upon the extremities of which rounds of compass bearings were taken at intervals. As each round of bearings were taken, the reading of the patent log was also noted, and the distances passed through the water by the ship, as indicated by the log, were used as bases. As these islands are situated not far from the cape, their positions relatively to it were determined by the same means, and near the cape on the main land a series of observations were taken both to determine the latitude and longitude. A snug little harbour which was called Port Burwell was also discovered just inside the cape, and a sketch survey made of it and soundings taken. A prolonged attempt was made to discover a harbour along the coast of Resolution Island, which forms the northern limit of the great gateway into the interior of our country, but nothing in the shape of an inlet or bay fitted to afford protection and an anchorage for a ship could be found. The whole coast presents an unbroken front of solid rock, and towards the interior of the island attains elevations of about one thousand feet.

On the south shore of the strait, near Cape Prince of Wales, a fairly good harbour was discovered and called Stupart Bay, after the first observer who was stationed there. Series of observations were taken at this place to determine its geographical position; the instruments used for the observations being two Hadley sextants and six chronometers, whose rates were compared daily with a standard. Then, from Stupart Bay as a starting point, the writer with a small

party was sent out in one of the ship's whale-boats to make a track survey of the coast toward the south-east.

This was accomplished, and about twenty miles of hitherto unknown coast-line added with a fair degree of accuracy to the chart, besides forty more determined approximately by ship's bearings upon prominent points.

Considerable difficulty was met with in carrying on this survey, for the compass, which is very sluggish in all this region, was found in some places to be of no use whatever on account of the occurrence of great masses of magnetite. As the only instruments furnished me for making the survey were a boat's compass and patent log, it seemed to me at first difficult to know how to proceed, but by adopting the principle of table surveying from points on the shore when the compass was unreliable, I managed to get along fairly well. Wherever the compass worked satisfactorily, bearings were taken from point to point along the shore, and the distance measured with the log.

It is worth noting just here that, at a point about ten miles south of Stupart Bay, four small iron cannon (one of which may now be seen in this hall) and a large anchor were discovered by Mr. Payne, who was the observer situated at Stupart Bay. They were lying upon the rocks, and some distance above high water mark. As appears evident from the cannon now on exhibition here they must have been lying there a great number of years.

There were no signs of buildings or other wreckage about, and it is a matter of some curiosity to know where they came from; but I must not get too far from my subject. On the shore of Big Island, near the north shore of the straits and directly opposite Stupart's Bay, a large harbour was discovered and named Ashe Inlet, after Mr. Ashe, D.L.S., of Quebec, who was the observer placed in charge of a station at this point the first year of the expedition. Considerable track surveying was done at this place, during the winter of 1885-86, by the writer.

Proceeding westward we come to Charles Island, which, as shown on the chart, we found to be considerably out of place in longitude. Observations were taken to correct its position, and, as we steamed along the north shore, bearings were taken to determine the general shape of the coast line. The next place in order as we proceed westward, where considerable work was done, is in the vicinity of the Digs Islands and Cape Wolstenholm. Here again, in the more westerly of the Digs Islands, an excellent harbour was found and christened Port Laperrier.

The position of this port was also carefully determined, and the track surveys which were afterwards made in the vicinity were tied on to this fixed point. At one time, while Lieut. Gordon was taking a series of observations, Doctor Bell, the scientist of the expedition, and the writer, were sent out in a boat with two or three men to make a traverse, or perhaps more properly called a running or track survey of the islands. The shooting in this neighbourhood we had reason to believe was very fair, but the instructions we received were not to

take our rifles, as we would have no time for sport. One of the party, however, disobeyed the commander's orders, and, along with the rest of our outfit, smuggled aboard our boat his Remington rifle.

A boat's compass, a prismatic and a patent log, were, as usual, our surveying instruments, and we proceeded from point to point taking our bearings and measuring the distance in the usual way. When we had traversed a short distance—not more than two miles—along the north shore of the outer island, and were about to enter a little cove in the shore, our attention was diverted by the appearance, a few yards ahead of us, of two polars swimming in the water—a large she bear and her cub. They did not appear to take much notice of us until we got between them and the shore, hoping to cut off their escape by land. But things did not seem to work that way, for the old bear, seeing our move, headed for the boat and in a moment disappeared below the water.

Our rifleman had taken up his position at the bow of the boat, and the writer, having along with him a 38 cal. S. & W. revolver, took a position beside him and waited for the reappearance of the bear. Presently she appeared, but at the stern of the boat, where the doctor was seated steering, and immediately she proceeded to climb in. We in the bow dare not fire as two sailors and the doctor were standing in front of us; but some way or other, through the assistance of a pike pole and the motion of the boat—for besides it being under considerable headway, the water at the time was very rough—we managed to part with our new acquaintance. It was about here that the track surveying proper came in. Several parting shots were fired as the bears were swimming ashore, and afterwards as we saw them disappearing among the rocky hills, but on account of the roughness of the water and the tossing of our boat they were without effect. About fifteen minutes after leaving the site of the above encounter, we came upon two other large male bears, and had a hard fight with them, in which conflict, however, we were more successful. These little incidents, though not exactly coming under the head of surveying, were some of the difficulties we had to overcome, and so I consider it quite proper that they should be mentioned. If any of our friends here should have occasion to make surveys in the same district, it would be to their advantage to know what instruments would be found most suited to that particular locality.

The traverse of the coast was continued for about seven miles, when the eastern extremity of the outer island was reached, where a fine, deep, but narrow channel, was found to separate it from the inner island. The shores were chiefly high, and in some places were found perpendicular cliffs of rock standing up from five hundred to one thousand feet out of the water.

At these places thousands of sea-fowls were seen flying about and resting on the ledges along the face of the cliffs. The birds were not so numerous as to prevent us from getting clear sights from point to point; but just here our progress was again interfered with by the occurrence of local attraction in the shape of a herd of about thirty walrus. We did some clearing here, but nothing very extensive, and

then pushed on, passing the eastern end of the island and then turning shipward along the south shore. The rest of our trip, extending over about five or six miles, was comparatively plain sailing, the only obstacles met with being one small herd of walrus and one more polar bear. In some respects this eighteen or twenty miles of coast survey was the most difficult that I have had to deal with in my experience.

Just to the south of the Digs Islands a group of twenty-five or thirty small islands were also surveyed, and the main shore for a distance of about twenty miles south-west of Cape Wolstenholm. Near the south-eastern extremity of Nottingham Island a harbour was discovered, and called Port De Boucherville in honour of the observer left in charge of the station placed there.

The positions of the eastern coast of Mansell Island and the southern end of Southampton Islands were corrected in longitude.

A portion of Marble Island, in the north-west of the bay, was surveyed, and its geographical position determined. Then, arriving at the west coast of the bay, it was found according to the chart to be half a degree out of position for about one hundred miles south of Cape Esquimo. The true position of this coast having been ascertained, we passed southward and arrived at Fort Churchill, a place, for various reasons, the most interesting yet spoken of in connection with our voyage. For over two hundred years it has been one of the most important trading posts of the Hudson Bay Company. More than that, it was their chief stronghold against invaders, being protected by the massive stone fort Prince of Wales until about the year 1775, when it was taken by the French admiral, La Pérouse, and destroyed. At the present time it is an important trading station, and possesses the only harbour on the west coast of Hudson Bay, and lastly it is destined to be the future terminus of the Hudson Bay railway, and the Liverpool of Manitoba and the North-west Territories.

I have here a chart of this very excellent harbour, prepared from an accurate survey made by Lieut. Gordon and myself. I will briefly describe the methods adopted in performing this work. The first step taken was to erect a number of signals or small beacons at prominent points on both sides of the river and at intervals of about half a mile. Then a level stretch of shore was chosen between two beacons (I and H on chart) and the distance carefully measured; this distance was used as a base line, and from the extremities of it sextant angles were taken to the other points (with the exception of one or two, which were fixed by taking angles from other more suitable points, which had been fixed by the other sites). The shore line was then traversed by the compass and fitted in between the points fixed by triangulation. Having now obtained a correct plan of the shore line, the next work was to get a plan of the bottom of the river. The difficulty we met with in performing this part of the work was, not to take the soundings, but to locate them correctly; for, on account of the ebb and flow of the tides and the currents of the river, it was impossible to keep any kind of a straight line with a boat. In getting over the difficulty our beacons came into use again. At every cast of the lead,

by the use of two sextants, double angles were taken simultaneously from the centre of the boat to some three beacons on the shore, one beacon always being common to the two angles. Thus every sounding was an absolute fix, and was plotted upon the chart by means of a station pointer. It was also necessary to note the time when each sounding was taken, in order to be able to make the proper reduction to low water, as at this place the rise and fall of the tide varies from eight to sixteen feet. As may be seen by this plan, the area of water in the harbour within a four-fathom line is approximately half a square mile, and with a very little dredging this area could be considerably increased.

The mouth of the Nelson River was also surveyed in a somewhat similar manner, but not so completely, on account of the much greater dimensions of the work—the river being fourteen miles wide at the mouth—our limited time, and the less necessity for the survey. Sufficient soundings were taken, however, to ascertain the limits of the channel of deepest water, and to give evidence of the impracticability of making a harbour at York. The *Alert* was obliged to anchor ten miles outside the mouth of the river altogether, where she was exposed to the full sweep of the gales from the north-west, and one night experienced such a heavy sea that it was found necessary to let oil tanks run to prevent the seas from breaking over her.

I had intended to give you an account of some track surveys made during the winter season by myself, when travelling about the country on a sled drawn by an Esquimo dog team; but am afraid that I have already taken up as much time and space as my subject will warrant me in doing.

DISCUSSION.

Mr. Chipman—Will you describe the log that was used on this survey?

Mr. Tyrrell—Massey's patent log was used chiefly. Part of the instrument containing a dial was attached to the stern of the boat, and was connected with the other part—a screw-shaped affair, which was trailed in the water,—by a stout, tightly plaited cord. The screw—which revolved because of its motion through the water—twisted the cord which moved the clock-work in the part attached to the boat, and caused the hands on the dial to indicate the number of miles passed through the water.

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

COMPILED PLANS.

By P. S. GIBSON, P.L.S.

To prepare a complete or entire plan of an incorporated city, town or village, or village not incorporated, or parts of townships, involves an amount of work and trouble that only those who have undertaken such a contract can understand.

The object of the statutes in that behalf is evidently to furnish a consolidation of plans and surveys of such places to certain dates, and to serve as a reference plan for the registrar and for lawyers and others searching titles of properties.

These plans, when carefully and properly prepared, are of great advantage for ordinary assessment, and a real necessity in allocating the cost of works under the local improvement system.

The statute does not appear to require the registrar to open an index of the lands shown on such plans, although in some cases where plans are of incorporated villages it is done.

Where, in conveyancing, reference is made to such plans, the registrar, if the reference is not to a certain number of a formerly registered plan shewn thereon, simply registers the instrument on the township lot.

An entire plan should show every governing plan registered to date, and every subdivision held by deed or other instrument not shown on a registered plan, and where there is a re-subdivision of a part of a registered plan, and such re-subdivision is registered, it should be shown on the plan, but where lots of a registered plan are only divided by deed they should not be shown.

It often occurs in looking up the titles to lots not shown on a registered plan that reference is made to a plan which after considerable trouble may be found, and, if so, should be registered under Sec. 85 of the Registry Act, if survey made before 4th March, 1868, or under Section 84 if after, and then entered on plan. Here, however, a formidable difficulty meets the unfortunate Provincial Land Surveyor who has entered into a contract to make an entire plan per Registry Act in consideration of a small sum of money which the corporation has, as a great favour, agreed to pay him.

In making his contract it is likely not stipulated that the corporation shall exercise any statutory powers they may have to enforce the registration of such plans, or that any extra expense the Provincial Land Surveyor may be put to in preparing such plans for registration will be allowed him as an extra.

In most of the older cities, towns and villages there are large numbers of lots sold under deeds by metes and bounds without reference to a plan by number or otherwise. There is clearly an obligation under the statute for the original owner or owners or their legal representatives to file a plan or plans of such subdivision to facilitate the making of the entire plan. In preparing such plans, or in entering such subdivisions upon the entire plan, when such previous registration is not made, difficulties arise continually. Lots often lap each other, or a space may be left between lots which were supposed to adjoin each other, thus leaving a remnant not conveyed. Lots supposed to be located on a particular street may by description be located a half mile away and covering a piece of land conveyed by another deed, thus causing a blank in one place and a duplicate in another. Again, a lot supposed to contain a quarter acre may by an erroneous description, cases of which I have known, cover from ten to twenty acres of the village. Again, the courses of adjoining lots present most formidable difficulties. On one side of the division line will be entered the old patent bearing, on the other side for the adjoining lot will be a late magnetic bearing, in both cases no explanation as to what kind they are. In another case there may be an astronomic bearing on the one side and likely a magnetic or conventional bearing on the other; or in some cases, in describing a lot, two or more of these bearings may be used, or the bearing of one or more sides, for some excellent reason, be left off entirely, and yet, at least under the Registry Act, you are required to enter them on your plan. Again, some of the courses and distances may follow a natural or artificial limit which has long ago disappeared, and often in such cases no bearing may be given, or the distance left out, or likely both. It often happens that the deeds of properties are not registered, and likely cannot be found. Many of the above difficulties occur when compiling the registered plans.

In all cases, rivers or streams should be traversed where not defined by registered plan or deed, and streets, where lands conveyed by deeds only or partly so, should be carefully measured, and frontages noted, and names of owners taken, and deeds of the lots copied as held by the owners, to save long and difficult searches in the registry office.

The principal streets should have the angles of intersection taken even if plans registered of them, and all original important monuments noted and properly marked by iron bars. This, of course, by special agreement with the corporation.

As to the surveyor's certificate for such entire plan, Section 87 of Registry Act provides that it shall have endorsed thereon the certificates of the clerk and head of the municipality and the surveyor that the same is prepared according to the directions of the municipality and in accordance with this Act, and to the map or plan the corporate seal of the municipality shall be attached.

This provision as to the surveyor's certificate is necessary, as it would not be possible for him to sign the usual certificate in the form of Schedule L of Registry Act.

This difference in the form of certificate is of importance, and may facilitate the making of an entire plan of a village, etc., as it will be noticed in said Section 87 that it is only specifically stated what scale it shall be made upon.

It is quite evident that the intention of the Act, with reference to entire plans of villages, etc., is good, but that the Act will require considerable amendments before the intention is fully realized.

DISCUSSION.

Mr. Gibson—The supposition is when a village is incorporated there shall be a plan at the date of incorporation, showing the outlines of the village referring to the by-law under which it is incorporated, and all plans registered up to that date should be shown on it, with the numbers.

In a great many of the old villages in Ontario two-thirds of the properties are described by metes and bounds, without reference to a plan. They may say according to Lots 1, 2, 3 and 4 on such a street, but no plan referred to, or if there is a plan it is not registered.

Under Sections 84 and 85 of the Registry Act provision is made to compel parties to register plans according to which they have sold properties.

If I can find the old plan I check it and put a certificate on it. My certificate is to the effect that it is made by such a surveyor and subsequently checked by myself and now to be registered under Section 85.

When you are asked by a village corporation to prepare these plans you are generally notified that it is a special favour on their part to give you the job, and as you are to get all the work you are expected to do it cheap. If you were just starting you would consider it perhaps an honour to get it. You get yourself into trouble if you want to make it in accordance with the Registry Act, as we understand it sometimes.

The fact is the pay you get is not sufficient for the first plan, and you are not prepared to enter into litigation in order to enforce this other plan, and there you are in a fix. Very few statutes passed by lawyers but what are pretty shaky and can be got through easily. The only proper way is that the statute should be printed and submitted to a committee of experts—I mean experts paid for it—and it would save a great deal of money.

I had an offer the other day to prepare a plan for a village in the county of York. I had tendered for the same job before, but another surveyor went lower, and the plan he made the registrar would not register. He did not go to the registry office, but took it out of his own brains. He made his plan, however, and got his pay too. That happened in two or three villages, and I would not discuss the matter with the councils until the surveyor had got his pay. The registrar would not register it, and I got a letter from the municipality to do

work. I said, "All right, but it will necessitate considerable expense." My father laid out the old village about 1830, and I have his plans, and they could not make it without them, and I didn't care about working it for nothing. I notified the surveyor. I said, "if you get your fees from the village for the work that I want you to do in getting proper plans in the way it should be done, or the intention was, and if the council will go into it in that way and facilitate the re-registering of the plans—which have been wrongfully registered without the proper judge's order—if they will take the responsibility of that, I will be adviser in the work; or will do the work, but they are to do their share." I made one bargain with a corporation that they pay my expenses at the hotel, furnish the assistance, and then I will do it for so much, or I will work for so much per day.

Mr. Chipman—In our county we have a very intelligent and enlightened registrar, who insists on every subdivision being put on the plan except subdivisions of lots which are registered, that is, ordinary building lots. In the subdivision of a large park lot, or a subdivision by deed, he insists on every one of them going on, and if they are not on he will not register the plan.

Mr. Gibson—There appears to be an obligation under the statute to do so, and especially under the Land Titles Act. If this matter were enforced more strictly, unlicensed people would do very little.

I remember a case in a village in the north part of the county of York, where I enquired of the man where his boundary was, and he said he had a proper deed of his property. I asked for the deed, and where his lot was. He says, "You are standing on it." After looking at the deed, I said, "You gave me the wrong deed; get me yours. The one you have given me locates your lot on top of the hill." I drew a sketch of it on the sidewalk, and got it into his head that it was misplaced confidence, as well as a wrong expenditure of money.

These "conventional bearings" have been introduced in the last few years, and are recommended and adopted under our Land Titles Act. If you are subdividing a property you take, for example, a patent bearing of the front of the concession, north 16° west, as the frontage line of the lots, and that you make the governing line of your survey, and lay off your angles entirely from that line, and refer to it, but sometimes the surveyor forgets to mention that it was done so. I laid out property in that way, and was careful to mark some points with iron bars, if using that class of conventional bearings. We have no right to vary the paper title of any title deed. I advise in all these cases a plan should be attached to the deed. Instead of making a formal plan for registration under the Registry Act, I make duplicate copies of my office plan and attach one to each deed, and it helps materially; and I give explanatory notes as to these things. Conventional bearings are not bearings properly speaking.

A man is living on a piece of property in the village, and you go to him and say, "Where is your deed?" He will say, "It is in the registry office." It is expensive to hunt that up, and you go there and cannot find it, but you find a memorial—which are so full of in-

formation, as you may know. Or when you get there you find neither deed nor memorial; what are you going to do about it? Are you going to hunt it up? The man says, "I have lived here long enough to hold it. There is no deed." I measure around the lot, and find so many feet, and govern it by the courses and distances of the properties around it. If the property has such a bearing, I put it on that property, and as I go around it I use the bearings of the adjoining lot.

Mr. Stewart—Do you not frequently use the word "parallel"?

Mr. Gibson—I always do when I use patent bearings.

It is almost impossible in one of these villages, where the properties have been conveyed by metes and bounds, to hunt up these title deeds and locate them in the right direction, because one wrong description upsets the whole thing.

In the United States they have plans prepared for the assessment commissioners, and they are exact plans of the properties. These plans are made to the decimal of an inch, showing every property as it is, and monuments put on corners of streets and other governing points. These assessment plans are very expensive, but still are of immense advantage. The assessment of cities and towns can be made without the least difficulty, and that is the class of plan we want here. What we have answers the purpose until something better is adopted. I never put on my own actual measurements when there are measurements on plans or in deeds; I have no authority.

Mr. McAree—You spoke about taking angles of the streets.

Mr. Gibson—My measurements of angles are for my use in plotting the plan.

Mr. Jones—Supposing the registered plan is very incomplete, and does not give the size of the lots, do you put it on as it is?

Mr. Gibson—Yes, generally.

Mr. Jones—Do you put on your own measurements at all?

Mr. Dickson—Not unless you make measurements in the field.

Mr. Jones—Suppose there is a registered plan of a whole city, and not a foot of measurement given on such plan, but drawn to a scale, there would be nothing to do but to duplicate it; is that your opinion?

Mr. Gibson—No; I always put a note on that such and such work has been done so and so. I don't take the responsibility at all, one way or the other. No corporation has any right to establish public roads except by by-law. You are ordered by a municipality to go and make a plan of certain property; that plan is to be the correct one; if you can get the individuals who own the property to sign that plan, all right.

Mr. Ross—In this case the lots are divided up wrongly, and plan does not answer the purpose.

Mr. Gibson—They should have a plan made and a statute passed to confirm it.

Mr. Gaviller—Get a judge's order.

Mr. Ross—Supposing he refuses to sign an order?

Mr. Gibson—He has no right to refuse if plan and procedure are as per statute.

Mr. Ross—There was a plan prepared under the Act, but containing many mistakes that made it useless, and the corporation had another plan made, but the registrar refused to register it.

Mr. Gibson—Rightly enough, if wrong likely. Did they get the County Judge to interfere, who has nothing to do with it?

Mr. Ross—Yes, but he would not look at it.

Mr. Chipman—I have compiled plans for several towns. Brockville was the largest, and at least two-thirds of the properties were held by deed, one tied on to the other, with no plan whatever; some of the plans dated back to 1816. I found plans in the registry office that were destroyed by mice and rats, or worn out, and of little use, and could not tell whether they had ever been signed either by a surveyor or by the owners. I also found plans scattered through the records of the Court of Chancery. I did not do as Mr. Gibson does altogether. I put on my own measurements, and I did not state on the plan that they were my own measurements. If the deeds placed the lot, as some of them did, on the wrong street, I was not governed by the deed, as some of them were wrong by hundreds of feet.

Mr. McAree—What kind of a certificate did you place on the plan?

Mr. Chipman—It was before this present certificate was added to the Act.

In Prescott I compiled a plan, and I found a plan in the registry office giving between certain streets, I think, eight or ten lots—ten lots, we will say, numbered and divided out; looked all right. They had been selling the lots according to this plan. In measuring up the town I found there was only room for nine lots for the same width as given on that plan. I demanded a new plan from the representatives of the estate, and I got it without any trouble through a judge's order. I have done that in several cases.

Mr. McAree—Did you divide that up into ten parts then?

Mr. Chipman—No; we dropped the one lot. The lots had been fenced, and houses built on almost half of them.

Mr. Gibson—When you started this plan, had you a contract for certain money?

Mr. Chipman—Yes, according to the Registry Act, but I was paid additional by representatives of the estate for drawing up new plans.

Mr. Gibson—Did the council assist you in attending to these things?

Mr. Chipman—I always stipulate that the town solicitor shall aid me wherever it is necessary, and I generally have it understood that

they pay the registrar's fees. There is one question I would like to submit to Mr. Gibson, as he is an expert in compiling plans. I now have a plan to make of a village that twenty years ago was in its palmiest days, but now degenerated. It was a manufacturing place, but everything has gone to ruin. I found quite a large tract was subdivided, whether by surveyor or not I don't know; at least I found, after I had ransacked the registry office, reference to certain lots by number that were not shown on any registered plan in the registry office and on no plan that I had seen. I investigated it as far as I could in the registry office, and at last discovered in the office of the Clerk of the Peace a copy of a plan, made by himself, of the whole village as it was then, with this section subdivided into lots. About one-half of these lots had dimensions on along the main road, those back of them had no dimensions given whatever, and they are the most irregular lots I ever saw. All the front lots have been conveyed and built upon and held by different owners. The representatives of that estate are in the grave; I don't think there is a representative living. What to do under the circumstances I scarcely knew, but I concluded at last I would merely put on the front lots as they are held by deed, with the dimensions, so far as they are on the old plan, and leave the others blank. There were no numbers, in fact, on the rear lots. I afterwards found another tracing, in which there were some alterations from the first; the dimensions appeared to be the same, but the numbering was different. I found also in this case, in measuring along the frontages for some little distance, the lots, as held by the owners, agreed with the plans. After going over a blank space where there was no subdivision at all on the ground, I found a man who had bought Lot 17 according to this plan and had it fenced, and he was at least fifty feet misplaced. He has held it for fifteen or twenty years. After we reach the limit of this property we find there is a surplus in the whole parcel of about that much. I cannot plot that according to the original plan at all; it is half a lot in excess.

Another matter connected with this same plan: I found a plan showing the subdivision of the property back from the main street, where they had a court-house square, a lot of public parks, and the lots were laid out regularly, dimensions on some of them, and the others were evidently intended to be the same. Now, that plan I don't believe was ever registered, as I cannot find any trace of it. I concluded to throw that plan out altogether, as none of the lots had been sold according to it, as far as I can ascertain, a number of streets being shown on it where it is now a commons.

Mr. Gibson—That is right. Suppose you find a plan registered, and another one registered on top of it without a county judge's order, what are you going to do about it? The intention of the statute was good, but it wants to be rearranged.

Mr. Ross—When you make a re-subdivision, do you require a judge's order, or should the judge give an order?

Mr. Gibson—Not unless you are changing roads.

Mr. Ross—When you are changing roads. Suppose there was a plan made of quite a large piece of property, and one or two lots sold and perhaps the rest changed hands, the new owner wants to make a new plan; should he secure a judge's order?

Mr. Gibson—Yes.

Mr. Gaviller—If it makes a re-arrangement of the whole subdivision?

Mr. Gibson—When you begin to change roads or re-arrange it the registrar won't register unless they get a judge's order.

Mr. Ross—Where the judge does not give an order would that plan hold?

Mr. Gibson—Not if you change the streets. If you get the judge's order it will require a proper petition, with affidavits.

Mr. Gaviller—Signed by the owners adjacent?

Mr. Gibson—Yes.

Mr. Abrey—If no lots had been sold?

Mr. Gaviller—No.

Mr. Gibson—Say no lots sold, and you want to make a new plan, changing roads, the registrar won't register it unless you get a county judge's order.

Mr. Abrey—Suppose I register a plan to-day, and to-morrow I change my mind and make the plan in a different shape, have I to get a county judge's order?

Mr. Gibson—If you are going to change the streets.

Mr. Selby—I think the judge's order will be required even if you only change the names of the streets, and not the location of them. If you make a plan to-day, and change the names of streets, you would have to get a judge's order to do that.

Mr. Gaviller—The corporation of Toronto does not do that.

Mr. Ross—In case where a plan is registered without the judge's order, would that affect the title of the lots?

Mr. Gibson—They would make you do it; some of the lawyers would be after you.

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THE ROMNEY TUNNEL DRAIN.

By J. C. McNABB, P.L.S.

IN bringing before you the drainage scheme known as the "Romney Tunnel Drain," it is not proposed to introduce any new ideas, but rather to give a short sketch of the work involved, together with its attendant incidents, so that some conception may be formed of the drainage question which is of such vital interest to the agricultural community of the Western District of Ontario.

The Township of Romney, situated at the south-westerly angle of the County of Kent, on the shore of Lake Erie, has presented a vexed question to its ratepayers as to the course to be pursued to secure to the people effective and economical drainage. From a general view of its situation, as shown on the maps, one would naturally suppose that with Lake Erie as one of its boundaries, the drainage question should be easily solved; such, however, is far from the true state of affairs, as in its consideration the surveyor was confronted by two serious obstacles to overcome: one, the natural ridge of drift formation which extends across the whole face of the township skirting the lake, and the other the unnatural rigidity of political formation found extending across the whole face of the community, and which expressed itself by the unremitting opposition of one party to whatever was advocated by the other. This latter difficulty was the hardest one to reconcile so that actual work might be prosecuted. Survey after survey had been made by different engineers, and the plans submitted to the Council, yet nothing was decided upon. In the meantime, however, the adjacent municipalities were moving in the matter of drainage, and were prepared to assess the township liberally and conduct the waters of it to Lake St. Clair, and past their own doors again *via* Detroit River and Lake Erie. A portion of the township lying to the north was so assessed, and became party to drains in Tilbury leading into Lake St. Clair; the westerly portion drained into two creeks, leaving the southerly and easterly portion unprovided for. Such is an outline of the position of the township as to drainage when the Council issued instructions for a survey and report, having for its object an outlet for the unprovided for territory within their own municipality. This action was taken owing to the acute sensitiveness displayed by the interested ratepayers at the prospect of a heavy assessment for drainage to Lake St. Clair, as rumours were afloat to the effect that large dredge cuts were about to be made in Tilbury West, in which the waters from Romney would be conducted through

the marshes to Lake St. Clair, and the township assessed accordingly. This work would necessitate the construction of levees, and the assessment therefor would be heavy on the townships using the dredge cuts as outlets. To obviate this, all interests were united for a "home" outlet. Two routes of altogether different characteristics presented themselves. One along the third concession from side road 30 and 31, traversing the submerged area westerly to Yellow Creek on Lot No. 15, and along the creek to Lake Erie; the other was the route as shown on the accompanying plan, running east along the third concession to line between lots 21 and 22, thence southerly to the second concession, and along side road 198 and 199, under the ridge, to Lake Erie—an expensive operation for a township of so small an area and so sparsely settled as this. Still, owing to the objectionable features met with in the proposed Yellow Creek outlet, in the shape of very heavy cutting through light sand for more than a mile, that route was abandoned, and it was deemed advisable to recommend the adoption of the second route, and the construction of a tunnel under the ridge as being the most direct, permanent and economical, and a report to that effect was made to the Council, and on its meeting with their approval a by-law was prepared to meet the expenditure proposed. The Bucolic mind was a little slow in absorbing the idea, and the "kicking" from those parties assessed was decidedly vigorous. After the Court of Revision and the County Judge had modified the assessment to their satisfaction the by-law reached its second reading, and no further action taken in the matter for two years, when it was again brought to the surface to offset an assessment of 80 cents per acre which Tilbury West had imposed on *all* the lands of Romney for three miles of dredging to be done at the northerly part of Tilbury, and from which Romney appealed, stating that on the completion of the tunnel drain they would not require any increased outlet through Tilbury West. Thus it was that the work was decided to be gone on with. The contract was let at the estimate as follows:—

BRANCHES.

| | |
|---|------------|
| Stn. 0 to 140 = 8,234 yards @ 14 cents..... | \$1,152.76 |
| Stn. 140 to 225 = 12,580 " @ 14 cents..... | 1,761.20 |
| Stn. 230 to 250 = 2,247 " @ 14 cents..... | 314.58 |
| Stn. 225 to 230 = 862 " @ 14 cents..... | 120.68 |
| Stn. 250 to 283 = 1,881 " @ 14 cents..... | 263.34 |
| Clearing 23.7a @ \$25.00..... | 592.50 |
| Culverts—2 @ \$15.00..... | 30.00 |
| Spoil bank—3a @ \$40.00..... | 120.00 |
| Expenses..... | 400.00 |

OUTLET.

| | |
|---|------------|
| Stn. 0 to 13 = 17,494 cubic yards @ 17 cents..... | \$2,973.98 |
| Stn. 13 to 28 = 1,500 feet tunnel @ \$4.00..... | 6,000.00 |
| Stn. 28 to 60 = 24,058 cubic yards @ 16 cents..... | 3,849.28 |
| Stn. 60 to Junction, 21,637 cubic yards @ 15 cents..... | 3,245.64 |
| Clearing 3.4a @ \$25.00..... | 85.00 |
| Spoil bank..... | 60.00 |

Total estimate..... \$20,968.96

The work on the branches is the ordinary ditching, forming a 16 feet roadway in the middle of the concession road allowance. That on the outlet is heavier cutting than is usually met with and is being excavated by team work using the wheel scrapers, Nos. 2 and 3, which will hold half a yard and one-third of a yard respectively. The material is hard blue clay, and the heavy cutting is handled by "uncovering" a stretch ahead of the teams, which are kept working on an incline from the bottom of the cut to the uncovered portion. The tunnel is lined with a double ring of hard burned sewer brick, and is provided with portals at each end of rubble stone work, estimated and let at \$4 per yard. The work of tunneling will be done by sinking shafts at about 200 feet apart, and then working each way from them along the line of the work, which will be carefully ranged over the surface and plumbed down to the depth required at each shaft. During the winter the work has gone on intermittently, and sufficient excavation has been made to show that no quicksand, pockets of water, gas, or boulders, will likely be met with in tunneling, which was commenced this week, so that I cannot speak as to its being an assured fact. Trusting at some future meeting to be able to give an account of the completed work.

NOTE.—Accompanying this paper was a plan showing the southerly portion of the Township of Romney, and a profile of the drain from the shore of Lake Erie for a length of 7,000 feet. For the first 1,300 feet of this distance the drain is an open ditch, the cut varying from 14 feet to 17½ feet, the bottom of ditch being level and 7 feet wide. From 1,300 to 2,800 is tunnelled, the grade being 0.066 per 100. From 2,800 to 3,200 the grade is 1 to 100, the cut being 17.7 to 13.1. From 3,200 to 7,000 the grade is 0.026 per 100, the cut varying from 13.1 to 8.7, the bottom width being 6 feet. The height of crest of the ridge over grade line of tunnel is 38 feet.

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LEVELLING.

By J. L. MORRIS, P.L.S.

MR. PRESIDENT,—Levelling is the art of determining the difference of the height of two or more points. Correct levelling depends upon a correct leveller, a correct level, a correct rod, and correct turning points

The leveller, before starting out to run a line of levels between any two points, should, if accuracy is wanted, test the adjustments of his level, ascertain if his rod will stand the test of graduated scales, or the standard measure furnished by the Department of Crown Lands, and give his rodman, if not an expert one, a lecture as to holding the rod and carefulness in choosing turning points.

The fourteen-inch Dumpy level for general use is probably as good an instrument as one could desire. A solid tripod is a necessity, as in using light tripods the lightest breeze has an effect on the work. I have done very good work with a twelve-inch Dumpy level and light tripod, but not as satisfactory as with the larger telescope and stronger tripod.

Of levelling rods the speaking rod is much more accurate than the target rod, and will be found much more satisfactory to the leveller, who in using it will be depending entirely upon himself. Of these speaking rods there are numerous varieties, but the rod of most common use is Gravatt's, the divisions of which are in one-hundredths of a foot, marked with alternate black and white spaces, the figures being shown in some way to bring them out distinctly. The Gravatt rod is usually made of two lengths, fourteen and seventeen feet, in three pieces, which fit into one another. I have found great fault with this make of a rod for winter use, as snow and water would get into the inside and freeze, making it impossible sometimes to get it apart, not a very pleasant experience when working during cold weather. In order to have a rod which would not be affected in this way I had one made, the first two parts having open backs. In this way you can have a rod fitting very close at the front, and with no trouble to take the pieces apart. I used for a time the divided feet on paper, pasted on the front of the rod, but dampness and irregularity in some of it caused me to do away with it and paint on the wood, giving me a superior rod.

All levellers who have not been using their level for some time should be careful to have it adjusted, especially if starting out to run a line of levels of any length. I have been with men who could not adjust their own transit or level, and had no idea of how to begin to

do so. The different modes of adjustment for Y and Dumpy levels can be found in Gillespie's "Higher Surveying," but for the Dumpy level the three adjustments necessary are (1) To cause the bubble to remain in the centre of the tube when the telescope is turned around horizontally; (2 and 3) To adjust the line of collimation by the "Peg method" for long and short distances.

The different forms used for level books amount to the same thing, the placing of the different heads depending upon what suits the leveller best. When a leveller once starts his line of levels he must be certain of the ability of his rodman to understand what is wanted. In running through a rocky country the rodman is certain to take boulders for his turning points, and the leveller, after warning him about keeping his rod in the same place, may find that he has given it a turn on the corner of the rod and is holding it three or four inches away from the first point. When the soil will admit of it, I always have the rodman carry a plug made of hardwood, about six inches long and one and one-half inches in diameter, which he drives to near the surface of the ground, and holding his rod on this, when he waves it, knows that there is no danger of the corner at the foot of the rod being raised or lowered. It will be found that about 200 feet is as economical a distance for a sight as you can take. Accuracy should govern all work, but especially when you are employed to run a line of levels for five or six miles, knowing that your elevations at start and finish should not differ more than a few inches, from evidence of still water, for instance; it will not do to have cross hairs covering a tenth on the rod when reading, or any slackness in the work.

When the leveller is taken as evidence in a dispute, no questions are asked as to your instruments, rod, or rodman (except to know if you had sworn him), and all that is asked of you to prove is your levels. For a leveller to run a single line of levels, and expect the result to be taken as evidence, is absurd, but when he levels back again to his starting point, and finds in a distance of a few miles that he varies, say, one inch, then he can conclude that his levels are correct.

In the spring of 1887, I ran a line of levels for a distance of five miles on ice, and left a bench mark. A suit arising out of the flooding of land, in connection with which these first levels were run, I thought it advisable the following summer to check them by running levels between the same points, but overland. I found a difference of one and one-half inches, and considering the distance of five miles and the care which had been taken, I considered that my levels would stand an examination in the witness box. How often surveyors go into courts of justice only half prepared with information for which they were brought there, causing a feeling among the legal profession of want of confidence, to our undoubted injury. It may be of some interest to know how the one and one-half inches were got over, and the following questions and answers (only from memory) may explain:

Q.—How many sets of levels did you run?

A.—Two.

Q.—Did they differ any?

A.—Yes; about one and one-half inches.

Q.—Are these levels infallible?

A.—Yes.

Q.—Are the first levels absolutely correct?

A.—No.

Q.—Are the second levels absolutely correct?

A.—No.

Q.—Yet you say that these levels are correct?

A.—Yes.

This finished the cross-examination on this point. The examiner was questioning from a standpoint of perfectness; I was answering from a standpoint of the frailty of level, rod, and everything else. The court upheld the evidence as being quite logical, notwithstanding strong argument to the contrary. Another line of levels run between two water powers on the Mississippi River, county of Lanark, were checked to within one inch, being a distance of over one mile apart. Considering the evidence which I had from former work, and the kind of country which I had levelled over, I concluded that this check was very close; so that from our own experience we must form some estimate of the difference between mistake and error in our work. I consider that one-half inch in a mile between first and second set of levels is a small difference, with the instruments which are used at present by levellers in general. If levels are being run across a country rising for some distance and falling again, it may be observed that any error made in levelling up the hill will be balanced by the levels going down the same distance. This is due to little discrepancies in the rod, and the short and long sights becoming long and short sights. When the levels which are run by a leveller are to settle any dispute, extreme care should be taken to have permanent bench marks established in the close vicinity of the disputed points, and in a case where water is in the question, wherever possible, to have bench marks, at numerous points along the stretch of water, as it is very certain that more than one set of levels will be needed before your work is complete. Rubbish, change of channel, wind, and other causes have a tendency in short times to cause the heights of the water in a stream to vary, which is the case when mill owners have the privilege to fill up the channels of small streams with sawdust and edgings.

The effect of wind on the levels of water in lakes can best be determined by practical experiment. At the foot of a lake five miles long by one wide (an expansion of Bear Creek, a tributary of the Ottawa River) a dam has been built. It has been observed that when this dam is opened there is a fall in the lake of two inches every twenty-four hours. The effect of a wind coming down the lake is to raise the water at the dam six inches higher than when flowing through in calm weather.

The case of the Muskrat River, county of Renfrew, is a strange one. It takes its source at the Muskrat Lake, which is about eight

miles long and one mile wide. Then for about two miles the river has a width of two hundred feet, and widening out into a lake two miles long by half a mile wide. From this lake to its mouth, a distance of seven miles, it has a width of about one hundred feet. For seventeen miles it resembles a slough in the North-West Territories, has very little current, and filled with a mass of weeds so dense that in many places the channel is narrowed to fifteen or twenty feet. It was claimed that a dam on the river below flooded lands for twenty miles back during and for some time after the spring freshets. The difference between the level of the water at the top of the dam and the water in Muskrat Lake was found to be about a foot. This small difference at a distance of twenty miles, with a nearly stagnant stream between them filled with weeds and rubbish, made it apparent that the dam must have a bad effect during the spring freshet, yet was the cause of only part of the trouble, the weeds and rubbish having a great deal to do with the holding back of the water, which had to percolate through instead of having a clear flow. All the formula which could be deduced from Rankine on the flow of water could not satisfy a case of this kind. We are now on the threshold of an era of disputes concerning water privileges in Eastern Canada, and with this in view more attention should be given to levelling and that part of Hydraulics which goes hand in hand with it, so that committees of inquiry and our courts may have less trouble in securing reliable evidence.

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THE GRAPHICAL METHOD OF CALCULATING STRAINS.

By G. B. ABREY, P.L.S., A.M. CAN. SOC. C.E.

IN announcing this paper in the programme I had not thoroughly appreciated the manner in which it would develop. There is unavoidably a very large amount of drawing required to explain the matter. This drawing cannot be reduced to an amount that would permit its reproduction in our annual report. I will therefore be obliged to modify the title of the heading, and perhaps the best to call it is "A Lecture on the Graphical Method of representing Strains in Structures."

Some years ago (1876), when this method was comparatively new, I took a considerable interest in it. Sheets 1 to 10 and H were prepared at that time, simply for my own instruction, and to save labour I now make use of them. Some others are added that I think necessary to complete the illustrations required.

I am not sure but that a paper of this kind is out of place to read before an association composed as this is, of one's compeers, some members of which, I know, could so much better tell what I have assumed to do. Also, probably nothing new may be found to have been brought out, and perhaps it may show to a great extent merely a compilation from books that many are familiar with.

My excuse is that the subject is so generally useful and interesting, few succeed in originating much that is useful, and my hope is that some criticism may be provoked that will bring out features in a new shape.

The graphical method is not confined to any particular figure or procedure, but generally many ways may be had of accomplishing desired results. In difficult cases, such as drawbridges of complex design, continuous girders, cantilevers, etc., I do not think many of us could estimate by any other method.

PARALLEL CHORD TRUSS.

Sheet 1 shows a ten-panel truss with parallel chords. All the necessary diagrams for the complete calculation of the stresses in this truss are shown on the sheet.

They consist of—

Elevation diagram.

Load and stress diagrams.

Moment curve for bridge, and full moving loads, and Shear diagram for combined dead and moving loads.

Maximum stresses on any portion of either chord may be taken off the full load moment curve by scale, multiplied by H on the stress diagram, divided by height of truss, or from the shear diagram by adding horizontal components of strains on diagonals.

Maximum stresses for verticals and diagonals may be taken from shear diagram. Diagrams also show what counter bracing is required.

PARABOLIC TOP CHORD TRUSS.

Sheet 2 shows an elevation of an eight-panel truss with a parabolic top chord.

Some additional drawings are required to get the stresses, besides those required for trusses with parallel chords.

We will require moment curves for all positions of the moving loads for the purpose of constructing the supplementary shear diagrams. See sheet $\frac{1,2}{2}$.

As an example, suppose we take the diagonal in panel 4 sloping upwards towards the centre. The maximum stress will occur when 1, 2, 3 only are loaded. Draw moment curve for this loading. From the curve obtain tension in the bottom chord of panel 4 equal to 29.3 tons, and compression in top chord of same panel equals 32.3 tons. From the shear diagram the shear in same panel is found to be 2.5 tons. Now from these data construct the a figure by drawing shear vertical, and chords and diagonals parallel to the same, in the elevation. Then scale off the diagonal for its stress.

To obtain the stress on the vertical 4, draw a line parallel to the next following section of the top chord. With the same shear the vertical drawn from the extremity of the bottom chord equals stress on No. 4 vertical.

All the stresses are fully illustrated and shown on the sheet $\frac{1,2}{2}$.

BOW STRING.

Recently I have been engaged professionally to make an examination of the highway bridge over the Desjardins Canal at Hamilton, which has plate girder, end spans 31 feet long each, with a parabolic or bowstring span in the centre 115 feet long.

The bowstring is of the Whipple design, so fully described in his treatise on bridge building.

The sections of the arch are of cast iron of cross section shown in the drawings. The lower chords are wrought iron link bars placed around cast iron pins. The verticals and truss diagonals pass through the pins, and are of round iron rods. The verticals are subject under a moving load to both tension and compression stresses. Diagonals are subject to tension only.

The cross beams are flanged plate girders resting on the pins and attached to the verticals by iron loops.

The bridge is divided into an odd number (9) panels, and has a camber in the centre of 1.5 feet. The arch rises at the centre twelve

feet above the centre line of chords, or 13.5 feet above the horizontal line of the centre of the chord connections at the ends.

All rods are weakened by cutting their ends down for screw threads.

The arch is kept upright by spreading its bearings at the ends to three feet wide, and by splitting the central vertical to the same extent. Diagonals and sway braces are connected by bent eyes. Arch section ends abut without fitting each other than as they left the mould.

One end of the bridge is placed on small rollers made of rod iron. These have long ago ceased to act as intended. The whole rests on piers of framed iron standing twenty-eight feet high above stone abutments.

The bridge has been up and in use for a considerable number of years, and is apparently as good as ever. Engineer inspectors have recently condemned the whole structure, and it is shortly to be replaced by another. I have calculated the strains very fully, as shown, for a moving load of eighty pounds per square foot of platform area, and for wind at forty pounds per square foot of side area. And it will be seen that some of the parts are dangerously weak.

This bridge is not selected as an example to be imitated in any way, nor as a type of a desirable design. I chose it partly for convenience, on account of having it fresh, and partly as one presenting some difficulties in calculation by the usual analytic methods. It also brings out most of the devices of the graphical method for single spans.

Most of the parts of the bridge are calculated by several methods, and it is seen that the graphical method is fully competent for every part. For some portions the method seems laborious, and I do not think I would adopt it everywhere. For the sake of completeness in the illustrations, I have shown the method even for the most simple calculations, and where reciprocal diagrams are used the drawings (sheets 12 and 13) show much more work than is required. The portions drawn in heavy lines are all that are necessary to obtain the stresses. I would call attention to the reciprocal diagrams for maximum strains under bridge loads and full moving loads. These drawings are of easy construction, leave no ambiguity, and fully exhibit every portion. Supposing the arch to be parabolic, these diagrams reveal some unexpected results in the stresses in the diagonals that would probably not have been discovered by other methods. I think no other method so good for this girder under symmetrical equal loading as the reciprocal figures. The sheets also show by the same method the maximum stresses in the diagonals and verticals for all positions of the moving load. Except that some other graphical process is shorter than by reciprocal figures, for moving loads none are so satisfactory when completed. See another method on sheet 14.

See also another method on sheet $\frac{1,2}{2}$. See also on sheet 17 a graphical method adopted by Whipple for calculation.

For the cross beams (built girders) there is shown on sheet 16 the bending moment diagrams for both concentrated and distributed loads.

For concentrated loads the graphical method is admirably adapted, or, as in this case, the combined concentrated moving loads, with the distributed bridge load. Also the strength, or moment of resistance of the beam to bending, is very effectively shown by the resistance figure. The usual analytical rule is not accurate, as the moment of the flanges is assumed, and not calculated. This same remark applies to the girders of the end spans.

METHOD OF MOMENTS.

Sheet 21 shows the drawings and calculations in detail for the stress of every member of the girder of the same bridge by the method of moments, or better known as Ritter's method, recommended by Dubois as the best method of checking the graphical method.

In the drawing the lever arms are obtained graphically, though they might all be found by calculation. The draft was made in a hurry, though you will see the results check well enough to show that no material error has been committed anywhere by any of the methods.

In this girder, as before remarked, it is not apparent by simple inspection from which direction of the moving load the maximum stress on the verticals would be produced; the drawings show calculations for load both ways.

(Explained on the drawings.)

In the central bay the chords become parallel, and their intersection at an infinite distance. By forming the equation in the usual manner, it is found that each term of the equation has a factor of infinity. So that it is only necessary to divide it out to get a simple resulting equation similar to those for the other members of the truss. This Ritter's method is very simple in its theory and practice, and seems capable of solving all stresses in bridge and roof trusses, as well as in other pieces of mechanism, and deserves more than a passing notice by the engineer.

CONTINUOUS GIRDER.

Sheet 9 shows and explains all the diagrams necessary for the calculation of all the stresses in a continuous girder of two spans of unequal lengths, with parallel chords. The design is for one span 80 feet and the other of 100 feet. The bridge weight is supposed to be uniform, as well as the live, full load.

Clapeyrons, or the three-moment method of computation of stresses, has been employed on the sheet. This method, when applicable as it is here, is rather shorter than what we might term the graphical method.

The design on this sheet is in general a copy of one in "Green's Bridge Trusses," shown on a larger scale and in more detail on the sheet. I will therefore direct attention to that treatise for full explanation and proof of the method.

I would remark that if the loading be not uniform on a girder, as also uniform on the other, though not necessarily the same on both, that

the clapeyron method will not apply, nor if it is desirable or necessary to draw curves for partial loads. Then the points, B''' , B'' , B' , must be obtained by another process, say the following :

Graphical Method.—Join AM, CM, calculate areas between the curves and the lines now drawn, multiply the areas found by the distances of the centres of gravity from the outer ends respectively. Call these moment areas, the one on the left Aa , and on the right Cc , also let the length of the span on the left be a' , and on the right c' .

$$\text{Then } M.B' = \frac{3Aa a' + Cc c'}{a' c' (a' + c')} = \frac{3}{a' + c'} \left(\frac{Aa}{a'} + \frac{Cc}{c'} \right)$$

$$\text{If } a' = c' = l, \text{ then } MB' = \frac{3}{2l^2} (Aa + Cc)$$

Join $A'M$ and $C'M$, calculate the curve areas now enclosed as before, and obtain the moment areas. These will be $A'a$ and $C'c$. Then—

$$MB'' = \frac{3}{a' + c'} \left(\frac{Aa}{a'} + \frac{C'c}{c'} \right)$$

$$MB''' = \frac{3}{a' + c'} \left(\frac{A'a}{a'} + \frac{Cc}{c'} \right)$$

$$MB'''' = \frac{3}{a' + c'} \left(\frac{A'a}{a'} + \frac{C'c}{c'} \right)$$

Sheet 10 shows a four-span continuous girder. Spans of 125, 75, 50 and 50 feet, with parallel chords and triangular bracing, Clapeyrons rule is sufficient for all the strains in this, as in the last, to get chord and shear maximum strain diagrams, it is only required to know the bending moments for full and empty loads and their various combinations. All maximum strains are represented on this sheet.

See Green's treatise for an example of a four-span truss somewhat different to this one, and of spans differently arranged and calculated by the graphical method.

I would call attention to the moment at the central pier, when the first and third spans are alone loaded. The point C' on the centre vertical being raised completely off, or requiring very strong holding down bolts to keep the truss on its bearing.

DRAWBRIDGE.

Sheets Nos. 3, 4, 5, 6, 7, 18, fully illustrate and explain this girder under all positions, but as these drawings cannot be issued with the published report, I will try and explain as well as may be in this written description.

First, draw the load line and stress diagram for each system of the truss, light and loaded (truss is cancelled, that is, the diagonals cross an upright in passing from one chord to the other, and each system of the truss has to be calculated separately). Next, draw the

funicular curves of each system separately for these stress diagrams. For the curves unloaded the funicular polygons may be at once completed by drawing the closing lines to meet the centre vertical. To get the closing line for and curve loading of the truss that causes it to bear on the abutment requires some calculation. Say for full loads, connect both ends of the funicular curve by a straight line, calculate the area enclosed, and multiply it by the distance of its centre of gravity from its outer end. This may be called its moment area. Also calculate the area enclosed in the complete funicular polygon of the truss with loading, and multiply this area by its distance of centre of gravity from the outer end of the span, as before. This product will be its moment area. Add these two moment areas, and divide their sum by one-third the square of the length of the truss span. The quotient gives a point on the centre vertical. Then connect this point by a straight line with the outer end of the full load curve, and it is the closing line completing the funicular polygon for full loads on both spans.

Next, it is necessary to complete the polygons for the bridge, one span loaded and the other span unloaded. Connect the ends of the curve for no load by a straight line, calculate its moment area the same as was done for the full load curve, add together the moment areas for full load, no load, and twice that of the completed polygon for no load, divide the sum by two-thirds of the square of the length of span, and the quotient gives a third point on the centre vertical. Connect this point by straight lines drawn to the outer ends of both curves, and complete polygons are obtained for the truss with one span loaded and the other unloaded.

From these three polygons the maximum bending moments may be scaled for the truss, with both spans loaded, both unloaded, one span loaded with the other unloaded, and the span unloaded and the other loaded. The closing lines drawn crossing the full load curve indicate the points of contra flexure of the truss.

Next, draw in the stress diagram lines parallel to the closing lines of the various polygons. The points, when these intersect the centre vertical, give the supporting forces for the different loadings. We may now proceed to the construction of the shear diagrams.

First, lay off a horizontal line the same length as the truss; lay off on the centre vertical a line equal to the load line for the unloaded truss, connect this point with the outer end, and the figure gives the shear for the bridge, or dead load.

Next, lay off at the outer end, the vertical upwards, equal the supporting force for full loads on both spans, and on the centre vertical lay off the difference between the full load and the supporting force. Join these points; then the figure enclosed gives the shear for full loading.

Next, lay off on the end, vertical downwards, below the horizontal line, the pull on the locking bolts, and draw a line to the centre vertical parallel to the sloping line of the shear diagram for dead load, and the figure enclosed between this and the horizontal gives the shear for the unloaded span when the other span is loaded.

Next, lay off on the end, vertical upwards, the supporting force for the loaded span when the other is unloaded, and draw a line to meet the centre vertical parallel to the sloping line in the shear figure for full loading. The figure enclosed by these and the horizontal gives the shear for the loaded span when the other is unloaded.

Again, lay off parabolic curves tangent to the two lowest lines at the centres of the extreme panels, and we have the maximum shear line for moving load when the other span is loaded.

Lastly, draw a parabolic curve tangent to the two upper sloping lines at the centre of the two extreme panels, and we have maximum shear lines for moving load when the other span is unloaded.

Sheet 18 shows moment and shear diagrams for the drawbridge of the International Bridge near Buffalo, more fully described, so far as the bridge is concerned, in Gzowski's published report.

The bridge, when unloaded, is supposed to rest entirely on the central pier, and when closed the ends to just rest on the abutments. Then, in order to prevent the unloaded end from rising when a load comes onto the other span, cams are used to raise the ends sufficiently. In the drawings I have supposed locking bolts to be used. The diagrams on this sheet show all the maximum strains for chords, locking bolts, reactions at abutments, and shear for each panel of the bridge. From the diagram of the elevation it is seen that the truss is cancellated, making it necessary to make the two complete drawings shown. Each system of the truss is calculated separately, and the results added.

Observe how elegantly the strains on the locking bolts are shown. Also, the reactions or supporting forces caused by loading; also the points of contra flexure. These points vary from the outer ends, with no load, to the seventh panel from the outer end, when the span is loaded and the other light. So that the first seven panels from each end must be provided for plus and minus strains.

If, instead of locking bolts, the lifting cams had been supposed used, and of just sufficient power to raise the ends when closed, so that a load on one span would not lift the other when unloaded, the same drawings given here will, with slight modifications and without the necessity of entire new drawings, give all the strains.

Next, if the cams are strong enough to raise, so that three-eighths of the dead load of each span is borne by each abutment, it is then when closed to be calculated as a continuous girder of two equal spans, and when open a special moment and shear diagram would be required to obtain the strains in that position.

In order to obtain the stress on the diagonals and uprights of this bridge, in consequence of the upper chord being inclined, moment curves for all positions of rolling load will have to be drawn, and supplementary shear diagrams constructed, as shown on sheets 4, 6, 7.

From Gzowski's published report I was unable to get all the data necessary for the actual bridge, so that in the diagrams some of the data were assumed. This does not interfere with the example for purposes of illustration, but might be unreliable if applied to the actual bridge.

MOMENT OF INERTIA.

Sheet 19 shows a moment of inertia diagram for an irregular figure (the section of an American steel rail). The diagram, drawn accurately to scale full size, shows the section, next the resistance figure, and lastly the moment of inertia figure, all the construction lines for each of the figures show in red, and full explanations are written on the sheet. The whole is very simple, both in drawing and principle, and perhaps the section is as difficult as occurs ordinarily in practice. I would say that the graphical method furnishes other methods both approximate and exact, to accomplish same result.

The above is theoretically exact.

RESISTANCE DIAGRAMS.

Some of these are shown on sheets 16 and 19, to illustrate the subjects there. There are a lot of sketches of various figures here also. There is nothing difficult about them, neither are they tedious in construction.

TO FIND THE RESISTANCE AREA OF A SECTION OF A BEAM.

Find the centre of gravity of the section G , draw a horizontal line through G . Then, if the G is in the centre between the upper and lower surfaces of the beam, draw horizontal ordinates through the section, and the same through the resistance area section. Lay off the breadths of the ordinates on the beam section, on the upper and lower surfaces of the resistance area sections, and from these points draw lines to g , and at the intersections with the ordinates draw a curve. The area enclosed is the resistance area.

Lines that are horizontal in the section of beam are horizontal in the resistance section.

Lines that are vertical in the beam section are straight and inclined in the resistance section.

Lines that are inclined in the beam section are parabolic curves in the resistance section.

Lines that are curved in the beam section are curves in the resistance section.

If the centre of gravity of the beam section does not pass at the same distances from the upper and lower surfaces of the beam section, draw the resistance area for that portion of the beam that has its extreme surface nearer to its centre of G , same as instructed above, and for the portion that has its extreme surface farther from the G line, draw through the section a line (xx) parallel to the G line and at a distance from it equal to the extreme surface of the other portion; then on this line, xx , lay off the breadths of the ordinates of the beam section, same as before, and from the points found draw lines to g and produced backwards and through the intersections of the ordinates, as before, draw the curve for the resistance area.

In all cases the areas on each side of the G line are equal.

See sheet 20 for the following :

Let it be required to design a beam such that it is equally strong to resist failure by tension or pressure. Suppose a cast iron beam is wanted—

$$\frac{\text{Tension strength of cast iron}}{\text{Compress strength cast iron}} = \frac{3.6}{10}$$

Let the depth of the beam be 13.6 inches, let the breadth of the bottom flange be 16".0, and let the thickness of the flanges be 1" throughout.

Now from the above data draw a section of the bottom flange and web. Draw the axis xx parallel to the bottom line of the beam through its neutral axis (the neutral axis will be at the distance of 3".6 from the bottom, and 10" from the top). Draw xx parallel to XX , cutting the web at 3".6 therefrom.

Next construct the resistance area in the usual way, of the lower flange and web of the beam. Calculate its tension area, also its pressure area. Subtract one from the other. If the pressure area is the greater, the required upper flange will be a minus quantity. However, in the present instance the tension area exceeds the other, and its excess must be added to the pressure flange. In the diagram it is

found to be $\frac{81}{100}$ ", and is laid off as shown on the resistance diagram marked ef . Join eo , cutting off jk from $xx' = 0.3$ " equals the breadth required of the top flange to be added, half on each side, to the web.

The beam is now constructed such that the stress on the pressure flange is to that on the tension flange as $\frac{10}{3.6}$, having its centre of gravity on the axis XX .

Compare the above with the usual way of determining the same (see Cotterell's "Applied Mechanics," page 319), which generally includes an error of supposing the maximum stresses of the flanges as being in the line of their centres of gravity.

I had intended, in order to complete this description, to show drawings for centre of gravity of figures and moment of inertia other than those on the sheets explained, and central ellipse of section diagrams. I would refer to Clark's treatise on The Graphical Method for full instructions on that subject.

I have to regret, also, that I had not time at my command to show the application of the method to actual examples of the braced and stone arches, two difficult structures to calculate by the ordinary methods. This method is sufficient for them. See Dubois' "Graphical Statics."

As before remarked, it is quite impossible to publish the large amount of drawing shown here, but to all members that are convenient the writer would now or at any time be pleased to exhibit the drawings to be examined at leisure.

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

A FEW THOUGHTS ON DRAUGHTSMANSHIP.

By F. L. FOSTER, P.L.S.

AMONG the many useful topics written on and discussed at our yearly meetings, the subject of Plans and Plan-Making has, I believe, been conspicuous by its absence; and it has occurred to me that a word or two on the practical part of it may be acceptable to the members of our Association.

In consequence of the rapidity expected of draughtsmen in our modern day of hurry and excitement, and the somewhat unreasonable demands made upon surveyors, we are, I think, too apt to look at the merely utilitarian aspect of the art, and lose sight of those qualities attained by many of our predecessors who lived in a less progressive age, namely, artistic finish.

That the merely useful has, to a great extent, supplanted the ornamental, and that young draughtsmen of the present day are, from the cause just mentioned, apt to ignore it altogether, is a conclusion easily arrived at by those giving the subject careful consideration.

It is on this account that I have felt tempted to write a few words on the subject, and to urge upon our members the desirability of assisting their pupils in attaining a carefully finished style of draughting.

One of the first requisites of the art is *utility*, under which head may be placed permanency and accuracy, clearness of detail and absence of all ambiguity. Secondly, artistic design and finish; and I propose—presuming on your patience and good-will—to say a few words in reference to each, adding one or two more on materials and methods of embellishment.

As to the utility of our plans of record, it will be apparent to those who have occasion to examine the contents of our registry offices and Departmental plans that, notwithstanding the high finish attained by some of the draughtsmen of old, much is lacking in this respect. Leaving out of consideration the ambiguity displayed in the lack of bearings and distances, it is to be noticed that the want of permanency is to be added to the faults of the old system. It seems to have been considered a desideratum of good draughtsmanship with many of our predecessors to carry out practically the mathematical definition of a line “length without breadth,” and to demonstrate their ability to write the ten commandments on a six-penny piece, and in consequence of this attenuation of lines and minuteness of lettering, the most powerful reading-glass fails to bring their good intentions

within the scope of ordinary vision. This, coupled with the poor quality of paper and the pale ink used, is a constant source of annoyance to those having occasion to make use of them.

The remedy for this evil is, of course, apparent to us all: which is good, solid lining and lettering, with the best inks, upon well mounted drawing paper or tracing linen.

To think, however, as some appear to do, that firm, strong black lines and fair-sized letters and figures denote a coarse method, is a mistake which perhaps arises from the disagreeable effect caused by the unevenness and lack of uniformity sometimes displayed in lining and lettering. If the draughtsman takes a standard suitable to each plan for his thin lines, and another for his heavy ones, and adheres to them throughout his work, it cannot look coarse if otherwise fairly done.

The exception to this rule may consist in the pen and ink work on the topographical features of maps drawn to a small scale where a high finish is required; but even this finer lining is not always desirable or necessary to good effect.

If this simple rule is carried out (as I see it is being done by some of our modern draughtsmen), and the best materials used, we need no longer fear for the present or future illegibility of our plans of record.

As to artistic design and finish, it will be observed that the chief characteristics of the ornamental parts of maps and plans are somewhat analogous to those of any pictorial design, namely, *form, light and shade, balance and colour.*

That of form applies to the exterior shapes of titles, scales, meridian points, notes, certificates, etc. Light and shade relates to the lightness or depth of tone as separate bodies in relation to the whole space within the border; balance, to the positions they should occupy, and colouring, to the juxtaposition of tints having such relations of harmonious contrast with each other as to be agreeable to the eye while filling their intended office.

From the irregular shape of plans it is often impossible to apply all the rules based upon the above requisites; but, when practicable, it will be found that if the spaces occupied by the different parts of a plan—title, notes, etc.—be placed so as to leave proportionate, or nearly equal areas of the ground or paper between each, the proper effect of balance will be attained.

Upon the proper shaping of the letters and their true balance in relation to each other will principally depend the good effect derived in this respect. The spacing of the letters should be so done as to leave the areas between them as nearly equal as possible, and those between words about twice as large. The same rule of equal areas should be observed in reference to spaces between lines of letters, and no lettering or figuring should touch any other figure or line. As the forms and proportions of letters have been exhaustively treated in works upon the subject of draughtsmanship, it would be beyond the scope of this paper to say more than a word or two in reference to it. Type founders' pamphlets for advertising purposes contain a great variety of letters, and can be studied with profit; but the inventive

powers of the student should be freely exercised in this direction. For ordinary plans, however, the plainest and simplest lettering is the best.

Titles have a pleasing appearance when their general shapes assume those of some regular mathematical figure, such as the ellipse, oblong, triangle, etc.—the first named being generally recognized as the most agreeable; complying, as it does, with one of the requirements of a well-considered design, “the just relation of the straight line with the curve.”

When colours are used on plans, their harmonious contrast with each other can be secured by observing a simple rule based upon the Newtonian theory of the three-fold nature of light, followed by the most successful colourists of all times.

Light, by this theory, is divided into three primaries, three secondaries, and three tertiaries. A good practical way of remembering and applying this theory is to draw an equilateral triangle, and at the three angles place a primary—red, yellow, and blue. On the opposite sides place the secondaries, resulting from the admixture of the two primaries at the adjacent angles. It will thus be found that the secondary opposite the primary red will be green, which is the resultant of the admixture of yellow and blue, and that it will form a harmonious contrast; causing each colour, red and green, to be greatly enriched by being placed in juxtaposition.

For the same reason the primary yellow forms a pleasing contrast with purple, the secondary formed by mixing the primaries blue and red. The primary blue forms a similar contrast with orange, the secondary formed by the mixture of the primaries red and yellow; it will thus be seen that harmony is produced by the presence of the three primaries, or their equivalent of mixed colour. Of the tertiaries, brown, broken green, and gray, it is not necessary to more than make mention in this connection, as they are not applicable to general plan embellishment, though very important in pictures and designs where much variety of light and shade is represented; as in natural scenery, figures, subjects, etc. Darker shades, however, of any primary or secondary colour, when judiciously placed upon a similar colour lighter than itself, will enrich the appearance of both by contrast of tone.

Flat washes of colour of any considerable extent are most successfully and evenly laid in the following manner:—

The material to be coloured should be pinned as tightly upon the drawing board as possible; the farthest side of the board should then be raised to an angle of about 25 degrees with a horizontal line, and, after the full amount of colour to be used is mixed in a suitable receptacle, it is to be applied to the plan with a brush as large as can be safely used, and beginning at the upper edge of the part to be covered and working with horizontal sweeps from right to left and *vice versa* alternately, keeping the brush full so that the lower edge of the extending colour may be very wet till the surface is nearly covered; the remainder can then be worked over with the brush in a drier state, and any pools of colour at the finishing edge, however small, carefully

absorbed before the drying begins. The lack of these simple precautions often causes plans, otherwise well executed, to have an unpleasant appearance in consequence of the unequal drying of the colour. Flat camel-hair brushes of different sizes are the best instruments to use for this work.

The most useful colours for the draughtsman are Crimson Lake, Madder Lake, Carmine, Yellow Ochre, Light Cadmium Yellow, Prussian Blue, Cobalt, Hooker's Green (No. 2), Burnt Sienna and Sepia. All the colours required for the purpose are contained in these or their mixtures. Madder Lake is the most permanent of the three reds mentioned, the other two being liable to fade. The rest are generally considered permanent.

A word or two about materials, in conclusion: Among the various papers used for making plans that are intended for frequent reference and much wear and tear, there are none more serviceable than Whatman's; which, when well mounted on strong cotton, are as nearly imperishable as any drawing paper can well be. Some of the American made "endless" papers are good, and others worthless as regards wearing qualities; being brittle, hard-surfaced and liable to crack and break where folded. As a rule, a paper that has these faults—that will not admit of erasure, that will not take a smooth and even wash of water colour over an erased surface—should not be used by a draughtsman.

The use of tracing linen for plans of record, so prevalent now and for some years past in many of our registry offices, is not, I think, a useless innovation on our old methods. This material, when mounted on stiff pasteboard, is not liable to wear out readily, will preserve the details on the plans satisfactorily, and forms a convenient mode of reference. Any colour applied to the back of a mounted tracing will be practically permanent.

Some of the best inks now used are in a liquid form, and can be recommended for convenience and permanency. After several years' trial of a number, I find that Higgins' waterproof India ink is excellent for general purposes, and possesses the quality so rarely found of allowing a wash of water colour over it without disturbance to any appreciable extent.

Coloured inks should, I think, be used with caution where permanency is required, as some are disturbed by the slightest moisture and become blurred and indistinct from this cause. We often see small letters and figures rendered illegible when proper precaution is not taken in this respect. I have no reason to doubt, however, that the coloured inks advertised by Keuffel & Esser, of New York, and others, are what they are said to be, indelible and proof against disturbance by moisture.

As a concluding remark, permit me to say that when examining and criticizing the draughtsmanship of our professional brethren of old, we are reminded of the fact that we are daily handing down to posterity records of our skill or want of it, and upon the training of ourselves and pupils depends the question whether the verdict will be favourable or otherwise.

DISCUSSION.

Prof. Galbraith—I think draughting is a thing, in the present utilitarian age, too much neglected. One of the worst things that ever happened to surveyors was the invention of these stencil letters. I think that has done more to spoil good draughting than perhaps any other thing—at least in the way of inventions. I believe in the old-fashioned hand practice in lettering, and do not think that one can be made a draughtsman unless he makes his letters by hand, and is thoroughly practiced in the work. It is a slow and difficult process with the average man. It is just as difficult to learn to make good letters as it is to learn copper-plate. The importance of lettering on a plan cannot be over-rated. It is the one thing that the public can appreciate better than anything else, and it has more influence in commending an engineer to his employers than any other one thing.

I have found it a most useful exercise for a student to have him attempt to cover as large an area as possible with as small a brush as possible. When he is able to do that he can then very easily use larger brushes and get an even tint on a comparatively large surface; and for anyone trying to learn to use his colours properly, I think it is a most useful exercise. However, in doing work I would not do it that way; I should follow Mr. Foster's plan. But I mean when a draughtsman is trying to instruct himself, I think he will succeed better in laying on colours by making that attempt.

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

WATER-WORKS FOR TOWNS AND VILLAGES.

By HERBERT J. BOWMAN.

Supt. Water-works, Berlin.

Now that our country is rapidly progressing, its hamlets developing into villages soon to seek incorporation as towns and eventually to become chartered cities, the question of water supply for many places is demanding attention. This being the case, many of the members of this Association who have not as yet paid particular attention to this subject, will sooner or later require to look into it, either professionally or from the standpoint of a private citizen. For the benefit of such members, the writer will endeavour to point out the principal features of an efficient water-works system, and will look to those members of the Association who are familiar with this branch of engineering for assistance in discussion of the same.

The necessity of a system of water-works for a town or village is, as a rule, first recognized after some disastrous fire, either in the place itself or in some neighbouring community, and then the municipal council applies itself to the subject, concerning the details of which its members are usually densely ignorant. A committee is appointed to visit towns already supplied with water-works, and after a sum, often more than would be required to employ a competent engineer, has been spent in travelling expenses, etc., some cheap scheme is submitted to the people, who show their want of confidence by voting it down. Thus the agitation for water-works is thrown aside, perhaps for years, unless private capital comes to the rescue, and often the best solution of the difficulty is to contract with some reliable company to put in a complete system on the franchise plan, the town paying an annual rental for its fire protection, water for street sprinkling and public buildings. Under our Ontario Statutes the town may assume control of the works at the end of ten years upon paying their actual value, as fixed by arbitration, or at any time at an advance of ten per cent.

In either case, whether the works are built by the municipality or by a private company, a competent engineer should be employed by the council to prepare plans and estimates for a comprehensive system capable of extension, and all bids, either for construction or maintenance, should be based thereon. This will save time and money, both for the municipality and for the contractors, and will result in the construction of a much more carefully designed system than if left to chance.

The first question to be considered by the engineer is that of the source of supply, and this differs in nearly every case. Occasionally a town is so situated that an available supply of good water may be conveyed to it through pipes by gravity from some natural or artificial reservoir at an elevation sufficient to furnish the pressure required for domestic and fire purposes. This pressure, for the residence portion of a town, should not be less than 40 pounds at the hydrants, which should not be more than 500 feet apart. With 40 pounds pressure at the hydrant and using 100 feet of two and one-half inch rubber hose and one inch ring nozzle, the water will be thrown 70 feet in the air. Even should the fire break out midway between two hydrants, and 300 feet of hose be required, the vertical distance reached by the jet of water would be nearly 60 feet, as may be seen by reference to an excellent little work, Ellis' "Fire Streams," and this should be sufficient for any suburban district.

In the business portion of a town a system of water-works to furnish fire protection without the addition of steam fire engines, should carry a pressure of at least 60 pounds at the hydrants, which should not be more than 300 feet apart. This pressure, with 100 feet of two and one-half inch rubber hose and one inch ring nozzle, would throw a stream 95 feet in the air, or midway between the hydrants; that is with, say 200 feet of hose, the vertical distance reached by the jet would be 90 feet.

Some of our Ontario towns and villages are thus favourably situated that they have or can have a gravity water supply system, but in the majority of cases water must be pumped either by water power or steam.

Where pumping is necessary, and some high elevation is situated close to the town, the best system will be obtained by constructing an earthen reservoir in connection therewith—provided the elevation be sufficient to give at least the fire pressure spoken of before for a gravity supply. If this cannot be obtained a storage stand-pipe may be erected on the high ground, and of sufficient height to give the necessary pressure, or probably ten pounds more, as the stand-pipe will not be filled to the top at all times. However, there are cases where neither of the above systems are used, and "direct pressure" is applied to the mains by continuous action of the pumps alone. This is sometimes called the Holly System, and while it saves the first cost of a reservoir, or water tower, as the case may be, still for towns and villages it is not economic, as it will require a night engineer, and besides the sudden variations in pressure that will result from the opening and shutting of hydrants or railroad water-cranes is very hard upon the pipe system and house plumbing, and will interfere with the satisfactory operation of water motors and hydraulic elevators, etc. Where the consumption is small the duty of steam pumps will not be as great with the continuous and variable action required by a direct pressure system as it will be with a reservoir or stand-pipe in connection, as then the pumping will be done in a couple of hours running at the most economic speed, the fires being banked the remainder of the time. However, the arrangement of valves or gates should be

such that should extremely heavy pressure be required in case of a large fire, the reservoir or stand-pipe may be disconnected, and the system will then possess all the advantages of a direct pressure system for fire service. When the fire is over the gate is opened, the pumps stopped if necessary, and the stored water will maintain the pressure for domestic supply.

When pumping is necessary, the possession of a good water power to drive the pumps is a great advantage to a town, as the yearly cost of pumping will be small and besides the pumps can, at a moment's notice, furnish their maximum supply, which as a rule is not the case with steam. The pumps of several of the earliest water-works systems of this Continent were driven by overshot or breast water-wheels, and turbines are now in general use, connected with the pumping machinery by suitable gearing.

Where the water from the pump is first delivered into the reservoir or stand-pipe and fed from thence through a separate main to the distribution system of the town, the pump may be a single cylinder one, as in this case the fluctuation or pulsation in the water pressure due to each reversal of the stroke will cause no inconvenience. However, usually no separate main is used, and the distribution system is in direct connection with the pumps, so to overcome as much as possible the fluctuations in pressure before spoken of, a duplex or double cylinder pump is used. Comparatively few towns, however, have water power to drive their pumping machinery, and in the majority of cases steam must be used.

For small towns a duplex high-pressure engine is often used, having two steam cylinders side by side and opposite the two water cylinders, which are similar to the duplex power pump. In this form of steam pumping engine the piston of one cylinder works the valve of the other cylinder, and *vice versa*, and neither half can work alone. However, where economy in fuel is an object, the steam cylinders are "compounded," and we have the compound duplex pumping engine with its four steam cylinders working in pairs. The steam exerts its force through one stroke upon the smaller steam piston and expands upon the larger during the return stroke and operates to drive the piston in the other direction, being in effect the same thing as a cut-off on a crank engine.

Every pump-house should contain a duplicate set of pumping engines, as the best of machinery requires to be stopped for the re-packing of steam cylinders, and other like repairs. The capacity of these pumps should not only be sufficient for present requirements, but ample to permit of future extension of the works, and in a small town where the domestic supply will be comparatively light, the capacity is fixed by the number of fire streams that will be required. This will probably not exceed four hose streams, and would be kept up by a pumping engine of one million U.S. gallons capacity per diem. Should the town increase rapidly in population and more water be required for domestic supply, and at the same time at a large fire probably six fire streams be used, the reserve pumping engine will be required to be running simultaneously.

The next question that will present itself is that of the size of the principal supply pipe, and in answering this reference may be made to the following table of

FRICTION OF WATER IN PIPES.

Friction-loss in pounds pressure per square inch for each 100 feet length in different sizes of clean iron pipes, discharging given quantities of water per minute:—

| GALLONS DISCHARGED PER MINUTE. | SIZE OF PIPES—INSIDE DIAMETER. | | | | | | |
|---|--------------------------------|-------|-------|--------|--------|--------|--------|
| | 4 in. | 6 in. | 8 in. | 10 in. | 12 in. | 14 in. | 16 in. |
| 100 | 0.33 | 0.05 | .... | .... | .... | .... | .... |
| 150 | 0.69 | 0.10 | .... | .... | .... | .... | .... |
| 200 | 1.22 | 0.17 | .... | .... | .... | .... | .... |
| 300 | 2.66 | 0.37 | 0.09 | 0.04 | .... | .... | .... |
| 400 | 4.73 | 0.65 | 0.16 | 0.06 | .... | .... | .... |
| 500 | 7.43 | 0.96 | 0.25 | 0.09 | 0.04 | 0.017 | 0.009 |
| 750 | .... | 2.21 | 0.53 | 0.18 | 0.08 | .... | .... |
| 1000 | .... | 3.88 | 0.94 | 0.32 | 0.13 | 0.062 | 0.036 |
| 1250 | .... | .... | 1.46 | 0.49 | 0.20 | .... | .... |
| 1500 | .... | .... | 2.09 | 0.70 | 0.29 | 0.135 | 0.071 |

Suppose that a town has a gravity supply from an empounding reservoir a mile away and 200 feet above it, what ought the size of the supply main to be to maintain six fire streams and the domestic supply? When there is no water being drawn, the pressure at the hydrants expressed in pounds per square inch would be 200 divided by 2.31, or about 86 pounds. Now, referring to the table for a discharge of 1,250 gallons per minute, which should be ample to maintain the fire streams and domestic supply, it will be found that a ten-inch pipe to supply this amount would have a friction loss of nearly half a pound for each 100 feet of its length, or a total loss of 26 pounds per mile. Deducting this from the pressure with no discharge there is just 60 pounds left, which as before shown would be a fair fire pressure under these circumstances even for a large town.

If in this case, however, the water had to be pumped, it would be better to lay a twelve-inch main, as this would furnish the same fire pressure while discharging the 1,250 gallons per minute, and the reservoir would only require to be located at an elevation of 160 feet above the town instead of 200 feet with a ten-inch pipe. This reduction in the head to be pumped against will result in a great saving in the work to be done by the pumps.

At the present time cast iron pipes protected by coal tar varnish are in general use for water-works mains. They are cast vertically in lengths of twelve feet, and should be tested at the foundry to a pressure of 300 pounds per square inch. The following table will show the weights commonly used for

CAST IRON WATER PIPE.

| SIZE. | 4 in. | 5 in. | 6 in. | 8 in. | 10 in. | 12 in. | 14 in. | 16 in. |
|---------------------------------|-------|-------|-------|-------|--------|--------|--------|--------|
| Weight in lbs. per foot..... | 20 | 25 | 30 | 45 | 60 | 80 | 105 | 135 |

The same foundry that furnishes the pipe will usually make all the special castings, such as tees, crosses, sleeves, bends and reducers required to connect the different branches of the pipe system.

Before beginning pipe-laying all the necessary materials should be on hand, so that the job may be pushed to completion, and no time lost in waiting for pipe, specials, hydrants, gates, or lead and yarn for the joints.

In the climate of Ontario the axis of the pipe should be at least five feet below the surface of the ground to ensure proper protection from frost for the hydrant branches, and particularly for the small service pipes leading to private houses. The ditch will require a width on the bottom of from eighteen inches upward, according to the size of pipe, and the top width will vary according to the nature of the ground, being not much wider than the bottom in clay and often three or four feet wide in loose sand. Four-inch and six-inch pipe may be rolled into the ditch, being only held back by a man with a rope around the spigot end, while eight-inch pipe will require a man at each end with a rope, and the larger sizes of pipe require to be lowered into the ditch with a derrick, some form of differential pulley being used.

A water-tight joint capable of standing great pressure has next to be made between the pipes, and this is secured by using a soft, compressible substance in combination with molten lead. A tarred gasket of jute or hemp is the best, and the office of the "yarn," as it is usually called, is to prevent the molten lead from running into the pipe. The yarn is usually slipped into the joint when the spigot end of the last pipe lowered is being entered into the bell of the pipe already in position, and the pipe being pushed "home," the yarn is packed in the joint with a long yarning-iron and a hammer. To guide the molten lead into the joint a "roll" made of ground clay, such as may be obtained at any pottery, is often used, and the lead should be poured in hot enough to run freely. The roll being removed, the caulker follows, and begins by driving his chisel lightly between the lead and the surface of the pipe all around. Having thus lifted the lead away from the pipe he begins with the smallest caulking tool and drives back the lead a little at a time all around, and following with the larger tools, sets the metal in firmly with strong, even blows.

Those wishing to pursue the practical part of this subject will do well to obtain a copy of Billings' "Details of Water-works Construction," and if the good advice therein given is followed, water mains may be laid to withstand from 100 to 150 pounds pressure with very little risk of failure.

DISCUSSION.

Prof. Galbraith—We all owe a great deal to Mr. Bowman for his very clear paper on Water-works Construction. It is not often that we have opportunities for hearing how works, in ordinary towns of a few thousand inhabitants, are conducted. The principal information that we have, I suppose, is of the water-works in very large cities, and engineers in Canada find details given there which are practically of very little use to them. I think papers such as the one that Mr. Bowman has read will prove of a great deal of interest. I only hope that every engineer in charge of works of the same kind will make up his mind to give a description of how the work is actually done. In connection with fire streams there is a series of papers now being printed in the *Sanitary Engineer* giving the results of very careful experiments on different qualities of hose, and I think they are all the same size, nominally $2\frac{1}{2}$ in. hose, and on the effect of different nozzles. I am awaiting with a great deal of interest the next paper on this subject. So far only a general description of results has been given, but it is such to make the paper of a great deal of interest to water-works engineers. I may, perhaps, describe the experiments. They are performed by the engineer, Mr. Neeman; I forget the place. The experiments were made with nozzles ranging from 1 in. to $1\frac{3}{4}$ ins., both smooth and ring, with different brands of $2\frac{1}{2}$ -in. hose. When he came to caliper the hose, with the fire stream running, he found that they varied a good deal in cross section, that some hose were practically $2\frac{3}{4}$ ins. and others less than $2\frac{1}{2}$ ins, which made a great deal of difference in the discharge. He also found that there was as much as 40 per cent. difference in the discharge, depending on the inside nature of the hose, the sizes being the same. Smooth, solid rubber hose gave a discharge practically of about 40 per cent. greater than the opposite extreme, cotton hose with slight rubber lining. The difference caused by these seemed something remarkable. On the other hand the difference due to nozzles was extremely small. His conclusion was, if you had taken the ordinary lengths and sizes, provided the inside was a fair working, smooth finish without any extreme care being spent upon it, that the discharge of the different nozzles with the same bore was practically very much the same. The way that was settled was this: it was important to separate the influence of the nozzle from the influence of the nozzle, and for that purpose a coupling was arranged by which a pressure gauge could be attached immediately at the base of the nozzle, so that when a certain pressure was shown by that pressure gauge, one nozzle could be said to be under the same conditions as the other, and simply the amount of water that passed per minute had to be measured. Arrangements were made to measure this water exactly, and the discharge of the different nozzles, under the same pressure, was found simply to depend on their diameter in the bore at the end. The discharge from ring is slightly less than from smooth nozzles.

He also said he was inclined to think that the Ellis tables—which, I think, are the only tables we have—were too small by a certain per-

centage; that really the amount of water used was somewhat greater than shown by the table engineers have used, and if that is true, I think, of course, these experiments will be of great interest to water-works engineers. He proposes to use the nozzle itself as a water meter. He found the results so constant for the purpose of measuring the discharge of steam pumps, that he considered a nozzle sufficient, and the method that he proposes being applied is this: near the engineer's room there was to be a reservoir connected by pipes with the force pipe of the pump, and on one face of the reservoir there were two couplings arranged for the direct attachment of these nozzles without any hose at all, and pressure gauges were to be attached to this reservoir, and when the pump was discharged the pressure gauges could be read, and the pump made to increase its discharge or vary the discharge, until the pressures shown on the reservoir were nearly those for which the discharge of the nozzle had been determined; and simply the calibre of the nozzle should be noted, the time of the discharge and the pressure. From this data, he considered, that a more accurate measurement of the water discharged by the pumps could be made than by almost any other way. Now, we take the nominal discharge of a pump calculated from the bore of the cylinder and the stroke of the piston and consider that, with some arbitrary allowance as the discharge of the pump. Now, if this thing can be actually carried out, one can see that it would settle this uncertain quantity called the "slip." In some water-works there is a chance to measure the slip. For instance, in the Toronto Water-works there is almost no possibility of measuring it, and an arrangement of that kind, I think, would be most useful.

Mr. Bowman—One part of that paper might be criticized, in view of what has happened in the last few weeks, and that is advocating for the residence portion of a town a pressure not greater than 40 lbs. I saw by the papers that during the late destructive fire in our Provincial University, that the pressure in that neighbourhood was supposed to be about 45 lbs. That is more than I judge necessary for a town, although we see the failure of the water-works to cope with that fire. It was not due so much to the low pressure as the distance which the hydrants were placed from the building. On the way to the meeting I called at one of the fire stations here, and found that during that fire hydrants instead of having one length of hose attached to them were forced to carry three, and the length of the hose required was very great—400 and 500, and, I suppose, 600 feet. The nozzles they have here are adjustable, from $1\frac{1}{4}$ in. to 1 in., and the firemen required to adjust their nozzles down as small as they could to get any height of stream. With 45 lbs. pressure and 100 feet of hose we get a stream 75 feet in the air. With 200 feet of hose it would only throw it 66 feet in the air. With 300 feet of hose it only threw it 58 feet in the air, and with 400 feet of hose about 50 feet in the air. It goes down very rapidly. Also, 1,000 feet of hose, with an inch nozzle, would throw only 30 feet in the air. So that the trouble was not so much the pressure as the long distance the hose lines had to be carried. If there had been hydrants enough so that only 300 feet of

hose were required, they would get streams from 50 feet to 60 feet in the air, which, if they got into the building with them, would be ample. For a building like the University it is not sufficient to have hydrants placed around to protect from fire. One of the best methods of fire protection in connection with a system of water-works is to have the place protected by automatic sprinklers throughout the building. They are used particularly in cotton mills and woollen factories, and so on. They have a system of piping throughout the factory, and every eight feet there is one automatic sprinkler which is capable of discharging 20 gallons or upward per minute. They will begin to discharge if a fire occurs underneath them by the melting of a very sensitive alloy. This alloy can be set to go off at a temperature of 150 degrees Fahrenheit, and either puts the fire out or holds it in check until larger streams can be brought to bear on it. In case of a large library, the building being fireproof would not prevent the library burning, unless some such means as this were used.

Mr. Stewart—Are these automatic sprinklers used in the city and tested here?

Mr. Bowman—I think the Massey Works and the *Mail Building* are protected by them.

Mr. Stewart—I saw them in Rat Portage, and I believe they work satisfactorily there.

Mr. Dickson—They have them in Rathbun's mill at Deseronto, and in the dry lumber rooms they found a fire had been started and was put out by these sprinklers.

Mr. Stewart—Do you consider one engine sufficient, or whether it would not be likely to get out of order and require two engines?

Mr. Bowman—Yes; two would be preferred. No machinery is such but it will get out of order for a couple of days. One boiler would be sufficient for one pump. There is not so much danger of that getting out of order.

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

EXTRA STRESSES IN STRUCTURES.

BY G. B. ABREY, P.L.S., A.M. CAN. SOC., C.E.

IN choosing the subject under the above title, I would say that my little experience and study have led me to believe that too many of the loads and stresses that all structures actually have to sustain, are ignored or thought to be covered by the convenient terms, "factor of safety," "good and bad practice," etc. It is perfectly certain that all structures subject to variable loading and conditions have to sustain stresses not estimated for in the original design. Some of these unprovided for stresses depending upon many circumstances may appear in unlooked for and aggravated quantity. Except under one or two headings which are treated here more fully, I will only call attention to some others of the more prominent, and not attempt to follow them to details.

Impact.—If a weight or load be applied suddenly or fall from a height, it will move with a velocity in coming in contact with a body and produce the effects of impact on that body. When a body in motion strikes another body a mutual action takes place, consisting of a pair of equal and opposite forces, and acting on the striking body, the other, on the body struck. Changes of figure and dimensions, or strains, are produced in both bodies because of the stress applied to them. The simplest case, and the only one here considered, is when the impact is direct—take for example a pile being driven by the action of a falling weight.

If R be the resistance which the pile offers to being driven or is the load which would, resting on the pile, just cause it to commence to sink, and if W be the falling weight from a height h and x the space through which the pile sinks in consequence of the blow, then the mutual action between the pile and the weight consists of a pair of equal and opposite forces, R .

The whole height through which the weight falls is $h + x$, and the space through which the resistance is overcome is x ; therefore, by equating energy exerted and work done, we have $W(h + x) = rx$. This question shows that the force of the blow measured by the space the pile is driven is proportional to its energy.

We have assumed that the whole energy of the blow is consumed in driving the pile; though always there will be some used in causing vibrations and damage to the head of the pile.

As the pile is driven deeper, its resistance increases and ultimately becomes equal to the crushing stress of the material; then it will not

sink further and the whole energy of the blow is wasted in crushing. If the striking body is of such material that it may also be damaged or crushed, the energy of the blow would be expended in damaging both bodies, so that we may write down as general question of impact :

Energy of blow = work done in overcoming resistance to movement of body struck, + work done in internal changes of striking body, + work done in internal changes in body struck ; and of these three terms the most important will depend on the relative magnitude of the resistance to movement and the crushing stress of the materials of the two bodies, so that as the body struck offers great resistance to motion, the damage to the one or both of the bodies becomes correspondingly great.

Let us apply the equation to the case of impact on perfectly elastic materials. Suppose a structure or piece of material of any kind resting on fixed supports and struck by a body harder than itself, so that we may neglect all changes in the striking body, we will also neglect all vibrations of the nature of sound produced in both bodies which would consume some energy, so that the whole energy of the blow is considered expended in straining the piece of material or structure struck.

Now, the effect of impact is to produce a mutual action S , representing a force applied to the structure at some definite point, and the structure suffers deformation, and the point of application moves through a space x . The resistance to deformation is proportional to x , because the limit of elasticity is not reached ; it therefore commences by being zero, and increases gradually till the velocity of the striking body is wholly destroyed,

The mean value of R is half its maximum value. During the first part of the period of impact, the mutual action S is greater than the resistance, and during the second part less ; but when the maximum strain has been produced the mean value during the whole time must be exactly equal to the main resistance ; the weight and the structure being momentarily at rest. The strained structure will immediately, in virtue of its elasticity, commence to return to its original form, but for the moment a strain was produced, which is a measure of the effect of the blow and which must not exceed the power of endurance of the material.

Let, now, R = the maximum resistance and let the blow consist in the falling of a weight W through a height h , above its first contact with the structure, then $h + x$ is the whole height fallen through, and it follows that $W(h + x) = \frac{1}{2} R x$, and $x = \frac{Wh}{\frac{1}{2}R - W}$.

The resistance R may also be described as the "equivalent steady load," being the load which, if gradually applied at the point of impact, would produce the same stress and strain which the structure actually experiences.

We most conveniently compare it with W by supposing that we know the deflection δ , which the structure would experience if the

striking weight W were applied as a steady load at the point of impact. We then have $\frac{x}{\delta} = \frac{R}{W}$; substituting the value of x we get

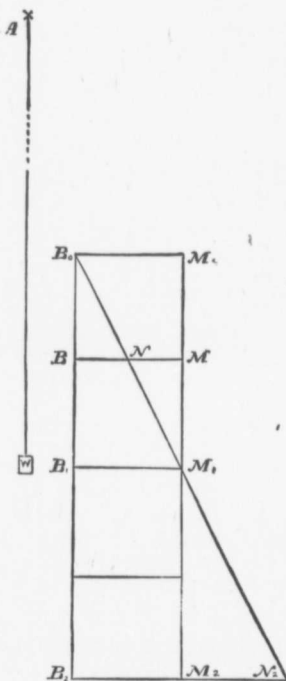
$$\frac{R^2}{W^2} = \frac{2R}{W} + \frac{2h}{\delta}.$$

Let the height h be n times the deflection δ , then solving the quadratic, the positive root of which is $R = W(1 + \sqrt{2n + 1})$, thus showing how the effect of a load is multiplied by impact.

A particular case of the foregoing is when $h = 0$ then $R = 2W$, so that if a load W is suddenly applied to a perfectly elastic body from rest (not as a blow) it will produce a pressure just twice the weight. This is a very important case.

If a long elastic string be fastened at A , say, and if a gradually increasing weight be applied, the string will stretch and the weight descend; now let the weight required to produce any given extension be represented by the ordinate of the sloping line, B_0N_2 . (See figure).

Next, instead of applying the load gradually let W , represented by B_0M_0 , be applied suddenly, the string will of course stretch and the weight descend; when it has reached B the tension of the string pulling upwards, represented by BN , will be less than W acting downwards; also in the descent B_0B_1 an amount of energy has been exerted by W , represented by the area or the rectangle B_0M_0MB . At the same time the work done in stretching the string is represented by the area of the triangle B_0NB , and the excess of energy exerted over work done, has given velocity to the descending weight and is stored as kinetic energy in W . On reaching B , the tension of the string is just equal



to the weight, but the stretching goes on; the weight has its greatest velocity, which corresponds to kinetic energy shown by triangle $B_0M_0M_1$. Now any further extension causes the upward pull of the string to be greater than W , yet W goes on descending until the energy it has exerted is balanced by the work done in stretching the string; then its kinetic energy will be exhausted and W will be brought to rest. This will occur when the area of triangle $B_0N_2B =$ that of rectangle $B_0M_0M_2B_2$, that is when $B_2N_2 = 2 B_2M_2$ or $B_0B_2 = 2 B_0B_1$. So that the tension of the string, caused by the sudden application of the load, is twice that due to the

same load steadily applied. The string will not remain extended so much as B_0B_2 , for now the upward pull of the string exceeds W and will cause it to rise again; on reaching B_1 it will have the same velocity upwards that it had downwards on first reaching B_1 . This will carry it up to B_0 , when it will again fall, and so on. Practically the internal friction, due to imperfect elasticity and air resistance, will soon absorb the energy and bring W to rest at B_1 . For the purposes of this paper it is not necessary to consider the case of impact from high velocities. In such cases the inertia of the structure becomes a factor, and the energy of W is largely expended in damaging the part struck and not the whole expended in straining the structure. In the case of vibrating loads, synchronism comes into action. From the illustration of the elastic string and figure above, suppose in the first instance W at rest, then the corresponding extension (δ) is B_0B_1 and W is at B_1 . Next imagine W suddenly and vertically raised, it will oscillate about B_1 , as a mean position. In any position B , the tension, is represented by BN and W by BM , so that NM is the unbalanced force which draws W downwards when it is above B , and upwards when below. Now NM is proportional to BB_1 and W therefore moves under a force always proportional to its distance from B_1 . This is a simple harmonic motion. Now the time

of a double vibration of the weight is given by equation $t = 2\pi \sqrt{\frac{\delta}{g}}$

being the same as that of the small oscillations of a pendulum of length B_0B_1 . It is dependent only on the elasticity of the string and the magnitude of W and not on the extent of the vibration. The vibrations of any structure may be distinguished into general and local, or into those of the whole and those of its parts. Next, suppose W oscillating about B_1 and let B be its extreme upward position. At the instant when W is at B ; imagine a small downward force, P applied, the effect will be that W descends to a position B_2 before coming to rest. Such that B_1B_2 will be greater than BB_1 , instead of being equal as would otherwise be the case. Then suppose P removed, W will rise to a point as much above B as B_1B_2 is greater than BB_1 . Again, suppose P applied, then W will descend below B_2 and this process may be continued indefinitely. So it would appear that a load P , however small, applied and removed at intervals corresponding to the natural period of vibration of the weight, will produce a vibration of continually increasing extent, and indefinitely augmenting the tension of the string until it breaks. If P be applied as before at B , but removed and replaced at a different interval, the vibration will still augment at first but will be limited and will be followed by a diminution, etc., indefinitely. In actual structures the circumstances are much more complex and calculations difficult, but the principles are right. Whenever a load on a structure fluctuates the stress caused is greater than that calculated for its maximum and the stress is greater the more nearly the period of fluctuation approaches the period of vibration of the structure or the part of it affected. For the portion on impact, I would refer to "Cotterell's Applied Mechanics." Much

of what is here written is compiled and extracted from that excellent treatise on the subjects it treats of.

Initial Tension.—Most of the smaller members of a truss requires to be screwed up to an extent regulated by theory. This stress is called initial tension. In small rods and braces, this stress is a large factor or proportion and should never be neglected. I would refer to Waddell's valuable treatise on bridges for information and tables relating to these strains.

Reversion of Stresses.—Girders of the triangular or Warren type, the web members of which are subject to change of stress from tension to pressure, or *vice versa* from moving load. These changes may be more or less sudden, and approximate to nearly twice that estimated for the movable portion of the load.

Inertia.—The slowness of a structure or its parts to come into action always adds to the stress in practice. I mean that a part of a member may have to sustain a sudden application of a load, while the drag or inertia of the whole takes time to adjust itself into action. This is, perhaps, a special case of impact from imperfect elasticity. (See Impact in another place.)

Stress from Traction.—An engine in starting a train often exerts its full power, as will be observed, by the slipping of the drivers on the rails. The weight of the engine on its drivers may be, say 40 tons, so that if the coefficient of friction be 1.5 of w the traction of a locomotive would be eight tons. This force would be exerted horizontally on the rail or support of the drivers. Suppose any bridge (sheet 24): Let the engine stand at l with a train attached to the right, off the bridge, in starting forward a pull of eight tons would be exerted on the chords, l to A , either causing motion to the whole structure, or resisted by the friction or fastenings at the support A . If the engine were to back up, the stress would be at m to B . In the case of light bridges, motion should be provided for, and in all cases the extra stress should not be neglected. In a design like the one here, no portion would be affected except the lower chord and its fastenings. In the reciprocal diagram for full load and maximum stresses, the portion x shows the extra stress and amounts to from 37% to 14% additional in the panels on the lower chord. In small bridges the extra stresses from this source became a large factor.

(Drawings referred not published.)

Temperature.—In calling attention to extra strains from temperature, I would again refer to the bow string, described in my other paper, as a particular example. One end of this bridge is secured by bolts to its support. The other end rests on round iron rods on top of the bed plate. These rods were, no doubt, originally intended to ease the friction caused by expansion from change of temperature. At the time I examined the bridge, none of these rollers were in a position to do service. They lay diagonally at all angles to the line of bridge and were embedded in sand, etc., accumulated on the bed plate. The

bridge has, therefore, either to slide on the iron support or sway the pier backwards and forwards. If the latter, then the shorter end span would have to slide. Suppose the pier to be immovable and the bridge to slide, suppose it expands equally and symmetrically and does not suffer deformation, therefore the extra horizontal component of pressure on top chord from rise of temperature is :

$$\frac{\text{dead load}}{\text{coef. } F \times 2} = \frac{24.82}{6 \times 2} = 2.07 \text{ tons,}$$

and the extra tension stress on bottom chord, from fall of temperature is the same, or in this case they amount to 2.6% on the chords. (See sheet 11—not published in proceedings.) All examples may not be as bad as this one selected, but it instructs caution in design and the extra is seldom a cipher in amount.

Compound Stresses.—Some members of a structure, such as cross beams in the floor system, which are designed chiefly to resist bending action, are usually subjected to other stresses as pressure members to the floor truss carrying the vibrations and wind loads to the abutments. The extra stresses in these in some parts of a structure may be great and must be estimated for.

Workmanship and Details.—Workmanship is never theoretically perfect, and when it is bad, we cannot estimate for the defects. The workmanship and details are perhaps the most important factor in the structure. The calculation of stresses and resistances of details and connections are tedious and sometimes not practicable; when bad workmanship, etc., enters as a factor, the process is much complicated. I will only suggest a few imperfections:—

A member may be cut too long or too short and forced home.

Threads of screws and nuts not properly cut or fitted.

A weld not perfect or complete.

Abutting joints not planed to fit or at the true angle.

Pins and eyes ill-fitting; eyes not at right angles to stresses, nor in the axes of bars.

Rivet holes not opposite, or bored, or punched true.

Riveted connections of members not true and causing bending action in pressure members where perhaps the intention was to fix the ends.

Want of homogeneity and imperfections in materials.

Factor of Safety.—After all stresses are tabulated, some factor of safety is assumed for the material to cover all deficiencies and ignorance. Usually permanent and movable loads are added together and a factor of safety taken for their sum, making no distinction between the two parts of the load. Now evidently this is not good practice; a much larger factor should be taken to cover the movable load than for the steady load, and as these two components enter in all propor-

tions, the factor of safety should be applied separately and before the stresses are added. Of course every foreseen stress should be estimated carefully and allowed for before filling in the sections of the members. The working load proper for the material, if not well understood, should be ascertained by careful experiments. I am aware of the many shortcomings of this essay and that a practical bridge engineer would have handled the subject so much better than you now find it. Some mole hills may have grown to mountains and some mountains may be reduced to mole hills, perhaps, and some large hills may have been passed unseen. Still I hope some hint may have been thrown out or idea suggested that will serve a useful purpose.

APPENDIX.

BIOGRAPHICAL SKETCH

OF

THE LATE COLONEL CHEWETT.

COLONEL CHEWETT, whose portrait we have selected to accompany this year's proceedings of our Society, was one of the Surveyor Generals of Upper Canada. Our engraving was made from a miniature on ivory, by Hoppner Meyer, and appears to be exquisitely painted. We are assured by the family that the likeness is good, and when one considers that the old gentleman was past ninety when he sat for his portrait, we are struck with the remarkable freshness of his complexion and the abundance of his hair, though in this latter the appearance is deceptive, for, Mr. Chewett wore his hair in powder on all occasions of state or ceremony, the survival of a fashion prevalent in his early days. Our illustration, therefore, presents Mr. Chewett younger looking than one would expect, yet at ninety years he was really both healthy and active, was always an early riser, and in summer took a "constitutional" on the pathway before his house every day the weather permitted.

We propose in our sketch of Mr. Chewett's life to note only a few prominent events and confine ourselves in the main to extracts from a private journal, for the years 1792-3, in the possession of his family, in which he dwells almost wholly on professional matters, and therefore cannot be otherwise than interesting to the members of our Association.

Mr. Chewett, born in London on the 21st December, 1753, was educated as a hydrographical engineer for the East India Company's service. He received his appointment to an East Indiaman towards the close of 1770, but shortly before sailing he was taken with small-pox, and his place supplied by another. On his recovery, rather than wait for another ship, which in those days were few and *very* far between, he embarked on a small vessel bound for Quebec, where he arrived in 1771 and commenced the practice of his profession.

On the 20th May, 1774, a little past the age of twenty, he was taken into the office of the Surveyor General of the Province of

Quebec, and afterwards served in the Quebec militia from the latter end of September, 1775, to the 6th May, 1776, during which time the place was besieged by the rebellious Americans. The siege was put an end to on the latter date by the arrival of His Majesty's ship of war, *Isis*, and the *Surprise*, frigate, under the command of Sir Charles Douglass, having on board the flank companies of the 29th Regiment, commanded by Lord Petersham. During the siege Mr. Chewett was employed, by order of His Excellency, Captain-General Carleton, Governor of Quebec * (there being no Engineer in the Province, and the Surveyor-General, Major Holland, being with the army at New York), under the direction of the Deputy Surveyor-General, the Hon. John Collins, in surveying the fortifications surrounding the city, and in determining the distance of the rebel batteries, whenever and wherever erected. After the defeat of the Americans, Mr. Chewett was appointed acting Paymaster of Works for the posts of St. John, Isle aux Noix, and their dependencies on Lake Champlain; to the Engineers, Quarter Master General and Naval Departments, and remained in these appointments until 1783, when he was recalled by Lieutenant-Governor Hamilton to Quebec and again placed in the Surveyor-General's Department.

In 1786, Mr. Chewett was sent by the Surveyor-General, Major Holland, to take charge of the district of Lunenburg, formerly the eastern Townships of Upper Canada, and now comprising the easternmost counties of Ontario. Here he was employed for several years surveying and laying out lands for the disbanded troops and loyalists.

Mr. Chewett married in 1791, but before doing so he wrote the following letter to his friend, the Hon. John Collins, to procure him a marriage license, and which the writer discovered some years ago in the office of the Crown Lands Department in Toronto, where, no doubt, it still remains. It is a curiosity, and will bear analyzing; there is a bashfulness about it that seeks to conceal *love* by representing *expediency*, and a *timidity* lest his superior should think that at his age (37) he might be guilty of a folly. One can hardly help thinking that were he not obliged to send so far (Quebec) for the license, and to a

* General Carleton arrived at Quebec in November, 1775, from Montreal, by the assistance of Mr. Bouchette, the master of a small vessel, who was afterwards made a Provincial Navy Captain for this service. General Carleton, at Quebec, issued a proclamation that all who were desirous of leaving the country from national feeling were at liberty to do so. Very few availed themselves of the permission, the French-Canadians preferring to remain in the city, and those occupying St. Rocque and St. John's suburbs said if arms were given them they would come in and defend the city. The Americans attacked on the 31st December, and these Canadians fled, leaving their arms in the hands of the Americans. The suburbs were then burned, by order of General Carleton. In May, 1776, volunteers were required to act against Montreal, then in the hands of the Americans—only *one* volunteered from Quebec. A Canadian, however, named Baygeau, of St. Thomas, redeemed his countrymen's want of piuck by bringing forward over two hundred from his place of residence. He afterwards became a priest, and died a bishop.

friend, who happened to be the Chief of his Department, he would have been less embarrassed. However, here is the letter :—

“ CORNWALL, 22nd April, 1791.

“ DEAR SIR,—Having found out a girl whom I mean to make a partner for life, and without which it is impossible to exist in this settlement, having no settled place to retire to after the fatigues of a survey, or take care of the little property I have (this, I hope you will not think unreasonable at the time of life I am come to, as it does not proceed from motives of folly, but of a mature and deliberate consideration), I therefore must pray you as my friend, to obtain a license for me and Isabella McDonell (she is of the family of Major Archibald McDonell, of the Long Sault), to be sent by the first opportunity; and in doing so you will oblige an old servant who is, with the greatest respect,

Dear Sir,

Your most obedient, humble servant,

“ W. CHEWETT.

“ The Honourable JOHN COLLINS, Esq.”

We have no means of fixing the date of his marriage, but his first son was born on the 20th May, 1792.

In the autumn of 1791, Lieutenant-Governor Simcoe, the first Governor of the new Province of Upper Canada, arrived at Quebec, when Mr. Chewett was recommended to him to take charge of the Surveys Department of the upper country. Governor Simcoe accepting the recommendation, Mr. Chewett was ordered to report at Quebec, and we will now confine ourselves chiefly to extracts from his journal, which is the one he carried in his pocket, and consists of rough notes made, for the most part, daily, often in pencil, and from which he must have made up his regular journals, some of which are to be found in the Crown Lands Department. It commences on 23rd December, 1791. From that date until the 25th January, 1792, he was engaged in making plans of the District of Lunenburg for the Surveyor-General's office, and on the 26th he notes: “ Employed making into letters the certificates for the family and bounty land for the Township Osnabruck, sent up in the summer, 1790, as the people did not attend to receive them agreeable to the advertisement of the 3rd February, 1701,” and afterwards engaged on plans for Williamsburg, Charlottenburg, and “ of the present situation of Cornwall for the Board.”

“ 5th February, 1792.—Writing to the Deputy Surveyor-General and making up my account current, as there is a mistake in the one sent to Mr. Frobisher, and packing up a plan of Cornwall of the original proprietors.

"6th.—Making a plan of Cornwall," this work and "strengthening the lines on the several plans of the Grand River in order to reduce to the standard scale of the district," occupied his time till the 27th.

"27th.—Set out from the Grand Remous and arrived at Charlottenburg (probably Glengary House, or the mouth of the Riviere aux Raisins).

"28th.—Set out from Charlottenburg and arrived at the Cedars.

"29th.—Set out from the Cedars and arrived at Lachine.

"30th.—Set out from Lachine and arrived at Montreal."

We call the reader's attention to the date of his arrival in Montreal, 30th February—1792 being Leap Year, he must have arrived on the 29th. He probably started on the 26th, not the 27th. It would be interesting to see if has copied this error into his official journal in the Crown Lands Department. He remained in Montreal on the 1st March, and on the

"2nd.—Set out from Montreal and arrived at Berthier.

"3rd.—Set out from Berthier and arrived at Point du Lac.

"4th.—Set out from Point du Lac and arrived at St. Anns.

"5th.—Set out from St. Anns and arrived at Point aux Trembles.

"6th.—Set out from Point aux Trembles and arrived at Quebec.

Waited on Governor Simcoe—promised employment—presented him my plans—very well received—engaged to dine with him the next day." He appears to have been in attendance upon Governor Simcoe till the 18th, when he "waited on Governor Clark, when I am informed there is a requisition from Governor Simcoe to the Surveyor-General's office for my departure.

"19th March.—The Surveyor-General has sent Governor Simcoe's requisition to Governor Clark to know how he is to act.

"20th.—Governor Clark's answer is that since the separation of the Province he does not conceive there can be any outfit from his Government, therefore Mr. Surveyor-General says he can give no orders. But the Surveyor and Deputy Surveyor-General have given me the strongest recommendation as the most proper person to carry the business into execution. So far, so good.

"21st.—Waited on Governor Simcoe—delivered him the plans—but upon entering into conversation, he was pleased to say he had dropped the idea of carrying on the survey until he took possession of his Government, when he should have everything at his command. Requested by him to copy all the instructions relative to settling the Upper Country—buy a book for the same and charge to the Surveyor-General." He was engaged in this work until the end of the month. On the

"25.—Waited on Governor Simcoe, and he requested me to lend him a copying glass. He desired me to enquire of Major Holland in what manner and in what quantity the lots of land were given in the Town of New Johnstown, now called Cornwall. Went to the levee of Governor Clark.

"26th.—Carried the copying glass to Governor Simcoe. He was not visible.

" 27th.—Applied to Major Holland agreeable to the order of Governor Simcoe to know in what manner the town lots were given away in New Johnstown, now Cornwall, and he says there was no settled mode of locating them, 'twas optional with the Surveyor-General, therefore Major Gray's *ipse dixit* does correspond with Major Holland's.

" 1st April, 1792.—Waited on Mr. Dunn relative to £100 6s 4d currency that Mr. Frobisher refused to pay me. Mr. Dunn said that Mr. Collins ought to pay me for the balance coming, as well as for my drafts (plans?). Attended the leveé. Employed bringing up my journal. Mr. Robert Coffin returned from his survey, having made as far as Cap la Magdelaine, the ice broke up at Three Rivers, consequently impassable. There should have been a provisional order for surveying by land.

" 2nd.—Employed copying instructions to the several surveyors. Dined with His Excellency, Governor Simcoe." From this date until the 15th he was engaged in copying instructions.

" 15th.—Waited on Governor Simcoe. He wishes me to go off as soon as possible, and I am to enter into his pay from the 10th April at the same pay I usually had, with permission, when not employed for Government, to work for the public. He wishes to have the plan of the River Rideau by Mr. French.

" 18th and 19th.—Employed making up my account to the 10th April.

" 20th.—Employed copying Mr. French's sketch of the Rivers Rideau and Petite Nation.

" 21st.—Carried the plans from the Surveyor-General's office to Governor Simcoe, with a receipt for the same. Dined with Governor Simcoe. He wishes to have the plan of Cornwall in its present situation; the plan of Kingston in its present situation; the harbor of Cataraqui and surroundings and Mr. Kotte's survey from the 8th or the Township of Elizabethtown with the Thousand Islands.

" 22.—Breakfasted with Governor Simcoe and received from him Point Henry Frederick in order to have a title put to it. Also the Town of Toronto to know whether it has ever been laid out, and a letter to Major Holland upon business. Went to Major Holland's lodgings, but he is in the country.

" 23rd.—Made a demand for the following plans:—The plan of Cornwall in its present situation. *Answer.*—Not in the office. The plan of Kingston. *Answer.*—Not in the office. The plan of Cataraqui Harbor and its surrounding. *Answer.*—Not in the office. Mr. Kotte's survey of the Mille Isles to be copied. Messrs. De Penueur and Pennoyer's plans on the River Rideau. *Answer.*—Not come to hand.

" 24th.—Reported them to Governor Simcoe.

" 26th.—Waited on Governor Simcoe with Major Holland. Governor Simcoe wishes to have the plans authenticated. Major Holland requests to have the box and plans sent back.

" 27th.—Went to Governor Simcoe and brought back the plans and began their examination." He was employed at this work and in

writing letters until the 10th of May. On the 6th he records as an event:—"This morning left Quebec, the *Recovery*, Capt. Forester, in which went Mr. Toosey and family,"—(for England.)

"10th May.—Governor Simcoe came to the office about 1½ o'clock p.m. and requested to have the plans as he should send off his baggage next morning. At 6 p.m. carried him the plans

"11th.—Employed writing letters and instructions into a book for Governor Simcoe.

"12th.—Ordered before a committee of Council with the several surveyors now at Quebec in order to give in an estimate of the number of days it would require to run the out-lines of a Township of ten miles square on a river, and gave the following, viz:

| | |
|---|---------|
| " Running the front on a river | Days 15 |
| " one side line..... | " 10 |
| " one rear line..... | " 10 |
| " Returning to the first station in order to finish the closing line..... | " 1 |
| " For the closing line..... | " 10 |
| " Allowance for bad weather and other casualties .. | " 14 |
| | — |
| Total days..... | 57 |
| " 1 Surveyor, 10/ per diem..... | 10/ |
| " 2 Chain Bearers, 2/ " each..... | 4/ |
| " 8 Axe Men, 1s. 6d. each..... | 12/ |

" Provisions for the party to be allowed the same as the Deputy Surveyor-General was allowed, 1s. 3d. per day for each man. Implements:—

" 6 New England axes.

" 4 Tommy-hawks.

" 1 Oil cloth.

" 1 Batteau or Canoe, and all the contingencies to be sworn to.

"13th.—Waited on Governor Simcoe, and he desired me to copy Mr. Gale's remarks on the District of Lunenburg, and to obtain from Mr. Collins his treaty with the Mississaga Indians. In consequence of which waited on Mr. Collins and he promised to give it me. Went to the leveé of Governor Clark."

Until the 19th he was employed copying orders, on the

"19th.—Copying a reference to a plan for Governor Simcoe, who came to the office and signified that I must leave Quebec on Monday. Mr. Collins promised to settle with me in the afternoon, but put it off until after leveé on Sunday.

"20th.—Breakfasted with Governor Simcoe and told him Mr. Collins was to settle with me after the leveé. Waited on Mr. Collins, who put it off until 9 o'clock a.m. on Monday, as he must have reference to the council books and to the account current book in the office. Packed up my little baggage ready for departure. Dined

with Governor Simcoe, and after dinner received my instructions and an order on Capt. McGill, Acting Receiver-General, for £30 stg.

"21st.—Waited on Governor Simcoe and received two letters, one for Sir John Johnson, and another addressed to Capt. Duncan and Capt. Munro. Waited on Mr. Collins to settle my account, which took us from 10 a.m. until 2 p.m. Waited on Governor Simcoe with Dft., but he was not at home. Waited again at 3 p.m. He seemed very much displeased. Went with him to Mr. Secretary Coffin—not to be found. About half-past 1 p.m. a boat upset in the river, in which were fourteen people. The Curé of Quebec, two ladies and all the rest were drowned. Went to the play.

"22nd.—Waited on Mr. Coffin with Mr. Collins and obtained a letter of credit for my balance. Finished the whole of my business at 1 p.m. Waiting for Mr. Angus McDonell. He came in the evening after the tide had turned and going down, so that it was impossible to go off, and I am therefore forced to delay my departure until the morning. At 9 p.m. went to bed in order to be ready for departure.

"23rd.—Rose at 4½ a.m. Called up Mr. Angus McDonell. Got our baggage on board. Breakfasted at 6 a.m. Paid my account. Set out at 7½ a.m. and arrived at Sillery at 8½ a.m. It being the turn of the tide the boat got on ground. Took out its load and launched her into the water. Made up a square sail of a cotton main sail. Waiting for the turn of flood. At six p.m., Mr. Angus McDonell having all his chemical apparatus on board, embarked and made Cap Rouge at 8 p.m., the wind being from the S.W. very strong against us.

"24th.—At 6 a.m. Left Cap Rouge, the wind from the S.W. against us and arrived at 10½ a.m. at Pt. des Ecoreuils. Waiting for the turn of the tide. At 7½ p.m. the tide turning. We embarked at Lotbiniere, opposite to Deschambault, at 10½ p.m.

"25th.—At 7½ a.m. the tide and the wind coming about from the N.E., got under weigh and came opposite Grandines' Church. Very squally with thunder and lightning. When about three miles further Mr. Angus McDonell was very much panic struck, let go the halyard, broached too the boat and frightened the crew, who lay on their oars and all I and Mr. Grant could say—we telling them there was no danger, which in fact there was not—they would not row a stroke and we drifted to Grandines. When about 100 yards from the shore he was in so great a fright that he attempted to get out of the boat, and when I asked him what he was about to do, he said he did not think there was so much water at the place. We arrived at 10½ p.m. and lay up the boat as snug as it was possible.

"26th.—Went down to the boat and found her full of water, which the people, by their negligence, had left last night, although ordered to bale her. I severely reprimanded them, and one of them took it into his head to desert. Mr. McDonell went after him. At 10 a.m. Mr. McDonell not returned, the tide making very fast and I am afraid if he does not come soon that we shall lose it. At 11 a.m. Mr. McDonell returned with the deserter and sat down to breakfast. The

wind continuing strong, we determined to reach Three Rivers. When we were abreast of Cap la Magdelaine, McDonell, seeing the church and one house, wanted to go in, let go the sail and made the people take to their oars, and as the boat came to the shore made a leap and ran as if the devil was after him, not waiting to secure his own baggage. The boat immediately filled, and Mr. Grant and myself did what we could to those articles that belonged to ourselves. When the business was over we found him (McDonell) sitting by a fire, and said he could not endure the cold.

" 27th.—A vessel from London passed Cap la Magdelaine at 3 p.m. Another ship from London at 6 p.m. We got out our boat, bilged and broken to pieces. We endeavoured to stop the leak, but could not, and forced to send over to Three Rivers for pitch and oakum, and to get a carpenter.

" 28th.—Employed the carpenter examining and repairing her, which detained us until 4 p.m. Embarked and made a little river about half a league beyond Three Rivers at 6½ p.m. The wind being from the S.W. so strong that we could not proceed further.

" 29th.—At 6½ a.m. left the little river, the wind strong from the S.W. Came to Point du Lac, and there came to an anchor in order to see if the wind would change or abate, but it grew more violent and we were obliged to return to the place we set out from. At 6 p.m. Bouillard deserted the second time.

" 30th.—Embarked again at 6 a.m. and made Machiche, the wind being very strong against us from the S.W.; but we could not get into the river, and so we were forced to anchor off the point exposed to the whole of the lake.

" 31st.—At 4 a.m., the weather being calm, got under way and stood through the lake in hopes of the wind freshening. When about three miles above River du Loup the wind came from the S.W. so strong that we were forced to stand in for River du Loup, which we made with much difficulty at 2 p.m. At 6 p.m., the wind coming from north, we made the entrance of Chenal du Nord at 10 p.m.

" 1st June, 1792.—At 6 a.m. embarked. Light wind from the N.E. and S. At 11 a.m. the wind failed. At 8 p.m. made the upper end of the Seigniorie of La Valtrie.

" 2nd.—Embarked at 6 a.m., the wind variable from N.E., N. and S. Made Montreal about 4½ p.m.

" 3rd.—Sunday. No business to be done. Waited on Sir John Johnson.

" 4th.—Waited on Sir John Johnson. The letter not ready. Employed packing up my little baggage. Waiting for my provision.

" 5th.—Waiting for Sir John Johnson's letter.

" 6th.—Set off for Lachine and arrived in the evening.

" 7th.—At 1 p.m. left Lachine and arrived at the Cascades at 8 p.m. Very rainy.

" 8th.—At 4½ a.m. left the Cascades and arrived within about one league and a half of Coteau du Lac at 9 p.m.

" 9th.—5½ a.m. departed, and arrived at the mouth of the Riviere aux Raisins at 9½ p.m., the wind being against us all the time.

" 10th.—Sunday. 6 a.m. left the Riviere aux Raisins, and arrived at Cornwall at 9 p.m.; the wind being against us all the fore part of the day.

" 11th.—Set out from Cornwall at 6 a.m., and arrived at the head of the Long Sault at 9 p.m. We found very much difficulty in getting up the Long Sault.

" 12th.—Left the Long Sault, and arrived at Grand Remous at 10 a.m. Breakfasted. Employed unloading the boat and searching for the leak. Found it in her bottom. Exchanged the batteau. Put the provision again on board. Employed packing up my little necessities for campaign, and settling my little family affairs. At 9 p.m. Mr. McDonell not yet arrived. A report is spread that a Mr. McDonell was drowned this evening. Sent off my servant with a horse to enquire after him.

" 12th.—At 4 p.m. servant not returned. Employed packing up the remaining part of my little necessities.

" 13th.—At 10 a.m. Mr. McDonell returned. At 3 p.m. part of Governor Simcoe's corps came too and made a halt, commanded by Capt. Shaw. Obligated to wait this afternoon for my servant.

" 14th.—At 1 p.m. set off, and made Capt. Munro's at 9 p.m. Delivered my letters.

" 15th.—At 6 a.m. left Capt. Munro's, and made Campbell's at the Town of Johnstown at 8 p.m.

" 16th.—At 6 a.m. left Campbell's, and made Airs' at 7 p.m.

" 17th.—Left Airs' at 5 a.m., and made the middle of the 11th township at 7 p.m.

" 18th.—Departed at 5 a.m., and made Kingston at 7 p.m.

" 19th.—This day one of my servants refused to go any further, and the commanding officer interfered in his behalf, in consequence of which I was forced to let him remain, althought he was £1. 10. cy. in my debt. Waited to get another man in his place, and to lay in a little stock for our voyage.

" 20th.—6 a.m. left Kingston, and arrived at Lieut. Parrott's at 7 p.m.

" 21st.—6 a.m. left Parrott's, and arrived at the Green Point at 7 p.m.

" 22nd.—At 6 a.m. left the Green Point, and arrived at Crisdall's and informed Capt. Meyers—to whom I had a letter from the interpreter at Kingston, in order to find me an Indian (? guide or interpreter). Two miles below building a sawmill.

" 23rd.—At 6 a.m. set off for Capt. Meyers', who informed me the person whom he wished to go with me was at the Appanne Mills (? Napanee), but was hourly expected. Employed getting an Indian who knew the Salt Springs, and a Scotch lad who speaks Indian as an interpreter.

" 24th.—Employed as yesterday. At 12 m. left Capt. Meyers' and arrived at the head of the bay, waiting for the person whom he wishes to go with me. Employed grinding axes.

" 25th.—Employed grinding and making helves for our axes, securing our baggage, laying up our boat, getting a canoe for the ex-

pedition. This evening arrived Capt. Meyers and informed me that Mr. Blacker would arrive in the morning.

"26th.—Mr. Blacker arrived, and after having spoken concerning the springs on the Trent, he informed me that he saw Mr. Jones, surveyor for Niagara, who informed him that he has a salt spring at the head of Lake Ontario which produced a large quantity of salt. A salt spring being a mineral water, consequently, as a mineral, therefore cannot belong to Mr. Jones, and so ought to be inspected. At 1 p.m. set out from the mouth of the River Saggettewedguam, and arrived at 6 p.m. about four miles from its confluence. On the east side the land in general is high—that is to say, from 10 to 20 feet; on the west side low, and on both but indifferent and stony land. Encamped about 7 p.m. Rainy weather all the evening. The water very strong from its mouth, so that the Indians are forced to get out of the canoe and lead it all the way except about a mile from its mouth.

"27th.—Departed from our encampment about 6 a.m., and arrived at the head of the first rapid at 3 p.m. and dined at 3½ p.m. Set out for the head of the second rapid and arrived at 7½ p.m. and encamped. The land on the north side appears tolerably good, except in some few places above the head of the first rapid, and that on the south side for about five or six miles; the rest appears to be low and swampy.

"28th.—At 7 a.m. set out for the spring.

"29th.—Blazed the track all the way from about four miles and a half. The first part,* for about a mile, is very swampy. Arrived at the spring about 9 a.m., and upon examination found it to be a pool of about 2½ ft. in diameter, with no run from it, strongly impregnated with sulphur. Smell and taste nearly like to a solution of gunpowder, which induced me to believe it had been some imposition of the Indians, but Mr. McDonell and myself, after having with our kettles taken out all the water and dug down to a clay and gravel bottom, the water rose from about 10 a.m. to 10 a.m. the next morning the same height, very clear, and about the same quality.

"30th.—At 10 a.m. began the operation of examining and weighing the water, after which Mr. McDonell filled two kettles for boiling. Employed the people digging with axes and shovels we had made, and dug down about five feet and about four feet in diameter and the spring made no more water. At 5 p.m. it began to rain, and rained hard all the night.

"1st July, 1792.—At 10 a.m. Mr. McDonell, having finished his operations, we packed our baggage and McDonell went across the "carrying" in order to go down in the canoe, and I remained, waiting for the people to return, to go across the woods to the mouth of the Saggettewedguam, as one canoe could only take three people and the baggage. One was a person who acted as interpreter, a John McIntosh, and the other a son of Capt. Meyers, who knew the greatest part of the country, and who volunteered the journey. At 2 p.m. the people returned and we set off, and made 8 miles and at 7 p.m. encamped.

"2nd.—At 6 a.m. set off, and came to the hills of Lake Ontario at 10 a.m., about five miles west from the head of the Bay of Quinte, in

order, as the Indian said, to avoid the swamps, and at 2 p.m. arrived at the mouth of the Saggettedwedguam. Mr. McDonell arrived at noon with canoe. So soon as the people had dined, sent them for the batteau. We are informed by some other Indians there is another spring. Sent for the chief, who says it only runs in the winter, but that he must have a bottle of rum this evening. His whole aim seems to be for the bottle of rum. He has now trumped up another story, that he knows of another which he has seen while hunting; that it is about a yard in diameter, boils up and runs, but that a person may drink the water of it. That salt has never been made of it, and that the spring or mud hole we were at is the only place where salt has been made, consequently, it certainly must be the spot to which we were directed, as it corresponds perfectly in regard to the situation, but not to the quantities of salt that has been made there. As no person in the country ever having seen above a few ounces, and exactly of the same taste with that McDonell made. Another thing that makes it appear to be the place, we found at our encampment the trees blazed all around at the foot of a high hill on the east, and the spatulas with which they had stirred the salt; also a scum they had thrown off, like unto that which McDonell had from clarification with eggs, both in taste and smell.

"3rd.—McDonell employed asking several questions of the chief, but his answers tend to the same purport of last evening—that is to say, the bottle of rum. Returned the interpreter to his master, and made every acknowledgment in our power for his politeness.

"4th.—At 6 a.m. set off from the Saggettedwedguam, and made Capt. A. McDonell's on the Presque Isle de Quinte at 11 p.m.

"5th.—At 6 a.m. set out from Capt. A. McDonell's, and arrived at Kingston at 8½ p.m.

"6th.—Ordered by the Major of Brigade to wait on the Governor at 10 a.m. The Governor gone to visit the Mills and did not return until 2 p.m. Waited on him and gave our remarks concerning our journey to the Salt Springs. Mr. McDonell neglected to make out his report. Ordered by the Governor to wait on him at 8 a.m. on the morrow, as also Mr. McDonell.

"7th.—Waited on the Governor at the hour appointed, but Mr. McDonell did not attend. Ordered to call again at 10 a.m., and to bring Mr. Aitkin along with me. Attended. Employed labelling and sorting plans.

"8th.—The Governor was sworn in at 10 a.m. Ordered by him to attend at 7 a.m. on the morrow.

"9th.—Attended at the hour appointed. Employed in labelling plans and answering several questions with regard to the Surveyor-General's Department, in regard to dividing the districts. Ordered to enquire whether the settlement of the District of Nassau was numerous. Ordered to attend early, that is to say, at 7 a.m. on the morrow. Agreeable to the order of enquiry, applied to Mr. Secord, who is a young man of about twenty, and the only person in the place who knows. He says the settlement in general is full of inhabitants from

the Chippeway Creek to the head of Lake Ontario, and in many places from ten to twelve miles in the rear.

"10th, 7 a.m.—Repeated the information I had received to the Governor. Employed docketing plans and writing a list of them. Ordered to enquire concerning the strength of the militia in the District of Nassau. Mr. Wm. McKay reports concerning the number of militia in the district of Nassau, and from his having been a military man I should think it the best information we can obtain on this spot, that

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| The 1st Battalion, from the head of the lake to Niagara, consists of about | 160 men. |
| The 2nd Battalion, from Niagara to the Chippeway Creek, consists of about | 200 " |
| The 3rd Battalion, from the Chippeway Creek to Long Point, consists of about | 200 " |
| Total..... | 560 men. |

"He says the above-mentioned number is near the amount of the muster of the last year, and that he does not think they have increased to more than six hundred. Mr. Jones arrived this evening.

"11th, 7 a.m.—Attended on the Governor. Employed in docketing and referring plans, and in dividing the District of Lunenburg and Meiklenburg into counties.

"12th.—Employed dividing the District of Nassau and Hesse into counties," and so on at office work until the 24th, when he left Kingston, and arrived at Gananoque at 7 p.m.

"25th.—At 6 a.m., left Gananoque, and arrived at the upper end of the township of Augusta. Made all the interest I could in the behalf of Mr. White, the Attorney-General, with the principal people of Elizabethtown. The gentlemen seem much to favour him.

"26th.—At 6 a.m. left Augusta, and arrived at the Grand Remous at 9 p.m.

"27th.—Employed unlading my batteau and settling with my party. Allowed them five days to carry them home, it being customary." Here, as commanded by Governor Simcoe, he appears to have been busily engaged in making and copying plans, and closing up his work in this part of the country before handing the district over to his successor, Mr. Hugh McDonell. He was then to join the Government at Niagara, and take charge of the surveys of Upper Canada as Surveyor-General. Closing up his affairs occupied a month, for we read that on the 28th August he was "waiting the opportunity of batteau to take him up the river." On the 29th a "brigade of batteaux" passed up, and, taking passage, he was landed in Kingston at midnight of Sunday, 2nd September, 1792.

"3rd.—At 4 p.m. left Kingston, and arrived during the night within about fifty miles of Niagara.

"4th.—Gentle breezes, the weather cold. Came abreast of Niagara about noon, and lay off the whole of the day for want of wind. About 8 p.m. came to an anchor, but the wind changing, immediately

weighed anchor again, and about 11 p.m. came to alongside the wharf off Navy Hall.

"5th.—Waited on Major Littlehales to inform the Governor of our arrival. The Governor too unwell to see anybody.

"6th.—Waited on Major Littlehales to ask for a tent or marquee. Was answered, so soon as the Governor was well he would mention it to him." Here the Governor was confined to his bed with fever, and supposed to be dangerously ill. The Counsellors and members of the House of Assembly had arrived, but the House, on meeting, was prorogued to Monday, the 17th. In the meantime Mr. Chewett appears to have found lodgings in a tavern at the rate of three shillings per day, and his servant at two shillings.

"17th September, 1792.—At 1 p.m. the Governor came to the House of Peers and made a speech to the members of both Houses. The Commons then were ordered to return to their House, to be sworn in and to choose a Speaker." After this, till the 30th, Mr. Chewett does not seem to have seen anything of the Governor or to have had anything to do except to describe some boundaries of townships at the request of the Chief Justice, in order "to make them into patents."

"30th September, Sunday.—Attended the Governor, who, after speaking on various subjects, concluded with saying he had appointed Mr. David Smith Surveyor-General, and that we must enter into business immediately. After the levée was over, the Surveyor-General was pleased to say the Governor would appoint me Deputy Surveyor-General, and requested that I would attend him at 4 p.m. on Monday to begin business." Mr. Chewett was disappointed. When Governor Simcoe arrived at Quebec in the autumn of 1791, Major Holland, Surveyor-General of the Province of Quebec, proposed to Governor Simcoe his appointment as Surveyor-General of the Upper Province, but on Mr. Chewett's arrival in Quebec, early in 1792, Governor Simcoe candidly told him that he could not make the appointment, as it had been promised to Lt.-Col. Provost, who would not come to the country, but that Mr. Chewett should be the acting Surveyor-General. How Mr. Smith, a captain of the 5th Regiment, in garrison at Fort Niagara, became Surveyor-General in place of Colonel Provost, is not explained; at least there is no record among Mr. Chewett's papers, though until this date official documents were signed by Mr. Chewett as "acting" Surveyor-General.

"1st October, 1792, Monday.—Attended the Surveyor-General at 4 p.m. No business to be done, as he had not received instructions.

"2nd October.—Ordered to the Governor at Navy Hall relative to a tract of land prayed for by a Mr. Easton. Ordered to write a description of the place. Complied with the order." And after this date he appears to have been busily engaged in office work and attending at Navy Hall, etc., until he records that on

"3rd November, 1792.—Received from Mr. Smith fifty H. joes, which Mr. Smith received from the Receiver-General, all of them light, and given as full weight. I expostulated with the Receiver-

General, but he said the merchants would give a draft for them on Montreal.

"4th November.—Dined with the Agricultural Society at the Freemasons' Hall. Governor Simcoe and his suite were present.

"5th.—Left Niagara about 10 a.m., and

"6th.—Arrived at Kingston at 6 p.m.

"7th.—Remained to settle my accounts with Mr. Forsyth." This occupied him till the 9th, when he left Kingston at midday, and arrived at midnight at No. 10 in the township of Young.

"10th November.—At 6 a.m. left the place where we slept the last night, and arrived at the place of my residence at 9 p.m." Here he remained all winter, making plans and schedules of pretty nearly all the townships in the Eastern District. On the 17th April, 1793, he records: "Packing my little necessaries for the voyage to Niagara. On the 18th four batteaux arrived about half-past six in the evening, belonging to Mr. Frobisher, but were too much loaded to take in passengers." He was told that others were following, and would arrive the next day. It was not till the 20th that two belonging to Mr. Glenny came by, in which were Dr. Burns and Mr. Bowman, passengers. With these gentlemen he proceeded to Kingston, and arrived on the 24th. Here he was detained until the 5th May waiting for a fair wind to enable the *Mississaga* to make a start. On the 5th, the wind being fair for Niagara, he embarked and they weighed anchor. It, however, died away, so he came ashore and returned to Kingston. It was not until the 9th the *Mississaga* got off at 6 in the morning, and they arrived at Niagara the next day at 11 a.m.—not bad sailing. He now records: "The Governor and his suite being gone to Toronto, waited on the Chief Justice."

"11th May.—Waited on the Receiver-General.

"12th May, Sunday—Waited on the commanding officer Major Smith,

"13th.—Arrived at half-past two p.m. His Excellency Governor Simcoe from Toronto.

"14th.—This morning arrived the Surveyor-General.

"15th.—Waited on the Surveyor-General, and received a balance of £10 currency, which I paid to Mr. Crooks on account for Mr. Glenny." From now on he appears to have been hard at work upon plans, etc.

"31st May, Friday.—Both Houses being assembled at one o'clock p.m., and on the appearance of the Governor the garrison of Niagara fired a royal salute, a compliment to him as the representative of the crown. The Governor being seated, an order was sent to the Commons for their attendance. The passage to the bar was so crowded they could hardly come up to it, owing to the sergeant-at-arms being out of the way. Methinks there should be a pale to the bar for the Commons to enter, in order to be separate from the populace. The Governor was then pleased to make a most noble and gracious Speech from the Throne, which made the heart of every true Briton jump for joy.

"4th June, 1793.—Being the anniversary of His Majesty's birthday, attended the leveé, but being dressed in boots, was told by the

sentries that none but military men were thus admitted. Returned in order to dress myself accordingly, but was too late. In the evening an elegant ball and supper was given for all His Majesty's loyal subjects, and the ladies made a splendid appearance, though not very numerous. After supper a number of loyal toasts went round, suitable to the occasion. The company went to their homes about 2 a.m. in great good humour, and a few of the gentlemen spent the evening all night!

"5th June.—Employed by His Excellency the Governor making a reference to a plan of Toronto by Joseph Bouchette." Shortly after this date, Mr. Chewett set out with a surveying party, going up the Niagara river, transporting his batteau round the falls, and arrived at Fort Erie on the 18th. From this point he proceeded westward, and was engaged in surveying the county, its shores and harbours, the rest of the year.

Mr. Chewett settled in Toronto when the Government was moved from Niagara, and occupied a log house near the north-east corner of York and Wellington Streets, afterwards converted into a root-house when he built a residence for his family on Market Street (now Wellington). This building, a little changed by additions, still (1890) stands, the foundation of which was laid in 1799.

On the 1st January, 1800, Mr. Chewett was appointed Registrar of the Surrogate Court for the Home District, and retained that office upwards of forty years.

In 1802 Mr. Surveyor-General Smith retired and left for England, and, although Mr. Chewett was promised the appointment, it was found that Mr. Smith had disposed of his office, together with his house and land in the town of York (Toronto) to Mr. Charles B. Wyatt. Mr. Wyatt, however, was suspended the same year for having conspired with Mr. Justice Thorpe and others against the Administration of the Hon Mr. President Grant, and Mr. Chewett was afterwards appointed joint Surveyor-General with Mr. Ridout.

During the American War of 1812-14 Col. Chewett commanded the 3rd Regiment of West York Militia, and upon the reported landing of the Americans near the Humber on the night of 26th April, 1813, Major-General Sheaffe withdrew his troops, believing he could not sustain an attack, and (leaving instructions with Col. Chewett and Major Allen, residents of the town, to treat with the American commander for terms,) retreated for Kingston.

The next day, the 27th, the Americans advanced on the town, and the Canadians, seeing the capture of the place inevitable, blew up the powder magazine to prevent its falling into the hands of the enemy. Unexpectedly, the force of the explosion caused the stones and debris of the building to be discharged directly amongst the American soldiers drawn up in the square of the Fort, killing General Pike and over two hundred American soldiers. The terms of capitulation were signed the same day, by which, among other concessions, two hundred and ninety-three Canadian militia were surrendered prisoners of war.

In 1832 Mr. Chewett was permitted to retire on full pay, after a governmental service of over fifty-eight years. The remaining period of Mr. Chewett's life was passed in a quiet, uneventful manner. An

ardent lover of his country and a true British subject he always kept His or Her Majesty's birthday, and marked the occasion by loyal toasts at his dinner table; and we find recorded in his journal for 1838 (the Rebellion year): "November 19th.—This morning came Messrs. Walton and Capreol, under the resolutions adopted by the Common Council, to visit all the male inhabitants of the city of Toronto who had not been enrolled for the defence of the city, dated 15th inst., when they were pleased to receive me as a volunteer for the Ward of St. George—my own patron saint!" Mr. Chewett was then within a month of completing his eighty-fifth year. After this there was still before him nearly eleven years—eleven years of healthful, pleasant life. No sickness, pain or trouble that too often renders the closing years of the aged, years of labour and sorrow. To the day of his death he was up and about, making notes of little trifles of interest to himself alone—one of which was winding his watch, which he daily did at noon. On the 24th September, 1849, appears in his own handwriting the last words he ever wrote, "Wound up." Four hours and a half afterwards he laid himself down on his bed, dressed as he was, and quietly fell asleep in death.

LIST OF MEMBERS.

ACTIVE MEMBERS.

| NAME. | OCCUPATION. | ADDRESS. |
|---|-------------|---|
| Abrey, George Brockitt | | 17 Arcade, Yonge Street, Toronto. |
| Aylsworth, Wm. Robert | | Deseronto. Engineer for Napanee, Tamworth & Quebec Railway, also Township of Tyendinaga. |
| Aylsworth, Charles Fraser, Jr. | | Madoc. Engineer for Tps. of Sydney, Thurlow, Rawdon, Huntingdon, Hungerford and Madoc, also Village of Madoc. |
| Baird, Alexander | | Box 195, Leamington. Engineer for Tps. Romney, Tilbury W., Colchester S., and Malden, also Town of Leamington. |
| *Beatty, David | | Parry Sound. |
| Berryman, Edgar, M. Can. Soc. C.E. | | Sherbrooke, Que. Chief Engineer Quebec Central Railway. |
| *Blake, Frank Lever | | Toronto. Astronomical Assistant at Observatory. |
| *Bolger, Thomas Oliver | | Kingston. City Engineer. |
| 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., | | 393 Division Street, Kingston. |
| *Bowman, Arthur Meyer, Grad. S.P.C., Toronto | | Berlin. |
| Bowman, Clemens Dersteine | | West Montrose. |
| *Bowman, Herbert Joseph, Grad. S.P. Sc. (Toronto); A.M. Can. Soc. C.E. | | Berlin. Superintendent B. W. W. |
| *Bowman, Isaac Lucius | | Berlin. |
| *Bray, Edgar | | Oakville. |
| Browne, Harry John | | 17 Toronto Street, Toronto. |

| NAME. | OCCUPATION. | ADDRESS. |
|--|---|-----------------------------------|
| Browne, Wm. Albert | | 17 Toronto Street, Toronto. |
| Burke, Wm. Robert | | Ingersoll. |
| *Burt, Frederick Percy | | New York City. |
| | Chief Draughtsman "Engineering News." | |
| Campbell, Archibald Wm., A. M. Can. Soc. C.E. | | St. Thomas. |
| Campbell, David Suter | | Box 153, Mitchell. |
| | Engineer for five Townships. | |
| Casgrain, Joseph Philip Baby, A. M. Can. Soc. C.E. | | Morrisburgh. |
| Cavana, Allan George, D.L.S. | | Orillia. |
| | Engineer for Townships of Rama, Mara, Carden and Dalton; Land, Loan and Ins. Agt. | |
| Cheesman, Thos. | | Mitchell. |
| Chipman, Willis, B.A.Sc. (McGill); M. Am. Soc. C.E. ; M. Can. Soc. C.E. | | Brockville. |
| | Consulting Engineer and Engineer for Town of Brockville. | |
| Coad, Richard | | Glencoe. |
| Cozens, Joseph | | Sault Ste. Marie. |
| | Mem. Am. Soc. M. E., Pres. Sault Ste. Marie & Hudson Bay Ry. | |
| Davidson, Walter Stanley | | Petrolia. |
| *Davis, John | | Guelph. |
| | Engineer Guelph Junction Railway. | |
| Deans, William James | | Oshawa. |
| De Morest Watson | | 240 Lisgar St., Toronto. |
| De Gursé, 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) | | 7 Princess Street, Winnipeg, Man. |
| Ellis, Henry Disney | | 76 St. Patrick Street, Toronto. |
| | Assistant Engineer Ontario & Atlantic Div. C. P. Ry. | |
| Esten, Henry Lionel | | 32 Adelaide Street East, Toronto. |
| Evans, John Dunlop M. C. Soc. C.E. | | Trenton. |
| | Chief Engineer Central Ontario Railway, Engineer Canadian Copper Company. | |
| Fawcett, Thomas, D.T.S. | | Gravenhurst. |
| | Dominion Government Surveys | |

| NAME. | OCCUPATION. | ADDRESS. |
|--|--|---------------------------------|
| Fitton, Charles Edward | Engineer Wahnapatae Mining Company, Land and Insurance Agent. | Drawer 31, Orillia. |
| Flater, Frederick William | | Chatham. |
| Foster, Frederick Lucas | | 176 Argyle Street, Toronto. |
| Galbraith, John, M.A.; Assoc. M. Inst. C.E., D.T.S. | Professor of Civil Engineering, School of Practical Science. | Toronto. |
| Galbraith, William | | Bracebridge. |
| Gardiner, Edward | Engineer County of Lincoln. | St. Catharines. |
| Gaviller, Maurice, C.E. (McGill) | | Box. 32, Barrie. |
| *Gibson, Peter Silas, B.Sc.; C.E.; M.Sc. (Univ. of Mich) | | Willowdale. |
| *Hanning, Clement George, C.E. (Trinity College, Dublin, Ireland) | | 135 Bloor Street East, Toronto. |
| Henderson, E. E. | | Henderson P. O., Maine. |
| Johnston, R. T. | | 131 Wellington St. W., Toronto. |
| Jones, Thomas Harry, B.A.Sc. (McGill) | City Engineer. | Brantford. |
| Keefer, Thos. Coltrin, C.M.G.; M. Inst. C.E.; Pres. A. Soc. C.E.; Can. Soc. C.E. | | Ottawa. |
| Kirk, Joseph | Engineer for Townships of Mornington, South Easthope, North Easthope and Village of Melverton. | Box 373, Stratford. |
| Kirkpatrick, George Brownly | Chief Clerk Survey Branch, Department of Crown Lands. | 8 Coolmine Road, Toronto. |
| Klotz, Otto Julius, D.T.S.; C.E. (University of Michigan) | Astronomer for Department of Interior. | Preston. |
| Laird, Robert, Grad. S. P. C., Toronto | | 771 King St. W., Toronto. |
| *Lendrum, Robert Watt | | Vankleek Hill. |
| Low, Nathaniel E. | | Warton. |
| *Lumsden, Hugh David, M. Inst. C.E.; M. Can. Soc. C.E. | Engineer for Atlantic & North-West and International Railways. | Sherbrooke, Q. |
| McAree, John, Grad. S.P.S.; D.T.S. | | 113 Winchester St., Toronto. |

| NAME. | OCCUPATION. | ADDRESS. |
|---|---|-----------------------------------|
| McCulloch, Andrew Lake | Grad. S. P. Sc., Engineer for Town of Galt, Townships of Beverly and North Dumfries. | Toronto Galt. |
| McEvoy, Henry Robinson | Tourists' Guide, North Bay. | St. Mary's. |
| *McGeorge, Wm. Graham | Engineer County of Kent. | Chatham. |
| McGrandle, Hugh | | Huntsville. |
| McKay, Owen | Assistant Engineer L. E. E. & D. R. Ry. | Windsor. |
| *McKenna, John Joseph | | Dublin. |
| McNabb, John Chisholm | Engineer for Erie & Huron Ry. and Town of Chatham. | Chatham. |
| *McPhillips, George | | Windsor. |
| *Manigault, Wm. Mazyck | Engineer for Townships of Caradoc, East Williams, Adelaide and Town of Strathroy. | Strathroy. |
| Miles, Charles Falconer | Engineer Minto, Normanby, Carrick, Brant, Greenock, Bruce, Arain and Town of Wingham. | Walkerton. |
| Moore, John McKenzie | Engineer for four Townships. | London. |
| Morris, James Lewis, C.E. (Toronto University), A. M. Soc. C. E. | Engineer County of Renfrew. | Pembroke. |
| Mountain, George A. | Engineer Can. Atlantic Ry. | Ottawa. |
| Murphy, Chas. Joseph | | 32 Adelaide Street East, Toronto. |
| Niven, Alexander | Outline Surveys, Crown Lands Department. | Haliburton. |
| Ogilvie, William, D.T.S. | Dominion Land Surveyor. | Ottawa. |
| Patten, Thadeus James | | Little Current. |
| *Paterson, Jas. Allison, M. C. Soc. C.E. | Engineer on C. P. R. | 26 St. Mary St., Toronto. |
| *Proudfoot, Hume Blake, C.E. (University of Toronto) | | Toronto. |
| *Purvis, Frank | Engineer for Townships of Bromley and Wilberforce. | Eganville. |

| NAME. | OCCUPATION. | ADDRESS. |
|---|---|---------------------------------------|
| Rainboth, E. J. | | 25 Sparks St., Ottawa. |
| Robertson, James, Grad. S. P. Sc. | | Glencoe. |
| *Rogers, Richard, Birdsall; B.A.Sc. (McGill) | Superintending Engineer Trent Canal. | Peterboro'. |
| Ross, George, B.A. Sc. (McGill) | Engineer for Town of Welland and six Townships. | Welland. |
| Russell, Alexander Lord | Mining Engineer. | Box 240, Port Arthur. |
| Sankey, Villiers | City Surveyor. | City Hall, Toronto. |
| Saunders, Bryce Johnston, B.A.Sc. (McGill) | Engineer for Counties Leeds and Grenville, Townships Augusta and Elizabethtown. | Box 114, Brockville. |
| Sanderson, Daniel Leavens | | Enniskillen. |
| Scane, Thomas | Engineer for Townships of Orford and Done, and Town of Ridgetown. | Ridgetown. |
| *Selby, Henry Walter | Engineer for Townships of Nottawasaga, Sunnidale and Floss. | Stayner. |
| *Sewell, Henry DeQuincy, Assoc. M. Inst. C.E. | | Port Arthur. |
| Sherman, Ruyter | Assistant City Engineer. | Brantford. |
| Speight, Thomas Bailey | | Arcade, Yonge Street, Toronto. |
| Stewart, Elihu | | Collingwood. |
| Stewart, Louis Beaufort | Lecturer on Surveying. | School of Practical Science, Toronto. |
| Tiernan, Joseph M. | Engineer for three Townships. | Tilbury Centre. |
| *Traynor, Isaac | Engineer for Townships of Egremont, Proton, Melancthon and Osprey. | Dundalk. |
| Tyrrell, James Williams, C.E. (Toronto) | Engineer for Townships of Ancaster and Flamboro' West, and Village of Burlington. | 42 James St. N., Hamilton. |
| Unwin, Charles | | 17 Toronto Street, Toronto. |
| Van Nostrand, Arthur Jabez | | Arcade, Yonge Street, Toronto. |
| *Vicars, John | Engineer for Township of Brock and Village of Cannington. | Cannington. |

| NAME. | OCCUPATION. | ADDRESS. |
|--|--|--------------------|
| Warren, James, Mem. Can. Soc. C.E. | Engineer for the Townships of Greenock, Ashfield and Culross, and Lucknow Water Works. | Kincardine. |
| Weatherald, Thomas | | Box 116, Goderich. |
| Webb, Adam Clark, D.L.S. | | Brighton. |
| *Wheeler, Arthur Oliver | Department of Interior. | Ottawa. |
| Wheelock, Chas. Richard | Engineer for Counties of Wellington, Dufferin and Peel. | Orangeville. |
| Whitson, James Francis | Engineer for six Townships. | North Bay. |
| *Wicksteed, Henry King, B.A.Sc. (McGill), M. C. Soc. C. E. | Chief Engineer Brantford, Waterloo & Lake Erie Railway. | Ottawa. |
| Yarnold, William Edward | Engineer for Townships of Brock, Reach, Scugog, Mariposa and Georgina. | Port Perry. |

JUNIOR MEMBER.

Rathbun, Edward Walter, Jr. Desoronto.
 Assistant Engineer N. T. & Q. Ry.

HONORARY MEMBER.

Carpmael, Charles, M.A. Toronto.
 Superintendent of Meteorological Service.

