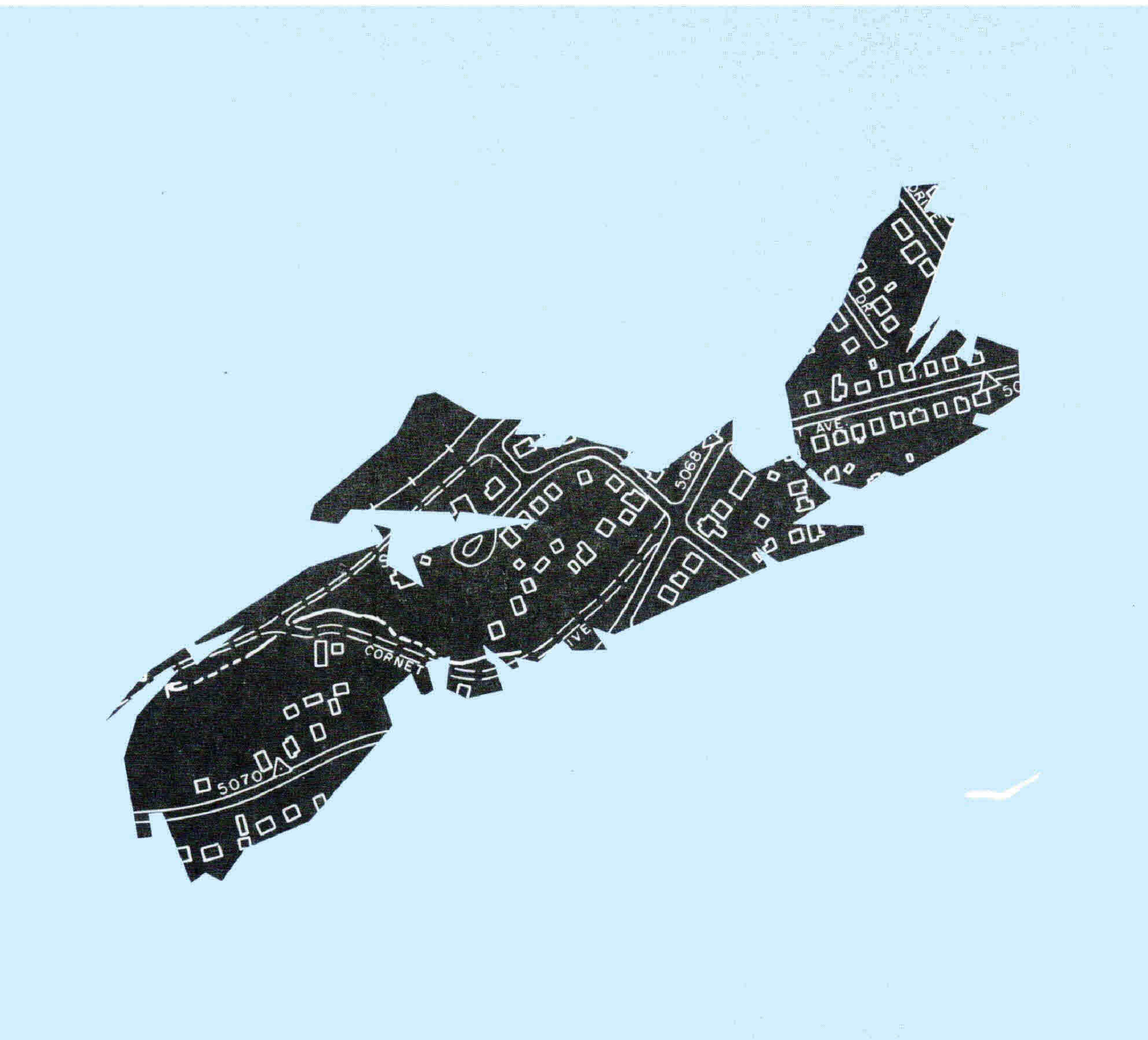
The NOVA SCOTIAN SURVEYOR



OCTOBER 1971

The NOVA SCOTIAN SURVEYOR

Published four times a year by

THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS INCORPORATED

L. Robert Feetham
President

Walter E. Servant
Editor

Edward P. Rice
Secretary-Treasurer

Address all communications to P.O. Box 1541, Halifax, Nova Scotia

Founded 1951 | Incorporated 1955

Vol. 23 | OCTOBER 1971 | No. 67

George Streb receiving the Massachusetts Flag from the Schofield Brothers

- C O N T E N T S -

Views, expressed in articles appearing in this publication are those of the authors, and not necessarily those of the Association.

REPORT ON M.A.L.S.C.E. MEETING - *L. R. Feetham, President*

The 17th Annual Meeting of the Massachusetts Association of Land Surveyors and Civil Engineers was held at the Sea Crest Hotel, North Falmouth, Cape Cod on September 30th, October 1st and 2nd, 1971. As your President, I was very pleased to represent our Association at this meeting.

The programme was very interesting and the following speakers were included:

1) Russell L. Voisin - President of the American Congress on Surveying and Mapping, was the keynote speaker. Mr. Voisin presented an excellent paper on the Structure and purpose of the A.C.S.M.

2) Captain Leonard S. Baker - Chief, Geodesy Division, National Ocean Survey(formerly the Coast and Geodetic Survey) presented a paper on Control Surveys and Monumentation in the Commonwealth of Massachusetts.

3) Mitchell S. M. Krock - An Attorney with the Chicago Title Insurance Company of Boston presented a paper on Title Insurance and the Requirements for Title Surveys.

4) Moses M. Frankel - An Attorney, presented an excellent paper on "Law of Seashore, Waters and Water Courses - Maine & Massachusetts" with court decisions of interest to the Surveyor.

5) Robert L. Woodbury - Chief Engineer,Massachusetts Land Court, presented a talk on the New Proposed Instructions for Surveyors.

6) Charles K. Mone - Assistant Attorney General, discussed pending Legislation and State Legislation of interest to Land Surveyors.

I have some copies of the above papers and if any of our members are interested I would be pleased to supply one to them. I would personally recommend Nos. 1 & 4 above.

The 1971 slate of officers is as follows:

President - John J. Unwin, Pittsfield

Vice President - John P. Lienesch, Foxboro

Secretary - Richard D. Thomson, Wayland

Treasurer - C. Edwin Anderson, East Longmeadow.

Included in the Nova Scotia delegation were E. P. Rice our Association Secretary-Treasurer and George T. Bates.

This Conference was very well attended with a diversified program designed to cover all aspects of the Survey Profession. With some eighteen displays of equipment in evidence it was an education to anyone willing to spend a few minutes and see the latest advancement made.

- A SHORT REPORT ON THE HISTORY OF SURVEYING ACTIVITIES -

We are told by the old Egyptian chronicles, that in those times, when the water of the Nile, which had overflowed the neighbouring cultivated fields,had receded,a group of officials was ordered into these fields to ascertain the extent of the changes caused by the inundation. These officials were in most cases accompanied by a group of land-surveyors and it was the task of these men to make sure that the landmarks had not been displaced in the course of the last year. For this reason the most aged land-surveyor compared the position of the landmarks with the registration in the land-registers.While at least three clerks were busy in noting and attesting the correctness of the measurement, three other men were, at the same time, engaged in holding the tape-measure. It is about the year 1980 B. C. that these groups of land-surveyors are mentioned for the first time. In the Egyptian land-registers there were not only inscribed the size of the property,the name of the owner and the kind of cultivation, but the extent of the canals and that of the cultivated areas as well.

In Mesopotamia land-surveying was of a similar importance as it was the case with Egypt. In this country the land-surveyor made use of a tape-measure and of a mechanism which seems to have consisted of a number of pales, bound together by means of a rope.It was as early as about the second half of the third millenary that land-surveyors were familiar with methods of recording exactly within a land-register the land allotted and leased by the King, the clergy and by financiers. Here in Mesopotamia and in the above mentioned period,landmarks were used for the first time in history by land-surveyors.

Today a Babylonian clay-tablet is considered to be the oldest map hitherto discovered. This clay-tablet is likely to date from the time of about 3800 B. C. and shows in outlines the northern part of Mesopotamia. The mountains and the river are very distinctly outlined and the towns are marked out by circles. There is still another map in existence which is likely to go back in its origin as far as to the year 500 B. C., and this map shows us the universe as imagined by the Babylonian people; a disk swimming in the ocean with Babylonia in the centre of the disk.

Aristagoras of Milet demonstrated to the people of Lacedaemonia by means of a self-produced iron map, which included Asia Minor and a part of Iran, the situation of the Ionian colony and he tried to fill the Lacedaemonians with enthusiasm for a campaign against the Persians. Apart from this attempt there is some reason to assume that in classical Greece surveyors were only capable of covering small territories cartographically.

Apart from the development of early cartography there were nevertheless some possibilities given to people in assisting them to find their way when they travelled by land or by sea. In Greece, for instance, there existed a guide-book, the so-called Periplus. In this book a voyager had written down all about the landscape he had seen when he was sailing along the coast. Marinos of Thyros (about 114 A.D.) mentions a caravan-guide intended for travellers to China and we can, therefore, suppose that such guide-books intended for country-roads were in existence too.

In ancient Greece there were known at that time only diopters without lens. The Greeks, however, had discovered the linear transmission of the light and, basing upon this discovery, they developed the dioptra consisted of a wooden rule of about 2 meter's length and of a small board provided with a loop-hole which was fastened at the frontal side of the rule. The instrument used by Archimedes in order to calculate the diameter of the sun is described in ancient literature as well as the dioptra of Heron of Alexandria, which,above all, was intended for carrying through measurements of heights.(Fig. 1) Heron's dioptra consisted of a pedestal, where upon a gauging-board was fastened in such a way, that it could be moved by means of a helix in the horizontal and vertical direction. The gauging-board could be replaced too by a water-level which was working according to the system of the communicating tubes. Besides Heron gives us a description of such levelling-crosses, which could be adjusted in the vertical direction by means of plumbs.

In Greece there were on the one hand registers of the landed property, but on the other hand there were no such land-registers in existence as those used by the land-surveyors in Egypt or Mesopotamia. We know the Greek surveyor to have used a ruler, a rule, a triangle, a circle, a tape-measure and a dioptra in order to fulfil his task. He showed his abilities in a very manifold kind of way. For solving his geometrical problems he made himself acquainted with some formulae, which enabled him to make his calculations both in regard to segments and areas.

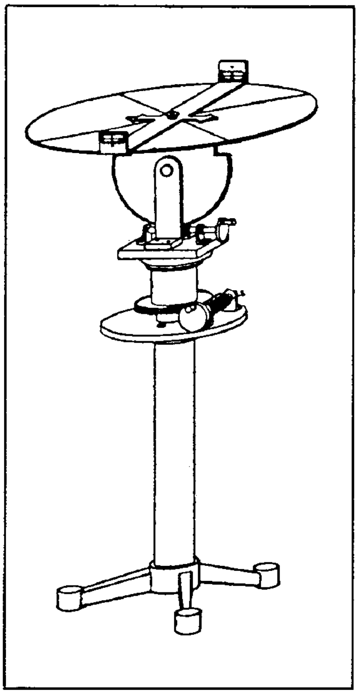


Figure 1

The Etruscans and the Romans took over these methods. These peoples regarded the allotment of land as protected by the Gods. The Roman land-surveyor, excellently trained in a public institute,decided the way of allotting the land, he caused the cultivated fields to be separated one from another by means of an intervening space and he supervised the setting of the landmarks. The land-register was not introduced before Julius Caesar's reign and it was completed by Emperor Augustus. In this land-register there were not only inscribed the land intended for cultivation,pasture and viticulture, but the number of olive-trees, family-members, domestic animals and slaves as well. In the Roman Empire there were regional and central land-registers in existence. Today we are able of making exactly visible the so-called "Centuriation" of a former Roman region with the help of aerial photographs.

In the time when the Roman Emperors were on the throne, there came into being the "Itineraria". These were itineraries intended for travellers with informations concerning the roads, the resting-houses and the distances. Notices dealing with the state of the roads were given as well. One differentiated the "itineraria picta"(maps without text)from the "Itineraria adnotata" (commented descriptions of the roads). There is only one map from that time which remained in existence to this present day, and this is a map which outlines the network of all those roads that communicated Spain with India. This map is known as the "Tabula Peutingeriana" and is preserved in Vienna. Besides this map there are only some itineraries with detailed texts which have been kept to this day.

The Arabs translated the Greek word"Dioptra" into their own language and called it "Alhidade". The latter consisted of a disk which was divided into degrees. In the centre of the disk was fastened a vertical axis, around which the dioptricrule could be turned. The "Alhidade" was the best known and most important instrument in regard to astronomical measurements.

We know that in ancient China land-registers existed too; but these were, by far, not so exact as those we have spoken of in relation with Egypt and Mesopotamia. Chinese land-survey based on several procedures of which most were very primitive. It was at least at the beginning of the Christian era that in China the land-surveyors were familiar with all those methods, needed to calculate triangular, right-angled, wedge-shaped and round areas. At that time the square and the gauging-rod were known in China too.

It was as early as about the year of 1125 B. C. that the Chinese had succeeded in making a map of their whole Empire. This map based, as it seems to us today, upon the already existing cadaster-plans and forest-maps. Under the rule of the Tschou (1000-256 B.C.) government-officials, especially responsible for the making of maps, were appointed. Maps, specially intended for the administration, were engraved in bamboo-boards, while such maps intended for travellers' use were painted on silk. After the paper had been invented and, in consequence, the costs of the production of maps were going down, the publication of maps was transferred of the Ministry of Public Labour. In 267 A. D. Pei Hiu was head of this Ministry. He wrote a scientific compendium about cartography.

The Development of Manchurian (Fig. 2) and Korean maps was large influenced by the Chinese maps. In 646 A. D. an imperial decree was published in which it was ordered that maps should be produced in Japan. At first this was carried out by producing only maps of separate parts of the Country;but later on, between the years 670-749 A.D., the first map of the whole of Japan came into being. It is said that a Korean monk by the name of Gyogi Bosatsu has caused the making of this map.

The Sibirian nomads and the Indian tribes in North-America used to take the bark of the birch in order to make their maps. This they did for the reason because this bark is very light and can be rolled together.The Indians are said to have carried along with them a great number of these rolls, when they were roaming the prairies and the forests. We are told that the Indios, who had lived in Columbia, had shown their special talent in finding out the right way with the help of modern maps, without having been able to read the markings.

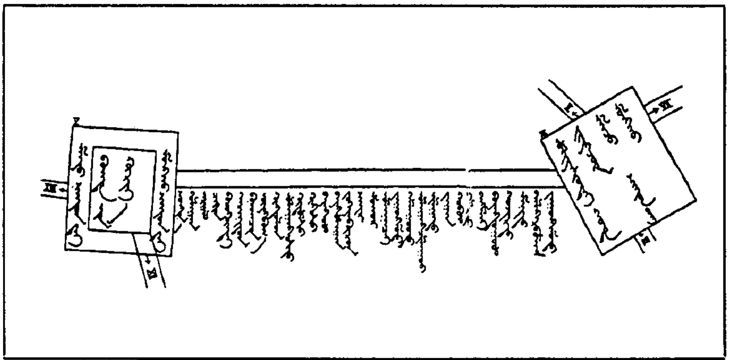


Figure 2

The Aztecs possessed a number of many-coloured and detailed maps. Montezuma presented Cortez two of these maps when the latter started for an expedition from Nexico to Honduras. The Mexican maps consisted of pita-fibres, but paper made of the bark of the fig-tree was taken too and in some cases people used tanned skins.

- Dr. E. Schmidt - Dortmund

INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY

1972 Congress Committee
Surveys and Mapping Branch
615 Booth Street
Ottawa, Canada

Canadian Surveyors, Photogrammetrists
and Friends:

The Canadian Institute of Surveying will have the honour of being host in 1972 to the XII Congress of the International Society for Photogrammetry, an event that will be a milestone in the development of surveying and photogrammetry in Canada. Because these sciences are of major importance to Canadian progress, it is believed that all members of the Institute will wish to know more about the International Society for Photogrammetry and how it relates to our surveying profession.

The term "*Photogrammetry*" is derived from three words -"*photo*", meaning "*light*"; "*gramma*" meaning "*that which is drawn*"; "*metron*" meaning "*to measure*". With the advent of photography in France about 1840, it became apparent that to determine the measurements of an object, it is not necessary to measure the object itself: one can also measure the image of the object on a photograph. By means of stereographic photographs, it is also possible to measure in three dimensions. The conversion of such measurements to real values is then a matter of suitable instruments and mathematics and the name "*Photogrammetry*" has been applied to this technique.

Very early photogrammetric surveys were undertaken in 1851 by Laussedat in France and in 1858 by Meydenbauer in Germany. The first Canadian application was by Dr. Deville in 1886, when he introduced a survey camera for mapping in mountainous areas. Similar methods were in use in the United States at about the same time. Prof. Dr. Dolezal, a university professor in Vienna, foreseeing the future importance of this survey technique, founded a photogrammetric publication and published the first "International Archives of Photogrammetry" in 1907, and set up the "International Society for Photogrammetry" (I.S.P.) in 1910. He also organized the "1st International Congress of Photogrammetry" in Vienna in 1913. The "II Congress" was held in Berlin in 1926, and meetings have since been held at four year intervals in various European capitals except for the 1952 Congress which was hosted by the American Society of Photogrammetry in Washington, D. C.

This definition that appeared in a recent number of Photogrammetric Engineering, the journal of the American Society of Photogrammetry, places photogrammetry in modern perspective -

"Photogrammetry is the art, science and technology of obtaining reliable information about physical objects and environment through processes of recording, measuring and interpreting photographic images and patterns of electromagnetic and accoustical radian energy and magnetic phenomena.

"The principal application of photogrammetry consists of the derivation and production of topographic maps and surveys based on measurements and information obtained from aerial photographs. Photogrammetry also includes the compilation from aerial photographs of various similar types of graphic and numerical data used in highway planning and construction, property surveys, stockpile volume determinations, etc. Another very important aspect is called "photographic interpretation" in which highly accurate discrete information is recognized in the fields of forestry, soils, geology, military defense, urban area analysis, archaeology, etc. Numerous special applications include X-ray technology, dentistry, laboratory deformation of construction materials, shapes of radar telescope dishes, etc. Conventional aerial photogrammetry is sometimes correlated with "remote sensing" in which various other types of data are recorded and analysis such as infrared scanning systems, and scintillometers and magnetometers for mineral exploration."

The aim of the International Society for Photogrammetry (I.S.P.) is to increase the usefulness and expand the application of the science of photogrammetry. This is accomplished by continuous study and research carried out in seven scientific technical Commissions identified as:

1. Aerial Photography and Navigation
2. Theory, Methods and Instruments of Restitution
3. Aerotriangulation
4. Mapping from photographs
5. Special Applications of Photogrammetry
6. Bibiography, Education, Terminology
7. Photo-Interpretation.

In the four years between each Congress, these Commissions study the problems pertinent to their respective fields and at the Congress they report and discuss the results. The sessions cover research, experience in application, future possibilities and information on the state of the science.

Invited papers on selected subjects, prepared by outstanding photogrammetric scientists, are discussed and prints can be obtained some months before the meeting. An extensive and varied assortment of papers are also presented by experts in the field and are available to those in attendance.

The Exhibition will present a magnificent display of the most modern surveying and photogrammetric instruments and equipment, provided by leading manufacturers from all over the world. The well known names of Wild, Kerns, Zeiss, SFOM, Space Optic, Williamson, K & E, Aga, Tellurometer, Kelsh, Galileo and many others will be well represented and technical staff will be available to explain and demonstrate.

In addition to the technical deliverations and the exhibition, the Congress offers a number of technical visits, tourist excursions, social events and, of course, a program for the ladies. Thus, visitors will have an opportunity to become better acquainted with the land and people of the host country. For Canadians, it is a chance to see their national capital region and the developments that are in progress.

Surveying in this modern day must keep abreast of the changing needs and the new techniques that are applicable in the survey field. Photogrammetry is one of the most important tools and it is dependent on basic ground survey control. Hence, the surveyor and the photogrammetrist must work together as a closely integrated team. This relationship will become more and more essential as planning for large metropolitan areas is developed across the country, where property dimensions and ownerships must be shown as an integrated package with other planning data. The surveyor looking to the future will therefore, want to become informed about how he can make the best use of photogrammetry and what instruments and methods are best suited to his requirements.

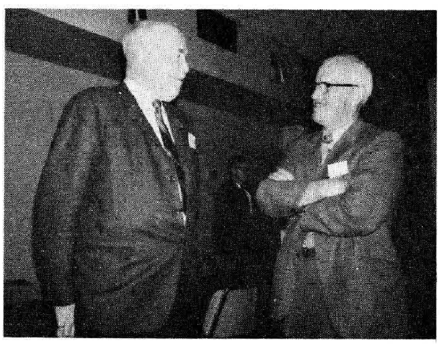
The XII Congress of the International Society for Photogrammetry in Ottawa provides an unique opportunity for Canadian surveyors to hear about the latest developments and to see the instruments in action. This is a "once-in-a-lifetime" opportunity - Canada will not have the honor to host this Congress again in several decades. Consider carefully before you pass it up!

- S. G. Gamble,
Congress Director

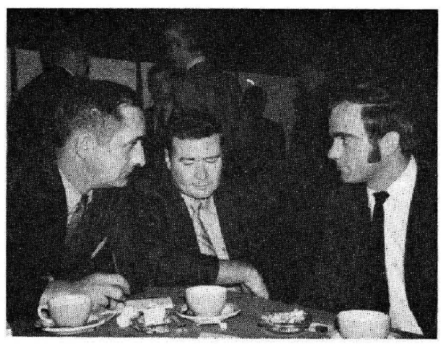
LAND SURVEYORS AND FRIENDS

1970 ANNUAL

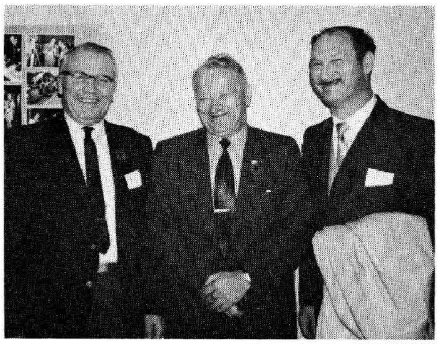
Some of the Head Table and other eaters at THE BANQUET



Murray Cossitt
Joe Archibald

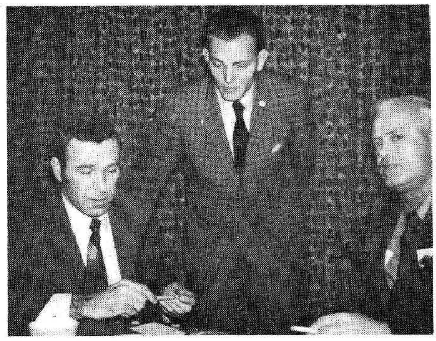


Sterling Snow
Ed Hingley
Doug Mehlman



John McElmon
Jim Sherren
Ian Murray

"The exhibits are now officially open"
Rusty March - Hans Klinkenberg - George Streb

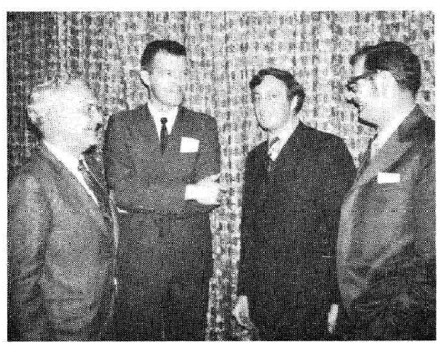


Roy Dunbrack
David Schofield
Bob Sutherby NLS

Bill Dabbs A.L.S.
Brent Schofield
Willis Roberts

Hans Klinkenberg
at Technical Session

C.I.S. "Conjunction Luncheon"
Speaker Hans Klinkenberg



Win Schofield
Walter Nason NBLS
Neil Flemming
Carl Granter NLS

- C O N T R O L   S U R V E Y S -

In 1961, the Surveys and Mapping Branch of the Department of Mines and Technical Surveys, issued a technical instruction *Specifications for Control Surveys*. These specifications were intended to set a uniform and consistent standard of accuracy for control surveys carried out by the Surveys and Mapping Branch.

Over the years, these specifications were distributed quite widely in the survey field and, though not necessarily accepted by all into whose hands they fell, their distribution served a useful purpose in setting out the standards of the Surveys and Mapping Branch and suggesting the precision of measurements and other criteria necessary to meet these standards.

Control survey specifications are presently under review by a special committee in the Surveys and Mapping Branch, Department of Energy, Mines and Resources. A new specification based on studies of results obtained using modern survey equipment and computer adjustment and analysis will be produced. It would seem that the new specification should lead to a classification as to order of accuracy based upon the results obtained from an analysis of the completed survey. Preliminary specifications may be produced in about one year.

In view of the wide use of the specifications, the special committee of the Surveys and Mapping Branch is interested in the views of all who may come into contact with them.

To enable interested surveyors to put forth suggestions for consideration by the committee, a reprint of the 1961 specifications follows. While it is recognized that no single set of specifications will satisfy the requirements of all, it is the belief of the committee on Control Surveys of the CIS that much more acceptable specifications will result if they reflect the opinion and requirements of as many surveyors as possible. Survey specifications and standards form the basis for consistent thought, action and communication in the field. A myriad of specifications and standards in use results in confusion and misunderstanding in attempts at communication in the control survey field.

Your comments addressed to the Chairman, Control Surveys Committee, The Canadian Institute of Surveying, 157 McLeod Street, Ottawa 4, will be given to the Surveys and Mapping Committee for consideration.

SPECIFICATIONS FOR CONTROL SURVEYS

Surveys and Mapping Branch

Department of Mines and Technical Surveys

Ottawa, 1961

FOREWARD

These specifications are the result of a joint study by the field survey division - Canadian Hydrographic Service, Geodetic Surveys, Legal Surveys and Aeronautical Charts, and Topographical Survey - of the Surveys and Mapping Branch, Department of Mines and Technical Surveys, and the Army Survey Establishment, Department of National Defence. They are intended to serve the following three purposes: to set up standards of accuracy for control surveys that will be uniform and consistent throughout the Surveys and Mapping Branch; to encourage and assist field officers in attaining accuracies consistent with the results obtainable using available modern survey instruments; to facilitate classification and handling of the wealth of survey information being accumulated by the surveying agencies of the Federal Government.

To arrive at these specifications, two committees, one on horizontal control and one on vertical control, carried out studies of the accuracies that were desirable and ways of attaining them. The results of the study by the committee on horizontal control were published previously, and that publication, with a minimum number of changes, has been incorporated in this paper. Also included are the results of the study by the committee on vertical control.

The following members of the staff of the Surveys and Mapping Branch and the Directorate of Military Surveys served on one or both of the Committees:

J. E. Lilly, Dominion Geodesist (Chairman, both committees)
W. V. Blackie, Legal Surveys and Aeronautical Charts
H. N. Spence and C. E. Hoganson, Topographical Survey
S. R. Titus, P. Brunavs and C. M. Cross, Canadian Hydrographic Service
Lt.-Col. L. M. Sebert and Capt. H. C. Honeyman, Directorate of Military Surveys.

In future, all control surveys undertaken by this Branch will be governed by these specifications. Any such surveys that do not meet the standard for fourth order in all respects will be interpreted according to the specifications.

- S. G. Gamble,
Director, Surveys and Mapping Branch

HORIZONTAL CONTROL

RELATION BETWEEN ACCURACY AND ORDER OF CONTROL

Horizontal control shall be classified as first, second, third, or fourth order without regard to the method of survey. Special instructions may be issued for work that does not fit into the standard classification. Any order of control may apply to triangulation, trilateration, or traverse,or to any combination of these,implying in all cases the same order of accuracy.

Each order of control implies a certain standard of accuracy, as tabulated below (Table I). The accuracy is expressed as the maximum anticipated error in the computed length or azimuth of the line joining any two points of the survey (after adjustment).

Table I

Maximum Anticipated Errors in Adjusted Horizontal Control

	Length	Azimuth
First order		
Distance greater than 400 miles	2 $\sqrt{M}$ feet*	4"
Distance less than 400 miles	1 in 50,000	4"
Second order	1 in 20,000	10"
Third order	1 in 10,000	20"
Fourth order	1 in 5,000	40"

* M is the distance in miles.

The term "maximum anticipated error" is used to indicate the greatest error that may reasonably be expected, taking account of systematic as well as accidental errors. While this error cannot be accurately computed, it is believed that it may be more meaningful than a previously calculated probable or standard error, in the computation of which some sources of error may be neglected.

ACCURACY REQUIREMENTS

Table II shows the detailed requirements for attaining the necessary accuracy to qualify the work for the various orders of control. These detailed requirements should not be taken too rigidly but should be regarded as examples of the class of work necessary to attain the specific accuracy. In some cases, one requirement may be relaxed if another is tightened. For example, the length of a circuit may be increased if the accuracy of individual measurements is increased correspondingly.

No requirements are given for combined operations,where both lengths and angles are measured, such as, for example, the establishment of first-order control by a chain of triangles with all sides and angles measured. Any such operation must be regarded as a special survey, calling for its own separate specifications.

The specifications call for length, azimuth and closure controls. In general, work lacking these controls shall be classified at a lower order than would otherwise be indicated, but such downgrading is not necessary for short spur nets of triangulation or trilateration. Traverses shall be provided with closure control whenever possible and always with azimuth control.

Following are some explanations to assist in using Table II.

A. *Strength of figure*

In triangulation the strength of figure is defined by the quantities R_1 and R_2, which are explained in Appendix I. In the table, the figures for first and second order indicate the maximum allowable values, respectively, for R_1 between length controls, R_1 for a single figure and R_2 for a single figure. Desirable limits are about two-thirds the maximum figures shown. The existence of these quantities can follow only on the

Table II

Horizontal Control Specifications

	1st order*	2nd order	3rd order	4th order
Triangulation				
A Strength of figure	110;25;80	130;40;120	20°;15	20°;15
B Length of circuit	2000	1000	500	100
C Accuracy, lengths	1:300000	1:150000	1:50000	1:20000
D Accuracy, directions	0".2;16;2".5	1";8;5"	1";3;6"	10";2;20"
E Triangle closure	1";3"	3";5"	5";12"	10";25"
F Side equation test	0".7	1".5		
G Control azimuths	10;0".3	12;0".5	15:3"	20;6"
H Closure, azimuth**	$2\sqrt{N}$	$3\sqrt{N}$	3N or $10\sqrt{N}$	8N or $30\sqrt{N}$
I Closure, length	1:25000	1:0000	1:5000	1:2500
J Closure, position	1:25000	1:1000	1:5000	1:2500
Traverse				
B Length of circuit	200	200	200	25
C Accuracy, lengths	1:100000	1:50000	1:15000	1:5000
D Accuracy, directions	0".2;16;2".5	1";8;5"	1";3;6"	10";1;20"
G Control Azimuths	5;0".3	10;0".3	15;3"	20;6"
H Closure, azimuth**	$2\sqrt{N}$	$2\sqrt{N}$	3N or $10\sqrt{N}$	8N or $30\sqrt{N}$
J Closure, position	1:50000	1:20000	1:5000	1:2500
Trilateration				
A Strength of figure	4;20°	3 1/2;20°	3;20°	3;20°
B Length of circuit	2000	1000	500	100
C Accuracy, lengths	1:100000	1:50000	1:25000	1:10000
G Control azimuths	10;0".3	12;0".5	15;3"	20;6"
H Closure, azimuth**	$2\sqrt{N}$	$3\sqrt{N}$	3N or $10\sqrt{N}$	8N or $30\sqrt{N}$
J Closure, position	1:25000	1:10000	1:5000	1:2500

* In first-order work all measurements, whether of lengths or angles, should be spread over at least two days or nights.

** N is the number of courses, by the most direct route, between azimuth controls. The closure is expressed in seconds of arc. In third- and fourth-order work, the smaller of the two alternative limits should be adopted.

assumption that lengths may be computed through the triangulation network by two distinct chains of triangles. This is considered fundamental. For third- and fourth- order triangulation the requirements for R_1 and R_2 are replaced by the requirement that no angle of the best chain of triangles shall be smaller than the specified quantity, and that the distance between length controls shall not exceed the number of figures quoted. The word "figure" is here used to mean a braced quadrilateral or a centre-point figure.

In trilateration the first figure represents the minimum number of lines for each point to be fixed, and the second shows the minimum size for the angles of the best chain of triangles connecting all points of the net. It must be emphasized, however, that present knowledge of trilateration is very limited, and further experience may well indicate the desirability of a change in these requirements.

B. *Length of circuit*

The length of a closed circuit in triangulation, traverse, or trilateration should not exceed the number of miles shown. These figures are based on past experience and it is quite possible that more experience will lead to some change in the requirement. The term "length of circuit" may be taken to mean the length of a closed circuit, or the distance between junction points with adjusted control of the same or a higher order.

C. *Accuracy, lengths*

The maximum anticipated error in measured lengths,after reduction to sea-level, should not exceed the quantities shown. In triangulation this limit applies to measured base lines, and in traverse and trilateration it applies to all the lines of the survey.

D. *Accuracy, directions*

The table shows, first, the description of the recommended instrument in terms of the smallest reading of the horizontal circle; second, the number of circle positions that should be used on each direction; and, third, the permissible deviation of any accepted reading from the mean. (A circle position implies a pair of pointings and readings,clamp right and clamp left. Such readings should be taken at different orientations of the instrument, so that different parts of the horizontal circle are used.)

E. *Triangle closure*

Two figures are given in each case, the first being the allowable limit for the average triangle closure,and the second a limit for any individual closure, which should seldom be exceeded.

F. *Side equation test*

The test is explained in Appendix II. The permissible average correction, as indicated by the test, is shown in the table. For third- and fourth-order triangulation, this test may be omitted.

G. *Control azimuths*

The first figures given show the allowable number of courses along the most direct route between azimuth control points. Such control points may be previously adjusted control of the same order as the work being carried out, or higher, or it may consist of Laplace or astronomic azimuths. The second figure in each order is the allowable probable error of astronomic azimuth. In the case of first- and second-order control,an astronomic azimuth must be combined with astronomic longitude in a Laplace equation. For these classes of control the anticipated error of astronomic longitude should not exceed 0.03 seconds of time.

H. *Closure, azimuth*

The figures given in the table indicate the permissible discrepancy between azimuth carried through figurally adjusted triangulation, through traverse, or through figurally adjusted trilateration, and the control azimuth.

I. *Closure, length*

This test applies only to triangulation,and the table indicates the permissible discrepancy between length computed through figurally adjusted triangulation and the control length. This control length may be a measured base line or a line of previously adjusted horizontal control of the same or higher order.

J. *Closure, position*

The table indicates the permissible closing error for triangulation or trilateration after adjustment for figural, length, and azimuth controls, or for traverse after the application of aximuth adjustments.

MONUMENTATION

It is planned to issue specifications for monumentation, referencing and bench marks at a later date. In the meantime, officers are reminded that even unclassified surveys will be monumented when much of the work meets acceptable standards and it is likely that the survey will be used extensively.

VERTICAL CONTROL

DEFINITION

For our present purpose we define the different orders of vertical control in terms of maximum error expected in the adjusted difference of orthometric elevation between any two bench marks of the survey. The allowable limits, expressed in feet, are as follows:

first order - $0.035 \sqrt{M}$

second order - $0.07 \sqrt{M}$

third order - $0.20 \sqrt{M}$

fourth order - $1.0 \sqrt{M}$

In these expressions, M represents the straight-line distance between the bench marks concerned, expressed in miles.

The term "maximum anticipated error" is used to indicate the greater error that may reasonably be expected, taking account of all systematic as well as accidental errors. While this error cannot be accurately computed, it is believed that it may be more meaningful than a precisely calculated probable or standard error, in the computation cf which some sources of error may be neglected.

INSTRUMENTS

In order to attain the standards of accuracy set out above, the instruments used must be of good quality, and the field work must conform to certain specifications. The following is adapted from "Advice Concerning the Execution of Levelling of High Precision", published in *Bulletin géodésique*, No. 18, December 1950, Page 490:

The magnification of the telescope should be at least 25 diameters.

The radius of curvature of the level vial should be between 40 and 100 metres (from 4 to 10 seconds per 2-millimetre division).

The length of the level bubble should never become less than 25 millimetres.

The smallest graduation of the rod should not exceed one centimetre.

The rod graduations should be marked on invar strips.

The rod should be furnished with a spherical level of radius of curvature between 0.2 and 0.5 metre.

First-order levelling is approximately equivalent to Levelling of High Precision, and the same standard of instruments should be employed. Results of lower accuracy could be obtained by the use of instruments of lower standard, but good instruments should always be used. Fourth-order results may sometimes be obtained by the measurement of vertical angles, involving the use of a transit or theodolite.

SPECIFICATIONS

Recommended specifications for field work are given in the following paragraphs. These specifications should not be taken too rigidly, but should be regarded as examples of the class of work necessary to attain the specified accuracy.

Length of Circuit

The length of circuit should not exceed 500 miles for first- or second-order levelling, 750 miles for third-order, or 1000 miles for fourth-order. The term length of circuit may be taken to mean: the length of a closed circuit, the distance between junction points with adjusted control of the same or a higher order, or the distance between a junction point with such adjusted control and a satisfactory elevation based directly on tidal observations. If it is anticipated that a line of levels will terminate at sea level at a locality where no tidal bench marks exist, the Tides and Water Levels section of the Hydrographic Service should be consulted regarding the necessary program of tidal observations at that locality to provide a satisfactory value of mean sea level. In general, observations spread over at least 24 hours are required.

In order to maintain the specified accuracy it is also necessary to avoid long narrow circuits. The distance between any two bench marks, measured along the levelling route, should not exceed 5 times the straight-line distance.

Procedure

First order - On first-order work,the difference of elevation between successive bench marks must be determined by two independent levellings in opposite directions,preferably by two different levellers (these two levellings are usually referred to as forward and back levellings). Only under exceptional circumstances may forward and back levelling be done by the same man. Furthermore, three wires in the instrument should always be read on the rod, the mean of the three being the accepted reading.

Second order - On second-order work, levelling may be carried out in both directions (forward and back) with only one wire read, or a single levelling may be accepted, with all three wires read. If the levelling does not form part of a closed circuit, or if the length of circuit exceeds 25 miles, double levelling (forward and back) must be employed.

Third and fourth order - On third- and fourth-order work, only one wire need be read. It is preferable that the difference of elevation between successive bench marks be determined twice, by two independent levellings. If the levelling does not form part of a closed circuit, or if the length of circuit exceeds 25 miles for third-order work, or 50 miles for fourth-order work, some form of double levelling must be employed. Such double levelling may consist of: two independent levellings,in opposite directions or in the same direction; levelling with one instrument and two sets of turning points; or simultaneous levellings with two instruments and one set of turning points. In every case,the rod readings must be recorded as two separate levellings,and the two differences of elevation between successive bench marks compared.If two series of turning points are used with one instrument, two rods graduated in different units should be employed.

Fourth-order levelling may sometimes be carried out by measurement of vertical angles, in conjunction with traverses of short lines (measured by tape or, under favourable circumstances, by stadia), or in conjunction with tellurometer traverses or triangulation.For short lines, using tape or stadia, the same criteria apply regarding double levelling as stated in the last paragraph. If double levelling is required, it may be performed by the measurement of vertical angles at both ends of each line. For vertical angles on long lines, vertical angles should be observed at both ends of every line, and it is preferable that the two measurements on any line should be simultaneous. It must constantly be kept in mind that, because of variations in vertical refraction, vertical angles on long lines cannot be depended on to give results of fourth-order accuracy.

Discrepancies

Discrepancies between forward and back levelling, or between any two lines of a double levelling,should never exceed the following limits between successive bench marks:

first order - $0.017\sqrt{M}$

second order - $0.035\sqrt{M}$

third order - $0.10\sqrt{M}$

fourth order - $0.5\sqrt{M}$

In all cases the limiting errors are expressed in feet,and M is the distance in miles between bench marks (measured along the levelling route. This test is not applicable to trigonometric levelling (the measurement of vertical angles accompanying triangulation).

Circuit Closures

The circuit closures should seldom exceed the limits given in the preceding paragraph for discrepancies, taking M as the length of circuit in miles (measured along the levelling route), and they should *never* exceed these limits by more than 20 per cent.

APPENDIX I

Explanation of the Quantities R_1 and R_2

In any survey figure, the quantity R is equal to $\frac{D-C}{D} \sum(\delta_A^2 + \delta_A \delta_B + \delta_B^2)$ where A is the angle opposite the required side in a triangle, B is the angle opposite the known side, is the sixth-place difference in logarithmic sine corresponding to one

	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50	55	60	65	70	75	80	85	90°
10°	428	359																					
12	359	295	253																				
14	315	253	214	187																			
16	284	225	187	162	143																		
18	262	204	168	143	126	113																	
20	245	189	153	130	113	100	91																
22	232	177	142	119	103	91	81	74															
24	221	167	134	111	95	83	74	67	61														
26	213	160	125	104	89	77	68	61	56	51													
28	206	153	120	99	83	72	63	57	51	47	43												
30	199	148	115	94	79	68	59	53	48	43	40	33											
35	188	137	106	85	71	60	52	46	41	37	33	27	23										
40	179	129	99	79	65	54	47	41	36	32	29	23	19	16									
45	172	124	93	74	60	50	43	37	32	28	25	20	16	13	11								
50	167	119	89	70	57	47	39	34	29	26	23	18	14	11	9	8							
55	162	115	86	67	54	44	37	32	27	24	21	16	12	10	8	7	5						
60	159	112	83	64	51	42	35	30	25	22	19	14	11	9	7	5	4	4					
65	155	109	80	62	49	40	33	28	24	21	18	13	10	7	6	5	4	3	2				
70	152	106	78	60	48	38	32	27	23	19	17	12	9	7	5	4	3	2	2	1			
75	150	104	76	58	46	37	30	25	21	18	16	11	8	6	4	3	2	2	1	1	1		
80	147	102	74	57	45	36	29	24	20	17	15	10	7	5	4	3	2	1	1	1	0	0	
85	145	100	73	55	43	34	28	23	19	16	14	10	7	5	3	2	2	1	1	0	0	0	0
90	143	98	71	54	42	33	27	22	19	16	13	9	6	5	3	2	1	1	1	0	0	0	0
95	140	96	70	53	41	32	26	22	18	15	13	9	6	4	3	2	1	1	0	0	0	0	
100	138	95	68	51	40	31	25	21	17	14	12	8	6	4	3	2	1	1	0	0	0		
105	136	93	67	50	39	30	25	20	17	14	12	8	5	4	2	2	1	1	0	0			
110	134	91	65	49	38	30	24	19	16	13	11	7	5	3	2	2	1	1	1				
115	132	89	64	48	37	29	23	19	15	13	11	7	5	3	2	2	1	1					
120	129	88	62	46	36	28	22	18	15	12	10	7	5	3	2	2	1						
125	127	86	61	45	35	27	22	18	14	12	10	7	5	4	3	2							
130	125	84	59	44	34	26	21	17	14	12	10	7	5	4	3								
135	122	82	58	43	33	26	21	17	14	12	10	7	5	4									
140	119	80	56	42	32	25	20	17	14	12	10	8	6										
145	116	77	55	41	32	25	21	17	15	13	11	9											
150	112	75	54	40	32	26	21	18	16	15	13												
152	111	75	53	40	32	26	22	19	17	16													
154	110	74	53	41	33	27	23	21	19														
156	108	74	54	42	34	28	25	22															
158	107	74	54	43	35	30	27																
160	107	74	56	45	38	33																	
162	107	76	59	48	42																		
164	109	79	63	54																			
166	113	86	71																				
168	122	98																					
170°	148																						

second variation in angle, D is the number of observed directions,and C is the number of geometric conditions determining the strength of the figure. D is found by summing all the directions observed for the figure and subtracting the two belonging to the starting line, which is considered fixed. C is found from the formula:

$$C = 2L - L^1 - 3S + S_u + 4,$$

where L = the total number of lines,

L^1 = the number of lines observed one way,

S = the total number of stations,

S_u = the number of unoccupied stations.

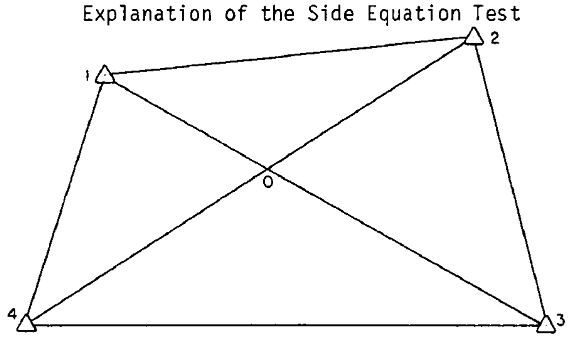
R_1 and R_2 are the quantities calculated as above for the best and the second-best chain of triangles through the figure, respectively.

For convenience, the table on page 16 gives values of the quantity $(\delta^2_A + \delta_A \delta_B + \delta^2_B)$ for various pairs of angles. The values across the top are to be used for the smaller of the two distance angles and the values in the left-hand column for the larger angle.

For a fuller explanation of these quantities, the field officer is referred to Publication No. 66 of the Geodetic Survey, *Manual of Reconnaissance for Triangulation.*

APPENDIX II

Explanation of the Side Equation Test



In the quadrilateral above the following equation holds for the pole at point 1:

$$\frac{\sin 3\ (2\text{-}1)}{\sin 2\ (1\text{-}3)} \cdot \frac{\sin 4\ (3\text{-}1)}{\sin 3\ (1\text{-}4)} \cdot \frac{\sin 2\ (1\text{-}4)}{\sin 4\ (2\text{-}1)} = 1$$

$$\text{or } \log \sin 3\ (2\text{-}1) + \log \sin 4\ (3\text{-}1) + \log \sin 2\ (1\text{-}4)$$
$$- \log \sin 2\ (1\text{-}3) - \log \sin 3\ (1\text{-}4) - \log \sin 4\ (2\text{-}1) = 0$$

The notation 3 (2-1) means the angle formed by subtracting the direction from 3 to 1 from the direction from 3 to 2,and similarly with the other elements of the formula.

Since this equation can only be true if the angles form a closed figure, and since the error in any particular angle is not likely to be compensated by errors in the other angles, the algebraic sum of the log sines is almost never equal to zero. The average correction to angles is found by dividing the difference from zero in the sum of the log sines by the sum of the differences for one second.

In a quadrilateral any one of the four corners or the intersection of the diagonals may be used as a pole. For the centre-point figure the centre point is used as the pole. For the centre-point triangle, any one of the corners or the centre point may be used.

The side equation test is explained more fully in Publication No. 5 of the Geodetic Survey, *Field Instructions for Geodetic Triangulation.*

- REPRINTED FROM THE CANADIAN SURVEYOR

- NOTICE TO THE ASSOCIATION -

from Richard L. Weldon
Weldon and Misener, Barristers and Solicitors
Dartmouth, Nova Scotia

I have recently had a case in the Supreme Court, 1969, Supreme Court No. 13954, Marwood & Charter Credit in which the matter of necessity for survey and title search has been brought up.

I have sent you page 5 of that Decision which may be of interest to those of you in the Survey Profession.

.......The conduct of the conveyancing did not amount to a fraud which could be attributed to the respondent, although this case certainly points out the fact that in a transaction between vendor and purchaser it is unwise to have the same lawyer representing both parties. It is frequently done in the case of purchaser and mortgagee because very often it is the solicitor for the purchaser who places the mortgage and the mortgagee accepts that solicitor's opinion as to the title. Certainly, this case makes it clear that a certificate of title under circumstances such as those with which the parties were met is completely useless in the absence of a survey. It may well be that purchasers do not always wish to go to the expense of making a survey, but as a matter of practice it is my view that solicitors should always advise them in advance on this matter and make it clear that the certificate of title which will be issued is at all times subject to a survey. If this is done ahead of time and a purchaser still insists on going forward without retaining a surveyor, then the responsibilities are obvious. In the present case, the evidence is that the purchasers did not even see the report on the title until the transaction had been completed.

Nevertheless, I do not think that the purchasers under the authorities can put themselves in a position of claiming against a vendor on the basis of fraud.

OFFICE RULES IN 1852

1. Godliness, cleanliness and punctuality are necessities of a good business.

2. This firm has reduced the hours of work, and the surveying staff will now only have to be present between the hours of 7 a.m. and 6 p.m. on week-days.

3. Daily prayers will be held each morning in the Main Office. The surveying staff will be present.

4. Clothing must be of a sober nature. The surveying staff will not disport themselves in raiment of bright colours, nor will they wear hose unless in good repair.

5. Overshoes and top-coats may not be worn in the office, but neck scarves and headwear may be worn in inclement weather.

6. A stove is provided for the benefit of the surveying staff. Coal and wood must be kept in the locker. It is recommended that each member of the surveying staff bring four pounds of coal each day, during cold weather.

7. No member of the surveying staff may leave the room without permission from Mr. MacDonald. The calls of nature are permitted, and surveying staff may use the garden below the second gate. This area must be kept in good order.

8. No talking is allowed during business hours.

9. The carving of tobacco, wines or spirits is a human weakness and, as such, is forbidden to all members of the surveying staff.

10. Now that the hours of business have been drastically reduced the partaking of food is allowed between 11:30 a.m. and noon, but work will not, on any account, cease.

11. Members of the surveying staff will provide their own pens. A new sharpener is available, on application to Mr. MacDonald.

12. Mr. MacDonald will nominate a senior clerk to be responsible for the cleanliness of the Main Office and the Private Office, and all boys and juniors will report to him 40 minutes before prayers and will remain after closing hours for similar work. Brushes, brooms scrubbers and soap are provided by the owners.

13. The new increased weekly wages are as hereunder detailed:

Junior Boys (to 11 years)	.15
Boys (to 14 years)	.25
Junior Surveyors	1.05
Senior Surveyors (after 15 years with the owners)	2.50

The owners recognize the generosity of the new Labour Laws but expect a great rise in output of work to compensate for these near Utopian conditions.

PERSONALITIES IN THE NEWS

H. B. Robertson, Director of Surveys for the Department of Lands and Forests recently attended a meeting in Regina of the Federal-Provincial Survey Officers.

In the south western district, Russell Melanson has joined Errol Hebb's survey firm after spending many years with Mersey Paper Company.

While in the Valley, Brian Peel has opened an office for the practice of land surveying in the Kings County area.

Angus Hamilton has been appointed head of the Surveying Engineering Department at the University of New Brunswick. Angus is a Past President of C.I.S., and spent a number of years with the Department of Energy, Mines and Resources, engaged in many aspects of surveying. Surveyors across Canada will wish this popular surveyor well in this position.

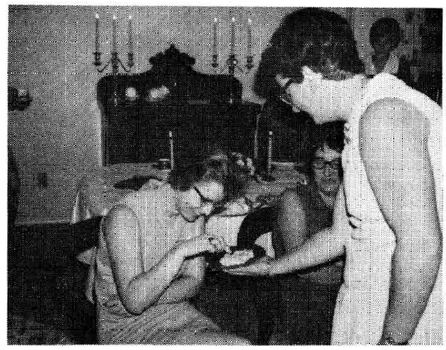
Ralph White has returned to the Department of Transport at Moncton, after having a leave of absence which he spent with the Nova Scotia Department of Lands and Forests.

The Ontario Law Reform Commission has recommended that the Province of Ontario put into effect, as soon as possible, a complete coordinate surveying, mapping and computerized land titles system. The system recommended for Ontario is practically the same as the present Atlantic Provinces Surveying and Mapping Program.

THE PRESIDENT'S WIFE'S TEA - 1970

Mrs. George Streb - Hostess

Mrs. George (Helen) Streb
Mrs. Rusty (Marg) March
Mrs. Walter (Phyll) Servant
Mrs. H. B. (Jean) Robertson
Mrs. Hans (Ann Marie) Klinkenberg



Thank you very much!

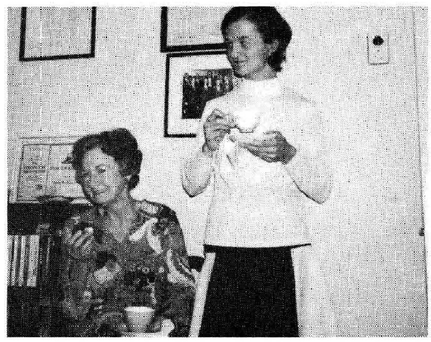
Mrs. Brian Peel
Mrs. W. S. Crooker, Jr.

Mrs. David Schofield
Mrs. Win Schofield

Mrs. Burney (Lyn) Smith
Mrs. Jim (Dot) Chisholm
Mrs. Brent Schofield
Mrs. Colin (Marilyn) Clark

Mrs. Ed (Betty) Rice
Mrs. Robert (Gerry) Donovan

Mrs. Murdock Hattie
Mrs. Ivan (Betty) Macdonald
Mrs. Everett Green



Mrs. George (Helen) Bates
Mrs. Bill Dabbs

Mrs. Colin (Marilyn) Clark
Mrs. Ronald Chisholm
Mrs. Otto Rosinski

Mrs. Errol Hebb
Mrs. George Swanberg
Mrs. Neiff (Susie) Joseph

- CONTROL SURVEYS INFORMATION CORNER -

The Nova Scotia, Surveys Directorate of the Department of Lands and Forests, has embarked on a program of establishing an interconnected network of permanent points throughout Nova Scotia.

Each point is a reinforced concrete pillar six feet long buried in the ground. The pillar has a metal marker fixed in the top and inscribed with an identifying number. The number provides a basis for computer storage of the values established on the marker.

Three dimensional plane rectangular coordinate values are determined from field measurements. These measurements are made from each marker with a one second reading theodolite, an electronic distance measuring device and a precise automatic level.

The network is directly related by survey ties to the National Primary framework established by the Geodetic Surveys of Canada. This relationship provides the basic datum for all coordinated control across Canada.

Coordinated points, at a density sufficient to satisfy the users, provide adequate permanent information to integrate all types of surveys- legal, engineering, topographical, as built, etc.

In an integrated survey area all coordinated control markers have a relationship with each other regardless of the distance apart. This feature gives the assurance that all planning in a large area will be consistent and accurate.

Coordinated points also provide the control that is necessary to make accurate maps at any scale.

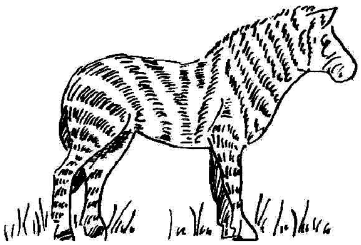
As the 1971 survey season comes to a close Control Surveys Section of the above directorate have established and supervised the establishment of 5687 Control Survey Monuments.

Data for monuments established at the user's density is available for the areas within the listed counties:-

Victoria	- Baddeck
Cape Breton	- rural and urban
Richmond	- rural and urban
Inverness	- S. E. portion
Guysborough	- Sherbrooke, Drumhead, Lochaber
Antigonish	- Town of Antigonish
Pictou	- rural and urban
Colchester	- Truro, Route 11 and Tatamagouche
Cumberland	- Amherst, Springhill
Halifax	- Cities of Dartmouth and Halifax, Sackville, Eastern Passage and along Eastern Shore to Head of Chezzetcook
Queens	- Liverpool
Annapolis	- Middleton to Bridgetown.

For this data send inquiries to:

Control Surveys Section
Surveys Division
Department of Lands and Forests
Dennis Building
1740 Granville Street
Halifax, Nova Scotia - or Phone 424-3234



WHO OWNS THE ZEBRA ?

Many people enjoy a brain twisting riddle and the Nova Scotian Surveyor found this one to be a real challenge requiring a high degree of ability in deduction and analysis as well as a generous sprinkling of persistence.

The two questions that can be answered after all these questions have been dealt with are: Who drinks water? and, who owns the zebra?

(1) There are five houses, each of a different colour and inhabited by men of different nationalities, with different pets, drinks and cigarettes.

(2) The Englishman lives in the red house.

(3) The Spaniard owns the dog.

(4) Coffee is drunk in the green house.

(5) The Ukranian drinks tea.

(6) The green house is immediately to the right (your right) of the ivory house.

(7) The Old Gold smoker owns snails.

(8) Kools are smoked in the yellow house.

(9) Milk is drunk in the middle house.

(10) The Norwegian lives in the first house on the left.

(11) The man who smokes Chesterfields lives in the house next to the man with the fox.

(12) Kools are smoked in the house next to the house where the horse is kept.

(13) The Lucky Strike smoker drinks orange juice.

(14) The Japanese smokes Parliaments.

(15) The Norwegian lives next to the blue house.

O.K. No cheating, now! Who drinks water? And, who owns the Zebra? When you develop your answers, send to the Editor, or if you are chicken wait for next issue.

George T. Bates, Nova Scotia Land Surveyor No. 106 of 1271 Edward Street, Halifax was recently honoured by the Massachusetts Association of Land Surveyors and Civil Engineers. George was made an Honorary Life Member of the Association at their 17th Annual Meeting held at North Falmouth, Cape Cod, Mass., on October 2, 1971, at their Annual Awards Luncheon.

The above photo shows George receiving the Membership Plaque from Thomas E. Kelley, President, of the Cape Cod Association of Professional Engineers and Land Surveyors at the Sea Crest Hotel, North Falmouth.

We, in the Association of Nova Scotia Land Surveyors, should feel justly proud that one of our members has been selected for this worthy honour. George is Past President of our Association and has served faithfully on Council for many years. Prior to serving as Association President he was local Chairman for the C.I.S. He is known throughout the Maritime Provinces as well as Upper Canada and New England as Mr. Nova Scotia. Decked out in kilt and sundry apparel, he has attended countless meetings and conventions acting as a Good Will Ambassador for our Province wherever he goes.

George is noted for his excellent map productions and penmanship over a wide area of the continent. Many of his Order of Good Times Scrolls have found their homes in foreign countries.

The Presentation was witnessed by our President, L. R. Feetham, and Secretary-Treasurer, E. P. Rice, together with their wives.

It is reported to this Editor that for the first time in his life, George was left speechless. The presentation was so well planned that it was a complete surprise to him. - CONGRATULATIONS GEORGE -

Topographical mapping has been recently completed by the Mapping Section of the Department of Lands and Forests of the following areas:

South of Tatamagouche Aerial Photography - June 1970	1" = 400'
Antigonish - South of Town Aerial Photography - June 1969	1" = 400'
Waverley, Kinsac, Fall River Aerial Photography - June 1969	1" = 400'
Halifax, Bedford, Lower Sackville, Spryfield and Herring Cove Aerial Photography - May 1969	1" = 100'
Preston Aerial Photography - October 1969	1" = 200'
City of Dartmouth Original Aerial Photography - June 1967 Revised Aerial Photography MacKay Bridge Area - May 1970	1" = 200'
Area Canso (Port Hawkesbury) Aerial Photography - May 1968	1" = 100'
Town of Guysborough Aerial Photography - May 1968	1" = 200'
Town of Port Hawkesbury Aerial Photography - June 1967	1" = 40'

Sydney, North Sydney and Glace Bay, Mapping not available until mid-summer 1972.

Mapping of the complete Town of Antigonish, Liverpool and Sherbrooke, not available until Fall 1972.

Survey personnel are at present obtaining control for the mapping of Sable Island at a scale of 1" = 400'.

Information and Maps available from:

Mapping Section
Surveys Division
Department of Lands and Forests
Dennis Building
1740 Granville Street
Halifax, Nova Scotia - Phone 424-3939

- RECORD KEEPING FORMS FOR LAND SURVEYORS -

In today's business world no one can operate profitably without adequate records and systems being maintained. With this thought in mind these forms are being presented as a guide to the requirements for a successful accounting system for Land Surveying firms. One cannot possibly anticipate all accounting problems which might arise, since each individual firm will have unique problems to solve, so from these forms the individual firm may deviate according to its own needs.

Each firm should have a system of recording costs incurred by individual jobs; development of a system would be as follows:

Once a surveying proposal has been accepted it is given a work order, numbered and filled out by listing the client's requirements, required completion date, etc.

The next item would be the time sheet which is a basic source of cost information. It provides written information on hours, salary, kind of work done, work order number, name and a breakdown of any particular work order into the various services that are rendered. Time sheets should be prepared and signed by the employees and approved by the surveyor in charge and turned over to the bookkeeper. The time sheets should also provide room for additional information such as out-of-pocket expenses for meals, hotels while on out-of-town engagements, telephone, travel, or expenses to be reimbursed by the client. The information on the time sheets is posted to a cost record card, which is a record of costs incurred on each individual job. In addition to the information obtained from the time sheets, it is also necessary to post any other direct costs incurred.

The accompanying exhibits are samples illustrating what should be contained on a time and cost card. It is important that records be properly maintained and controlled in order to serve management. The following steps should be taken in order to do this:

1) Employees should be instructed on how to maintain complete and accurate time sheets.

2) All hours and expenses should be posted from the time sheets to the cost record cards by the bookkeeper.

3) The bookkeeper should post all other direct costs that are incurred in addition to those on time sheets.

4) The cost record cards should be broken down by office functions and by field functions. The office functions would include such items as: boundaries, plans and negotiations. The field functions would include: surveys, stakes, etc. This detail is invaluable when a client requests a complete analysis of the job costs.

W O R K   O R D E R

Date ______________________

Job #______________________

Ordered by ______________________ Invoice to ______________________

______________________ ______________________

Address ______________________ ______________________

______________________ ______________________

______________________ ______________________

Phone ______________________ ______________________

Location of site for survey ______________________________________

____

____

____

Type of survey required ______________________________________

____

EMPLOYEE WEEKLY REPORT

NAME:

WEEK ENDING:

	JOB NUMBER	F		EXP.	MILES	HOURS	EXTRA	
MON.								
TUES.								
WED.								
THUR.								
FRI.								
SAT.								
SUN.								

SUGGESTED FUNCTION CHART

OFFICE	FIELD
1. Perusal of documentary evidence	51. Boundary Survey
2. Research	52. Topographical Survey
3. Plot of field notes	53. Site Location Survey
4. Preliminary Plan	54. Route Survey
5. Tentative Plan	55. Hydrographic Survey
6. Final Plan	56. Road ℄ Profile
7. Site Plan	57. Road Cross-sections
8. Plot Plan (Mortg., etc.)	58. Road ℄ Staking
9. Profile Plan	59. Road Boundary Staking
10. Cross-section Plan	60. Setting Grade Stakes (Road)
11. Street Plans (Highway and Route)	61. Setting Curb and Gutter Stakes
12. Sewer and Water (Const. Plans)	62. Setting Sewer Stakes
13. Computing	63. Setting Water Stakes
14. Design - calculation of S/D	64. Setting Pole Location Stakes
15. Plan Tracing	65. Setting Out for Building Construction
16. Plan Scribing	66. Mortgage Certificate Lot Survey
17. Plan Lettering	67. Building Location
18. Plan Compilation	68. Subdivision Lot Staking
19. Plan Enlargement or Reduction	69. Monument Construction
20. Field Inspection	70. Site Levelling (Contours)
21. Plan Checking	71. Reconnaissance
22. Reports	72. Horizontal Control (Angles)
23. Description Writing	73. Horizontal Control (Distances)
	74. Vertical Control
	75. Supervision

CLIENT________________________

PROJECT________________________

COST RECORD
of
POSTED TIME

JOB Nº________

for month of__________________19____

OFFICE EMPLOYEE	FUN-CTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL HOURS	RATE
TOTAL																																		

FIELD EMPLOYEE	FUN-CTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL HOURS	RATE
TOTAL																																		

CLIENT______________________

PROJECT______________________

COST RECORD
of
SURVEYING SERVICES *rendered in month of ______________ 19__*

JOB Nº________

ORDER Nº________

CUMULATIVE TIME

FUNCTION	DESCRIPTION	HOURS	RATE	SUB-TOTAL	TOTAL
TOTAL TIME CHARGES					
DIRECT COST CHARGES					
PROGRESS FILLING DATA			TOTAL		

	OFFICE HRS	OFFICE AMOUNT	FIELD HRS	FIELD AMOUNT	MILEAGE	TRAVEL EXPENSES	OTHER
PRIOR CHARGES							
CURRENT CHARGES							
TOTAL							
PRIOR BILLING							
CURRENT BALANCE							
TRANSFERS THIS MONTH							
BALANCE UNFILLED							

DIRECT COSTS

DATE	MILEAGE	MI.
TOTAL		
MILES @		

DATE	PRINTS	AMOUNT
TOTAL		

TRAVEL EXPENSES

DATE	VOUCHER	PARTICULARS	AMOUNT
TOTAL			

MISCELLANEOUS COSTS

DATE	VOUCHER	PARTICULARS	
TOTAL			

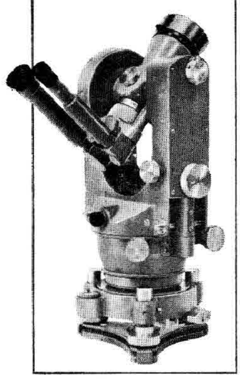
RECAP DIRECT COSTS	AMOUNT
MILEAGE	
PRINTS	
TRAVEL EX	
MISC.	
TOTAL	

nw
wade

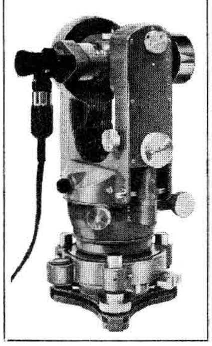
INFORMATION

DRAFTING, DESIGN, REPRODUCTION, SURVEYING, TECHNICAL SCHOOL MATERIALS & EQUIPMENT; LETRASET & ACS TAPES; WADE DI-LINE & DI-LAR, TRANSTEX & TRANSLAR PAPERS & FILMS; DRAWING TABLES.

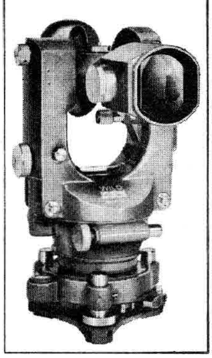
Wild T1-A Double Centre Theodolite with mounted Diagonal Eyepieces



Wild T1-A Double Centre Theodolite with the Wild GOA Autocollimation Eyepiece



Wild T1-A Double Centre Theodolite with the Wild GPM2 Parallel Plate Micrometer



Three of many possibilities

We are showing here just three of the many possibilities to extend the practical usefulness of the Wild T1A, T16 and T2 theodolites through optional accessories. These are available for distance measuring, centring, levelling, orientation, plumbing, for alignments, and for autocollimation. Most of them are identical for all three theodolite types and therefore interchangeable.

In the detachable tribrach with its swivel knob locking device, the theodolite can be exchanged under forced centring against targets, 2m subtense bar, etc. Please ask for brochure G1256

WILD
HEERBRUGG

trade mart · scotia square · halifax · nova scotia

423·8992
423·6603

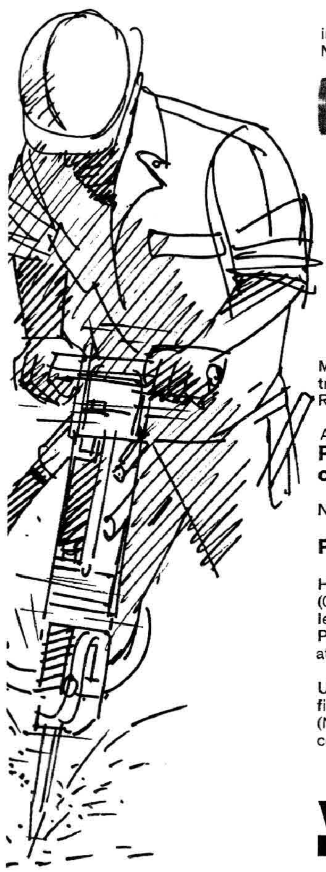
norman wade company ltd

wade

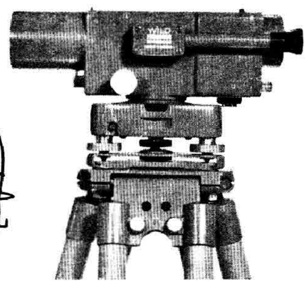
INFORMATION

DRAFTING, DESIGN, REPRODUCTION, SURVEYING, TECHNICAL SCHOOL MATERIALS & EQUIPMENT; LETRASET & ACS TAPES; WADE DI-LINE & DI-LAR, TRANSTEX & TRANSLAR PAPERS & FILMS; DRAWING TABLES.

Shockproof is our new compensator



in the Automatic Engineers' Level Wild NA2 (NAK2)



Maximum damping in winds, by road traffic and other causes of vibration. Robust pendulum for hard work.

Also new:
Press button control for compensator:

No more tapping on tripod or instrument.

Plus, as before:

Horizontal line of sight within ~0.3" (0.05 mm in 30 m), therefore precision levelling is also possible with the Parallel Plate Micrometer Wild GPM1 attached.

Upright, brilliant image, telescope magnification 30x, horizontal glass circle (NAK2), endless drive screw, stable, compact and neat design.

WILD
HEERBRUGG

Wild Heerbrugg Ltd.,
CH-9435 Heerbrugg/Switzerland

trade mart · scotia square · halifax · nova scotia

423·8992
423·6603

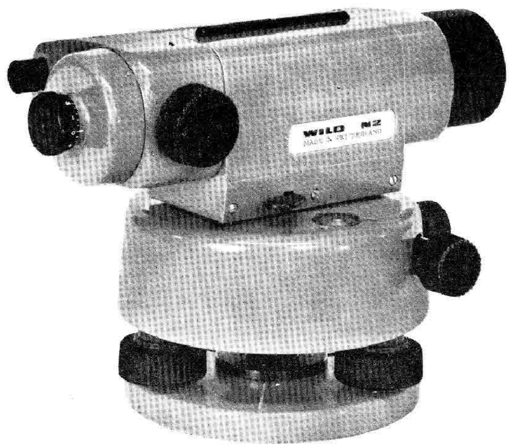
norman wade company ltd

INFORMATION

DRAFTING, DESIGN, REPRODUCTION, SURVEYING, TECHNICAL SCHOOL MATERIALS & EQUIPMENT; LETRASET & ACS TAPES; WADE DI-LINE & DI-LAR, TRANSTEX & TRANSLAR PAPERS & FILMS; DRAWING TABLES.

Wild N2 Engineer's Level

with rotatable telescope
and reversible tubular level



Special design features		offer the following advantages
Well arranged layout and controls	➡	quick, convenient handling
Rotatable telescope with reversible tubular level	➡	simple collimation check and cutting out instrument error by observing in both positions
Erect, high contrast, bright image	➡	staff readings of high accuracy
Arrow in the split bubble showing how to turn the tilting screw	➡	rapid coincidence setting with a minimum of turning
Ventilation slits around the level housing	➡	excellent bubble stability as air circulation prevents heat building up
Friction-brake and endless fine motion drive with a knob at each end	➡	effortless pointing with either hand
Parallel plate micrometer attachment	➡	precise measurements for special tasks

423·8992
423·6603

norman wade company ltd

trade mart · scotia square · halifax · nova scotia

21ST

ANNUAL MEETING

NOVEMBER 4,5,6
HOLIDAY INN

DARTMOUTH
NOVA SCOTIA