

F.P.S. del.

— Γεωμετρης Αγνιωτης —

PROCEEDINGS

OF THE

ASSOCIATION OF

Provincial Land Surveyors

OF ONTARIO,

AT ITS FIRST ANNUAL MEETING HELD AT TORONTO,
FEBRUARY 23RD, 24TH, AND 25TH.

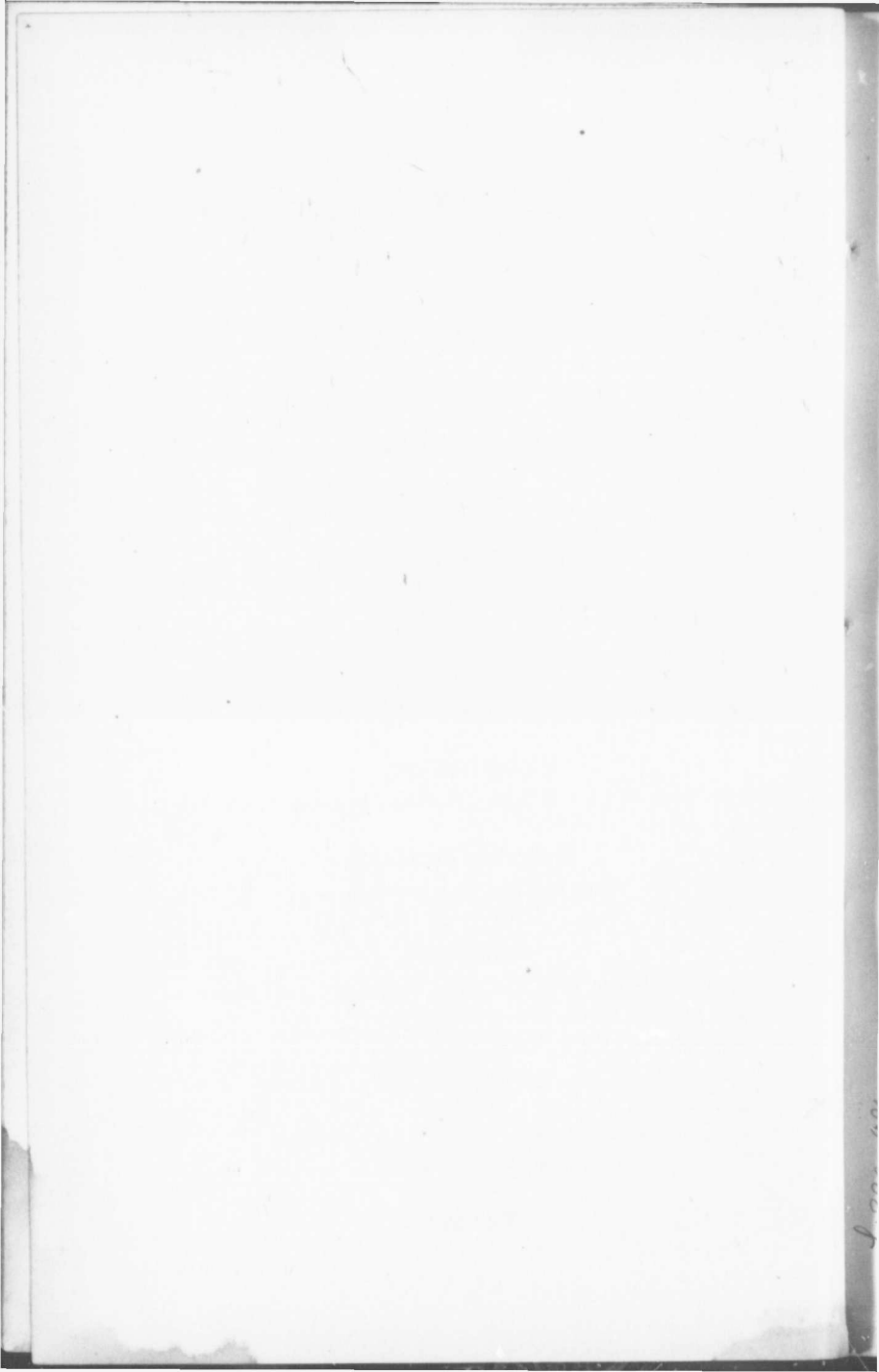
1886.

*The Second Annual Meeting will be held at Toronto on Tuesday, 22nd February,
1887.*

PRINTED FOR THE ASSOCIATION

BY

C. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO.





Association of Provincial Land Surveyors

— OF ONTARIO. —

ORGANIZED 23rd FEBRUARY, 1886.

OFFICERS FOR 1886-87.

President,

George B. Kirkpatrick, P.L.S., Crown Lands Dep't, Toronto.

Vice-President.

John Galbraith, M.A., A.M. Inst. C.E., School Practical Science, Toronto.

Secretary-Treasurer.

Willis Chipman, B.A.Sc., Brockville.

Councillors.

Matthew J. Butler, A.M. Inst. C.E., M. Am. Soc. C.E., Napanee.

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

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

Auditors.

George Brockitt Abrey, P.L.S., Toronto.

Lewis Bolton, P.L.S., Listowel.

Bankers.

Bank of Montreal.

507-2581

Standing Committees.

- LAND SURVEYING.—P. S. Gibson (Chairman); T. O. Bolger, R. Coad, J. H. Jones, Alex. Niven, Wm. Ogilvie, V. Sankey, E. Stewart, T. B. Speight, Chas. Unwin, A. C. Webb.
- DRAINAGE.—H. B. Proudfoot (Chairman); J. L. Bowman, W. R. Burke, R. H. Coleman, Joseph Kirk, J. S. Laird, W. G. McGeorge, I. Traynor.
- ENGINEERING.—J. Galbraith (Chairman); H. J. Browne, M. J. Butler, J. D. Evans, Wm. H. Furlonge, E. Gardiner, T. H. Jones, T. C. Keefer, H. D. Lumsden, Chas. Sproatt.
- INSTRUMENTS.—G. B. Abrey (Chairman); F. L. Blake, Edgar Bray, Thomas Fawcett, O. J. Klotz, J. McAree, Hugh Wilson.
- LEGISLATION.—G. B. Kirkpatrick (Chairman); Thos. Byrne, E. Stewart, V. Sankey.
- PUBLICATION.—W. Chipman (Chairman); J. McAree, A. J. VanNostrand, A. W. Campbell.



PREFACE.

THE Provisional Executive Committee have considered it proper that the Report of Proceedings of the first meeting of the Association of Provincial Land Surveyors of Ontario should be prefaced by a statement of the circumstances which led to its organization.

Early in December, 1885, a correspondence was carried on between Willis Chipman, of Brockville, and the conveners of the meeting held in Toronto on 23rd February, which correspondence resulted in the issuing of the following circular to the Land Surveyors of the Province:—

CIRCULAR.

We, the undersigned Provincial Land Surveyors, deem it advisable, for the purpose of improving ourselves and maintaining and elevating the standard of our profession, to organize an Association of Provincial Land Surveyors in Ontario.

We request your earnest co-operation. Associations of this kind are now in successful operation in many of the States, and are doing a great work, and we feel that if we do not wish to fall behind in the race we must follow their example.

A meeting for organization will be held at Toronto, on Tuesday, 23rd February, 1886, at 2 p.m. Arrangements have been made for meeting in the Crown Lands Department.

It is desirable that all P. L. Surveyors should attend this meeting, that a Constitution may be adopted that will meet with the approval of the majority of the profession. Those who may find it impossible to attend will oblige the conveners by communicating their views to Willis Chipman, Brockville, Secretary *pro tem*.

Conveners: Otto J. Klotz, G. B. Kirkpatrick, T. H. Jones, Jno. M. Moore, P. S. Gibson, G. B. Abrey, M. J. Butler, Lewis Bolton, Prof. Galbraith, Alex. Niven, Edgar Bray.

At this Convention a Constitution and By-laws were adopted, which are embodied in this Report of Proceedings.

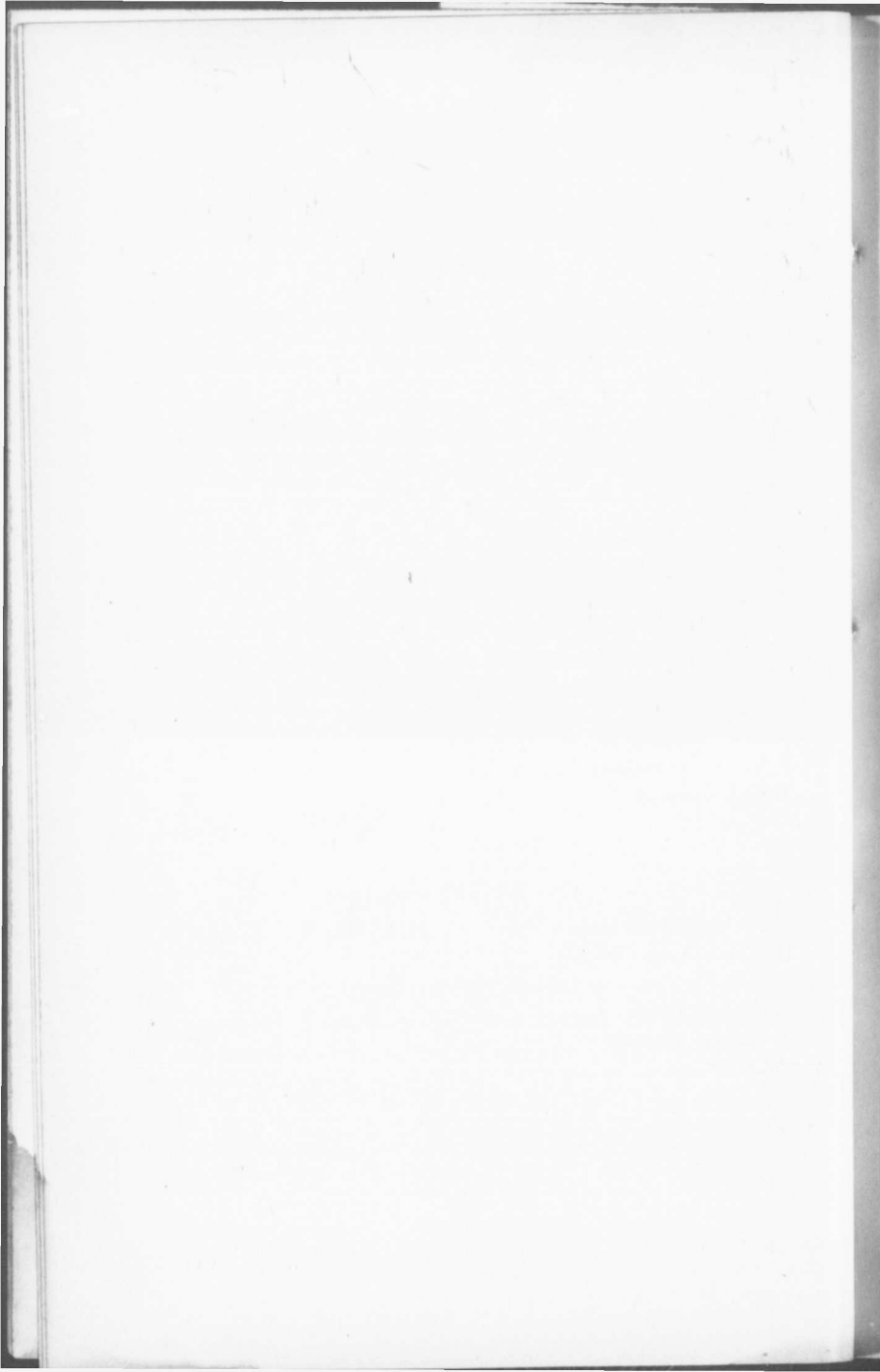
The meeting was a very enthusiastic one, and thoroughly representative. Many letters of encouragement and hearty approval were received by the Secretary from members of the profession who were unable to be present.

All the papers published in this Report were prepared upon only two weeks' notice, and the Committee takes this opportunity of thanking the members who so kindly volunteered them.

To our exchanges we may state that our first Report of Proceedings is necessarily very imperfect, but we hope that next year we may be in a position to publish something of more interest.

Signed on behalf of the Provisional Executive Committee.

WILLIS CHIPMAN.

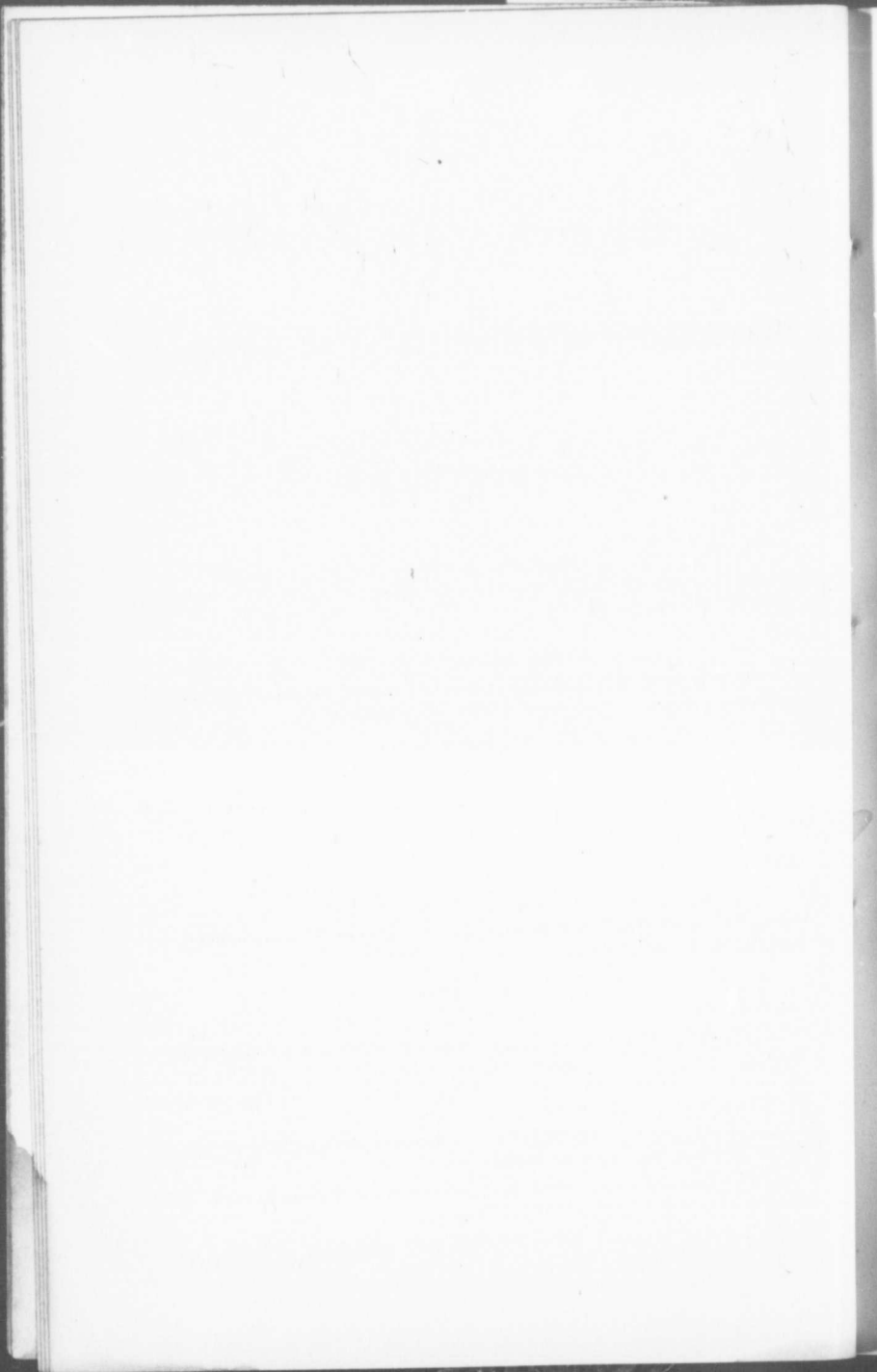


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CONSTITUTION AND BY-LAWS
OF THE
Association of Provincial Land Surveyors
OF ONTARIO.

CONSTITUTION.

ARTICLE I.

NAME OF THE ASSOCIATION.

This Association shall be known as "The Association of Provincial Land Surveyors of Ontario."

ARTICLE II.

OBJECTS OF THE ASSOCIATION.

The objects of this Association shall be the promotion of the general interests, and elevation of the standard of the profession.

ARTICLE III.

MEMBERS.

1. The Association shall consist of Active Members, Associate Members and Honorary Members.
2. Active Members must be Provincial Land Surveyors, and only such shall hold office.
3. Articled pupils may become Associate Members.
4. Honorary Members shall be those persons only who are distinguished by professional attainments. They shall be exempt from dues.

ARTICLE IV.

OFFICERS.

1. The Officers of the Association shall consist of a President, a Vice-President, a Secretary-Treasurer, and three Councillors, who shall constitute an Executive Committee, which shall have the direction and management of the affairs of the Association.
2. The meetings of the Executive Committee shall be held at the call of the President or Secretary-Treasurer.
3. The Executive Committee shall, as soon after its election as possible, strike the several Standing Committees.
4. Three members of Committee shall form a quorum.

ARTICLE V.

ELECTION OF MEMBERS.

1. Any Provincial Land Surveyor shall be eligible as a Member of this Association upon payment of the necessary fees.

HONORARY MEMBERS.

2. Candidates for election as Honorary Members must be recommended by at least two Members.

ASSOCIATE MEMBERS.

3. Candidates for election as Associate Members must be recommended by at least two Members.

VOTING FOR MEMBERS.

4. All voting for the election of Honorary and Associate Members shall be by ballot and at a General Meeting of the Association.

5. A majority of the ballots cast shall decide.

ARTICLE VI.

ELECTION OF OFFICERS.

1. The nomination of Officers shall be made at the General Annual Meeting.

2. The voting for Officers shall be by letter ballot, which ballot will be issued by the Secretary-Treasurer to all Members on or before 15th day of March in each year.

3. The ballots are to be returned to Secretary-Treasurer on or before 1st day of April in each year and opened by him.

4. Ballots are to be retained by Secretary-Treasurer, and submitted at the next General Meeting to Scrutineers.

5. Candidates and retiring Officers are to be notified by the Secretary-Treasurer of result of election.

6. The Secretary-Treasurer is to have vote only in case of a tie.

ARTICLE VII.

MEETINGS.

1. The General Annual Meeting shall commence on the Fourth Tuesday in February, in the City of Toronto.

2. Special Meetings of the Association may be called by the President, and shall be called by him at the request in writing of ten or more active Members.

3. The Secretary-Treasurer shall give at least one month's notice to all Members, of any Special Meeting to be held.

4. Fifteen active Members shall form a quorum at any meeting for the transaction of business.

ARTICLE VIII.

AMENDMENTS TO CONSTITUTION.

1. This Constitution may be amended by a two-thirds vote of the active Members of the Association, such vote to be taken by letter ballot.
2. Any amendment of the Constitution must first be proposed at the General Annual Meeting, and be favourably considered at such meeting before being voted upon.
3. The Secretary-Treasurer shall then prepare letter ballots, specifying the amendment proposed, and issue the same to the Members of the Association at the same time as the letter ballots for the election of Officers.
4. Sub-sections 3, 4, and 6, of Article VI. of this Constitution, are to be read as Sub-sections 4, 5, and 6 of Article VIII.

ARTICLE IX.

AUDITORS.

Two Auditors, to be elected by ballot, shall audit the accounts of the Association annually, and present their report of the same annually at the Annual General Meeting.

ARTICLE X.

SUBSCRIPTIONS.

1. The fee for Membership for Active Members and Associate Members shall be \$3, and an annual subscription of \$2 for each subsequent year; both payable in advance.
 2. The Association Year shall begin on the 1st day of April in each year, and annual subscriptions must be paid to Secretary-Treasurer on or before that date.
 3. Any Member twelve months in arrears shall be struck off the roll, and no Member in arrears shall be allowed to vote.
-

BY-LAWS.

I.—ORDER OF BUSINESS.

1. Reading of minutes of previous meeting.
2. Reading correspondence and accounts.
3. Reports.
4. Unfinished business.
5. Nomination of Officers (if at the General Annual Meeting).
6. New business.
7. Adjournment.

II.—All motions must be in writing, and shall contain the names of the mover and seconder, and must be read by the Chair before being discussed.

III.—Reports of Committees must be in writing, signed by the Chairman thereof.

IV.—No Member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every Member, however, shall have the right to explain himself, subject to the discretion of the Chair.

V.—When a motion has been finally put to the meeting by the Chairman all discussion thereon shall be closed.

VI.—The Chairman shall appoint two Scrutineers when a ballot is taken.

VII.—Every Member while speaking shall address the Chair.

VIII.—Parliamentary rules to govern in all cases not provided for in preceding sections.

DUTIES OF OFFICERS.

1. The President shall preside at all meetings at which he is present; in his absence the Vice-President; and in the absence of both the meeting shall appoint a Chairman.

2. The Presiding Officer shall only have the casting vote, but not a deliberative one.

3. The Secretary-Treasurer shall keep an accurate record of all meetings, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys, pay no bills unless sanctioned by the Executive Committee and signed by their Chairman, make an annual report of all his receipts and disbursements, and shall perform such other duties as may from time to time be assigned him by the Executive Committee.

MINUTES OF MEETING

HELD IN THE PARLIAMENT BUILDINGS, TORONTO, ONTARIO, FOR THE PURPOSE
OF ORGANIZING AN ASSOCIATION OF PROVINCIAL LAND SURVEYORS,
FEBRUARY 23RD, 1886.

In response to the circular issued in January, the following Provincial Land Surveyors met at 2 p.m., on 23rd February, 1886, in the Private Bills Committee Room of the Parliament Buildings:—

Abrey, G. B., Toronto.
Apsey, J. F., Toronto.
Barrow, E. G., Hamilton.
Blake, F. L., Toronto.
Bolton, Lewis, Listowel.
Bowman, C. D., West Montrose.
Bowman, J. L., Berlin.
Bray, Edgar, Oakville.
Bray, H. F., Oakville.
Butler, M. J., Napanee.
Cavana, A. G., Orillia.
Campbell, A. W., St. Thomas.
Chipman, Willis, Brockville.
Davidson, W. S., Arkona.
Davis, John, Guelph.
Ellis, H. D., Toronto.
Evans, John D., Trenton.
Fawcett, Thomas, Gravenhurst.

Galbraith, John, Toronto.
Gibson, P. S., Willowdale.
Hermon, E. B., Rednersville.
Jones, T. H., Brantford.
Kirkpatrick, G. B., Toronto.
Klotz, Otto J., Preston.
Livingstone, T. C., Hamilton.
McAree, John, Toronto.
Niven, Alexander, Haliburton.
Pope, R. T., Bracebridge.
Proudfoot, H. B., Clinton.
Sankey, Villiers, Toronto.
Selby, H. W., Stayner.
Speight, T. B., Toronto.
Spry, W., Toronto.
Stewart, Elihu, Collingwood.
Willson, Alfred, Toronto.
Wilson, Hugh, Mount Forest.

Motions were then passed appointing P. S. Gibson, of Willowdale, Chairman, and Willis Chipman, of Brockville, Secretary.

The Chairman then called upon the Secretary to read the circular calling the meeting, and extracts from replies received thereto.

The Chairman then spoke of the desirability of forming a P. L. S. Association, and the prospects of making such an association a success. In Law and Medicine they had such societies. He thought the objects of a P. L. S. Association should be to revise and improve the Survey, Municipal, Drainage, and Registration Acts, and other Acts of Parliament in which surveyors have an interest.

The Association might suggest amendments to the Board of Examiners of list of subjects upon which candidates are now examined. American associations of surveyors are now agitating for legal recognition.

He then called for a general expression of opinion from all Provincial Land Surveyors present.

ORTO J. KLOTZ was the first speaker, and heartily supported the movement. He alluded to the fact that various attempts had been made in former years to form an Association. Such attempts had always been directed in the wrong course, *i.e.*, seeking incorporation, and obtaining rights now vested in the Crown. In fact *incorporation* had up to the present time been looked upon as the sole panacea of the Provincial Land Surveyors. Organization and unity of purpose is the first step towards success. As an Association, as individuals, our success is dependent upon ourselves. There is the material among the Provincial Land Surveyors of Ontario to form an Association creditable to themselves and to the country, and which will ever bear "Progress," the watchword of the nineteenth century, on its banner.

He then read the following letter from Lindsay Russell, late Surveyor-General, being a reply to the circular of October 21st, 1878:—

"In answer to circular of 21st inst. sent me, I have to reply that while "I sympathize in all efforts to raise the standard or status either, of our "profession, I cannot see that it is practicable to do anything in the latter "direction by legislation. The only object that legislation respecting any "profession can legitimately have is to ensure to the public proper protection from the exercise of such profession by unqualified persons. There "cannot be any legislation for the benefit of a special class, or, rather, there "should not be.

"The only legitimate means of raising the status of the profession consists in the effort of each individual thereof, by the evidences of conduct, "acquirements, and ability, to win for himself the good opinion of those of "his fellow-citizens with whom he comes in contact. The more as individuals the members of any profession succeed in this, the higher as a "class they will stand. If as a class they are held in slight esteem by the "public, it is because they do not merit more. Public opinion is, on the "whole, tolerably just, and no doubt rates the services of any class at their "true value. I am afraid we will have to rest content with being of no "more importance in the eyes of our fellow-creatures than the circumstances of our own merits, and the value of our services to them, have "combined to prescribe. I would willingly join in any discussion of the "interests of the profession, but shall be unable to attend the meeting proposed, as I have to go elsewhere at the date specified.

"I remain, dear Sir, yours truly,

"F. H. LYNCH-STAUNTON,
"Hamilton."

"LINDSAY RUSSELL.

THOMAS FAWCETT, of Gravenhurst, President of the Dominion Land Surveyors' Association, spoke as follows :—

Although he has not been engaged for a number of years in making surveys in the Province to any extent, yet any movement which had for its object the elevation of the standard of the profession met with his entire approval. All classes, professional and otherwise, have found it advantageous to form themselves into societies for the means of self-protection, and for the purpose of better securing their rights. There is no reason, so far as he could discern, why the Provincial Land Surveyors of this Province should be an exception to that rule. He could easily see how meetings of the Association, if properly conducted, may be a great means of education. In a profession covering so wide a field as that of land surveying, it is next to impossible for any one person to become an expert in all its branches ; but through the medium of papers prepared by different persons on the branches to which they had devoted the most study, and through experience acquired knowledge, facilities would be offered for gaining information which do not now exist, and all members of the profession would be benefited by attending the meetings. For those reasons he was ready to support the movement.

LEWIS BOLTON, of Listowel, thought an organization of the kind proposed would be beneficial to the profession. At our meetings we could discuss the Survey Act and matters connected with our practice. He thought it would result in a great amount of good for Surveyors to meet and see each other. He would assist as far as possible in forming an Association.

ALEXANDER NIVEN, of Haliburton, said he was very glad indeed to see such a good representation of the Surveyors of Ontario as was here to-day, and he thought it looked well for the future.

He thought it very desirable to form an Association ; it would bring the Members of the profession together once a year, and an interchange of views and discussion of matters in which they were all interested would certainly be beneficial.

The Surveyors' Act required amendments, as there were often cases turning up in the practice of surveying to which the Act did not apply.

He would recommend the organization of a society at once, and although they could not now tell exactly what was required, they would after a few meetings know better what was wanted.

WILLIAM SPRY, of Toronto, was not very sanguine as to the success of an Association unless it was a very inexpensive one. Unlike the legal and medical professions, which were constantly increasing and becoming more lucrative, our profession was dying out. In surveying there were no prizes to be looked forward to, as in law or medicine. He considered that there were more surveyors than there was necessity for. He thought he could attend to all the local surveying in one or two counties himself if he had a horse. He approved of the sentiments expressed in the letter read by Mr. Klotz. He also stated that he had not practised as a Provincial Land Surveyor for twenty years, having been engaged on railroad work.

ELIHU STEWART, of Collingwood, then made the following remarks:—

The fact of our meeting here to-day is evidence that we are favourable to the idea of forming an Association for Ontario. There are many ways in which an organization such as proposed would be useful to the profession. Every surveyor knows that there are several sections of the Surveyors' Act which need amending, and, without going into detail, he would strongly urge that candidates for final examination should be examined in certain branches of engineering, especially levelling. Also in the Act are several other sections which should receive the attention of the Legislature; but before going that far they should be examined, and proposed amendments advised by those best acquainted with the subject, viz., the surveyors themselves, and this can only be done by a committee appointed by an Association embracing a fair representation of the profession throughout the Province.

He thought we need not further discuss the subject as to the advisability of forming a Provincial Association, and would make the following motion, as there was nothing else before the Chair:—

Moved by Elihu Stewart, seconded by Lewis Bolton, "That we proceed at once to organize."

The motion was then read from the Chair.

G. B. KIRKPATRICK, in speaking to the motion, was very glad to see the movement started for the formation of an Association of Provincial Land Surveyors for Ontario. At present the surveyors were strangers to each other, but meeting together as was proposed, yearly or oftener, for the discussion of matters of interest to the profession, and for the reading of papers of practical utility to them in their work, they would improve themselves, and an interest would be stirred among them to advance the best interests of the profession as was hardly possible in any other way.

He hoped some of the older members would give the younger men the benefit of their experience in some of the disputed cases that have come up before our courts from time to time. He would always be happy to do what he could to help the Association in every way.

From a social point of view he thought that if arrangements could be made so that they could dine together on the evening of their annual meeting, as was usual in similar associations, the interchange of thought and the feeling of union that would be evoked could not fail to have a most happy effect.

H. W. CAMPBELL, of St. Thomas, expressed himself highly in favour of forming an Association, or of co-operating in any measure which would tend to the improving of ourselves and the furthering and elevating of our profession. The legal, medical, and dental professions have each their Association, and in no particular are they considered other than beneficial to their members. He did not see why we in this Province should not organize a similar institution, whereby we might meet and discuss questions of interest and importance. At meetings of such an Association we could propose and advocate changes in the Surveyors' Act, and consider amendments offered thereto which are being constantly introduced by inexperienced men. And as the Ditches and Watercourses Act of 1883 has opened

up to us a new field of labour and a new class of work under its provisions, the great necessity of certain amendments is evident, in justice to the surveyor and in order that the work may be satisfactorily carried out which it was intended to perform. He wished the movement every success.

Mr. Stewart's motion was then put and carried.

The following were then appointed a Committee to draft a Constitution and By-laws :—

P. S. Gibson, G. B. Kirkpatrick, Alexander Niven, M. J. Butler, Elihu Stewart, Prof. Galbraith, Otto J. Klotz, and Willis Chipman.

This Committee then withdrew and prepared a Constitution and By-laws, each article of which was submitted to the meeting.

After some further amendments the Constitution and By-laws were adopted as a whole.

The meeting then appointed the following an Executive Committee to conduct the business of the Association until the election of officers, as provided for in the Constitution :—

Prof. Galbraith, School of Practical Science, Toronto ; John McAree, Toronto ; Willis Chipman, Brockville.

On motion, this Committee was empowered with the privilege of adding to its number if found necessary.

The Chairman then called for nominations for officers.

(See Articles IV., VI., IX. of Constitution.)

The following candidates were then nominated :—

For President—

Peter Silas Gibson Willowdale.
George B. Kirkpatrick Toronto.
F. F. Passmore Toronto.

For Vice-President—

Alexander Niven Haliburton.
Prof. J. Galbraith Toronto.
George Brockitt Abrey Toronto.

For Secretary-Treasurer—

Willis Chipman Brockville.
(No other nominations.)

For Councillors—

Matthew J. Butler Napanee.
Prof. J. Galbraith Toronto.
Elihu Stewart Collingwood.
Villiers Sankey Toronto.
T. B. Speight Toronto.
T. Harry Jones Brantford.
J. H. Davis Guelph.
Isaac Traynor Dundalk.

For Auditors—

George Brockitt Abrey Toronto.
 Lewis Bolton Listowel.
 H. W. Selby Stayner.

A motion was then carried empowering the Provisional Executive Committee to publish in the first Report such papers on professional subjects as they might deem advisable, and to solicit advertisements.

Upon motion, the meeting then adjourned.

The following is the form of ballot adopted for the election of officers for 1886-87 :—

RETURN THIS IN THE ADDRESSED ENVELOPE.

NOTE.—Ballots without endorsement on outside and back of Envelope are not opened.

ASSOCIATION OF PROVINCIAL LAND SURVEYORS

OF ONTARIO.

BALLOT FOR OFFICERS FOR 1886-1887.

FOR PRESIDENT (one vote)—

PETER SILAS GIBSON, C.E., Willowdale.

GEO. B. KIRKPATRICK, Department of Crown Lands, Toronto.

FOR VICE-PRESIDENT (one vote)—

ALEXANDER NIVEN, Haliburton.

PROF. GALBRAITH, Toronto.

GEORGE BROCKITT ABREY, Toronto.

FOR SECRETARY-TREASURER—

WILLIS CHIPMAN, Brockville. (No other nomination for Sec.-Treas.)

FOR COUNCILLORS (three votes)—

M. J. BUTLER, M. Inst. C. E., Napanee.

PROF. GALBRAITH, Toronto.

ELIHU STEWART, Collingwood.

VILLIERS SANKEY, Toronto.

T. B. SPEIGHT, Toronto.

T. HARRY JONES, B.A.Sc., Brantford.

J. H. DAVIS, Guelph.

ISAAC TRAYNOR, Dundalk.

FOR AUDITORS (two votes)—

GEORGE BROCKITT ABREY, Toronto.

LEWIS BOLTON, Listowel.

H. W. SELBY, Stayner.

EXTRACTS FROM CONSTITUTION.

ARTICLE IV.—The Officers of the Association shall consist of a President, a Vice-President, a Secretary-Treasurer, and Three Councillors, who shall constitute an Executive Committee, which shall have the direction and management of the affairs of the Association.

ARTICLE X.—Two Auditors to be elected by ballot, etc.

ARTICLE XI.—The fee for membership for Active Members and Associate Members shall be Three Dollars, and an annual subscription of Two Dollars for each subsequent year; both payable in advance.

DIRECTIONS TO VOTERS.

1. Make a distinct Cross opposite the names of Candidates for whom you wish to vote. The cross to be on the right hand side of the name.
2. Write your name on the back of Envelope after enclosing your Ballot duly marked.
3. Enclose Ballot and Envelope with your THREE DOLLARS, if not already paid, and address the same to the Secretary-Treasurer, on or before 31st March, 1886.
4. Register your Letter.

The Secretary desires each member to give his name in full, with Post-office address, University degree, if any; and if Engineer of any Public Work, or for any Corporation, please state the same.

WILLIS CHIPMAN, *Secretary-Treasurer.*

With this ballot paper was sent an addressed envelope on the back of which the following was printed:—

NAME IN FULL—	ADDRESS—	DEGREE OR DIPLOMA—	OCCUPATION—	DATE OF SENDING BALLOT—
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REPORT OF PROVISIONAL EXECUTIVE COMMITTEE.

Members of the Association of Provincial Land Surveyors of Ontario :

GENTLEMEN,—We congratulate you upon the successful formation and organization of our Association upon what we consider a proper basis.

While in the United States we find the American Society of Civil Engineers, Boston Society of Civil Engineers, Engineers' Club of Philadelphia, St. Louis Engineers' Club, Michigan Engineering Society, Connecticut Society of Civil Engineers and Surveyors, Illinois Engineers' Association, and kindred Associations in Ohio, Indiana, and Iowa, we, in Ontario, have remained idle witnesses of the advances made by our professional cousins. Some few of us may be members of the Institute of Civil Engineers of Great Britain or of the American Society of Civil Engineers, while a few others have the advantage of practising in the vicinity of the Dominion or Provincial capitals, thereby being able to exchange views and opinions on professional topics, although not joined together by the fetters of a written constitution.

Mention should be made of the Association of Dominion Land Surveyors, which was organized in 1883, the papers published in the proceedings being of great interest to the profession.

The vast majority, however, of our Provincial Land Surveyors are without the advantages arising from association with fellow-professional men, which state of things must cease to exist before they can expect to accomplish much towards their advancement.

Class legislation we do not think is at present deserved, however much we may desire it. We must first become a united body, and be able to present our request to our Legislature so intelligently, so justly, and so forcibly, that they cannot do otherwise than comply.

We anticipate many changes in our Statutes within the next few years, especially in reference to municipal matters, and if we choose we can offer such suggestions as will be certain to benefit ourselves as well as the public at large.

Professional work is now being done for our municipalities by persons who have no credentials but those of being good political canvassers.

We cannot expect the Lawyer, the Physician, the Dentist, the Veterinary Surgeon, or the Pharmaceutical Chemist, to interest himself in our behalf; each has sufficient to do in furthering his own particular professional interests.

The Lawyer and Physician are slowly but surely encroaching on our field, and we must unite and resist the invaders.

The fact is, while the other professions have been advancing and keeping up with the times, we have, in comparison, been in a state of lethargic indifference since the time when the recognized fee of a Surveyor was £1 per day.

By Sub-section 3 of Article IX. of the Constitution, the Executive shall, as soon after its election as possible, strike the several Standing Committees.

The object of these Committees is to facilitate the carrying-on of the business of the Association. All questions and problems arising in practice may be referred to its particular committee for consideration, and it is hoped the members of the Association will see that these Committees are not kept wholly idle. All communications should be sent to the chairman of the committee having in charge the consideration of the subject of the communication, who should bring the matter before his committee, and report to the Association at its next meeting, if he considers it of sufficient interest.

Each Committee should endeavour to advance the interests of that branch of the profession which has been placed in its charge.

We would suggest to our successors that the following Standing Committees be appointed :—

1. Committee on Land Surveys.
2. Committee on Land Drainage.
3. Committee on Municipal Engineering.
4. Committee on Instruments, etc.
5. Committee on Legislation.
6. Committee on Publication.

COMMITTEE ON LAND SURVEYS.

This Committee should be carefully selected, and be as thoroughly representative as possible.

Its duty should be to examine carefully the "Act respecting Land Surveyor's and the Survey of Lands," and the "Registry Act," and suggest to the Association any necessary changes or amendments.

They should also prepare, or have prepared, for the General Meeting one or more papers to be read thereat on this particular branch of the work of the Association.

This may include difficulties experienced in interpreting the "Lands Act" and "Registry Act"; field-work practice; means of attaining a uniformity in notes and plans; investigating decisions of Courts, etc., etc.

The Annual Report of this Committee will become, in a short time, a valuable document, and alone worth our annual subscription.

COMMITTEE ON LAND DRAINAGE.

Upon examination of Appeal Reports for the last few years, this Committee will realize the muddle into which our legislators and our judiciary have managed to get this matter.

Legislation is required at once in this important matter. The "Municipal Act" and "Ditches and Watercourses Act" should be carefully criticised.

This Committee should, besides making an Annual Report, prepare one or more papers on this subject for publication in the Proceedings of the Association.

COMMITTEE ON MUNICIPAL ENGINEERING.

The work of this Committee will be, probably, more interesting to a large part of our Association than that of any other Committee.

It will have for its consideration, Sewerage, Water Supply, Street Paving, Roads, Bridges, etc.—subjects enough for a separate Association.

This Committee should prepare one or more papers for publication, and make an Annual Report.

COMMITTEE ON INSTRUMENTS.

This Committee should strive to bring before the notice of the Members of the Association all information obtainable regarding improvements in field instruments and office appliances, the recording of field notes, perpetuating boundaries, etc.

This Committee should also make arrangements with manufacturers of instruments, etc., to exhibit their manufactures at our Annual Meetings, and also arrange for exhibition of instruments belonging to Members of the Association.

COMMITTEE ON LEGISLATION.

This is probably the most important of Committees suggested, as upon the work done by this Committee depends much of the usefulness of the Association.

Its duties should be to draft and present to our legislators any bills that this Association may wish to become law, and endeavour to secure the passing of the same with as little mutilation as possible. They should also guard the interest of the profession by discouraging legislation thought to be unwise, unjust, or impracticable.

This Committee should act upon the recommendations of the second, third, and fourth Standing Committees, after the matter has been discussed at a General Meeting of the Association.

COMMITTEE ON PUBLICATION.

The duty of this Committee shall be to arrange for the publication of our Proceedings, including printing, lithographing, engraving, etc.

They shall also solicit advertisements from instrument manufacturers, bridge companies, drain tile manufacturers, stationers, etc., and see that the advertisements appear properly and correctly in the Proceedings.

This Committee should report to the Executive Committee immediately upon completion of its work.

We will conclude our Report by giving some reasons why every Land Surveyor in the Province should become a Member of our Association.

1. By becoming a Member you will have through the Association and its Committees a channel by means of which you can convey to the profession your views on anything affecting said profession, and become acquainted with the opinions of other Members.

2. The volume of Proceedings published annually will alone be worth to you more than your yearly fee, which is placed at such a figure as merely to cover cost of publication of Report and necessary expenses of Association.

3. You will receive through our Association copies of Proceedings of several State societies of surveyors and civil engineers, making in all several hundred pages of the cream of professional literature.

4. To the very clever surveyor we would say that you will undoubtedly become a "crank" unless you occasionally rub up against your professional brethren and get the "corners" polished off. To the "rusty" brother, we think there is probably no better way of brightening you up than by joining what we are confident is the permanent organization of the "Association of Provincial Land Surveyors of Ontario."

Signed on behalf of the Provisional Executive Committee.

WILLIS CHIPMAN.

THE SURVEYOR'S ACT.

BY VILLIERS SANKEY, P.L.S.

At the late meeting of P. L. Surveyors, held in Toronto, nearly every one who spoke, made some allusion to "The Act," and referred to the satisfaction it would give to have the said Act thoroughly and intelligently discussed from a surveyor's point of view.

This is most natural. It is the authority by which we act; it is our charter, so to speak, defining generally who may be surveyors, how they may be surveyors, what they may be called upon to do, and how it shall be done, together with sundry other regulations governing and relating to the same.

This Act, however, cannot be said to be very clear or concise, though the operations, etc., etc., which it regulates admit of the greatest exactness and accuracy. Why then should the above imputation attach to our act? I think the great reason is that while the practice of surveying has gone on improving, and the means and methods, as well as the persons who may be surveyors, what they may be called upon to do, and how it shall be done, together with sundry other regulations governing and relating to the same, have advanced with the rapid strides of the last twenty-five or thirty years of this nineteenth century. The Act itself has not advanced, but will be found to be practically the same that it was in 1849, and many of its sections date back as far as 1818 and even 1798.

This brings us to the object of this Paper, "The thorough understanding and consequent improvement of the Act."

For the preparation of a paper which would have the effect of starting intelligent discussion the time available has been entirely too short. The collecting of the necessary amount of material in the shape of legal decisions, and of surveyors' experiences in all parts of the Province being a matter of months not weeks, for without such material any paper compiled even with the greatest care, would be but the opinions of an individual, leading only to criticism and not to discussion.

I have decided, therefore, to confine this paper to a chronological history of "The Act respecting Land Surveyors and the Survey of Lands," R.S.O. Chap. 146.

By way of preface, and in order to enable us to understand the subject more perfectly, it will be necessary to recall very briefly a few important points in Canadian History.

By *The Treaty of Paris*, 1763, Canada was ceded to the Crown of England, and in the same year General Murray was appointed first Governor General of the British Province of Quebec.

The Quebec Act, of 1774, provided among other things for the introduction of the Criminal Law of England, but declared "That in all matters of controversy relative to property and civil rights, resort should be had to the Laws of Canada, as the rule for the decision of the same." Thus the Civil Laws of French Canada were confirmed.

The Constitutional Act, of 1791, divided the Province of Quebec into Upper and Lower Canada, with separate Legislatures and Governors. *The Union Act*, of 1840, united the Provinces of Upper and Lower Canada into one Province under one Government.

The British North America Act, which came into force July 1st, 1867, provided that the Provinces of Canada, New Brunswick, and Nova Scotia should be one Dominion under the name of Canada and divided it into four Provinces—Ontario, Quebec, New Brunswick, and Nova Scotia, with separate Governors and Local Legislatures.

Starting then (1763) with the new British Province of Quebec, we see that if the Civil Laws of French Canada had any regulations or ordinances relating to the Survey of Land, by such were surveyors governed, of these I have been unable to find any records. No doubt there were such. In 1785, "An Ordinance concerning Land Surveyors and the Admeasurement of Lands" was passed by the Legislative Council of Quebec, 25 Geo. III., Chap. 3; but of this Act I have been unable to procure a copy, though I have searched in the Library at the Parliament Buildings and at Osgoode Hall.

The next Legislation we find is in the year 1798, when "An Act to ascertain and establish on a permanent footing the boundary lines of the different Townships of this Province," was passed by the Legislature of Upper Canada, 38 Geo. III., Chap. 1. From this act we gather that a Surveyor-General existed at the time, for it provides for the planting of stone monuments, or monuments of other durable materials, at the several corners, governing points etc., of Townships and concessions under his inspection and order, after application had been made to the Governor. These monuments, so planted, governed the courses and distances of the boundaries and lines in said Townships and concessions, any distances expressed in any patent of grant or other instrument, to the contrary thereof notwithstanding, Sections 34, 35, 36, and 37 of our present Act, are similar provisions slightly extended. Section 4, of this Act of 1798, is, I think, worth while giving in full, as, no doubt, it will be new to many members of the profession. "And be it further enacted, by the authority aforesaid, that if any person or persons shall, knowingly and wilfully, pull down, deface, alter, or remove any such monuments so erected, he, she or they shall be adjudged guilty of felony, and shall suffer death without benefit of Clergy."

The remaining sections of this Act lay down how application for the planting of the said monuments was to be made, and how the expense was to be levied. It will be noticed that no provision, up to this time, was made, at any rate in Upper Canada, as to the qualification or admission of surveyors, the Act even does not refer to them but only to the Surveyor-General, on whom all responsibility was thrown. How the Surveyor-General was appointed I have not been able as yet to discover, but I think it probable, however, that each Governor granted a new commission to the former Surveyor-General, or appointed a new one. It is certain, also, that some of the Surveyors-General were not surveyors by profession.

We now come to the year 1818, where we find that in the Third Session of the Seventh Provincial Parliament, which met at York, October 12th, of that year, an act (59 Geo. III., Chap. 14,) was passed intituled "An Act

to repeal an Ordinance of the Province of Quebec, passed in the twenty-fifth year of His Majesty's reign, intituled an Ordinance concerning Land Surveyors and the Admeasurement of Lands, and also to extend the provisions of an Act passed in the thirty-eighth year of His Majesty's reign, intituled an Act to ascertain and establish on a permanent footing the boundary lines of the different townships of this Province, and further to regulate the manner in which lands are hereafter to be surveyed." This Act extends the previous Act with regard to the front angles of lots, and declares that all lines run and all monuments planted in the first survey shall be the true and unalterable boundaries. It also declares that the governing lines of all division lines or side lines shall be the boundary line of each and every concession, on that side of the township from which the lots are numbered, when such lines "are required to go the same course," (Section 51 and following ones of present Act). Here provision is first made for examination of surveyors. The Act provided that every surveyor thenceforth was to be examined by the Surveyor General, or Deputy Surveyor-General, as to his fitness and capacity and competent knowledge of the theory and practice of surveying in all its branches.

An appointment to act and a licence had to be obtained from the Governor, also a bond with two sufficient sureties in the sum of £500 had to be entered into, and the surveyor had to subscribe to the following oath: "I, A. B., do solemnly swear that I will well and truly discharge the duty of a surveyor of lands agreeably to the law, without favour, affection, or partiality, when and as often as I may be required thereto by any person or persons, or by the rule or order of any Court of Justice, and which I will faithfully and without unnecessary delay submit to the party requiring the same, or the Court directing my duty; also a plan of survey if required. So help me God."

For the first time, also, provision is made for swearing chain-bearers, but no distinction is made as to who may act.

The front of each concession is declared to be that end or boundary which is nearest the boundary of the township from which the concessions are numbered, and that when several lots in different concessions have been granted in one patent they are to be surveyed separately. (Sec. 63 present Act.)

Here we first find the provision for dividing up between the nearest undisputed monuments into the same number of lots as the same contained in the original survey. (Sec. 65 present Act.) There is also a provision in the case of lands entered into and improved through unskilful survey.

The next legislation on surveying is in the year 1839, when the Legislature of Upper Canada passed an Act (2 Vic., Chap. 17) to extend the provisions of the previous Act. This was a very short one, dealing chiefly with the cases of ejection or compensation through unskilful survey. It is also the last as to surveyors passed before the Union Act of 1840; the preceding Acts, therefore, refer entirely to Upper Canada.

We will now pass on to (4 and 5 Vic., Chap. 9,) 1841-42, "An Act to grant authority to licensed surveyors in that part of this Province called Upper Canada, to administer oaths in certain cases and to protect them while in discharge of their duty in surveying lands."

By this Act, licensed surveyors had authority to administer oaths to persons giving information as to boundaries or monuments; further, that evidence on oath had to be reduced to writing and signed by the person giving same, and had to be filed in the registry office for the county, to be used afterwards in any court of law. Sections 77 and 78, present Act, embody these provisions. The Act also declared it to be a misdemeanor to interrupt, molest, or hinder any licensed surveyor while in the discharge of his duty; anyone so doing might be punished by fine or imprisonment; the amount of fine or length of imprisonment, however, is not stated.

This ends the fourth Act of what we might term the first period of the Land Surveyor's existence in this Province. There were, as we see, four Acts which guided his operations, and these continued in force till the year 1849, or, in all, for a period of some fifty-one years, during which time the Land Surveyor had been gradually developing from an assistant or deputy of the Surveyor-General to an independent responsible public officer, who owes his position to neither party nor government, but only to his own intelligence and capacity, and the ability with which he has been able to convince the Board of Examiners of that capacity and fitness.

In 1849, we find an Act (12 Vic., Cap. 35) entitled an Act to repeal certain Acts therein mentioned, and to make better provision respecting the admission of Land Surveyors and the Survey of Lands in this Province, *i. e.*, the united Provinces of Upper and Lower Canada.

This Act repeals all the previous ones, and then sets out various regulations and enactments which governed the profession in both Provinces. There were in all fifty-two Sections; of these twenty-two relate especially to Upper Canada, and ten to Lower, the rest being general regulations common to both.

This Act forms the ground work of our present one, though several of its sections have been repealed, some of them important ones too. Thus Section two, now repealed, enacts "That no person shall after the passing of this Act survey lands for hire or profit within Upper Canada or Lower Canada, or act in any way as a Land Surveyor within either portion of this Province, unless duly authorized to practise, under a penalty of £10.

The Board of Examiners was here first appointed, consisting of the Commissioner of Crown Lands, and six other competent persons appointed by the Governor, the subjects for examination being:—Geometry, six books of Euclid, Plane Trigonometry, Mensuration, Plotting and Map drawing, and a sufficient knowledge of Spherical Trigonometry and Astronomy to ascertain latitude and draw a meridian.

Persons applying had to have served under an instrument in writing for three consecutive years as an apprentice to a Land Surveyor for Upper or Lower Canada, duly admitted and practising as such, and had to be at least twenty-one years of age. The Board could appoint a Secretary and met as now on the first Monday in January, April, July and October.

The Secretary was to be paid certain fees for receiving notices of examination and for certificates when granted. These fees were his remuneration. Section eight enacted that each person, on receiving a certificate, should pay the sum of £2. 10s. out of which the expenses of the examination were to be paid, and the remainder divided equally among the mem-

bers of the Board present who were not salaried officers of the Government. As before a bond had to be entered into, and the oath of allegiance and duty subscribed to.

The Board had power to dismiss or suspend a surveyor for gross negligence or corruption. Chain-bearers were to be sworn, and were not to be related to the parties interested within the degree of cousin-german. The Commissioner of Crown Lands takes the place in this Act of the Surveyor-General, and under his order monuments were to be placed; he also kept the standards of length for surveyors to check their chains by.

This Act also declares the wilful pulling down of any stone monument placed in Upper Canada under the order of the Commissioner of Crown Lands to be a felony, and the pulling down of any other land mark, post etc. in either Province to be a misdemeanor. The other sections of this Act which treat of the determining of concessions and lots, and the running of the boundaries of the same, may be said to be the parents of the similar sections of our present Act, it will not therefore be necessary to refer to them particularly in this paper.

We now come to (14 and 15 Vict. Chap. 4) 1851-52, the chief features of which were to appoint two boards of examiners, one to meet in Toronto and one in Quebec, consisting of the Commissioner of Crown Lands and eight other persons, in each case. The fee on receiving a certificate was increased from £2.10s. to £5 which was divided as before. The Secretaries for each Board now kept the standards of lengths for comparison, and no instruments under which applicants claim to have served, were to avail unless deposited with the Secretary within two months after date.

The next Act we find is 18 Vic. Chap. 83, 1855, the principal provisions of which were: First, that the Commissioner of Crown Lands should receive all fees for examination, and pay out to each examiner, not an officer of the Government, £1.5s for each day's attendance. Second, The Primary Examination is here first established, the subjects being vulgar and decimal fractions, square and cube root, geometry, plane trigonometry, mensuration and logarithms. Third, Every Surveyor attending court as a professional witness was entitled to 20s. a day, and also had the power of compelling persons to give evidence. This Act also extended the previous one with regard to corners of certain lots and concessions.

In 1857, 20 Vic. Chaps. 37 and 73 were passed, the first of which made provision for the admission of applicants who had undergone training at Universities, without full period of service. Chap. 73 amends parts of the previous Acts as to the mode of running side lines in those Townships in which the concession lines were not run, but the side lines only. In all these cases the original surveys were to be adhered to and followed.

Here ends the scattered Legislation, for in Chap. 77 Consolidated Statutes of Canada, 1859, we find the various provisions embodied in one Act, being the same, so far as to Upper Canada in the Consolidated Statutes of U. C. Chap. 93; and which we now have in Chap. 146 of the Revised Statutes of Ontario. This is the Act with which we are all familiar, and which I might almost say we could willingly see committed to the flames, with all reverence and respect however, for out of its venerable ashes it should be the aim and determination of every surveyor in the Province, to assist in the production of such an Act, as would at the same time be concise simple and effective.

In the foregoing paper I have endeavoured to place before you the chief points of our Act. I must apologize for the crudeness of its form, as I before stated shortness of time was the great drawback.

In conclusion, I would suggest that the Standing Committee on Land Surveying should formulate a series of questions to all surveyors in the Province, giving plenty of time for their consideration and answers before our annual meeting. This would give us material to discuss, and would have the effect of bringing the whole matter to a focus. The back picket, as it were, would stand out clearly, and the cross-hairs being readily adjusted, the front picket would be placed true and plumb. So that our young Association may have no fear of planting a post, with even the brass nail in the head, so true that, in the future, surveyors may range from it with accuracy and precision to the satisfaction of themselves and the public at large, whose servants we are.

LAND DRAINAGE.

SUGGESTIONS CONCERNING THE WORKING OF THE DRAINAGE ACTS OF ONTARIO,
WITH A FEW HINTS ON THE CONSTRUCTION OF OPEN DITCHES—BY H. E.
PROUDFOOT, P.L.S. AND C.E., CLINTON, ONT.

Having been requested by the Executive Committee to prepare a paper on "Drainage," and having accepted their request before I knew in what a short space of time the paper had to be handed in, I consider I owe some apology to the Association for the crude manner in which the subject will be handled.

There are, in Ontario, two separate and distinct drainage acts: the first is that portion of what is now called the "Consolidated Municipal Act," relating to the "powers of Municipal Councils as to drainage and other improvements paid for by local rates"; and the second is what is known as the "Ditches and Watercourses Act of 1883." The Municipal Drainage Act and the Ditches and Watercourses Act, although arriving at the same object in the end, viz.: the rendering of land fit for cultivation, or the improvement of land partially or disadvantageously cultivated, attain that object by altogether different methods. In the first, the *majority in number of the persons as shown by the last revised assessment roll* petition the Municipal Council for the improvements in their drainage facilities, and the Council may procure an examination to be made by an engineer or Provincial Land Surveyor, whose duties it will be to make an estimate of the cost and the amount in dollars and cents of the cost to be borne by each lot or portion of lot improved. A Court of Revision is then held, and the engineer's assessment can be altered by it if shown to be wrong. If no appeals are then made from the assessment so altered to the County Judge (if the Council did not alter the assessment an appeal could still be made to the County Judge), who has power to alter such assessment if needs be, then the Municipal Council may pass a by-law empowering them to issue debentures to defray the cost of such work, advertise for tenders and let the work; the parties interested having no further trouble with the exception of paying so much extra taxes once a year for the next ten years. The Municipal Act is by far the best under which to construct a ditch of such magnitude that it would be impossible for the several parties interested to construct their several portions in a short space of time during the summer with only the ordinary farm help. Also, there are only certain short periods of time, and they are not consecutive, during which an owner of a farm lot can find time to work at a ditch, and as it is generally absolutely necessary that the lower sections should be completed before the upper sections, and if each party had his time allotted for completing his portion of the work to suit the intervals in harvesting, etc., it is quite apparent for these reasons that the work that could be done by a contractor in a few months would be extended over a space of time ranging from one to four years if

the ditch were long enough. Farmers, though, as a rule, have a great dislike to have anything done about their places by other parties. Being very conservative as a class they generally are of the idea that a piece of ditching would be cheaper to them if they did it themselves, although it should take up all their spare time for a summer, than if the whole job was let by contract and thrown out in a couple of weeks. Engineers will find that to be their greatest trouble in advocating the Municipal Act in preference to the 1883 Act, although the fact that the cost of such drainage will extend over ten years, with interest at the low rate of five per cent., is a great incentive to have drainage done under the Municipal Act. The Municipal Act does not provide for the appointment of an engineer, it says: "An engineer or Provincial Land Surveyor," whereas, the Ditches and Watercourses Act of 1883 (Sec. 4.) states that every Municipal Council shall appoint an engineer to carry out the provisions of this Act, and in Section 21 it defines the word engineer as meaning "civil engineer, land surveyor, or such person any municipality by by-law may deem competent to perform the duties required under this Act." I am informed that movements have at several times been made to have the word engineer struck out of Section 4, and the words Provincial Land Surveyor inserted in place of it. Such a proceeding is altogether unnecessary as the *engineers* (?) appointed by several municipalities are, by their awards, etc., working gradually their own extinction.

The Ditches and Watercourses Act (Sec. 5) provides that *any owner* may force an outlet for the drainage of his lands, which is a distinction from the Municipal Act, which makes it necessary for the majority in number, etc. To sum up the Ditches and Watercourses Act, any owner can call a meeting of the several other owners who would be affected or benefited by a ditch or drain to agree, if possible, on the portions of such ditch or drain to be dug by each. Failing to agree, the first-mentioned owner may request the engineer appointed by the municipality to be called on to examine the premises and make his award, from which award any party interested can appeal to the County Judge. Under this Act the award is made in respect to the *quantity of the ditch to be made and completed by each party*. The quantity is to be expressed in the award as from stake marked — to stake marked —, describing the position of each stake. It is always best, however, to determine the position of the stakes by the calculation of the number of cubic yards or feet, and find from the result, by a direct proportion, the amount of dirt each party has to remove, which will generally bear the same ratio to the whole number of cubic yards or feet that the amount of his land to be drained bears to the area of the whole tract to be drained. Any award made under this Act, which allots money payments to one or more parties, instead of portions of the ditch, would not be worth the paper that it was written on, and would be immediately set aside by the County Judge, should the award be appealed. The last sentence is a distinction from the Municipal Act, in which the report specifies a certain value of the improvement to each lot, which value the party owning said lot is to pay, or, as it is given in some reports, the value of improvement is given at a certain sum per acre, and the cost of the ditch or the increase of the rate of taxation is placed at a certain per cent. of that value. For instance, the value of the improvement is placed

at \$20 per acre, and the cost of the ditch, say, at \$2 per acre (calculated in the same manner as the lengths of ditch under the Ditches and Watercourses Act), then the special rate of taxation would be ten per cent. of the improved value of the land.

Section 8 of this Act is slightly ambiguous. It provides that the award must be made within thirty days, but it does not state when it is to be filed. It will be observed in reading over the Ditches and Watercourses Act that in Section 8 the following occurs: "*Specifying clearly the locality, description, and course of said ditch or drain, point of commencement and termination of same.*" I have heard of one case decided against the defendant by one of the County Judges of Huron in which one of the principal objections raised against the award of the engineer was that he described the ditch commencing in the front of a lot and terminating in the rear thereof, or words to that effect. I would strongly advise all township engineers to make a regular description of their ditches in the same way as they would make a description of a piece of land.

The Act provides that the engineer shall examine the premises, etc., and make his award in writing. The word "examine" should be understood to include survey, as without a survey it would be impossible to make a just award. In making a survey I would advise engineers to use a compass instead of a transit, especially in swamps, a 100 foot chain, and a good level. Before proceeding with the survey, make a small plan of the lots on which the tract to be drained is situated, drawn to scale, and walk all around the said tract and sketch on the plan the approximate intersections of the lot lines with the swamp to be drained; and having taken a few levels, and ascertained the lowest point in the said tract of land, and plotted them on his plan, by having which constantly before him, he can lay out the ditches at once to the best possible advantage when there is no defined watercourse through the swamp, as is very often the case in those of black-ash, cedar, etc., especially near the head of a watershed. In running lines through a bush or swamp for drainage survey, never cut any more trees than actually necessary in order to do the levelling, as the more trees cut the more grubbing to be done when making the ditch, it being far easier to grub out a standing tree than a stump, the weight of the top pulling out a large number of the roots which would otherwise have to be cut. The line of levels should always be run, not in the centre of where the ditch is to be, but at one side thereof, and a chainage stake, marked in consecutive numbers, should be placed at every 100 ft. space, with another small level plug driven firmly and exactly at the foot of the chainage stake, with its top flush with the level of the ground, which admits easy verification of the elevation of the bottom of the ditch. Some engineers stake out the centre of the ditch also, which is a good plan, provided you have some idea of how deep the ditch is to be; and place the centre stake far enough from your level plugs to insure that the latter will not be interfered with by the digging of the ditch on the one hand, and near enough to the level plugs so that the latter may be placed on the *berm*, and not under the spoil bank.

The area of the cross-section of the ditch will, of course, always depend on the amount of land to be drained, the amount of fall that can be utilized, and the kind of soil through which the ditch passes. Professor Schubler gives the amount of water 100 lbs. of dry earth will retain, so that none

would flow off, as follows:—Sand, 25 lbs.; loamy soil, 40 lbs.; clay loam, 50 lbs.; pure clay, 70 lbs. The following extract from a paper on "Drainage Engineering," by Professor R. C. Carpenter, of Michigan, will be found very useful in calculating the size of ditches.

Table for capacity of open drain: width of bottom, one foot; inclination of sides, one to one; drain full of water.

INCLINATION EXPRESSED IN FEET.	CAPACITY IN ACRES.				REMARKS.
	Depth, 1 foot.	Depth, 2 feet.	Depth, 3 feet.	Depth, 4 feet.	
1 in 10.....	949	2,555	6,870	14,268	One acre is considered the equivalent of 3,630 cubic feet, each day of twenty-four hours.
1 in 25.....	447	1,204	3,239	6,726	
1 in 50.....	314	846	2,290	4,725	
1 in 100.....	224	603	1,622	3,365	
1 in 150.....	204	542	1,458	3,027	
1 in 200.....	157	424	1,134	2,356	
1 in 250.....	142	382	1,027	2,132	
1 in 300.....	129	347	932	1,935	
1 in 400.....	108	289	779	1,619	
1 in 500.....	99	266	740	1,487	
1 in 1,000.....	70	189	507	1,053	
1 in 1,500.....	66	158	424	882	
1 in 2,000.....	51	140	367	763	
1 in 3,000.....	39	104	279	579	
1 in 4,000.....	32	87	234	487	
1 in 5,000.....	27	73	197	408	

"The capacity of drains of the same depth, but having widths and cross-sections differing from the areas tabulated, will be given approximately by considering that the capacity increases in the same ratio as the area. Thus, to ascertain the capacity of a drain three feet wide on the bottom and four feet deep, with slope of sides forty-five degrees, the area of cross-section would be twenty-eight square feet; the area of the tabulated form four feet deep is twenty square feet; the capacity would be the corresponding tabulated number multiplied by 28-20. The result would be more accurate if it even increased somewhat more, as the effect of friction is less as the breadth is increased for a given depth. The following factors should be introduced in the above results if a closer approximation is required":—

TABLE OF FACTORS.

DEPTH.	BOTTOM WIDTHS.							
	$\frac{1}{2}$ ft.	1 ft.	1 $\frac{1}{2}$ ft.	2 ft.	3 ft.	4 ft.	5 ft.	6 ft.
1 .....	.91	1.00	1.09	1.15	1.21	1.25	1.26	1.28
2 .....	.86	1.00	1.07	1.12	1.18	1.21	1.22	1.23
3 .....	.83	1.00	1.05	1.09	1.13	1.15	1.15	1.16
4 .....	.81	1.00	1.03	1.06	1.08	1.09	1.09	1.09

Professor Carpenter has made his calculations for a ditch with side slopes one to one, which I would never use unless at the upper end of a ditch in a stiff soil, and very seldom even then, as there is a great liability of caves being washed out by the water, and the "shelling" off is always greater in a steep bank in the spring. One to one and one-quarter is sufficiently steep, and one and one-half to one I consider the best slope of the three for a ditch which is supposed to be permanent. It is apparent that unless there is a surplus fall in the outlet part of the ditch it would be impossible to use side slopes of one and one-half to one in the upper part of the ditch, and slopes of one to one, for the sake of economy, in the firmer land in the outlet.

The term *outlet*, as I use it, requires a little explanation. In an amendment to the Ditches and Watercourses Act it is provided that an engineer cannot leave the surplus water brought down by a ditch on a lot of land if it overflowed the natural channel so as to damage the said lot unless so authorized by the owner thereof. The outlet is then made a great deal shallower than the main ditch, but on account of the alteration in the depth it should be made proportionally wider, so as to confine the surplus water as much as possible in the natural watercourse. In making the outlet it is sometimes expedient to clean out the natural watercourse, at others to make the outlet as straight as possible; but in such matters the engineer has to use his own discretion, the amount of fall generally assisting him in the determination of which is the most advisable course to pursue.

When the outlet to a ditch or drain is a creek which would not carry all the water brought into it without overflowing its banks on account of the creek bed being choked with fallen timber, logs, roots, stones, etc., it has been my custom to award the cleaning out of the said creek bed to all the parties interested combined; that is, that they should make a *bee* and have it done. It seemed to work very well, as I never heard any grumbling about it until lately, when I was informed that it was almost impossible to get the parties to work together, especially if they were not satisfied with the other portions of the award. The next case I have of the kind, it is my intention to give it to all the parties combined and place the date of completion of said portion (Sec. 8) very close upon the date of the

expiration of the time of appeal, making the time altogether inadequate to the amount of the work to be done, and then proceed as provided for by Section 13 of the Ditches and Watercourses Act.

The grades or fall of a ditch will generally depend on the natural fall of the land to be drained. The engineer will find that he is very seldom called upon to lay out a ditch with less fall than 2.5 ft. to the mile. When it does occur so level, and the cases are by no means exceptional, the ditch will have to be made deeper at the lower end, and thereby create what is termed an *artificial* fall. Should there be a good fall above and a good fall below the level portion, I do not consider it necessary to make the *artificial fall* so great as would be required should the fall be all below the level portion, the water above adding a certain force to the water in the level portion and tending to drive it out. I consider three feet to the mile a fall sufficient for all ordinary purposes, although I have had cases in which the fall was as low as 1.75 ft. per mile, which, however, is altogether inadequate for a ditch which is supposed to keep itself clean.

When a Municipal Council employ an engineer to locate, and make a report, as provided for in the Municipal Act, the surveyor's or engineer's duties sometimes cease when the by-law has been passed, the council appointing either one of their own number or an outsider as inspector. In which case, if the engineer has any regard for his fair name, he will not furnish either the contractor or the inspector with a profile, for in ninety-nine cases out of a hundred, neither of them understands the least thing about a profile, and the contractor, if he is not honest, will be sure to get ahead of the inspector (?) and make a botch of the job, and if the ditch should not prove a success the engineer is of course blamed. The Municipal Act provides for a profile and the engineer has to return a profile with his returns; but there is nothing in the Act to prevent him from making it as unintelligible as possible, so as not only to prevent any mistakes, but also to make sure that they will not get any information from it. In place of the usefulness of the profile, however, under both of the Acts, I always return a *schedule*, which is, in fact, award, report, plan, profile and specifications all in one. The schedule is divided in the following manner, which, I think, is sufficiently clear without any explanation.

SCHEDULE OF DITCH.

Stations 100 ft. apart.

SURVEY made on application of.....

STATION.	DEPTH.	BOTTOM WIDTH.	TOP WIDTH.	SIDE STOPES.	GRADER PER ST.	TO BE DUG BY	TO BE COMPLETED ON OR BEFORE	BEARING.	CUBIC YDS.	REMARKS.
75	ft. in. 3 06	ft. 3	ft. in. 11 09		ft. in. 0 12	John Brown.	1st Sept., 1885.	N. 25° 30' W.	Give cub. yds. between every five stations.	74+90 angle.
76	4 02	3	13 05	1½ to 1						76+30 - cross old creek bed.
77	3 09	3	12 04½							
78	3 10	3	12 07							

The last column, cubic yards, is not necessary for schedules for ditches done under the Ditches and Watercourses Act, as it is inserted only to enable the inspector to make a correct monthly estimate. Columns Nos. 7 and 8 are not necessary for ditches constructed under the Municipal Act; as was said before the whole job is generally done by contract.

Under the Ditches and Watercourses Act, it is always best to furnish each of the interested parties with a copy of the schedule of that portion of the ditch which said party has to execute, thereby doing away with the liability of mistakes in copying figures from the schedule filed with the Clerk.

The plan is very seldom referred to, and is, in fact, almost altogether useless, excepting where there is an appeal from an award, and then a copy has to be supplied to the Court from the Clerk's office, certified by him as a true copy, etc., etc., which makes it needful to have one. In addition to the lines of the ditch and the lot lines I generally show on the plan the bearing (mag.) of each course, the numbers of the angle stakes, the changes in the bottom widths of the ditch, and the numbers of the stakes where one party's portion ends and another begins. Sometimes the land to be drained is shown on the plan in dotted lines with the area of each lot, or portion of lot, that is to be drained. It is sometimes the custom to draw a series of parallel lines on the plan at stated distances from the ditch and parallel thereto, and make the assessment according to the areas included within said lines; but, as this system is most materially wrong, the less said about it the better.

The form of specification here given is the result of a great many years' experience in ditching, and was originally compiled by the officials of the Canada Company, with the exception of paragraph *b*, which I have added myself, and I think it an improvement, and I have also added, or rather given, different names for the papers the contractor is to get his information from.

SPECIFICATIONS.

(a) The dimensions and cross-sections of the ditch shall in all cases conform with the plan, profile, and schedule hereto attached.

(b) The depths given in the schedule are *supposed* to be correct; but the contractor will, in all cases, verify the grade of the finished ditch, and make it conform with the grades given on the profile and schedule, even by so doing making a difference in the depth of any station.

(c) At all suitable places not more than — rods apart, spaces or openings, not less than three feet wide at the bottom and having side slopes inclined at the rate of one to one, shall be left in the spoil banks, on either side of said ditch, to admit of the ready inflow of surface water from the adjoining lands.

(d) The whole shall be brought to a regular inclination at the bottom so that no water shall stand stagnant therein. The slopes shall be brought to a uniform angle throughout, and shall be dressed to a straight line from the top to the bottom thereof. And a clear *berm*, or margin, of not less than — feet, shall be left between the top of the slope and the foot of the spoil bank throughout the entire length of said ditch. That side of the spoil bank next the ditch shall have a batter of not more than one and

one-half to one. Except where angles may occur the ditch shall be made in straight lines, and all such angles be turned with gentle curves, to facilitate the flow of water.

(e) All stumps, roots, logs, or other obstructions, shall be cut and removed from the body of the ditch to some point beyond the berm.

(f) In timbered lands the trees shall be felled to a distance of ——— feet each side of the centre of the ditch, and the logs and brushwood shall be removed a distance of ——— feet from each side of the centre of the ditch.

The blank spaces can be filled in to suit the circumstances of the case, as no positive rule can be laid down to suit all. I consider, however, that the clearing should extend a distance of not less than six feet from the outside of the berm, and I would never make the berm less than three feet wide, and would exceed that by another foot in clay soils.

Grave mistakes are sometimes made by taking water out of the natural watercourse in order to make the ditch shorter, and again by putting the ditch along the sides of two roads meeting at right angles to avoid the cutting of a field at an ugly angle. The engineer cannot be too careful of such deviations, as a great number of long and expensive lawsuits have been the result of such false ideas of economy, especially in the latter case. Another thing to be avoided is that an engineer should lay out a ditch in such a manner as to take the water that formerly flowed through a certain lot altogether away from it.

It is sometimes the case, when a contractor has a contract that is not finished when winter sets in, that he will continue work if there be nothing in his articles of agreement to prevent him, under which circumstances great vigilance has to be exerted by the inspector or engineer. All snow must be shovelled clear of the spoil-banks, and the spoil-bank made on the natural soil, and not on the snow. The berm should be made wider and always kept clean, and at his periodical visits the inspector should see that all ice, etc., is removed from the ditch, for in winter a sheet of ice bears the same relation to the bottom of a ditch that an old coat and charity bear to sin.

When commencing a survey of a ditch, especially should it run through a beaver-meadow, the engineer will often be informed by "ditchers" (?) that it will be impossible to drain that place, and that they (the ditchers and others) have often shoved a twenty-foot pole out of sight, etc. It is generally very true about the pole, but it is not so true about the drainage so long as the fall that can be obtained is sufficient to allow the water to run off. There are very few beaver-meadows in the country with more than three to four feet of black muck on the clay, although the presence of clay might never be discovered by the running of a pole through the muck, for in an undrained state the clay is just as soft as the muck. In the bottom of a ditch, however, the clay very soon becomes stiff and hard just from the water flowing continuously over it. I have heard it stated that clay below a beaver-meadow will rise on the same being drained; but I think it was more on account of the muck falling than the clay rising that that idea was induced.

Ditches, like everything else, vary greatly in cost, ranging from ten cents per cubic yard, in a light, sandy soil, to sixteen cents per cubic yard

for bush work, including grubbing and clearing, and for a hard, stiff soil. The total cost of ditches, compared with the number of acres drained, will depend greatly on the length of the outlet and the width of the area to be drained, a narrow swamp not requiring so deep a ditch as a wide one; but it generally ranges from \$2 per acre up to \$7 or \$9 per acre.

Since the Ditches and Watercourses Act was passed in 1883 the following amendments have been adopted:—

Section 3 amended by	47 V., c. 43.
“ 10 “	48 V., c. 47, s. 1.
“ 11 “	48 V., c. 47, s. 2.
“ 18 “	48 V., c. 43, s. 5.
“ 15 repealed by	47 V., c. 43, s. 2,
and another section substituted therefor.	

Since the portion of the Municipal Act we have been treating was consolidated in 1883, the following amendments have been adopted:—

Section 570 amended by	48 V., c. 39, s. 25.
“ 584 (1) “	48 V., c. 39, s. 25.
“ 584 (2) “	47 V., c. 32, s. 18.
“ 586 “	47 V., c. 32, s. 19.
“ 586 “	48 V., c. 39, s. 27.
“ 587 “	48 V., c. 39, s. 26.
“ 589 “	48 V., c. 39, s. 26.
“ 593 repealed by	48 V., c. 39, s. 28.

In conclusion, I would like to have the opinion of this Association on the exact meanings of the words *ditch* and *drain*, and whether there can be strictly such things as *closed ditches* or *open drains*.

In this paper I have attempted to throw out a few hints regarding the working of the two different Drainage Acts of Ontario, and the most economical methods and times for using the same. I have not attempted to touch upon the subject of *apportionments* and *assessments* under the different Acts, as those points will in all cases appeal to the engineer's judgment, being guided by the benefit received by the different parties.

Clinton, Ont., March 1, 1886.

MUNICIPAL ENGINEERING.

THE MANAGEMENT OF TOWNSHIP ROADS.

BY JAMES C. BURNS,

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THE purpose of this paper is to discuss briefly, from a practical standpoint, the management of the ordinary township roads of the Province. To do this I have selected as a typical case the roads of Blanchard Township, situated at the southern extremity of Perth County, convinced that what is here said in regard to this township will be applicable with some little variations, from local circumstances, to most of the townships of the Province. Generally speaking, this township has a rolling clay loam surface presenting few difficulties in regard to drainage. It is traversed from north to south by the River Thames, whose banks rise to a height of sixty to eighty feet on either side, giving to road makers a little experience in hill cutting and embankment. Entirely within the limits of the township is the market town of St. Marys, which, being an excellent grain market, attracts considerable heavy traffic, rendering it necessary to keep in good repair its main entrance. All the main roads of the township lead in the direction of this town. The cross lines or side roads are little used, and consequently need little attention. The main roads are those on which nearly all the expense occurs, and it is of them I will speak principally. In order to arrive at a correct opinion as to the manner in which these roads should be dealt with it is necessary to know how they have been built and brought into their present condition.

They have been built and maintained under what is known as the Statute Labour System. Under its working all the roads of the township are divided into sections, or "beats," from one to two miles in length, depending on the position of some suitable boundary. Each beat is put under the supervision of some local ratepayer with the title of pathmaster, who is appointed annually and expected to direct all the work done on his beat during his official year. Each resident ratepayer is taxed to do a certain number of days' labour on the beat, his amount of assessed property adjoining being taken as basis of apportionment. When the work thus done is found insufficient, contracts for repairing or construction are let by the councillors who act as road commissioners. All bridges and culverts are built and repaired by contract.

Such has been the practice in this township since its early settlement, and such is the practice generally throughout the Province for the maintenance of the ordinary township roads. Although possessing some good features, this system is not the most suitable for the construction and maintenance of good roads and should give place to a better.

All the roads of this township were located by the original surveys which were made with reference to main roads, built by the Canada Company, who were the first holders of the land of this township, before this township was settled. None of these pioneer roads touch Blanchard.

The turnpike system was made use of in the construction of seventeen miles of roads, but has been long since discarded as cumbrous and unprofitable. With the exception of this portion, all the roads have been built by Statute Labour.

The first thing done was to cut off the timber growing on the road allowance. Where low ground was encountered the smaller trees of this timber, from ten inches to sixteen inches in diameter, were cut in lengths of twenty feet. These were laid side by side transversely, butts and tops alternately, to keep the intervals at a minimum, the surface being kept as level as possible by the eye. If the spaces were unavoidably large small triangular pieces were split and fitted into them. Over this was thrown the earth from the sides to a depth of eight to twelve inches and thus was formed a corduroy road, so called from its ribbed character. The remainder of the timber was piled in heaps and burned. The stumps being green were often immovable, and to avoid those that were situated in the middle of the road allowance, bends were made in the graded portion. The old lines were always followed in all subsequent work, and these sinuities are common in all the concession lines except the turnpike. By the time the clearing process was through most of the stumps could be removed from the portions first cleared. A width of about twenty feet in the middle of the road allowance being left, the earth on each side was loosened with a plough to a depth of six to nine inches, and conveyed to the centre by horse-scraper and shovel to a depth of eight to twelve inches, and about eight feet wide. In places where the ground was high no grading was done at all, the longitudinal slope being depended on to keep the surface dry.

The traffic soon compacted the clay and pressed it down, so that in the majority of cases it was only from two to five inches above the original level of land, and where no grading was done the track became a depression, passable only in dry weather. On the other hand, the narrow roadway was raised, when the ground was low and wet, to a height of fifteen to twenty inches, making a dangerous place to teams turning off, when meeting.

This was what was known as the clay, or, more commonly and appropriately, the *mud* road, for many years in use.

On this as a road-bed, pit gravel was hauled and spread loosely to a depth of eight to twelve inches, according to the fancy of the man doing the work. It soon became necessary to repeat this operation on account of the ruts which formed rapidly in this loose gravel, and this was done until, in some places, where the road is wet and springy, there is a depth of twenty to twenty-five inches.

Where the formation of the road-bed interfered with the natural course of the surface water, culverts were put in. These were at first made of logs. The logs were cut twenty feet long, about sixteen inches in diameter, and laid vertically above each other. Two of these were sufficiently high for the smaller culverts. The lower log on each side was held in place by being partially imbedded in the clay; the upper pair were held apart by

cross pieces mortised into them. On these cross pieces were placed poles four to six inches in diameter. In the larger culverts the logs were squared and held in position by end logs dovetailed into them at the ends, making a small angle with the longitudinal section of the road. Stringers were laid across and covered with planking. The planking generally used was rock elm three inches thick, twelve inches wide, and sixteen feet long. Some of these wooden structures have since been replaced by stone. The proper width for the waterway plus the thickness of the two side walls was taken out of the road. A wall of boulder stone, or, in some cases, rubble, eighteen inches thick, was then built, in nearly all cases without mortar, on a foundation usually level with the bottom of the waterway. This wall was built up within three inches of the level of the road surface, spaces being left for the insertion of three cross girders of wood flattened on the upper surface, on which was laid the plank, as tight as possible.

The defects of this condition of things are obvious. The superintendence of the work is placed in the hands of parties who have had no training or experience in the best methods of work, who have given the matter no attention or consideration, and, who are consequently unskilled and incompetent to make the best use of the time and money spent.

No good road of any kind can be made and kept without a proper system of drainage, and this fundamental fact is almost entirely neglected by pathmasters. In many places no side drains exist at all, and where they do exist they are always too shallow. In the wet weather of spring and autumn, the seasons in which the traffic is greatest, the road-bed becomes saturated and softened, and unable to support the covering. Heavy vehicles cut through the gravel, bringing up the primeval muck, and mixing it with the covering, permanently ruining the road where it occurs, and rendering reconstruction necessary in the following summer. In other places, where the covering is not broken, but sinks, deep ruts are formed, which are allowed to develop till road-work time comes round. The gravel on the road soon becomes beaten down in three parallel lines, two where the wheels run and one in the middle where single horses travel. These constitute three shallow trenches which retain the water, and allow it to saturate the road covering, rendering it soft and easily cut by wheels. The original road-bed is too narrow, the highest portion in the centre being only ten feet wide and between side drains twenty feet. The high ridge of clay and gravel is dangerous to turn off, and in some places it is impossible to do so. Too great depth of gravel is put on at one time, and it is a long time before it is possible to go over it with a heavy load. In this condition the traffic seeks the side of the road when possible, cutting it and bringing the clay on the gravel.

The gravel is taken from the nearest pit, with no regard to its quality, and always contains too much clay or large stone to make a good road. All kinds, from coarse sand to stones three inches in diameter, are thrown on, and left for the traffic to compact. The large stones are the worst, as they cause ruts on either side from the concussion of the wheel as it drops over them. It usually takes about three months of light traffic to put the roads in condition for the heavier traffic.

Wooden culverts are a constant source of danger, being generally in a state of ill-repair. The foundations are not put deep enough, and the

water very soon undermines them, allowing the walls to fall in, in which condition they are usually allowed to remain, until complained of by some one who suffers by their condition. Then some one, who generally knows little about them, is entrusted with their reconstruction, and no improvement is effected. They are usually much shorter than the width of the road, leaving dangerous holes at the ends. Moreover, they are not economical, decaying, as they do, so rapidly from the alternate wetting and drying to which they are subjected. The cost in this township of culverts in repairs alone for the year 1884 amounted to \$358, a sum which does not include any new ones built.

Of the bridges—five in number—maintained by the township I need say nothing, as they have been well and properly built by competent engineers, and are models of their kind, except that I think it poor economy to build wooden structures when stone is as convenient as it is in this township.

To effect an improvement in the condition of these roads, thorough drainage of the road-bed is a prime necessity. This can be provided by an open drain on each side of the road, with side slopes of one to one and a width of one foot in the bottom. The slopes should be sodded or sown with grass seed to keep the clay from washing down. The earth from these drains should be used to level up the sides of the road. These drains will carry off all the surface-water of the adjacent soil, and prevent it from percolating through the road-bed.

Where the road-bed is spongy or inclined to be springy, cross-drains should be put in. Where there is no longitudinal slope to the road-bed these may be put in at right angles to the side drains; but if they are put in on a slope, they should be of the form of a broad letter V, with the angle pointing up the slope.

They should have a fall of one in thirty to one in one hundred, and should empty two inches above the bottom of the side-drains.

Another suitable style of underdraining is to put in longitudinal drains, with cross-drains leading to the side-drains. Two of these will be sufficient, and should be equidistant from the side-drains and from each other.

They may be made of tile, brick, or stone. The ordinary one and a half inch or two inch draining tile will be sufficient, and where they can be obtained conveniently will be found to be the most economical, and give good satisfaction. A covering of straw or leaves on them before the clay is put on will act as a filter, and prevent the clay from washing into the tile. With a fall of one in one hundred, a one and a half inch tile will discharge 12,000 gallons of water, and a two inch tile 22,890 gallons per day of twenty-four hours, which is considerably more than will ever be required of them in the sub-drainage of roads. H. F. French, in his standard work on farm drainage, after a careful estimate and comparison of stone, brick and tile, concludes that "drainage with tiles will generally cost less than one half the expense of drainage with stone, and will be incomparably more satisfactory in the end."

As tiles are easily damaged by the action of frost, their ends should not be left exposed, but the last two or three feet of these cross mitre drains should be finished with a blind drain of stone, made by throwing the stone in loosely. Surface drainage of the road is provided for by the slope given to the road, as will be described further on.

To allow the water collected by the side drains to flow in the natural watercourses from the upper side of the road to the lower, culverts are needed. The size of the culvert should be proportional to the greatest amount of water it will ever be required to give passage to, and should always be large enough to admit a boy to clean it out. If square, eighteen inches each way, and, if circular, twenty inches in diameter, is sufficient for this purpose. Wood should not be used in the construction of culverts, as the alternate wetting and drying to which it is subject is peculiarly conducive to rapid decay, and the weakness cannot be noticed until it makes itself felt by some disaster to life or property; besides, it is a source of much annoyance to traffic to have to take the side of a road while a culvert is being built.

Culverts should be made so as to last as long as possible, and for this reason, if not as a matter of economy, they should be built of stone, concrete, or brick. Where stone can be obtained conveniently, it will be found to amply repay the extra cost of construction by its solidity, permanence and consequent safety. The floor should be made of concrete, or of small stone grouted with cement, to provide a bed that the water will not wash out, and to render the cleaning-out easier.

The walls should be built on a solid foundation, got by digging down to the solid clay, and should always go below the flooring. The mortar used should be made of cement, as it best resists the action of water. The floor should be concave, and have an inclination, towards the outlet, of one in one hundred and twenty to one in thirty.

To prevent the flooring from being undermined, the stones should be sunk on edge across the upper end of the waterway. To protect the sides, end walls are built a few inches higher than the road to prevent the water from washing over them. They are inclined at a suitable angle to the longitudinal section of the road.

The length of the culvert should be the same as the distance through the road on a line with the crown of the arch, which should always be low enough to allow a thickness of six to ten inches of road-covering on top, preserving the proper height of road.

A culvert properly built will never need repairing, will be always perfectly safe, and of no expense, save for cleaning out once or twice per year.

In excavations it is not advisable to leave open drains at the sides, as they would quickly fill up with the clay washed down from the banks. Covered side drains are much to be preferred. A sufficient cross-section of waterway should be constructed of rubble stone, and the drain then filled up on top with broken stone. This will allow the entrance of the water and prevent that of dirt.

The upper end of this side-drain should not be left open, as sticks, leaves and dirt will enter with the water and soon choke up the drain. A blind drain, three to five feet long, should complete this end, unless it be a case of cutting a short hill, when there will be a fall both ways, and, of course, such a precaution would be unnecessary.

To prevent the sides from washing down, they should not have a grade of more than two to one, or in extreme cases one to one. The banks of hill-cuttings, when the work is under the direction of non-professionals, are always left too steep, the object being to save the expense of making the cutting wide enough at the top.

When the cutting is on a hillside the upper edge should be protected by an underdrain to carry off the rainfall of the ground above, and prevent it from percolating through the bank. When the bank is spongy, or infested with springs, it should be drained in the same way as has been described for the sub-drainage of a similar road-bed. A light covering of fertile earth applied on the bank, and seeded with some suitable hardy grass, as June or Blue Grass, will produce in a few months a tough sod which will prevent the washing down of dirt, and hinder any tendency to the formation of water-ruts on the sides. This seeding or other sodding should be applied to all embankments or approaches to bridges, to prevent the growth of weeds or the washing away of the clay.

The width of a road is an important consideration in its construction. As a general rule, narrow roads are more economical than wide ones, and consequently roads should be made only wide enough to suit the convenience of the traffic over them. For an entrance to a town, where there is considerable traffic both ways, the road-covering should be wide enough to allow two vehicles to meet and pass without leaving the metalled portion, and if the traffic is very great, still wider. For this purpose sixteen feet to seventeen feet will be sufficient. On the ordinary concession roads of a township, where the bulk of the traffic is in one direction, provision for the width of one vehicle is sufficient, the unloaded ones conceding the right of way to the loaded ones. As the metalled portion is put in the centre of the road allowance, the sides should be wide enough to allow the easy passage of those turning off. Eight feet of metal and ten feet of side will give sufficient room for these purposes, so that we will have a total width between side-drains of $10 + 8 + 10 = 28$ feet. A common width prescribed is thirty feet, and this may be taken as the best for all common roads. The transverse form best for roads has given rise to a good deal of discussion among engineers. The arc of a circle or of an ellipse is recommended by some, while others prefer two inclined planes sloping towards the side-drains, and connected in the centre by a short convex curve. Objections are raised to the former that the centre will be nearly level, and will hold the water, unless it is carried off by a longitudinal slope; that carriages will keep on the centre in order to run on the level, thereby causing excessive wear along one line; and that the wear of the sides is great when traffic is forced on them, on account of the tendency to slide on the part of the wheels. For these reasons the second form is more generally adopted.

The highest point of the middle arc should be in the centre of the road, and it should be drawn to a radius of eighty-five or ninety feet. The degree of inclination of the flat slopes should be from one in twenty to one in thirty for township roads. Drainage is assisted by giving the surface a longitudinal slope of at least one in one hundred and twenty-five, which can always be done, even where the surface of the ground is level, at little extra expense.

Where sidewalks are constructed on the side of the road, the water from the gutter, between the sidewalk and road, is conveyed into the side drains by small covered drains running under the sidewalk.

They may be near the surface, but not rising higher than the surface of the sidewalk, and should have a fall of one in ten to one in twenty, so

that they may promptly discharge all water from the gutter, and do not need cleaning often. They should be of sufficient cross section to admit the easy working of a long handled hoe, which may be used for the removal of whatever the water does not carry through.

Sidewalks are not necessary on roads of so little foot travelling as those of most of our rural districts, except in the vicinity of towns, and in these places, their construction is a much needed improvement. Under present management, when the muddy seasons of the year come round, it is impossible to travel on foot, except on the road sides. The sides are not prepared for travel, and, in many places, they are impassable. Besides the advantage for foot travel, a sidewalk is a safeguard from getting off the road on dark nights, a consideration by no means insignificant.

In order to construct a sidewalk, the roadway should be widened to the extent of five or six feet, graded to about the height of the centre of the road, and sloped gently outwards towards the side drain. The new grading should be well compacted as it is filled in, and then given some time to settle. A light coating of broken stone, topped off with two inches of screened gravel, should then be added and rolled with a light roller, or, if broken stone be too expensive, a coating of rough gravel three inches thick should be put on the clay and rolled. After this has become compact, the fine, sifted gravel, which has passed through a sieve with meshes half an inch in diameter, is then added and rolled.

If there is much clay in the gravel, it should be screened through a fine sand sieve, and what will go through, be rejected.

Pit gravel usually contains too much earthy matter for road-making and should be screened: first, to remove the large stones, through a sieve with meshes one and a half to one and three-quarters inches square, or, if less troublesome, these stones may be picked out, as the gravel is being loaded; secondly, to remove the clay and fine sand, through a sieve with one-half to one-quarter inch meshes. What is retained on the sieve at the second screening is the most suitable gravel for the top layer of road-covering. As the majority of township roads have already a thick coating of gravel, this gravel would be the most suitable for application to them. The second screening must not be pushed too far, as it will be well to have sufficient earthy matter remain to act as a matrix for the gravel when it is rolled.

When it is necessary to secure a sufficient depth of road-covering, or where the proper cross section requires a coating of gravel, the present road surface should be prepared for its reception by cutting off the edges, which are generally higher than the tracks, and removing any stone that would interfere with the proper shape of the road.

The gravel should then be applied, and adjusted to the proper form with rakes or shovels. The work of compacting the gravel is best done by the use of a roller, five to six feet long, and weighing one and a half to two tons. This is as heavy as can be used at first on loose gravel, but, as it consolidates, a heavier one may be used. It is convenient to have a roller that may be loaded, as the work proceeds, to any desired weight up to six tons, which will be sufficient for any gravel road.

A good form of roller is made of two hollow cylinders of cast iron, set abreast on a strong wrought iron axle, making, together, a length of five

feet, with a diameter of five to six feet. These cylinders are set in a wooden frame, and have apertures in the ends, through which they may be loaded up to the desired weight. A roller of this kind, weighing one and a half tons and capable of being loaded up to six tons, would be the most suitable for township use. Another form of roller is so designed that when an increase in weight is wanted it may be filled with water which may be emptied out when moving from place to place. Road rollers propelled by steam are also used, but are more expensive and require more care.

Not more than three to four inches of gravel should be applied at once without rolling; layer after layer being formed until a sufficient height and proper cross section is attained. The rolling should be done when the gravel is damp, but not so wet that the earthy matter will collect on the surface in a semi-fluid state. If the gravel have not sufficient binding material to make it pack firmly, a little stiff, sandy clay or stone dust must be added.

The sides of the road should be rolled first, until they are compact enough to resist the tendency of the gravel to spread sideways when the roller is placed on the middle. While the rolling process is going on men should be in attendance to fill up depressions, and keep the surface at the required form of cross section. The rolling should be continued until the covering is forced down into a solid, firm surface which will be nearly watertight.

There are two methods in use on the best roads of keeping them in an efficient state, the choice of which depends on the amount of traffic to be provided for. (1) The method of minute and daily repairs by which the road-covering is constantly maintained at the proper thickness. (2) The method of partial repairs accompanied by the addition of material at stated intervals; the former applicable to roads of moderate traffic, the latter to roads of great traffic. As our roads come under the first heading it is the method we should adopt.

In order that the road-covering be maintained, so that extensive repairs will never be needed, minute repairs to the surface should be made systematically in small patches as soon as ruts or depressions appear. The road should be constantly undergoing repairs.

To have this done the road should be divided into lengths, on each of which an intelligent labourer should be placed, who thoroughly understands his business, to attend constantly and at all times to the condition of the road, and for which he should be held accountable. He should keep the ditches in good order, and fill in the ruts and depressions as soon as they appear.

To enable him to do this, gravel, or broken stone, should be deposited in suitable places on the side of the road, one heap in each quarter of a mile. He should be furnished with a wheelbarrow, a shovel, a pickaxe, and a rammer. In spring and autumn, when the road is wet, and more work needed, other men should be placed under their charge without, however, easing them of their responsibility.

The new material should be added, little by little, from time to time, in depressions and deficient places, and it should be broken fine in comparison with that used in the original construction. This patching should

be done so constantly that it will never be necessary to add more than one to two inches in thickness at a time. If done when the road is firm and dry the surface of the depression to be filled should be loosened with a pick to a depth of half an inch, and taken out to put over the new material. This will promote a close union of the two materials. The patching should be firmly rammed with a rammer of twelve to twenty pounds, or it may be rolled. Ruts should not be filled with material harder than the original substance of the road; but the filling should be as much like it as possible. The deeper the ruts to be filled the coarser the material used may be.

It is one of the greatest mistakes in roadmaking that can be committed to lay on thick coats of material. If the thickness of the road covering is to be properly kept up it should never be necessary to put on more than a stone's thickness at a time. A cubic yard nicely prepared and broken to a rod superficies will be quite enough for a coat, and if accurately noticed will be found to last as long as double the quantity put on unprepared and in thick layers.

This is what a high authority (Penfold) says of broken stone, and the same observation applies with equal force to gravel roads:—

In long continued drought the binding becomes baked and hard allowing the small stones to become loose and wear each other. This may be remedied by sprinkling the surface and rolling with a light roller. The sprinkling should be as much like a light shower as possible so as not to make the surface too wet.

In speaking of the system of keeping up the roads by constant patching, Gillmore says:—

“This system of maintenance for roads of moderate traffic seems open to the objection of being unnecessarily expensive, but observation and experience have fully demonstrated that such is not the case, and that the ‘stitch in time’ policy applies here with peculiar and significant force. It is not only vastly cheaper to maintain such a highway in good condition for a given traffic adapted to it than to pay the extra expense of conducting the same traffic on a bad road, but is also vastly cheaper to keep the road in excellent order than it is to restore it to that state after a period of injurious neglect, during which it has become filled with deep ruts and thickly covered with dust and mud.”

“The French engineers of the Corps des Ponts et Chaussées were the first to give anything approaching to an exhaustive practical study to this question. It was found that in proportion as the intervals between the periods of repairs were shortened upon roads of small traffic two important and valuable results invariably followed, viz., that the annual expense was lessened; and that the roads were always in better condition; and, finally, that the roads were never so good, nor the expense of maintenance so small as when the system of unremitting and minute attention was in full operation.”

That the cost of putting the township roads in a state of proper repair, and of so maintaining them, would be repaid many times over by the saving effected in the expense of conducting the traffic over them alone could be easily and completely demonstrated did the limits of this paper permit. The discussion of this phase of the question, however, must be omitted as also that of the many side advantages upon which it is difficult to place a

money value, but which are inevitable consequences of a good system of road maintenance, such as, economy of time due to greater speed, a longer endurance of animals and vehicles, the advantage of lighter and cheaper vehicles, freedom from excessive dust and mud, the increase of population attracted by the better facilities for commercial intercourse and consequent increase in the value of real estate.

These considerations alone would furnish sufficient argument in favour of putting our roads in a state of efficiency such as has been described—a thing which is manifestly impossible under the present system of administration.

The Statute Labour System was devised to meet the requirements of early settlements, when a simultaneous opening of all the roads in a township was the thing most desirable. Its chief advantages were that under its working each ratepayer was permitted to do his share of the road building in his own immediate neighbourhood, and that he was able to pay his road tax in labour rather than in specie; but these considerations, however important at first, have since lost all their force.

The portions of road in which all are most interested are those in the neighbourhood of the town, which are used in common by all, and the second consideration has come to be considered a doubtful privilege, as time is quite as valuable to the farmer on his property as on the road. Owing to the laxity of pathmasters, the time spent on the roads is flagrantly misapplied. The day required is eight hours long, and any pretence of work is accepted. The impression is prevalent that in road-work the time is to be put in with as little exertion as possible. The real amount of gravel hauled is never so great as the amount reported, on account of smallness of waggon boxes and the desire of teamsters to save their horses. Anyone who has observed statute labour will agree with me that over one third the prescribed time is wasted through the trickery of workmen and the carelessness or ignorance of directors. As an example I present the following:—

The Township Council pays thirty-five cents per cord for gravel, and counts five loads to the cord. By actual measurements I find the average gravel-box used is eight feet long, three feet one inch wide, and ten inches deep, five of which, if filled, would hold $\frac{3}{4}$ of a cord, showing a loss of $\frac{1}{4}$ of a cord on each cord paid for, or a total loss of $\frac{1}{4}$ of the money paid out, which in 1884 would be $\frac{1}{4}$ of \$524—\$110 nearly; and, besides, the boxes are seldom filled.

Subjoined is a statement of the expenditures on the Blanchard Township public roads for the year 1884, as taken from the Auditors' Report, together with a statement showing how a better result at a smaller cost is possible under a proper system of management, the standard wages in each case being that fixed by the Council:—

PRESENT SYSTEM.

2,757 days statute labour.....	\$2,757 00
Contracts for gravelling	805 00
Contracts for grading	238 00
Repairing culverts	358 00
Contracts for ditching.....	95 00
Other work on roads.....	6 00
	<hr/>
Total	\$4,259 00

PROPER SYSTEM.

Six men for eight months @ \$208.....	\$1,248 00
Seven teams and drivers for five months @ \$260.	1,820 00
Engineering.....	800 00
	<hr/>
Total	\$3,868 00

SURVEYOR'S INSTRUMENTS.

BY MATTHEW J. BUTLER,

P.L.S., Assoc. M. Inst. C.E., M.Am.S.C.E., Napanee.

By way of preface the writer would remark that in the use of instruments a great deal more depends on the eye that looks through the small end of the telescope than on any perfection of mechanical construction. A good man will do better work with an inferior instrument than a poor one with all the latest improvements.

For various reasons, the writer thinks it advisable in discussing this question, to divide the subject into two groups, viz.: those of English and those of American manufacture, then to select instruments of different manufacturers as typical of their class and give notes on the particular instrument.

ENGLISH INSTRUMENTS.

Only two eminent manufacturers are known to the writer, viz., W. F. Stanley, 4 and 5 Great Tarnstile, Holborn, London, and Troughton & Simms, of London, England; and, as the writer has had some ten years' practical experience with Stanley's instruments, they will be first described.

Stanley manufactures every variety of instrument that can possibly be required in the various duties of a surveyor. His drawing instruments are undoubtedly the best known to the writer, and when quality is taken into consideration, the cheapest.

Transits.—Two varieties are manufactured, one known as Stanley's Improved, with illuminated axis, diagonal eyepiece, extra fittings, striding levels, etc., his best workmanship; sold at, for six inch instrument, graduated so as to read to twenty seconds of arc, £34; when delivered in any part of Canada, duty and all other charges paid, will cost \$225.

The other instrument lacks the illuminated axis and the diagonal eyepiece, but is, in every respect, a very high-class instrument.

The writer has had one in constant use for the past ten years, during which time it has been used on all classes of work, viz.: Government surveys, farm and town surveys, railroad construction and location, hydraulic work, etc. It has been drowned once, been in a runaway accident, been through several railway accidents, and, in a word, have been subjected to pretty rough usage.

Notwithstanding all this, it has only been found necessary to adjust it four times, and, to-day, the writer can sight it on a fine picket and turn an angle of one hundred and eighty degrees, reverse the telescope, and strike the picket every time; or, even a more difficult test, plant five pickets in a direct line running from the instrument at distances of one, two, three, etc., chains, remove the instrument to the last one and sight back, and strike every picket on the line. But few instruments will stand this test. The objections to these instruments are their weight, lack of power in the telescope, and in their graduations. They only read from zero to three

hundred and sixty degrees around to the right ; in turning an angle to the left, subtractions from three hundred and sixty degrees have to be made—a great inconvenience in railroad work.

It is also somewhat difficult to set them exactly over a point, particularly on side-hills, as it has to be done entirely by the manipulation of the tripod ; the addition of a shifting centre would be a great improvement. This instrument costs, laid down in any part of Canada all charges paid, \$186. The five-inch Transit Theodolite, reading to thirty seconds of arc, similar in every respect, costs, laid down, \$145.44.

Levels.—A more marked difference is found in levelling instruments than in any other class, when we come to compare English and American instruments. The Dumpy Level is the usual form manufactured in England, whereas, in America, the Wye Level is the favourite. Equally good work can be done with either class of instrument. When we come to examine into a reason for this marked difference in the choice of a levelling instrument, we can only see a peculiarity in each nation. The Englishman wants his instruments handed to him in such a way that every part is of the most substantial character, and that everything that by good workmanship can be made permanent shall be so done. He requires that the instrument maker shall do his portion so well that but few parts can become disarranged ; therefore, his adjustments are few and difficult to make—but then they will not require to be so often attended to.

Whereas, in the case of the American, he wants everything left in such a way that if anything should go wrong the user can fix it himself, and it is natural that such should be the case, from the fact that in the early days on this continent, when the present types of instruments were selected, instrument makers were few and far between, the engineer or surveyor would find himself thousands of miles from an instrument maker, when, owing to a fall or other accident, some of the so-called permanent adjustments would become disarranged, and as only a maker could repair them, it would cost nearly the price of the instrument to have it done. In this way, improvements were brought about intending to obviate the necessity of sending the instrument to the factory ; but as there are instrument makers now to be found in nearly every city on the continent, it is a comparatively easy matter to reach them. Hence it seems to the writer that the fewer parts there are to an instrument the better ; that if provision is made in the manufacture of the instrument for adjusting parts that should be made perfect in the manufacture ; the necessity for the adjustment will frequently arise. Simplicity and not complexity should be the desideratum. Have as few adjustments as possible, but have the instrument perfect before leaving the factory.

Stanley, of London.

Stanley's Improved Level is of the Dumpy pattern with a few modifications ; the base or tripod-head is composed of three radiating arms, making a wide, firm base to level up from ; only three screws are used in this instrument in levelling it up. The collimation is put in differently from any the writer has seen elsewhere. It is formed by means of a dagger point which goes to the optical centre of the telescope, thus leaving one-half of the field of view wholly unobstructed. It permits of easy

adjustment by means of a jam nut and screw, which permit the moving in and out of the pointer so as to just exactly reach the optical centre of the telescope. The writer, however, does not consider it equal to the ordinary spider web, and has had it taken out and the latter substituted.

The telescope on this instrument is of extra good power; large, flat field, free from aberration. The writer has read an ordinary Sopwith self-reading rod, graduated to $\frac{1}{100}$ of a foot, at a distance of 2,000 feet in favourable weather. Although this instrument has been in pretty constant use for about four years on railroad work, it has not yet been found necessary to adjust it.

The cost of this twenty-inch instrument, laid down in any part of Ontario, all charges paid, is \$115. Stanley also manufactures Dumpy Levels of the well-known Grovatt pattern. A sixteen-inch instrument of this class can be laid down in any part of Ontario for \$103.

Troughton & Simms.

The instruments manufactured by this firm have long held a deservedly high place in the estimation of Surveyors. The writer regrets that he has not in his possession a price list so as to be able to compare prices with Stanley and other manufacturers of good standing. The Reiterating Transit of this firm calls for special mention. It has three verniers, the upper limb carrying the verniers is the only one that moves, the lower limb is permanently attached to the tripod-head. The telescope is of very high power, and is particularly suitable for astronomical observations and work of that class; in fact the instrument is only applicable to work where great accuracy in laying down meridian is called for. The wants of our Dominion Lands Department have brought it into existence.

AMERICAN INSTRUMENTS.

The style of Transit Instrument manufactured by American instrument makers of good repute, while embodying the same general characteristics as those of English manufacturers, differs in detail very much. Transit Theodolites of American manufacture are probably superior in many respects to any others in the world. They are very convenient in use, and as accurate as any made.

The improvements to be found on an American instrument may be enumerated as follows:—

The telescope has greater power, all screws are protected from rain and dust by caps, the object-glass and eyepiece slide are protected from rain and dust. By an arrangement the centre is made so as to shift, enabling the instrument to be easily and quickly placed over a given point, the tripod having first been set approximately. They are very much lighter, an instrument of the same size of English pattern will weigh from one-half to two-thirds more than an American one.

W. & L. E. Gurley, of Troy, New York,

Are large manufacturers of every kind of instruments; their Magnetic and Solar Compasses are to be particularly commended.

Heller & Brightly, and Young & Son, of Philadelphia.

Both of these firms manufacture a high-class Transit with all modern improvements. The cost of a six-inch Transit, laid down in Ontario, will be very approximately \$300.

They also manufacture Wye Levels of extra good quality. The cost, laid down in Ontario, for an eighteen-inch instrument is very approximately \$200.

Brandis of New York,

Manufactures very high grade instruments, both Transits and Levels.

His seven-inch Transit Theodolite can be laid down for \$345.

His eighteen-inch Ordinary Level can be laid down for \$195.

His Level of Precision costs, laid down, \$350.

Buff & Berger, of Boston, Mass.

This firm also manufacture high grade instruments; in many respects their instruments are very superior; they also, in addition to Transits and Wye Levels, make a Dumpy Level.

Their Transit Theodolite, six-inch instrument, costs, laid down in Ontario, about \$350.

Their Wye Level, eighteen-inch instrument, costs, laid down in Ontario, \$200.

Their Dumpy Level, fifteen-inch instrument, costs, laid down in Ontario, \$150.

There are other makers who do good work, but, as a fair representation of American manufacturers has been given, it has not been thought necessary to enumerate them.

The prices of American and English instruments given are current as taken from the published catalogues and price lists. The duty and freight charges have been added to bring them to Ontario.

In Canada, Foster, of Toronto, and Hearn & Harrison, of Montreal, also manufacture Transits, Levels and Compasses.

James Foster, King Street, Toronto, is now manufacturing a Micrometer (Lugeol's) that is said to give entire satisfaction. It may be briefly described as follows:

An ordinary telescope, thirteen inches long, with an object glass two inches in diameter. The object glass is bisected; by the aid of a screw the upper part is made to slide on the lower, in this way two images of an object are formed. The images of two vanes fixed on a target rod are brought into contact; by the aid of a Micrometer screw the angle is read, and a constant for each instrument, varying with the base, is determined by experiment. This constant is multiplied by the Micrometer reading which gives the distance.

It differs from the Rochon Micrometer in that both images are of equal brightness, thus giving better definition of the base. Price, \$65.

Foster also manufactures a new and improved form of Planimeter, designed by Cortez Fessenden, Esq., M.A., and the writer. It may be briefly described as follows: By the combination of the sliding motion of a parabolic curve and the revolving one of a bar at right angles to the axis

of the parabola a pointer is made to follow the outlines of any irregular figure. A wheel is placed at the vertex of the parabola, and is a function of it; it is so related to the pointer that while the pointer describes a periphery the wheel describes an area, thus integrating by polar coordinates any required area. The only skill required in its use is that of being able to read a vernier.

The prices of Foster's other instruments are about as follows :

10 in. Drainage Level	\$40 00
12 in. Dumpy Level	70 00
14 in. Imp. " Level	95 00
18 in. Wye Level	130 00
5 in. Railroad Transit Theodolite	160 00
5 in. Transit Theodolite	195 00

From the prices given of Canadian manufacture it will be seen that they compare very favourably with those of any other manufacturers in either the United States or England. Surveyors who have had practical experience with all kinds of instruments say that they are of equally good quality.

QUIRKS.

BY THEO. DELIGHT.

ALTHOUGH now considered by most of my professional brethren as somewhat *antiquated* and *rusty*, I am still in the field, and can, I think, run a line as well as the best of them.

My line of life, however, may soon be run, and I oftentimes think I hear them shouting at the post ahead, which necessitates, generally, an obtuse angle in my line.

Well, well, I did not intend moralizing; but to offer to the profession a few "quirks" which may be of interest to some, and furnish recreation for others.

Quirk No. 1.—When I first became the proud possessor of a *Theodolite*, I found that, in taking observations of *Polaris*, the azimuth angle read when the telescope was in normal position $1^{\circ} 30'$ different than when taken in reversed position, the upper plate being turned 180° in azimuth. I tested my instrument, and found that the line of collimation would cut a vertical line, and also that the graduations of horizontal plate were correct. Can some of our clever young surveyors suggest what was wrong?

Quirk No. 2.—A deed is placed in my hands which was drawn by a city lawyer (now a judge in the Superior Court), some twenty years ago.

The description reads as follows:—

"Being composed of the rear part of the west corner of the east half, of lot number three, in the sixth concession of——; containing by admeasurement five acres of land, being of the whole width of the said west corner of the east half of said lot, and of sufficient depth to comprise five acres."

The side lines in this concession are $N. 24^{\circ} W.$, concession lines $N. 56^{\circ} E.$

This property, although wild lands, is now valuable, a mine having been discovered on the rear of the lot, and I am asked by the present owner to survey it, giving him his five acres.

Quirk No. 3.—In 1870 a Provincial Land Surveyor makes a plan of a suburban property, shewing it as subdivided into building lots, streets, lanes, etc., which plan is duly registered with all necessary certificates thereon.

It is afterwards found that the surveyor never staked out on the ground the lots or streets shewn on the plan. He merely took the property, which was a ten acre park lot, as shown on a previously registered plan, and subdivided it on paper. Should such a plan have been registered?

Quirk No. 4.—The sides of a township lot are as follows:—AB 30 chains east, BC 80 chains north, CD 20 chains west, DA 81 chains, more or less.

The bearing of side lines is north. What is the method of dividing this lot into east and west halves—each of 100 acres.

Quirk No. 5.—A man purchases the east half of a township lot which was fenced when he bought it. After holding it over ten years he sells west half of his half, retaining the east quarter of lot.

The last buyer wishes his land, as purchased, surveyed; and it is then found that the east fence is correct, but the west fence, supposed to have been on the centre line of the lot, is too far east by one chain.

If from fence to fence is nine chains, and the farm has parallel ends and sides, how is the surveyor to proceed?



R. Hurwood
Dep^y Surveyor

BIOGRAPHICAL SKETCH
 OF
 REUBEN SHERWOOD,
 DEPUTY SURVEYOR.

THOMAS SHERWOOD, the first actual settler in the United Counties of Leeds and Grenville, located on lot No. 1, in the first concession of Elizabethtown, in June, 1784.

At the commencement of the Revolutionary War he remained loyal to the British Crown, and escaping to St. John's, Lower Canada, *via* Lake Champlain, was employed in the Secret Service, going into the States and enlisting men to serve His Majesty King George III. His two brothers entered the Continental Army.

Soon after his settling in Elizabethtown he was appointed a magistrate and a captain in the militia, and being a man of education was called upon to run the side lines of the lots for the first settlers, and to show them the location of their land. Though not a legalized Surveyor he had the instrument and understood its practical use.

His son Reuben was born in 1775. He studied with Ephraim Lay in the State of New York, then a British Province. There is no record of when he was appointed a Deputy Surveyor, but he was conducting surveys of townships in 1799.

From 1809 to 1820 he was employed in Government Surveys, subdividing into township lots (on the single front concession plan) the whole or part of each of the following townships, viz.:— Augusta, Bastard, Bathurst, Beckwith, Burgess, Crosby North, Crosby South, Drummond, Elizabethtown, Escott, Kitley, Lansdowne, Leeds, Marmora, Nelson, Pittsburgh, Sherbrooke, Storrington, Nassagaweya, and Yonge.

Until his death in 1851 he continued to practise his profession in this Province, and with him many served their apprenticeship who afterwards became prominent Surveyors. Among these were the following:—John McNaughton, Richard Birdsall, J. S. Dennis, and W. Harry Kilborn.

We will add to this brief sketch a few extracts from his Diary, which will give a fair idea of the hardships suffered by Surveyors seventy years ago.

EXTRACTS FROM THE DIARY OF REUBEN SHERWOOD, D.P.S., ON THE
SURVEY OF THE TOWNSHIPS OF NELSON AND NASSAGAWEYA.

SURVEY PARTY:

Alexander Robertson,	}	<i>Chainmen.</i>
Charles McLean,		
Alexander Hamilton,	}	<i>Axemen.</i>
Henry Glennon,		
Nathaniel Gilchrist,		
J. B. Pichette,		
Francis Pichette,		

Monday, 25th February, 1819.—A snowy morning, the party all employed in arranging for bread, axes, pease, etc. Mr. Hopkins not at home. Mr. Chisholm also away. Gave the men one quart of whiskey in the morn, and gave them one quart of spirits on the road up. Purchased from Ostrander, blacksmith, four axes, ready helved and ground, at eleven dollars. * * * *

Thursday, 4th March.—It snowed mostly all night and I could not get the stars in my horoscope, in the morning opened and proved Wilmot's line. * * * *

Saturday, 13th March.—Snowing again in the morning. I go out with the party and finish the 2nd concession line to 15 and road. Return again at 7 p.m.; find Hudson arrived. An exceeding cold night; about fifteen inches of snow on the ground. Broke my compass-glass in coming home.

Sunday, 14th March.—A cold day. The boys go out and bring three packs of biscuits in, and all get drunk. * * *

Sunday, 21st March.—Hamilton and Baptiste leave me. I go out to Hopkins. See Mr. Merritt in the evening with Capt. Chisholm. Go in search of snowshoes, and travel all night, and next day breakfast at Ancaster.

Monday, 22nd March.—Obtain four pairs, and return by the way of Dundas. Meet McLean and Gilchrist on Dundas Street with a keg of whiskey, and send out three pairs of the snowshoes. I sleep at Hopkins.

Tuesday, 23rd.—Go out and find all my party *squibby*, having drunk up my whiskey and their own, and they had not moved the camp. * *

Saturday, 27th March.—The snow having frozen last night, we mount the snowshoes and move to No. 6 in the 5th concession, and run said line to No. 11, all good land. A fine creek in No. 8 runs easterly. * *

Friday, 9th April.—A fine day. We move down to the east angle of the township again to commence the townline. Robinson being in rear of us, the ice left him on the other side of the creek, and he could not get to us till I sent an axeman to him. The low lands all spash, and all the flats afloat, so that I could not make any headway. I prepared for the meridian again and took it. * * * *

Thursday, 22nd April, 1819.—Commence the new township. Mosquitoes bite some to-day. * * * *

Sunday, 25th.—A fine day. I go out with McCollum. Find the men asleep in the road. * * * *

Monday, 3rd May.—Start to York on old buck, and arrive at 7 in the evening. * * * * *

Tuesday, 4th May.—Meet the Surveyor-General in the morning, and draw my lands in Nelson and Nassagaweya. * * *

Friday, 14th May.—Come out, and all hands *squibby*, nearly. I settled my accounts thereabouts.

Memorandum of "camp furniture" used on the survey of Augusta in 1810, as given in Reuben Sherwood's notes:—

- 4 axes.
- 1 hatchet.
- 6 tin cups.
- 4 iron spoons.
- 2 wooden spoons.
- 1 tin pan.
- 1 camp kettle.
- 1 tin pail.
- 3 bags.
- 8 blankets.
- 1 gun.
- Pouch, horn and shot-bag.
- 1 compass and chains.
- 1 marking-iron.
- Old case of protracting instruments.

LIST OF MEMBERS.

NAME.	OCCUPATION.	ADDRESS.
Abrey, George Brockitt	31 King Street East,	Toronto.
Aylesworth, Wm. Robert		Deseronto.
Beatty, David		Parry Sound.
Bell, James Anthony	City Engineer.	St. Thomas.
Blake, Frank Lever		Toronto.
	Astronomical Assistant at Observatory.	
Bolger, Thomas O.		Belleville.
Bolger, Francis		Penetanguishene.
Bolton, Lewis		Listowel.
Bowman, C. D.		West Montrose.
	Engineer for Townships of Woolwich, Pilkington and Nichol.	
Bowman, Isaac Lucius		Berlin.
	Engineer for Townships of Waterloo, Wilmot and Wellesley.	
Bray, Edgar		Oakville.
Browne, Harry John		Toronto.
Browne, Wm. Albert		Toronto.
Burke, William Robert		Ingersoll.
	Engineer for County of Oxford.	
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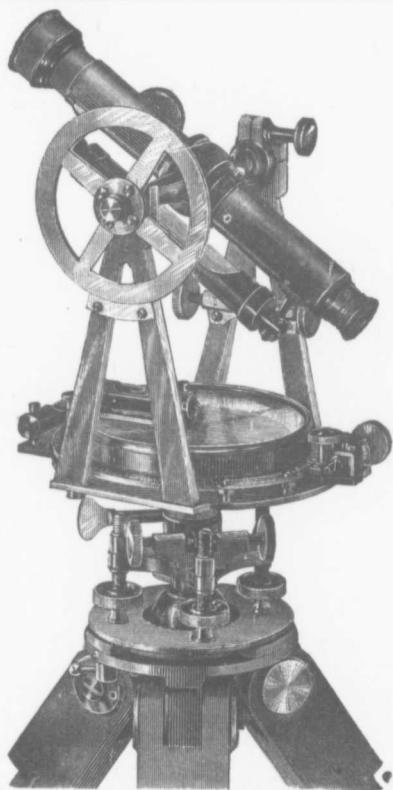
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