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CHARACTERISTICS OF MICHIGAN LAND SURVEYORS AND THEIR LIFELONG EDUCATION NEEDS

By

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A DISSERTATION

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ABSTRACT

CHARACTERISTICS OF MICHIGAN LAND SURVEYORS
AND THEIR LIFELONG EDUCATION NEEDS

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Wayne Edward Lesher

Introduction

Land surveying is an ancient profession with a tangible legal influence on the ownership of real property, but until 1971 there had never been a four-year baccalaureate program in the United States specifically for surveyors. Earlier, formal education for land surveyors was little more than a side-line, usually an appendage to education for other professions, chiefly civil engineering. Apprenticeship often was substituted because of the lack of educational offerings.

While several studies have suggested a rising demand for land surveyors, there has been a lack of in-depth information about the land surveyor and what his educational needs might be.

Purpose of the Study

The purpose of the study was to obtain information about the land surveyor and his lifelong education needs, with six major objectives:

1. To determine the personal characteristics of the present land surveyor.
2. To determine the educational background of the present land surveyor.
3. To determine what subject matter areas are desirable to become a land surveyor.
4. To determine which subject matter areas should be learned through formal educational versus experience on the job.
5. To determine the continuing education interests and needs of the present land surveyor.
6. To determine where and when the present land surveyor would be willing to participate in certain continuing education programs.

Procedure

The study was designed primarily on descriptive research methods. A questionnaire was the instrument developed which sought answers to the six objectives of the study. The questionnaire was mailed to all 436 registered land surveyors who were members of the Michigan Society of Registered Land Surveyors. A total of 361, or 82.8 per cent, usable questionnaires were returned in three mailings.

The data was analyzed principally by frequency and percentage statistics, although comparisons were made by a

multivariance analysis between land surveyors who were also professional engineers and those who were not engineers, and between those who had an interest in a surveying or engineering business and those who did not have a business interest.

The study was limited to land or property surveying and did not include engineering, geodetic or cadastral surveying.

Findings

Personal characteristics of the respondents were identified. Some of those included: age, sex, ethnic classification, years of surveying experience, other job expeience and membership in related organizations. It was also determined how many respondents were professional engineers, what proportion had a business interest in a surveying or engineering firm and how many had obtained their registration through the "grandfather's clause" of the Registration Act.

Information concerning the educational background of the respondents was obtained. It was found that the respondents' educational backgrounds varied considerably, ranging from less than high school diplomas to master's degrees. Those holding a baccalaureate degree usually had majored in civil engineering. Those who had some college education but less than a baccalaureate degree most often

had been enrolled in a civil engineering or a civil/ surveying technology curriculum. A number of respondents had taken correspondence courses in surveying and mapping. Data on other courses of study and the institution enrolled in was obtained. The year of graduation, the area of study and the state in which respondents reached their highest level of education were also determined.

Subjects for study were identified as to their importance in preparation for land surveying. Of sixty subjects suggested, fifty-one were considered necessary. Opinions on five subjects were rated significantly different between those land surveyors who were also professional engineers and those land surveyors who were not engineers. This was the only comparison of opinions in which significant differences were proven.

Respondents believed that knowledge about fifty-two of the sixty subjects should be acquired primarily through a classroom setting as opposed to on-the-job experience. For eight of the subjects, respondents felt that learning by on-the-job experience was the preferred method.

Interest in attending a continuing education seminar was expressed by 68.4 per cent of the respondents. Potential seminar subjects with their preferred geographic location were presented in tabular form. Forty or more respondents showed interest in attending a continuing education seminar in seventeen different subjects. The preferred length, day,

month and location between eleven cities in which to attend a continuing education seminar was presented in tabular and graphic form.

Information was acquired about the respondents' familiarity with reference books on land surveying. A question requesting an opinion concerning continuing education in order to maintain professional licensing brought no conclusive answer.

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CHAPTER I

INTRODUCTION

Value of the Study

Land surveying can name among its practitioners some of the most prominent men in American history, such as George Washington, who was probably the first professional licensed surveyor in the United States of America, and Thomas Jefferson.[1] Some of the great explorers of America were surveyors. Examples are John C. Fremont and John Wesley Powell.[2] Many of the large inland lakes in Michigan are named after or by surveyors. Examples are Burt and Mullett lakes. There is public demand for the services of competent land surveyors and these services require the exercise of independent and reliable judgment. Yet the public seems to know little about the surveyor and what his work entails. Until recently the surveyor was

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[1]Walter S. Dix, "Status of the Surveying Profession in the U.S.A.," Surveying and Mapping, Vol. XXIV, No. 3 (1964), pp. 425-426.

[2]Herman R. Friis, "Highlights in the First Hundred Years of Surveying and Mapping and Geographical Exploration of the United States by the Federal Government, 1775-1880," Surveying and Mapping, Vol. XVIII, No. 2 (1958), pp. 186-207.

unable to obtain a college education that even attempted to meet the needs of his profession. Any formal education available to him in his area of concern lay as an appendage to an engineering education. In the sense of his professional education he was an unwanted child, as very few hours of study in land surveying were offered to him.

In this study the term land surveying refers to property and boundary surveying and does not include engineering, geodetic and cartographic surveying.

Prior to this study, there has never been a comprehensive investigation of the land surveyor or his educational needs. Educators and committees have determined those educational needs without the benefit of adequate research. It is hoped that this study of the surveyor and his educational needs will help remedy the dearth of information and also open the way for additional studies. Results of such a study can help in the design of an appropriate or more nearly adequate educational program for the land surveyor. This study could find immediate use as a frame of reference and helpful source for committees setting up seminars for the continuing education of the practicing surveyor.

Purpose of the Study

It is the purpose of this study to obtain information about the land surveyor and his lifelong education needs. This is done through the following objectives of the study:

1. To determine the personal characteristics of the present land surveyor.
2. To determine the educational background of the present land surveyor.
3. To determine what subject matter areas are desirable to become a land surveyor.
4. To determine which subject matter areas should be learned through formal education versus experience on the job.
5. To determine the continuing education interests and needs of the present land surveyor.
6. To determine where and when the present land surveyor would be willing to participate in certain continuing education programs.

Limitations of the Study

This study is based upon the population group of the members of the Michigan Society of Registered Land Surveyors as of the December, 1974, membership roster. The study does not include land surveyors who were not members of the Michigan Society of Registered Land Surveyors nor does it include associate members of that Society. Society members who had addresses outside of the State of Michigan were included in the study.

The study is limited to land or property surveying as defined in the study and does not include engineering surveying, geodetic surveying, cartographic surveying, or types of surveying which may be defined differently from land surveying.

This is not a study of the public need for land surveyors or for employment opportunities, which other investigations have covered.

This study is not a study of persons who may have an interest in becoming a land surveyor, but it is a study of and about land surveyors.

Background Information

The occupation of land surveying and its definition

Although the public at large does not seem to be aware of the work and responsibility of the land surveyor, almost everyone who has purchased real property has used the services of the land surveyor, either with or without their being aware of it. Practically all real property transactions which involve mortgages demand the use of a land surveyor to determine if such real property does in fact exist where it is purported to exist and if and where there are encroachments upon said property.

The functions of the land surveyor may not only be unclear to the public but may also be undefined in the eyes of persons who are closely allied to the work of the land surveyor, such as the professional engineer and the architect. Some reflections on the land surveyor and his duties are made by several authors. Curtis M. Brown contemplated on the land surveyor and his duties in a simplified manner:

The land surveyor is a professional man who has specialized in the application of law, mapping, mathematics, and instruments to the problem of positioning land boundaries. The ability to use instruments, measure angles, and locate objects relative to one another is not the sole qualification for claiming the title land surveyor. Carpenters in establishing building lines, aircraft workers in setting up jigs, and civil engineers in determining the position of bridge abutments all use surveying instruments; but this cannot be considered land surveying. Most engineers are qualified to make measurements, use instruments, design buildings and structures, but few of them have sufficient training in the laws that determine the location of property lines to be considered proficient land surveyors. To refer to an engineer as a land surveyor is similar to calling a surgeon a dentist. A land surveyor may also be an engineer; many are not.

The surveyor is a fact finder. He goes upon the land armed with all the documentary evidence that is available and searches for markers, monuments, and other facts. After all the evidence, facts, measurements, and observations are assembled, the surveyor must come to a conclusion from the facts. Which monuments can be accepted and which must be rejected? If there are conflicting terms in a deed, which is correct? If there are conflicts between measurements and monument positions, which hold? The ability to arrive at a conclusion and answer such questions elevates the land surveyor from the status of a technician to that of a professional man. He is exercising independent judgment.

It is the land surveyor's duty to correctly locate and mark property lines as described in a deed furnished him and to relate lines of possession to title lines. The surveyor must be able to interpret the meaning of the terms of the deed and must be able to use surveying instruments to enable him to locate and mark the deed terms upon the ground. The surveyor cannot and does not assume the responsibility of proving that a given deed is correct and legal; that is a function of an attorney or court of law. But after a deed is furnished and he is told to mark the property on the ground in accordance with the terms of the deed as furnished, the surveyor must certify that his marks are in accordance with the terms of the deed. If there are conflicting terms within a deed and if the surveyor

> sets his marks in accordance with one of the conflicting terms, he is assuming responsibility for his decision. If the property lines, as described in the deed, encroach on others or if others encroach on the property lines described, the surveyor should note the encroachments.[3]

In addition, Clark and Grimes commented on the land surveyor's function:

> . . . it is not the surveyor's responsibility to set up new lines except where he is surveying heretofore unplatted land or subdividing a new tract. Where title to land has been established under a previous survey, the surveyor's duty is to solely locate the lines of the original survey. He cannot establish a new corner, nor can he even correct erroneous surveys of earlier surveyors. He must track the footsteps of the first.[4]

Philip Kissam stated that the land surveyor is called upon to perform the following functions:

1. Write descriptions
2. Survey land so that descriptions can be written
3. Stake out property corners
4. Determine the positions of various structures or lines with respect to boundary lines.[5]

In 1959 the Task Committee on Status of Surveying and Mapping appointed by the Surveying and Mapping Division

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[3]Curtis M. Brown, Boundary Control and Legal Principles (New York: John Wiley and Sons, Inc., 1957), pp. 231-232.

[4]Frank Emerson Clark and John S. Grimes, A Treatise on the Law of Surveying and Boundaries (3rd ed.; Indianapolis: Bobbs-Merrill Co., 1959), p. 12.

[5]Philip Kissam, Surveying for Civil Engineers (New York: McGraw Hill Book Co., Inc., 1956), p. 288.

of the American Society of Civil Engineers published its definition of land surveyor:

> Land Surveyor determines location of land boundaries; prepares maps showing shapes and areas of land; divides land into smaller tracts, including layout of roads and streets and rights-of-way to same to give access to smaller tracts; prepares official plats or maps of such land subdivisions; prepares and interprets land descriptions for incorporation in deeds, leases, etc.[6]

In 1971 a report by the Education Committee of the Michigan Society of Registered Land Surveyors expanded upon the Task Committee on Status of Surveying and Mapping's definition of land surveying and defined land surveying as:

> Land Surveying includes the measurements, research and calculations required for the correct establishment, or re-establishment, of land boundaries and areas and their description for conveyancing, and for the planning and platting of land and subdivisions thereof. The planning and platting of land and subdivisions thereof shall include, but not be limited to, the preparation of all surveys, studies, maps, plans and plats required under the provisions of Michigan P.A. 288 of 1967; including soils and land use studies and designs, plans, grades and specifications for roads and streets, grading and paving, drainage, flood and erosion control, and water main and sanitary sewer extensions, where such work is subject to standards precribed by, or subject to the approval of, local or state authorities, and is required for the completion of a subdivision. In the pursuance of the above objectives, the land surveyor may utilize the

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[6]The Task Committee on Status of Surveying and Mapping, "Status of Surveying and Mapping in the United States, Final Report," Journal of the Surveying and Mapping Division, Proceedings of the American Society of Civil Engineers (Sept., 1959), p. 21.

> techniques and principles of, or data from, any of the other following categories of surveying.[7]

The categories of surveying referred to were: Geodetic Surveying, Engineering Surveying, and Cartographic Surveying.[8]

These authors show similarities in the function and definition of land surveying. However, there is another factor which affects the land surveyor and his duties. This involves the legal definition of land surveyor and land surveying.

In Michigan, as in most states, the land surveyor is licensed and regulated by statute law. The law in Michigan is known as the "Registration Act for Architects, Professional Engineers and Land Surveyors" and is Act No. 240 of the Public Acts of 1937 and as amended by other Acts. This Act as amended is:

> An Act to license and regulate the practice of architecture, professional engineering and land surveying; to create separate state boards of registration for architects, professional engineers and land surveyors, and to prescribe their powers and duties; to impose certain powers and duties upon the state and the political subdivisions thereof in connection with public work; and

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[7]Education Committee, Michigan Society of Registered Land Surveyors, "Education Committee Files Report," The Michigan Surveyor News Letter (Lansing, Mich.: The Michigan Society of Registered Land Surveyors, Winter Issue, Vol. 6, No. 1, 1971), p. 9.

[8]Ibid., p. 9.

> to provide penalties for the violation of the provisions of this Act.[9]

The terms "land surveyor" and "practice of land surveying" are defined in this Act as:

> "Land surveyor" means a person who, by reason of knowledge of law, mathematics, physical sciences, and techniques of measuring land acquired by professional education and practical experience, is qualified to engage in the practice of land surveying. "Practice of land surveying" includes surveying of areas for their correct determination and description and for conveyancing, or for the establishment or re-establishment of land boundaries and the plotting of lands and subdivisions thereof.[10]

Other states have legally defined land surveying in similar terms. The states of Colorado, Indiana, Iowa, Montana, New York, South Carolina, Utah, and Wisconsin have the same definition of land surveying as the State of Michigan.[11]

In the surveying literature, the terms "cadastral surveying" and "property surveying" are often encountered. These terms are usually used synonymously with "land surveying" although the term "cadastral surveying" is found more frequent in the older publications and often refers to the public land survey.

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[9]Michigan, Act 240 of Public Acts of 1937 and as amended.

[10]Ibid., Sec. 2.

[11]Victor H. Ghent, "State Laws Defining Land Surveying," Surveying and Mapping, Vol. XVIII, No. 3 (1958), pp. 304-310.

It should be noted that there is not complete harmony between the Michigan Society of Registered Land Surveyors and the Michigan State Statute (P.A. 240) in the defining of land surveying. This may present future problems if the discrepancy in definition of land surveying is not remedied.

Definitions of other types of surveying

The term "surveying" has been used as "the single general name which best describes those disciplines involved in the science of measuring and representing the geometric physical features of any space."[12] Although there seems to be agreement in the overall meaning of "surveying" there seems to be discord when it comes to subdividing "surveying" into a main classification system. Some examples of different categories of "surveying" by authoritative sources are as follows:

The Sixth National Surveying Teachers Conference stated that:

> The main subdivisions of Surveying are:
> 1. Geodesy and geodetic engineering
> 2. Photogrammetry and photogrammetric engineering
> 3. Photointerpretation, including all remote sensors
> 4. Natural resources surveying

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[12]Arthur J. McNair, "Surveying Education at the Crossroads," Surveying and Mapping, Vol. XXIX, No. 3 (1969), p. 423.

5. Land or cadastral surveying
6. Cartography
7. Engineering and construction surveying

Lesser subdivisions include: Hydrography, geometry, charting (nautical, aeronautical or interplanetary), mineral land surveying, forest surveying, soil surveying, and other natural resources inventory surveys where the location or geometry of the resource is important.[13]

Rayner and Schmidt classify "surveying" into three main groups: land surveys, construction surveys, and informational surveys.[14]

In 1959, the Board of Direction of the American Society of Civil Engineers adopted the final report of its Task Committee on the Status of Surveying and Mapping in the United States. This Task Committee suggested six principal categories in the field of surveying and mapping. They are:

1. Land surveying
2. Engineering surveying
3. Geodetic surveying
4. Cartographic surveying
5. Aerial survey service
6. Cartography

The first four of these categories (land surveying, engineering surveying, geodetic surveying, and cartographic surveying) are considered as comprising the field of survey

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[13]Ibid., p. 423.

[14]William H. Rayner and Milton O. Schmidt, Elementary Surveying, 4th ed. (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1963), pp. 2-3.

engineering and are regarded as a branch of civil engineering.[15]

The Education Committee of the Michigan Society of Registered Land Surveyors in their report to the Board of Directors of this Society "concluded that the broad field of surveying could most readily be subdivided into four major categories:

Land Surveying
Geodetic Surveying
Engineering Surveying
Cartographic Surveying

as originally suggested in a report from a special task committee, and adopted by the Board of Direction of the American Society of Civil Engineers in 1959."[16] Section I, - Definition and Scope of Surveying, of this report defines "surveying" in general terms and then expands upon the Task Committee's explanation of the four categories of surveying as follows:

SECTION I, - DEFINITION AND SCOPE OF SURVEYING

> The professional practice of surveying is the art and science of making, assembling, and interpreting reliable scientific measurements and information relative to the location, size, shape, or physical characteristics of the universe or any

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[15]The Task Committee on Status of Surveying and Mapping, op. cit., p. 18.

[16]Ralph Moore Berry, "Education for Professional Surveyors," The Michigan Surveyor News Letter (Lansing, Mich.: The Michigan Society of Registered Land Surveyors, Winter Issue, Vol. 6, No. 1, 1971), p. 3.

part thereof, and the utilization and development of these facts and interpretations into an orderly map, plan, report, or construction project. Included in the profession are the following categories of surveying:

A. Land Surveying includes the measurements, research and calculations required for the correct establishment, or re-establishment, of land boundaries and areas and their description for conveyancing, and for the planning and platting of land and subdivisions thereof. The planning and platting of land and subdivisions thereof shall include, but not be limited to, the preparation of all surveys, studies, maps, plans and plats required under the provisions of Michigan P.A. 288 of 1967; including soils and land use studies and designs, plans, grades and specifications for roads and streets, grading and paving, drainage, flood and erosion control, and water main and sanitary sewer extensions, where such work is subject to standards prescribed by, or subject to the approval of, local or state authorities, and is required for the completion of a subdivision. In the pursuance of the above objectives, the land surveyor may utilize the techniques and principles of, or data from, any of the other following categories of surveying.

B. Geodetic Surveying, which is primarily concerned with the classical problem of the determination of the size and shape of the earth but which essentially includes precise control surveys (of first or second order), both horizontal and vertical, and their adjustments; geodetic astronomy; the establishment of datums and design of local coordinate systems; and other required non-geometrical measurements such as gravity and geomagnetism. It is generally understood that geodetic surveying does not include classical geodesy which is concerned with the analysis of the data obtained by geodetic surveying, with the objective of deriving numerical parameters which define the figure of the earth, nor the allied field of geophysics which is concerned with the physical structure of the earth.

C. Engineering Surveying, which is concerned directly with construction design and layout. This will always involve horizontal and vertical control surveys, which may be of the same high accuracy commonly associated with geodetic surveys, but may also include the acquisition of data acquired for design considerations associated with a particular site, such as profiles, cross-sections, large-scale topography (which may

involve photogrammetric techniques) and hydrography, soil types and characteristics, etc. It also includes the operations of construction layout and the determination of quantities and their certification for purposes of payment.

D. Cartographic Surveying, which is considered to be concerned with general purpose original mapping of large areas at medium or small scales. The basic types of mapping involved are topographic (including planimetric) and hydrographic. The operations will include the control surveys, horizontal and vertical, usually of less than second-order accuracy, required to meet the specific needs of a mapping project in accordance with its particular specifications of mapping accuracy. Also included are other field survey operations such as planetable, field edit, air-photo inspection and identification of control, determination of water depth (including use of electronic positioning) tides and currents, as well as office operations such as manuscript compilation by photogrammetric methods, plotting of hydrographic maps, critical review and edit of manuscripts, etc. It is usually understood that cartographic surveying, which is concerned with the production of original surveys (maps), does not include cartography, which is concerned with the production ("compilation") of maps (usually for a special purpose) which are not in themselves original surveys but which are based on data assembled, evaluated, and selected from a multiplicity of original surveys (maps) which frequently are obtained from other sources.[17]

Any reference to these four categories of surveying in this study means to refer to these definitions.

Requirements for becoming a registered land surveyor

The requirements for becoming a registered land surveyor in the State of Michigan are set forth in Michigan

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[17]Education Committee, Michigan Society of Registered Land Surveyors, op. cit., p. 9.

Act No. 240 of Public Acts of 1937 and as amended by Act No. 254 of P.A. of 1974. This Act states that:

> An applicant for examination for registration shall have had not less than eight years of professional experience in architectural or engineering work or land surveying satisfactory to the board, including up to six years of education satisfactory to the board.
>
> Beginning January 1, 1977, an applicant for registration shall have a baccalaureate degree acceptable to the board. A person who has commenced the taking of examinations provided under this Act shall be permitted to complete the taking of those examinations notwithstanding any provisions hereto to the contrary.[18]

Upon meeting these requirements satisfactorily, the applicant may qualify to take the examination that is given by the Board of Registration for Land Surveyors to become a registered land surveyor. This examination in the past has been a two-day (sixteen-hour) examination. It has been administered by the Michigan Society of Registered Land Surveyors with the approval of the State Board of Registration for Land Surveyors.

The requirements for becoming a land surveyor varies within the States of the United States. There is no national organization of land surveyors that controls the practice of or the licensing of land surveyors.

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[18]Michigan, Act 240, op. cit., Sec. 12.

Education of land surveyors

In the past the engineer stereotype has been pictured as a man peering through a surveying instrument known as an engineer's transit. This symbol of the engineer once had merit since an important phase of the engineer's education was courses in surveying. Although all engineering students were required to take surveying, it was the civil engineering students who absorbed the majority of the surveying course offerings. This surveying education in the engineering curriculum was of a general nature and encompassed all four categories of surveying (land, geodetic, engineering, and cartographic surveying). After graduation, civil engineers often found their first employment working in a surveying crew. Eventually, many of those engineers became registered land surveyors after meeting the experience requirements and passing the written examination.

Forestry majors were also required to take surveying courses. Such courses were usually the same or equivalent to those required of the engineering major and were often offered through the civil engineering department. Although the forestry curriculum did not emphasize surveying as strongly as the civil engineering curriculum, many graduate foresters also became registered land surveyors.

After World War II and through the 1950s and 1960s, engineering education was reorganized. There was a trend toward stronger theoretical orientation and less of the

practical applied-type courses. Contrary to the rumors at that time of making engineering a five-year baccalaureate curriculum, many engineering colleges, in fact, reduced the number of credits required for graduation, thus putting the engineering curriculum more in line with other curricula in credit requirements for graduation. The reduction of credit requirements, along with the new concept of the engineer as an "engineer-scientist," resulted in the deletion of some courses in the engineering curriculum; especially included were those courses of a practical applied orientation and also those courses which were looked upon with less professional esteem. Surveying courses were among those that were deleted. Professor Arthur J. McNair of Cornell University stated:

> In 1937 the average number of required semester hours of surveying courses in civil engineering curricula was 14.3. By 1948 required surveying courses averaged 11.3 semester hours. In 1958 the average was down to 7.7 semester hours. In 1964 the average amount of surveying required in the civil engineering curriculum was estimated to be approximately 5 semester hours.[19]

Milton O. Schmidt suggested in a synopsis that:

> Surveying, time honored subject of academic study and basic tool of generations of civil engineers, is vanishing from college curricula. . . .

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[19]Curtis M. Brown, "The Feasibility of a Technology Program in Surveying and Mapping," Surveying and Mapping, Vol. XXV, No. 4 (1965), p. 523, quoting Arthur J. McNair, 24th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D.C., March 16-19, 1964.

> It is predicted that by 1965 many first line, scientifically oriented programs will contain no surveying. Professional education in the geodetic sciences, including surveying, must be sought outside civil engineering curricula.[20]

Following the deletion of surveying courses from engineering curricula, it became apparent that education for surveyors constituted an acute problem. Many practicing surveyors and engineering educators were alarmed at the predicament. Position papers and articles substantiating the problem of surveying education may be found in "Surveying and Mapping," which is the Journal of the American Congress on Surveying and Mapping, and in the "Journal of the Surveying and Mapping Division," which reports some of the proceedings of the American Society of Civil Engineers. Some authors offered solutions, others only showed their concern over the problem. There seemed to be a lack of organized concern. Any organized effort, if it existed, did not have enough impact to bring about educational reform for surveying.

Positive action was not taken until the 1950s and 1960s, when surveying courses began appearing in technical institutes and community-junior colleges. The courses were usually found within two-year civil technology curriculums.

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[20]Milton O. Schmidt, "Role of Surveying in Civil Engineering Education," Journal of the Surveying and Mapping Division, Proceedings of the American Society of Civil Engineers, (Feb., 1963), p. 27.

The purpose of the two-year associate degree programs was to train technical aides to assist civil engineers. However, the curricula did contain courses in surveying. One curriculum in particular was also geared toward aides for land surveyors as well as for aides to civil engineers. The aides were not fully qualified land surveyors. The program was the two-year "Surveying and Topographical Drafting Technology" program at Ferris State College in Big Rapids, Michigan. It had its beginning in the Fall of 1957 and was one of the first surveying technology curriculums in the United States.

Perhaps of significance to the field of land surveying was the incorporation into the two-year surveying curriculum at Ferris Institute, later to be known as Ferris State College, of two courses that dealt solely with land or property surveying: Theory of Land Surveying I and Theory of Land Surveying II. Those two courses were not in the original curriculum that was approved by the Ferris Institute Board of Control in June, 1957, but were added to the curriculum prior to the inauguration of the program in September, 1957. It is interesting to note that this two-year curriculum was conceived and developed without a basis on any need study or research.[21] There was nothing of a statistical nature that could substantiate the need for or

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[21]Wayne E. Lesher, Personal File.

the value of this curriculum other than the conditions that existed during that time in history. At the time, 1957, there was a national demand for science technology education and there was a great amount of autonomy in the public colleges.

A study in 1965 of the graduates of this surveying curriculum, based upon 98 per cent returns to a questionnaire, showed that 69 per cent of the graduates were working in the occupation they were trained for, 23 per cent were continuing their education on a full-time basis, 4 per cent were in the Armed Forces, and 4 per cent were employed in areas other than their technical training.[22]

It was not the original intent of the two-year technology programs to be the sole educational background for becoming a land surveyor, but rather to train people as technicians to be a part of the engineering-surveying team. Those persons were to be aides to the professional person.[23] However, the two-year surveying curriculum at Ferris State College was a factor in contributing to the education of land surveyors. Many of those persons who have completed

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[22]Wayne E. Lesher, "Surveying Manpower and Ferris State College," Michigan Society of Registered Land Surveyors 25th Annual Conference Report, 1966, p. 132.

[23]Wayne E. Lesher, "The Role of the Two Year College in Surveying Education and the Opportunities for These Graduates," Michigan Society of Registered Land Surveyors 24th Annual Conference Proceedings, 1965, pp. 17-27.

the "technicians" programs have since become registered land surveyors. Whether this was desirable or not can only be conjecture, but the fact remains that the technician's-level education was one of the few opportunities for formal education in surveying. Historically, it filled a void that existed in surveying education.

In September of 1971, Purdue University at West Lafayette, Indiana, initiated what was probably the first offering of a four-year baccalaureate curriculum specifically designed for the education of land surveyors. The degree offered is a Bachelor of Science in Land Surveying.[24] This program appears to encompass all four categories of surveying (land, engineering, geodetic, and cartographic) as previously defined and does not limit itself only to land surveying.

Other colleges and universities in the United States followed with offerings of four-year curriculums in surveying. Notable to this study is the Bachelor of Science in Surveying curriculum which was first offered at Ferris State College, Big Rapids, Michigan, in September of 1972. This program was approved by the Michigan State Department of Education in 1971 and represents the first baccalaureate

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[24]Kenneth S. Curtis, "A Four-Year Bachelor of Science Degree in Land Surveying," Surveying and Mapping, Vol. XXXV, No. 1 (1975), pp. 59-62.

curriculum for the education of surveyors in the State of Michigan.[25] This curriculum covers the four categories of surveying (land, engineering, geodetic, and cartographic) as previously defined.

Although there is no formal accrediting agency for the Ferris State College curriculum, the Michigan State Board of Registration for Land Surveyors has given its approval of the program. On April 24, 1974, the Board issued this statement:

> Graduates of Ferris State College with the degree of Bachelor of Science in Land Surveying are approved to take the Fundamentals of Land Surveying examination given by the Michigan Board of Registration for Land Surveyors. This approval is granted for a period of two years from the date of this report.[26]

Thus the formal education of surveyors in the United States in this century has passed from many surveying course offerings in the engineering schools, to sparse course offerings in the engineering schools, to course offerings in the Technical Institutes and Community-Junior Colleges, and finally to baccalaureate degree offerings in surveying. In the State of Michigan there presently is only the one baccalaureate degree offering in surveying.

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[25] J. David Henry, "Surveying at Ferris State College," Paper presented at the Michigan Society of Registered Land Surveyors 32nd Annual Conference, Feb. 28, 1973.

[26] John J. McMahon, "Trends in the Registration Laws," Proceedings of the Eighth National Surveying Teachers Conference (June, 1974), pp. 13-10, Mont Alto Campus, The Pennsylvania State University.

Overview of the Study

Education to become a land surveyor has an involved and controversial past. Although the profession of land surveying is centuries old, until 1971 there was no four-year baccalaureate curriculum in the United States to specifically accommodate the education of land surveyors. There is a lack of statistical information about both the land surveyor as an individual and the specific knowledge needed to adequately carry out the occupational task.

This study was limited to the population group of the members of the Michigan Society of Registered Land Surveyors. Statistical information was gathered that gives personal information about the surveyor and his educational background. The study was designed to determine what knowledge the surveyor feels is important to his work and how that knowledge can best be acquired. The study was planned to make a comprehensive investigation of what his interests may be in continuing his education.

The study may open up ideas for additional studies of the Michigan surveyor and stimulate similar studies in other states. The study is not intended to be an end in itself, but rather to encourage further investigation.

CHAPTER II

REVIEW OF LITERATURE, REPORTS AND PAST RESEARCH

Availability of Literature on Land Surveying

A review of the literature on land surveying and land surveyors was incorporated into Chapters I and II. Articles which dealt especially with the education of land surveyors were found in the following publications with the first two the most numerous:

1. Surveying and Mapping
2. Journal of the Surveying and Mapping Division, Proceedings of the American Society of Civil Engineers
3. Civil Engineering
4. Journal of Engineering Education
5. Photogrammetric Engineering
6. The Canadian Surveyor
7. Proceedings, National Surveying Teachers Conference

Almost any textbook on surveying had one or two chapters devoted to land or property surveying. Those books were plentiful. Books that related almost exclusively to land or property surveying were less common. The books devoted to land or property surveying currently in print are:

1. Curtis M. Brown. Boundary Control and Legal Principles. 2nd ed. New York: John Wiley and Sons, Inc., 1969.

2. Curtis M. Brown and Winfield H. Eldridge. Evidence and Procedures for Boundary Location. New York: John Wiley and Sons, Inc., 1962.

3. Frank Emerson Clark and John S. Grimes. A Treatise on the Law of Surveying and Boundaries, 3rd ed. Indianapolis, Indiana: Bobbs-Merrill Co., Inc., 1959.

4. Ray Hamilton Skelton. The Legal Elements of Boundaries and Adjacent Properties. Indianapolis, Indiana: Bobbs-Merrill Co., Inc., 1930.

5. Bureau of Land Management. Manual of Surveying Instructions for the Survey of the Public Lands of the United States. Washington: United States Government Printing Office.

6. Bureau of Land Management and U.S. Department of the Interior. Restoration of Lost or Obliterated Corners and Subdivision of Sections. Washington: United States Government Printing Office.

A search for past research about land surveyors and land surveying revealed several limited studies which were reported in some of the listed periodicals. However, most did not relate to this study. Several reports and studies that were of interest to this study are reported in this chapter. No educational dissertation about surveying or land surveying was found in a search of dissertation abstracts or through a search by University Microfilm's DATRIX (Direct Access to Reference Information: Xerox).

Report of the Task Committee on Status of Surveying and Mapping in the United States, American Society of Civil Engineers

It was believed that the report of the Task Committee on Status of Surveying and Mapping of the Surveying and Mapping Division, American Society of Civil Engineers, had a substantial impact on the profession of surveying and surveying education. The formation of this Task Committee and the objectives of their study was as follows:

> The Surveying and Mapping Division of the Society was requested by the Board of Direction in October, 1953 to study the activities of its membership and to classify the varied operations of surveying and mapping into professional, sub-professional, and non-professional. After considerable deliberation, the Executive Committee of the Division in October, 1954 appointed the present Task Committee to work on this problem, and also to investigate the correlative question, whether all the professional activities in surveying and mapping should be recognized as civil engineering, or as a field of science apart from civil engineering.[1]

Subsequently, the Task Committee wrote four reports: a First Report in 1955, an Interim Report in 1956, a Second Interim Report in 1957 that was not published, and a Final Report in 1958.[2] It appeared that one of the greatest

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[1]The Task Committee on Status of Surveying and Mapping, "Professional Aspects of Surveying and Mapping," Journal of the Surveying and Mapping Division, Proceedings of the American Society of Civil Engineers (March, 1956), p. 921-2.

[2]The Task Committee on Status of Surveying and Mapping, "Status of Surveying and Mapping in the United States, Final Report," Ibid. (Sept., 1959), pp. 10-12.

contributions of the reports was the classification of surveying into various categories and then defining those categories. This classification system with its definitions allowed for a common denominator from which discussions, writings and understanding could take place. Prior to this there was confusion of terminology and meaning that appeared in writings and discussions. There had been no commonly accepted reference for classifying and defining the various aspects of the occupation of surveying prior to the Task Committee's report on Surveying and Mapping.

The Task Committee recognized the importance of their own work when they concluded that "the foregoing classification of positions should serve as a fundamental basis for any future study in the field of surveying and mapping."[3] Others recognized the contribution of this committee. William A. White stated that:

> The report on professional aspects of surveying and mapping provides us with an excellent analysis of the fields of surveying with appropriate titles for the practitioners in the various fields. This is in addition to its intended, and accomplished, purpose of delineating the professional grades of surveyors and mappers. The report should be a valuable adjunct to statutory and administrative definitions used by Boards of Registration in evaluating applications for licensure or registration. It should serve as an excellent guide to personnel departments

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[3]The Task Committee on Status of Surveying and Mapping, "Professional Aspects of Surveying and Mapping," Ibid. (March, 1956), p. 921-8.

> in governmental and large private organizations to rationalize job classifications and salaries.[4]

Albert A. Stanley also wrote:

> This report is highly important to the entire profession of surveying and mapping for its careful attention to defining and classifying the various components of surveying and mapping which contribute to the overall civil applications of engineering. . . . The concise terms developed in the report provide important guides to improved standards for job classifications, especially for those individuals employed by the Federal Government. Definitions of professional positions, given in reference D of the report, are particularly timely and valuable as a basis of comparison.[5]

Report of the Education Committee of the Michigan Society of Registered Land Surveyors

The Education Committee of the Michigan Society of Registered Land Surveyors reported on its study of requirements for surveyors in the Winter Issue, 1971, of the "Michigan Surveyor News Letter." The report was outlined with the following principle headings:

a. Foreward
b. Section 1 - Definition and Scope of Surveying
c. Section 2 - Suggested Four-Year Curriculum in Surveying
d. Section 3 - Instructor Requisites, Accreditation, and Supplementary Education
e. Section 4 - Suggested Qualifications for Applicants Desiring to Write State of Michigan

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[4]William A. White, "Discussion of Professional Aspects of Surveying and Mapping," Ibid. (Sept., 1956), p. 1066-5.

[5]Albert A. Stanley, "Discussion, Status of Surveying and Mapping in the United States," Ibid. (July, 1960), p. 36.

Examination for Surveyors - Between Years 1970-1977

f. Bibliography[6]

Section I, Definition and Scope of Surveying, gave the definitions of Land, Geodetic, Engineering, and Cartographic Surveying. The definitions were incorporated into this study as indicated in Chapter I. Under Section 3, the report touched upon continuing education with this recommendation by the Committee:

> It is recommended that the Michigan Society of Registered Land Surveyors sponsor a program of continuing education for its members, employees, and other interested persons. This program could be on new techniques, new equipment, and updating of members and their employees.[7]

One of the purposes of the current study was to help the Society develop their continuing education program by determining the kind of programs needed and identifying a desired location, a preferred month, and the best day of the week for such offerings. This information may be found in Chapter IV.

California Study

In 1965 the California Council of Civil Engineering and Land Surveyors (C.C.C.E. & L.S.) and the County Engineers

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[6]Education Committee, Michigan Society of Registered Land Surveyors, "Education Committee Files Report," The Michigan Surveyor News Letter (Lansing, Michigan: The Michigan Society of Registered Land Surveyors, Winter Issue, Vol. 6, No. 1, 1971), pp. 7-13.

[7]Ibid., p. 10.

Association of California (C.E.A.C.) acting through an existing Liaison Committee authorized the establishment of a Subcommittee on Surveying Education in California. The C.C.C.E. & L.S. consisted of 325 private civil engineering and surveying firms. The C.E.A.C. was an organization consisting of county engineers, county surveyors and county road commissioners which represented the 58 counties in the state of California.[8] This Subcommittee was instructed to attempt to find an answer to the following question:

> If additional facilities were available to supply a certain number of graduates each year who would be well-versed, well-prepared, and professionally motivated to proceed in a career of surveying and mapping, how many of this new breed of graduates could be employed by industries or by public agencies, and at what levels of remuneration?[9]

A questionnaire was composed by the Subcommittee and sent to members of these two organizations: C.C.C.E. & L.S. and C.E.A.C. Of special interest was the results from the third question of the questionnaire. The question was: "If graduates of a four-year course in surveying were available, how many positions in your organization are available for individuals with degrees in surveying, regardless of

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[8]Ira H. Alexander, "Joint Survey of Educational Needs," Surveying and Mapping, Vol. XXVII, No. 4 (1967), pp. 661-670.

[9]Ibid., p. 663.

whether the positions are now filled"?[10] A total of 606 positions was reported in reply to this question.[11]

Although this question did not solicit for a present need for surveyors with a four-year college education in surveying, it was interpreted that the job positions for this type of surveyor would eventually be available. In a sense, then, this did establish that there was a need in the state of California for surveyors with a four-year college education, although not necessarily an immediate need. These results were summarized in the cover material of a second questionnaire that followed. It stated:

> The results of investigations by the Subcommittee on surveying education in California have indicated a definite need for men who are educated and competent in the art of surveying. Private firms and county governments have stated the number of personnel that they estimate are required and the remuneration that graduates may expect.[12]

The number or percentage of returns to the first questionnaire was not reported. However, information from private sources indicated a return of slightly under 50 per cent from the C.C.C.E. & L.S. organization and slightly above 50 per cent from the C.E.A.C. organization.[13]

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[10]Ibid., p. 664.

[11]Ibid., p. 664.

[12]Ibid., p. 666.

[13]Wayne E. Lesher, Letters in personal file.

The first questionnaire was followed by a second questionnaire which was also sent out by the Subcommittee to the same two organizations: C.C.C.E. & L.S. and C.E.A.C. This second questionnaire dealt in "determining a desirable curriculum if a university program were to be initiated."[14] The questionnaire listed course topics that may or may not be important to a four-year college curriculum in surveying. A four-point rating scale was used to measure the importance of these topics to the respondent. The list of course topics was comprehensive, numbering 77 topics in the questionnaire. The responses were weighted and a "degree of intensity" determined for each topic. Unfortunately, the questionnaire returns were so few that the validity of this second study was questioned. There were approximately 15 returns from the C.C.C.E. & L.S. group representing less than 5 per cent returns from that membership and approximately 15 returns from the C.E.A.C. group representing 26 per cent of that membership. There was no attempt reported to determine if these respondents could be considered as representative of the non-respondents. Consequently, since the non-respondents far outnumbered the respondents and there was no statistical information that could substantiate a similarity or dissimilarity between the respondents and non-respondents, the data were not used in the current study.

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[14]Ira H. Alexander, op. cit., p. 666.

In summary to the first question (Question A) of the second questionnaire, it was stated:

> The numerical response, considerably smaller than the previous questionnaire, indicates much divergence of opinion on this question; valid conclusions are not too clear cut.[15]

The study also concluded:

> Because of the somewhat select sampling and confinement to only California, no claims can be made for absolutely complete quantitative data; however, the trend is clear. Can and will the universities accept the challenge?[16]

American Congress on Surveying and Mapping Study

A Task Committee of the American Congress on Surveying and Mapping was formed in 1966 to review the status of surveying and mapping education in the United States. Of the several objectives of this study, two appeared to be of interest to the current study. These were "to determine the need for professional and technician surveying and mapping personnel during 1970-1975" and to identify "the basic and major courses a student should take to obtain a sound educational background for the practice of surveying and mapping at the professional and technicians level."[17]

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[15] Ibid., p. 668.

[16] Ibid., p. 670.

[17] American Congress on Surveying and Mapping Task Committee on Education, "Surveying and Mapping Education," Surveying and Mapping, Vol. XXXI, No. 4 (1971), p. 531.

Four hundred and fifty questionnaires were sent on a sampling basis throughout the United States to organizations employing surveyors and mappers. One hundred and nineteen replies were received for a 26.5 per cent return of the questionnaires. It was estimated that the 450 organizations represented approximately 20 per cent of the total organizations employing surveying and mapping personnel.

The area of surveying and mapping was subdivided into the categories of Cartography, Charting, Geodesy, Land Surveying, Photogrammetric Surveying, Topographic Mapping, and General. The number of professional and technician personnel needed during 1971-1975 was determined for each category. Under the category of Land Surveying, a total of 421 professional personnel and 1,486 technician personnel were shown to be needed during the years 1971-1975. This was based upon the 119 responses to the 450 questionnaires sent out.[18] This indicated that there was some need for land surveyors on a national basis.

The second area of interest identified the courses of study in surveying and mapping which should be taught at the Associate Certificate (Technician) level, at the Baccalaureate (Professional) level, and at the Graduate level. This information was not incorporated into the current study. The sampling technique and method for deciding the survey

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[18] Ibid., p. 542.

sample was not known and there was no statistical information that showed whether or not the respondents to the questionnaire (26.5 per cent) were representative of the non-respondents of the population sample.

Purdue University Study

Purdue University at Lafayette, Indiana, conducted a study in 1968 which proposed "to provide data and recommendations concerning the land surveying profession in the state of Indiana."[19] A questionnaire and cover material was sent to certain government agencies, to private practice surveying firms and to industrial firms in the state of Indiana. There were 363 questionnaires distributed and 161 replies. This represented a return ratio of 44.4 per cent.

Of interest to the current study was the information acquired about the present and future job opportunities for a baccalaureate land surveyor graduate. The 161 questionnaire returns indicated that 187 of this type of land surveyor were needed immediately (at the time of study). By taking into account attrition, job expansion, and equating the job vacancies over a five-year period, it was

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[19]Report of the Need for Land Surveyors in Indiana and a Related Baccalaureate Program, Manpower Report 68-4, J. P. Lisack, Director, Office of Manpower Studies (Lafayette, Indiana, Purdue University, Sept., 1968), p. o.

found that approximately 100 land surveyors would be needed each year for the next five years.[20]

Other aspects of the Purdue study included: the type of surveying that the various organizations performed and the per cent of time spent on each type, the number of registered land surveyors and the number of non-registered people associated with surveying in the organizations, the salary a new graduate land surveyor could expect, and comments on a proposed land surveying baccalaureate curriculum that was included with the questionnaire material.

The Purdue study substantiated the need for four-year graduate land surveyors in the state of Indiana.

Ferris State College Study

In 1970 Ferris State College at Big Rapids, Michigan, conducted "A Study of the Need for Surveyors in Michigan."[21] A report of this study was attached to "A Proposal to the Michigan State Board of Education for a Baccalaureate Program

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[20] Ibid., pp. 8-9.

[21] The Surveying and Topographical Drafting Technology Faculty, "A Study of the Need for Surveyors in Michigan," Ferris State College, Big Rapids, Michigan, May, 1970 (Mimeographed).

in Surveying"[22] and was also reported in "The Michigan Surveyor News Letter."[23]

Essentially the study was the same as the Purdue study except performed in the state of Michigan. The same questionnaire was used as well as the same format for the cover material. A proposed baccalaureate land surveying curriculum resume (different from the Purdue curriculum) reflecting Ferris State College's proposed program was included with the cover material. The purpose of the Ferris State College study was as follows:

> The questionnaire (see Appendix III) was designed to determine (1) the need for professionally trained people now and in the future, (2) the number of persons practicing Professional Land Surveying in the state, (3) increments that such a trained person could expect from the existing professionals, (4) types of professional activity each member firm is engaged in, and (5) the reaction of the professional as to our proposed program.[24]

The questionnaire was sent to all 335 members of the Michigan Society of Registered Land Surveyors and 94 questionnaires were returned. This represented a 28 per cent response. A 35 per cent response was reported.

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[22]The School of Technical and Applied Arts, "A Proposal to the Michigan State Board of Education for a Baccalaureate Program in Surveying," Ferris State College, Big Rapids, Mich., March, 1971 (Mimeographed).

[23]John C. Norton, "College Staff Develops Study of Needs for Professional Surveyors," The Michigan Surveyor News Letter (Lansing, Mich.: The Michigan Society of Registered Land Surveyors, Fall Issue, Vol. 5, No. 3, 1970), pp. 2-4.

[24]Ibid., p. 2.

It was of interest to know how many positions employers might fill with graduates of a four-year baccalaureate degree surveyor. The Ferris report stated that:

> Seventy-two positions are immediately available, and 37 positions are estimated to be available for each year over a five-year period. . . . Projected to the entire membership of the Michigan Society of Registered Land Surveyors, it would indicate that there are 200 or more positions available now, with approximately 100 positions for each year for the next five years. These requirements are for Michigan firms only; out-of-state requirements are not known.[25]

Because of the possibility of inaccuracy of the interpretation of the questionnaire and of the statistical methods used or not used, the accuracy and significance of these figures was questioned. The questionnaire was sent to individuals and not to firms or organizations as was the Purdue study. However, it was accepted that the reported results did indicate some demand for need of a four-year baccalaureate degree surveyor in the state of Michigan.

Also of special interest was the results from the question: "Do you believe the attached proposed baccalaureate program is adequate for a registered land surveyor? Yes__ No__ . . . . Eighty-three per cent of those firms polled were in favor of the baccalaureate program as proposed in our questionnaire."[26] This baccalaureate program was

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[25]Ibid., p. 3.

[26]Ibid., pp. 3-4.

later inaugurated at Ferris State College in 1972, as reported in Chapter I.

Summary

Various periodicals were listed where the majority of literature on land or property surveying could be found. The books which relate exclusively to land or property surveying and which are still in publication or available were also listed. A search of dissertation titles and abstracts revealed that no dissertations were written in the area of surveying or land surveying. Studies and reports in periodicals over several decades have been reviewed and none of the studies accomplished what this study of the Michigan Land Surveyor was designed to research and reveal in detail.

Two reports contributed directly to this study: A report by the Task Committee of the American Society of Civil Engineers on The Status of Surveying and Mapping in the United States; and a report by the Education Committee of the Michigan Society of Registered Land Surveyors. The Task Committee's report contributed greatly to reducing the confusion that existed in the surveying and mapping profession. One of the contributions was the categorizing and defining of the areas of surveying and mapping. Parts of that report were used in this study to help delineate the scope and the limits of land surveying. The report by the Michigan Education Committee gave rise to one of the

objectives of this study: The investigation into the continuing educational needs of the Michigan land surveyor.

Other studies and reports established that there was a need for a four-year baccalaureate degree land surveyor. A national study substantiated a national need; a California study showed the need in the state of California; a Purdue University study established that there was a need in the state of Indiana; and a Ferris State College study showed a trend for the need of a four-year degree land surveyor in Michigan.

In addition, it has been pointed out in Chapter I that the Registration Act for Land Surveyors in Michigan requires that candidates who wish to be examined in 1977 or later must have completed an educational requirement of a four-year baccalaureate degree acceptable to the Board of Registration.

Although the studies that showed a public need for land surveyors were not considered as having a direct relationship upon this study, it was felt that such studies were of primary importance in determining whether to conduct this or any study on land surveying. If there was no need or demand for land surveyors, then additional studies on land surveying might be superfluous.

CHAPTER III

METHODOLOGY

Descriptive Research Method

The design of this study was based upon descriptive research methods but not limited solely to those methods. As Borg said: "Although some of these techniques are more frequently used in one type of research than another, any of the three types of research may employ any of the research methods available . . . there are no clear-cut lines that differentiate the three types of research described."[1] The three types of research methods referred to were descriptive, casual-comparative and experimental. The three types of research referred to were basic, applied and action.

This study was carried out by obtaining factual data and opinions from and about the Michigan registered land surveyor. These types of data were best obtained through descriptive research methods, namely through the design and use of a questionnaire as an instrument. Although descriptive research appeared to be held in less esteem than other

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[1]Walter R. Borg, Educational Research, An Introduction (New York: David McKay Co., 1963), p. 21.

types of research in the opinions of some, other authors have cited its value. Van Dalen spoke of descriptive research:

> Descriptive studies that obtain accurate facts about existing conditions or detect significant relationships among current phenomena and interpret the meaning of the data provide educators with practical and immediately useful information. Factual information about existing status enables members of the profession to make more intelligent plans about future courses of action and helps them interpret educational problems more effectively to the public. Pertinent data regarding the present scene may focus attention upon developments, conditions, and trends that might otherwise remain unnoticed. The data may convince citizens to keep pace with existing needs and to prepare for future events. Since educational conditions, processes, practices, and programs are changing constantly, up-to-date descriptions of what is taking place are needed.[2]

Barnes also saw the need for descriptive studies in that:

> Descriptive research is predicated on the fact that it is essential to know "where we are and what we have done" in order to know "where we desire to go and what we want to accomplish."[3]

George J. Mouly had this to say about descriptive research:

> No category of educational research is more widely used than the type known variously as the survey, the normative-survey, status and descriptive research. This is a broad classification comprising a variety of specific techniques and procedures, all similar from the standpoint of

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[2]Deobold B. VanDalen, Understanding Educational Research, Enlarged and Revised Edition (New York: McGraw Hill Book Co., Inc., 1966), pp. 235-236.

[3]John B. Barnes, The Dynamics of Educational Research (Tempe, Arizona: Arizona State College, 1958), p. 162.

> purpose--that is, to establish the status of the phenomenon under investigation.[4]

Mouly went on to say:

> The survey constitutes a primitive type of research in that the investigation of any problem must begin with a "survey" of its nature before it can move into the more structured and rigorous phases. At its most elementary stage, the survey is concerned with determining the immediate status of a given phenomenon. More important from the standpoint of its role as a technique in the development of educational science, however, is the extension of this clarification of the problem into the development of further insights and, eventually, into the more adequate investigations at the experimental level. Thus, its purpose is both immediate and long-range.[5]

Research Subjects

The subjects for this study were the entire population of the registered land surveyors belonging to the Michigan Society of Registered Land Surveyors. A current listing of names and addresses of society members was obtained in December, 1974, from the Society's Lansing Office. There were 436 registered land surveyors who were members of the Society at that time. An additional eighteen associate members of the Society were not included in the study as they were not registered land surveyors.

A 1974 Roster of Architects, Professional Engineers and Land Surveyors in the state of Michigan listed

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[4]George J. Mouly, The Science of Educational Research New York: American Book Co., 1963), p. 231.

[5]Ibid., p. 234.

approximately 830 registered land surveyors.[6] It was not in the interest of this study to include those registered land surveyors who held registration as land surveyors in the state of Michigan and yet did not belong to their professional society. The Michigan Society of Registered Land Surveyors is the only professional organization for land surveyors in the state. It was determined best to study those land surveyors who have a vested interest in their profession. It was believed that those persons who belonged to their recognized professional society were largely those who carry on the task of land surveying within the state. Those who chose not to be members of their professional group were believed to be less active as land surveyors. Therefore, the study was limited to the professional society's membership. Neal Sperhake made this note about the Michigan land surveyor: ". . . the land surveyors society has been getting about 85 per cent of all new registrants each year . . . 85 per cent of the land surveying work in Michigan was performed by members of the society and, as a result of this, there is no difficulty in convincing the legislators that our society represented the majority of working surveyors . . . our registration board permits our society to

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[6]State of Michigan, Department of Licensing and Regulation, Boards of Registration for Architects, Professional Engineers and Land Surveyors, Roster of Architects, Professional Engineers and Land Surveyors (Lansing, Michigan: Michigan Department of Licensing and Regulation, Feb., 1974), pp. 120-127.

prepare the state tests and correct them, and that many problems concerning the ethical behavior of registered surveyors are referred directly to our society for investigation and recommendations."[7]

In 1974, the Michigan Society of Registered Land Surveyors sent out questionnaires to Michigan registered land surveyors who were not members of that Society. Of the 269 replies received, 103 responded that they were practicing land surveying in Michigan. Other replies indicated that they lived out of state, were not practicing land surveying, or were retired or deceased.[8]

It was believed that a separate study of the reasons why some registered land surveyors in Michigan do not belong to the professional society for land surveyors would be of benefit to the surveying profession.

Questionnaire Construction

A questionnaire was used as the instrument through which the objectives of the study were obtained. The questionnaire was developed through aid from selected

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[7]Neal Sperhake, "Importance of Professional Surveyors Recognized by Society of American Foresters," The Michigan Surveyor News Letter (Lansing, Michigan: The Michigan Society of Registered Land Surveyors, Summer Issue, Vol. 2, No. 3, 1967), p. 3.

[8]Michigan Society of Registered Land Surveyors, Office Files, Lansing, Michigan.

persons with acute interest in and overall knowledge of the surveying profession and from a review of the literature. The study had six objectives:

1. To determine the personal characteristics of the present land surveyor.
2. To determine the educational background of the present land surveyor.
3. To determine what subject matter areas are desirable to become a land surveyor.
4. To determine which subject matter areas should be learned through formal education versus experience on the job.
5. To determine the continuing education interests and needs of the present land surveyor.
6. To determine where and when the present land surveyor would be willing to participate in certain continuing education programs.

The questionnaire was constructed in four parts:

1. Part I - Personal Data
2. Part II - Educational Background
3. Part III - Educational Needs for Land (Boundary) Surveying
4. Part IV - Continuing Education

The design of the questions in Parts I, II and IV were of the closed-form, check-list type as opposed to the open-form. This allowed a quantitative analysis of the questions. The questions in Part III were of the Likert rating-scale type, offering five choices. The odd number of five choices did not force an either/or selection but allowed for a neutral or no opinion choice.

Part I was designed to determine some of the characteristics of the land surveyor, such as his sex, age, ethnic classification, whether he was also a professional engineer, how he obtained his registration, information on his work experience, whether he owned his own business, and his membership in professional organizations allied to the surveying profession.

Part II was developed to obtain information on the land surveyor's educational experience, such as his highest level of formal education, the kind of degree and area of discipline, year of graduation, the state in which he received his highest degree, and information about any correspondence study he might have taken.

Part III was designed to find out to what extent land surveyors should know certain subjects and to what extent the knowledge of those subjects should be acquired through formal education or on-the-job experience. This was accomplished by dividing Part III into two sections and using a five-point rating scale in each section. Sixty subjects were listed for each section.

Part IV was developed in order to determine the specific subjects in which the land surveyor would be interested enough to attend a continuing education seminar or program. This part also delved into the length of educational session desired, the preferred day of the week, the most convenient month of the year and the choice of certain

selected cities which would be best suited for an offering of a continuing education program. Obtaining the number and percentage of the respondents who had attended a continuing education program in the past was also in the design of the questionnaire.

The use of the term "seminar" was used in the questionnaire as an inclusive term to include seminars, workshops, conferences, clinics, symposiums or whatever. The word "seminar" had been commonly used within the Michigan Society of Registered Land Surveyors to mean a group meeting to study some subject area under the leadership of an authority or expert. It was desired to use terminology with which the respondent was familiar, thence the word "seminar" was used as a general term.

A reaction was sought as to the feeling about compulsary continuing education programs in order to maintain registration. This question was intended as a preliminary inquiry to ascertain if there was any group trend in the opinions. It was also believed that the question on compulsary continuing education might stimulate some thinking on the matter, which could very likely become an issue in the near future.

An effort was made to find out how familiar the registered land surveyor was with five reference books on land or property surveying. A three-point rating scale was used as the measuring device.

Questionnaire Pre-testing

The questionnaire was pre-tested on ten persons. All but two persons were registered land surveyors. Originally the pre-testing of the questionnaire was attempted by mailings with instructions included. This method was not working satisfactorily, so appointments were made with volunteers and the questionnaires delivered in person. With a brief explanation of what was desired, the volunteer completed the questionnaire while being timed. This gave an approximation of the time required to fill in the questionnaire. An average time of thirty minutes was needed and this information was included in the cover letter.

After completing the questionnaire, the volunteer was interviewed for his reaction to the questionnaire. As a result, several minor changes were made in the questionnaire. These changes involved the rewording of a few of the questions and one of the sets of instructions. This interview technique of pre-testing was found very beneficial and satisfying, but time consuming. Several of the questionnaire pre-test volunteers were members of the Michigan Society of Registered Land Surveyors. Their questionnaires were included in the total replies since the changes in the questionnaire did not affect their responses.

Questionnaire Distribution and Response

The questionnaire, with a cover letter and a postage-free, addressed, return envelope, was mailed to the entire population of 436 registered land surveyors of the Michigan Society of Registered Land Surveyors. Three mailings of the questionnaire were made over a period of slightly more than three weeks.

The first mailing of 436 questionnaires brought 212 replies for a 48.6 per cent return. The second mailing of the questionnaire, second cover letter and a postage-free, return envelope was made twelve days after the first mailing. This second mailing produced 96 replies for 22.0 per cent additional returns. The third mailing of the questionnaire, third cover letter and postage-free, return envelope was made eleven days after the second mailing. This final mailing resulted in an additional 63 replies for 14.5 per cent more returns.

The three mailings resulted in a total of 371 replies to the 436 questionnaires for a return rate of 85.1 per cent. Of the 371 total replies, ten returns were deemed unusable. This represented 2.3 per cent of the 436 questionnaires sent out. There were 361 usable returned questionnaires of the 436 sent out which represented a rate of 82.8 per cent usable replies.

Based upon the relatively high rate of returns of the questionnaires, it was believed that this could be considered as being representative of the population group, the Michigan Society of Registered Land Surveyors. There seemed to be controversy over how large a return is necessary in order to validate a study. Borg advocates checking a portion of the non-responding group if more than 20 per cent of the questionnaires are not returned.[9] A study by Shannon about questionnaire returns of 285 studies of "reputable educational research" showed that there was an average of 65 per cent returns to the mailed questionnaires. He also stated that approximately 200 research reports did not reveal their percentage of returns and hinted that the failure to reveal that information may have been for a reason.[10] Barnes felt that, "generally speaking, a 'good' response should be at least 60 per cent of the sample."[11]

Responses to two items on the questionnaire were sufficient to form two sets of groups, as shown in Tables 2 and 5. The two sets of groups were: Registered land surveyors who were also professional engineers and those who were not engineers, and registered land surveyors who

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[9]Borg, op. cit., p. 219.

[10]J. R. Shannon, "Percentages of Returns of Questionnaires in Reputable Educational Research," Journal of Educational Research, 42 (Oct., 1948), pp. 138-141.

[11]Barnes, op. cit., p. 138.

had an interest in a surveying or engineering business and those who did not have a business interest. The study was expanded to include a comparative analysis of those groups. A research hypothesis assumed that the two groups in each set hold different opinions regarding the importance of knowing various subject matter for land surveying purposes.

Analysis of Data

The responses to each question of the questionnaire were coded and recorded on a computer data coding form. The coded data were then key punched on I.B.M. cards and verified for use with the Control Data Corporation 6500 computer at Michigan State University.

Several computer programs were used to compile and analyze the data: $SDATASET was used for the standardized data matrix; $PFCOUNT was used to obtain frequencies and percentages from responses to Part I (personal data), Part II (educational background) and most of Part IV (continuing education) of the questionnaire; $ACT (Analysis of Contingency Tables) was used to obtain frequencies, percentages, means and standard deviations from responses to Part III (educational needs for land surveying) and to obtain frequencies for a portion of Part IV (continuing education) of the questionnaire; and MULTIVARIANCE (Univariate and

Multivariate Analysis of Variance, Covariance and Regression)[12] was used in a comparison analysis between professional engineers, non-professional engineers, business owners and non-business owners. $DATASET, $PFCOUNT and $ACT were obtained from the CISSR (Computer Institute of Social Science Research)[13] system.

Item # (4-1) of questionnaire Part IV reads in part, "Circle the item number of any of the items in Part III that you feel you need and that you would like to see offered in a continuing education seminar," which was combined with the eleven cities listed in item # (4-6) of Part IV, which reads, "In which location would you prefer to attend a seminar? Please circle three choices." This resulted in a listing of the number of persons expressing an interest in attending a seminar in each of the subjects of Part IV and at each of the eleven listed cities. The results were presented in a table.

A comparison was made between respondents who were registered land surveyors and respondents who were dually licensed as registered land surveyors and professional

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[12]Jeremy D. Finn, "Multivariance," Modified and Adapted for Use on CDC 6500 by Verda M. Scheiflay and William H. Schmidt, Occasional Paper No. 22, Office of Research Consultation, School of Advanced Studies, College of Education, Michigan State University, Oct., 1973.

[13]Leighton Price, "CISSR Library Programs," Computer Institute for Social Science Research, Michigan State University, May 17, 1972.

engineers. A comparison was also made between registered land surveyors who had an interest in a business and registered land surveyors who did not have a business interest. A research hypothesis assumed that the aforementioned groups hold different opinions regarding the importance of knowing various subject matter for land surveying purposes. A null hypothesis was used for testing purposes at a .10 level of significance. This lower level of significance was believed adequate for the desired results in this type of study.

Summary

The design of this study was based upon descriptive research methods. It entailed the composition of a questionnaire which would answer the objectives of the study. The questionnaire was pre-tested and mailed to all 436 registered land surveyors who were members of the Michigan Society of Registered Land Surveyors. There were two follow-up mailings after the original questionnaire mailing. Of the 436 persons solicited, 371, or 85.1 per cent, responded. Of these, there were ten replies that were not usable, leaving 361, or 82.8 per cent, usable returns.

The results from the questionnaires were presented by quantitative data of frequency, percentage, mode, median, mean, standard deviation and combinations of these measurements.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

Personal Characteristics of the Respondents

One of the purposes of the study was to determine the personal characteristics of today's land surveyors. Part I of the questionnaire covered this aspect of the study.

Item # (1-1) of the questionnaire asked the sex of the registered land surveyor. Of the total 361 responses, 360 or 99.7 per cent responding were male and one person, or 0.3 per cent, was female. This showed that the Michigan Society of Registered Land Surveyors was almost exclusively male.

Answers to item # (1-2) of the questionnaire determined the age of the respondents based on five-year intervals. The median age of the respondent was calculated at 43.8 years. Table 1 shows the results of the responses.

Item # (1-3) asked for the ethnic background of the respondents: White, Black, American Indian, Oriental, Spanish American and Other were listed on the questionnaire. Of the 359 total responses, 358 replied White and one was marked Other. Those were the only classifications marked.

Table 1. Age distribution of responding land surveyors.

Age Ranges	Number	Percentages
Under 25	0	0.0
25-29	7	1.9
30-34	51	14.1
35-39	70	19.4
40-44	62	17.2
45-49	62	17.2
50-54	41	11.4
55-59	25	6.9
Over 59	43	11.9
Totals	361	100.0

Item # (1-4) determined how many registered land surveyors were also professional engineers. Approximately one-third of the respondents were dually registered as land surveyors and as professional engineers. Table 2 shows the response figures.

Item # (1-5) of the questionnaire inquired into the number of years' experience that the responding land surveyors have had in surveying. The median number was calculated to be 20.1 years' experience. The frequency and per cent of the experience groupings is shown in Table 3.

Item # (1-6) determined how many respondents had obtained their registration as a land surveyor through the "grandfather's clause" of the Registration Act rather than

Table 2. Land surveyors who were also professional engineers.

Type of License	Number	Percentage
Registered land surveyor only	243	67.3
Dual registered land surveyor and professional engineer	118	32.7
Totals	361	100.0

Table 3. Number of years of surveying experience of respondents.

Years' Experience	Number	Percentage
Less than 5	2	0.6
5-9	26	7.2
10-14	56	15.5
15-19	87	24.1
20-24	76	21.0
25-29	51	14.1
30-34	18	5.0
Over 34	45	12.5
Totals	361	100.0

by examination. Of the 361 responding, only seven, or 1.9 per cent, showed that they had received their registration by this "grandfather's clause." This meant that 98.1 per cent of the respondents had obtained their registration as land surveyors by examination.

Item # (1-7) determined if the respondents had practiced another profession or job prior to entering the land surveying profession. Of the 361 responding, 141, or 39.1 per cent, reported that they had practiced in another profession or job prior to entering the land surveying profession while 220, or 60.9 per cent, reported that they had not. Item # (1-8) established what profession or job the 141 respondents had prior to entering the land surveying profession. A majority of 80, or 56.7 per cent, of those 141 respondents had worked in engineering prior to entering the land surveying profession. The next greatest number of 48, or 34.1 per cent, of those 141 respondents marked "Other" as the profession or job that they had held prior to entering land surveying. If "Other" was marked, the respondent was asked to specify what job it was. No particular pattern as to type of work seemed to emerge from this, although "the building and construction industry" was the most frequent reply. Results of item # (1-8) are found in Table 4.

Table 4. Profession or job held before entering surveying.

Profession or Job	Number	Percentage
Engineering	80	56.7
Forestry	12	8.5
Architecture	1	0.7
Other	48	34.1
Building and construction industry	(11)	(7.8)
Factory and shop work	(9)	(6.4)
Military	(7)	(5.0)
Non-engineering office work	(4)	(2.9)
Auto mechanic	(3)	(2.1)
Sales	(2)	(1.4)
Teaching	(2)	(1.4)
Drafting	(2)	(1.4)
Government work	(2)	(1.4)
Various other	(6)	(4.3)
Totals	141 (48)	100.0 (34.1)

Item # (1-9) inquired into the respondent's individual interest in the ownership of surveying or engineering firms. Of the 361 responses, 224, or 62.0 per cent, reported that they were active or retired owners or part owners of surveying and/or engineering firms. This included those in private practice. Table 5 shows the compilation of the replies.

Table 5. Surveyors who own their firms.

Status	Number	Percentage
Owner	224	62.0
Not an owner	137	38.0
Totals	361	100.0

Item # (1-10) inquired into the membership in certain organizations which may be allied to land surveying. Whether membership was held in the Michigan Society of Registered Land Surveyors was asked only for the purpose of avoiding confusion of the respondent by not including it. This was added through recommendations from the pre-testing of the questionnaire. Discounting membership in the Michigan Society of Registered Land Surveyors, the American Congress on Surveying and Mapping had the largest response with 129, or 35.7 per cent, of the respondents being members. Other results of this inquiry are found in Table 6.

Table 6. Organizations of which respondents were members.

Organization	Number	Percentage
Michigan Society of Registered Land Surveyors	361	100.0
American Congress on Surveying and Mapping	129	35.7
Michigan Society of Professional Engineers	75	20.8
American Society of Civil Engineers	47	13.0
Michigan Engineering Society	37	10.2
Consulting Engineers Council of Michigan	36	10.0
American Society of Photogrammetry	8	2.2

Summary of personal characteristics of the respondents

Part I of the questionnaire dealt with the purpose of determining some of the personal characteristics of the registered land surveyor. It was found that the respondent was a white male with a median age of 43.8 years. The median number of years' experience he had in surveying was 20.1 years. There were 32.7 per cent who held dual registration as professional engineers and registered land surveyors. Only 1.9 per cent had obtained their registration from the old "grandfather's clause" of the Registration Act. About 39.1 per cent had practiced or worked in another

profession or job before entering the land surveying profession. Of those, 56.7 per cent had been in engineering work prior to entering land surveying. A proportion of 62.0 per cent of the respondents were active or retired owners or part owners of surveying and/or engineering firms, including those in private practice. Membership of the respondents in the American Congress on Surveying and Mapping was 35.7 per cent and in the Michigan Society of Professional Engineers, 20.8 per cent.

Educational Background of the Respondents

The purpose of Part II of the questionnaire was to determine the educational background of the land surveyor, accomplished through a series of items or questions in the questionnaire.

Item # (2-1) of the questionnaire inquired into the surveyor's highest level of education. The median education of the respondent fell in the range of from two to four years of college. One hundred fifty-two, or 42.1 per cent, of the respondents had a bachelor's or master's degree. One hundred sixty-two, or 44.9 per cent, of the respondents had some college, but less than four years. Forty-four, or 12.2 per cent, had as their highest education a high school diploma and three, or 0.8 per cent, had less than a high school diploma. No doctoral degrees were reported. Table 7 shows these results.

Table 7. Highest level of formal education of the respondent.

Level of Education	Number	Percentage
Less than high school graduate	3	0.8
High school graduate	44	12.2
Less than two years of college	59	16.3
Two year college associate degree	27	7.5
Two to four years of college	76	21.1
Bachelor's degree	131	36.3
Master's degree	21	5.8
Doctor's degree	0	0.0
Other	0	0.0
Totals	361	100.0

Item # (2-2) was intended to find what the area of study was for those respondents who had baccalaureate degrees. Seventy-eight per cent had received their degrees in civil engineering and nine per cent in forestry. Table 8 covers the areas of baccalaureate degrees.

Item # (2-3) determined the year of graduation of those 152 respondents who held baccalaureate degrees. The median year of graduation was 1952. Table 9 shows the various years of graduation.

Item # (2-4) examined the major area of study of those respondents who had some college education but less than a baccalaureate degree. Civil engineering and civil

Table 8. The area of study for respondents holding a baccalaureate degree.

Area of Study	Number	Percentage
Civil engineering	118	77.6
Forestry	14	9.2
Other engineering	4	2.6
Mining engineering	3	2.0
Mathematics	3	2.0
Business	2	1.3
Architecture	0	0.0
Other	8	5.3
Totals	152	100.0

Table 9. Year of graduation for respondents receiving a baccalaureate degree.

Year of graduation	Number	Percentage
1971 - 1974	5	3.3
1966 - 1970	12	7.9
1961 - 1965	17	11.2
1956 - 1960	21	13.8
1951 - 1955	32	21.1
1946 - 1950	23	15.1
1941 - 1945	11	7.2
1936 - 1940	11	7.2
Prior to 1936	20	13.2
Totals	152	100.0

or surveying technology absorbed 104, or 68.9 per cent, of the replies. Table 10 summarizes the results.

Item # (2-5) inquired into the date of graduation for those 45 respondents who held a two-year associate degree. The median date of graduation was 1963. Table 11 shows the breakdown of the years of graduation for the associate degrees.

Table 10. Major area of study of respondents with some college education but less than a baccalaureate degree.

Major area of study	Number	Percentage
Civil Engineering	53	35.1
Civil/Surveying Technology	51	33.8
Other Engineering	11	7.3
Mechanical Engineering	(6)	(4.0)
Chemical Engineering	(2)	(1.3)
Various other	(3)	(2.0)
General - No specific major	12	7.9
Forestry	5	3.3
Other major areas	19	12.6
Business	(4)	(2.7)
Pre-Med	(3)	(2.0)
Mathematics	(2)	(1.3)
Various other	(10)	(6.6)
Totals	151	100.0

Table 11. Year of graduation of respondents who hold two-year associate degrees.

Year graduated	Number	Percentage
1973 - 1974	1	2.2
1971 - 1972	2	4.4
1969 - 1970	1	2.2
1967 - 1968	2	4.4
1965 - 1966	3	6.7
1963 - 1964	16	35.6
1961 - 1962	4	8.9
1959 - 1960	5	11.1
Prior to 1959	11	24.5
Totals	45	100.0

Item # (2-6) sought to find from which state the respondent received his highest education or degree. Three hundred and two, or 89.1 per cent, of the respondents listed Michigan as the state. Table 12 covers this item.

Items # (2-7, (2-8), (2-9) and (2-10) investigated the involvement of the respondent with correspondence schools and courses. Item # (2-7) determined how many respondents had taken correspondence courses. Approximately 32 per cent of the 361 responding stated that they had taken correspondence courses, as shown in Table 13. Item # (2-8) searched for the precise studies of those who had taken correspondence courses. Sixty per cent of those who had enrolled in

Table 12. State from which respondents received their highest education or degree.

State	Number	Percentage
Michigan	302	89.1
Other	37	10.9
Indiana	(12)	(3.5)
Foreign countries	(4)	(1.2)
Illinois	(3)	(0.9)
Wisconsin	(3)	(0.9)
Ohio	(3)	(0.9)
Pennsylvania	(2)	(0.6)
Various others	(10)	(2.9)
Totals	339 (37)	100.0 (10.9)

Table 13. Respondents who have taken correspondence courses.

Participated	Number	Percentage
Yes	114	31.6
No	247	68.4
Totals	361	100.0

correspondence courses had taken a surveying and mapping course of study. Table 14 shows these results. Item # (2-9) inquired into the school from which the correspondence courses were taken. International Correspondence School (ICS) was listed most frequently, as shown in Table 15. Item # (2-10) determined that 39 per cent of those persons who took correspondence courses completed the requirements for a degree or certificate, as indicated in Table 16.

Summary of educational background of the respondents

Part II of the questionnaire determined the educational background of the responding land surveyors who are

Table 14. Course of study of respondents who have taken correspondence courses.

Course of study	Number	Percentage
Surveying and mapping	68	59.7
Civil engineering	26	22.8
Other	20	17.5
Business	(6)	(5.2)
Drafting	(5)	(4.4)
Highway engineering	(1)	(0.9)
Various others	(8)	(7.0)
Totals	114 (20)	100.0 (17.5)

Table 15. Schools from which respondents have taken correspondence courses.

School	Number	Percentage
I.C.S. - International Correspondence School	90	78.9
C.I.S.T. - Canadian Institute of Science and Technology	1	0.9
LaSalle Extension University	1	0.9
Pacific International College of Arts and Science	0	0.0
Other	22	19.3
Armed Forces	(7)	(6.1)
Chicago Technical College	(4)	(3.5)
Industrial Training Institute	(1)	(0.9)
Brinker School of Surveying and Mapping	(1)	(0.9)
Various others	(9)	(7.9)
Totals	114 (22)	100.0 (19.3)

Table 16. Respondents completing required correspondence courses for a degree or certificate.

Degree or certificate	Number	Percentage
Yes	44	38.6
No	70	61.4
Totals	114	100.0

members of the Michigan Society of Registered Land Surveyors. It was found that 42.1 per cent of the respondents held at least a baccalaureate degree. Of those, 77.6 per cent had their degree in the area of civil engineering. The median year of obtaining the baccalaureate degree was 1952. Of the 44.9 per cent who had some college education, but less than a baccalaureate degree, 88.9 per cent had been enrolled in either a civil engineering curriculum or a civil/surveying technology program. The median year of graduation for those with a two-year associate degree was 1963. Michigan was the state from which 89.1 per cent of the respondents received their highest degree or education. Indiana followed with 3.5 per cent. Correspondence courses were taken by 31.6 per cent of the respondents. Of those taking correspondence courses, 59.7 per cent had taken surveying and mapping as a course of study and 22.8 per cent had taken civil engineering. Of the respondents who had taken correspondence courses, 38.6 per cent had completed their course requirements for a certificate or degree. International Correspondence School (ICS) was reported by 78.9 per cent of the respondents, who had taken correspondence courses, as the school from which they had taken their course work. The Armed Forces followed with 6.1 per cent.

Educational Needs for Land or Property Surveyors

Data for two of the six objectives of the study were obtained through Part III of the questionnaire. One was to determine opinions on educational needs in becoming a land surveyor. The other was to determine opinions on which areas of knowledge and techniques should be learned through formal education versus experience on the job. Sixty items or subjects were listed.

In order to determine to what extent a surveyor doing property and boundary surveying should know each subject, a five-point rating scale was used on each of the sixty items. This rating scale consisted of the terms "absolutely necessary," "preferably necessary," "undecided (no opinion)," "preferably not necessary" and "absolutely not necessary." If either of the terms "absolutely necessary" or "preferably necessary" were marked, the respondent was asked to choose one of the additional five terms which answered the question: "Where should this knowledge be acquired"? These five terms were also on a five-point rating scale and were: "entirely in the classroom"; "3/4 classroom, 1/4 on the job"; "1/2 classroom, 1/2 on the job"; "1/4 classroom, 3/4 on the job" and "entirely by job experience."

Importance of various subject matter to the land or property surveyor

Table 17 entitled "The importance of various subject matter to the land surveyor" lists the frequency and percentage of responses of every possible choice in the five-point rating scale for each of the sixty items or subjects. In addition to the total number of responses, the mean value of the five-point rating scale and the standard deviation of the responses is given for each of the sixty items or subjects.

Both the mode, which is defined as "the value of the term that appears most frequently,"[1] and the sum of the frequency percentages in ranks number 1 ("absolutely necessary") and number 2 ("preferably necessary") were used to analyze most of the items in Table 18.

All of the modes of items # (3-24), (3-25), (3-32) and (3-41) fell in rank number 1 ("absolutely necessary") with greater than 91 per cent of the responses in this category. When the percentage for each item was combined with the respective frequency percentage from rank number 2 ("preferably necessary"), the sum gave a total frequency value of over 99 per cent.

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[1]George H. Weinberg and John A. Schumaker, Statistics An Intuitive Approach (Belmont, Calif.: Wadsworth Publishing Co., Inc., 1962), p. 12.

Table 17. The importance of various subject matter to the land surveyor.

Item #	Subject	Number and percent of responses expressing opinion to the question: To what extent should a surveyor doing property and boundary surveying know each subject? 1. Absolutely necessary	2. Preferably necessary	3. Undecided (No opinion)	4. Preferably not necessary	5. Absolutely not necessary	Total Responses	Mean	Standard Deviation
(3-1)	A basic understanding of electronic computers	13.6% 48	56.5% 200	13.8% 49	12.4% 44	3.7% 13	100% 354	2.36	.99
(3-2)	Ability to do computer programming	3.6% 13	33.9% 121	23.3% 83	29.4% 105	9.8% 35	100% 357	3.08	1.08
(3-3)	Application of computers in surveying problems	30.6% 110	51.8% 186	8.9% 32	7.0% 25	1.7% 6	100% 359	1.97	.91
(3-4)	Taking and computing astronomical observations for true bearing	51.5% 185	37.6% 135	4.5% 16	4.7% 17	1.7% 6	100% 359	1.67	.89
(3-5)	Taking and computing astronomical observations for latitude and longitude position	22.8% 82	42.1% 151	15.9% 57	14.5% 52	4.7% 17	100% 359	2.36	1.12
(3-6)	Theory and principles of photogrammetry	7.8% 28	51.0% 182	18.8% 67	19.0% 68	3.4% 12	100% 357	2.59	.99
(3-7)	Application of photogrammetry to surveying	15.2% 54	56.1% 199	14.1% 50	12.4% 44	2.2% 8	100% 355	2.30	.95
(3-8)	Computation and use of the State Plane Coordinate System	29.0% 104	44.1% 158	14.0% 50	9.5% 34	3.4% 12	100% 358	2.14	1.05
(3-9)	Ability to make neat and accurate drawings	70.2% 252	27.8% 100	0.6% 2	1.4% 5	0.0% 0	100% 359	1.33	.56
(3-10)	Ability in use of ink in drafting	46.4% 167	37.2% 134	7.8% 28	8.0% 29	0.6% 2	100% 360	1.79	.93
(3-11)	Ability to identify trees	19.7% 71	61.7% 222	10.0% 36	7.8% 28	0.8% 3	100% 360	2.08	.82
(3-12)	Conduct as an expert witness in a court of law	51.7% 185	42.5% 152	4.7% 17	0.8% 3	0.3% 1	100% 358	1.56	.65
(3-13)	Familiarity with the court system	22.6% 81	55.3% 198	12.6% 45	8.9% 32	0.6% 2	100% 358	2.09	.87
(3-14)	Familiarity with the liability of the property surveyor	80.0% 289	19.1% 69	0.3% 1	0.6% 2	0.0% 0	100% 361	1.21	.46
(3-15)	Familiarity with the more common State Laws that pertain to land surveying (eg; Michigan Coordinate System Act, Corner Recordation Act, etc.)	86.7% 312	13.0% 47	0.0% 0	0.3% 1	0.0% 0	100% 360	1.14	.37
(3-16)	Familiarity with the less known State Laws that may involve land surveying (eg; Malpractice Act, Soil Erosion Act, Mechanics Lien Act, etc.)	35.7% 129	58.5% 211	3.6% 13	2.2% 8	0.0% 0	100% 361	1.72	.64
(3-17)	Figuring survey costs and professional fees	69.1% 248	25.9% 93	3.9% 14	1.1% 4	0.0% 0	100%	1.37	.62
(3-18)	Professionalism, professional ethics, and relationship with client	79.4% 285	17.8% 64	2.0% 7	0.8% 3	0.0% 0	100% 359	1.24	.52

Table 17. (Cont.)

Item #	Subject	Number and percent of responses expressing opinion to the question: To what extent should a surveyor doing property and boundary surveying know each subject? 1. Absolutely necessary	2. Preferably necessary	3. Undecided (No opinion)	4. Preferably not necessary	5. Absolutely not necessary	Total Responses	Mean	Standard Deviation
(3-19)	Understanding real property interests (Freehold Estates, Leasehold Estates, Life Estates, Fee Simple, etc.)	28.3% 102	52.9% 191	10.2% 37	6.9% 25	1.7% 6	100% 361	2.01	.90
(3-20)	Understanding the written transfer of real property (Deeds, Wills, etc.)	55.4% 199	37.1% 133	3.3% 12	3.6% 13	0.6% 2	100% 359	1.57	.77
(3-21)	Understanding the transfer of real property not in writing (Adverse Possession, Oral Agreement, Accretion, etc.)	57.0% 204	36.6% 131	3.1% 11	2.5% 9	0.8% 3	100% 358	1.54	.75
(3-22)	Understanding junior and senior property rights	52.4% 188	31.7% 114	10.6% 38	3.6% 13	1.7% 6	100% 359	1.70	.92
(3-23)	Understanding the priorities of conflicting terms that may be found in boundary descriptions	84.7% 305	13.4% 48	0.8% 3	1.1% 4	0.0% 0	100% 360	1.18	.48
(3-24)	Ability to evaluate field evidence of property boundaries	92.8% 335	6.9% 25	0.3% 1	0.0% 0	0.0% 0	100% 361	1.07	.27
(3-25)	Ability to write property descriptions	96.1% 346	3.6% 13	0.0% 0	0.3% 1	0.0% 0	100% 360	1.04	.24
(3-26)	Understanding the legal terminology in real estate transactions	46.4% 167	41.7% 150	8.0% 29	3.9% 14	0.0% 0	100% 360	1.69	.78
(3-27)	Ability to locate, read and understand court cases in a law library	16.1% 58	41.8% 151	22.4% 81	17.5% 63	2.2% 8	100% 361	2.48	1.03
(3-28)	Ability to locate and research public records and documents dealing with real property	73.3% 264	22.0% 79	3.3% 12	1.4% 5	0.0% 0	100% 360	1.33	.61
(3-29)	Understanding riparian and littoral (water front) property ownership	67.5% 243	28.3% 102	3.6% 13	0.3% 1	0.3% 1	100% 360	1.38	.60
(3-30)	Understanding the mineral rights of property ownership	9.8% 35	40.1% 143	30.5% 109	16.5% 59	3.1% 11	100% 357	2.63	.97
(3-31)	Understanding reversion rights and easements in property ownership	49.6% 177	44.0% 157	2.8% 10	3.6% 13	0.0% 0	100% 357	1.61	.72
(3-32)	Understanding the handling of excesses and deficiencies between recorded and measured distances	93.6% 334	6.4% 23	0.0% 0	0.0% 0	0.0% 0	100% 357	1.06	.25
(3-33)	Ability to write descriptions for condominiums	45.5% 163	43.0% 154	8.7% 31	2.2% 8	0.6% 2	100% 358	1.69	.77
(3-34)	Ability to plat condominium projects	45.7% 163	42.0% 150	9.5% 34	2.0% 7	0.8% 3	100% 357	1.70	.79
(3-35)	Familiarity with field safety precautions	60.9% 218	34.1% 122	3.3% 12	1.4% 5	0.3% 1	100% 358	1.46	.66

Table 17. (Cont.)

Item #	Subject	Number and percent of responses expressing opinion to the question: To what extent should a surveyor doing property and boundary surveying know each subject? 1. Absolutely necessary	2. Preferably necessary	3. Undecided (No opinion)	4. Preferably not necessary	5. Absolutely not necessary	Total Responses	Mean	Standard Deviation
(3-36)	Proper dress and conduct in the field	49.0% 176	41.0% 147	7.2% 26	2.5% 9	0.3% 1	100% 359	1.64	.75
(3-37)	Knowledge of planning and designing subdivisions	72.8% 260	23.3% 83	1.1% 4	2.5% 9	0.3% 1	100% 357	1.34	.66
(3-38)	Knowledge of the procedure for preparing a preliminary plat	82.9% 295	15.4% 55	0.6% 2	1.1% 4	0.0% 0	100% 356	1.20	.49
(3-39)	Knowledge of the procedure for preparing a final plat	82.7% 296	15.9% 57	0.6% 2	0.8% 3	0.0% 0	100% 358	1.20	.47
(3-40)	Understanding the duties and operations of the various local government agencies (City Clerk, City Engineer, County Plat Board, County Treasurer, Planning Board, etc.)	44.9% 161	46.2% 166	5.0% 18	3.9% 14	0.0% 0	100% 359	1.68	.74
(3-41)	Understanding the general principles of how the original sectionalized Government lands were subdivided into townships, sections, and quarter sections	91.9% 330	7.5% 27	0.3% 1	0.3% 1	0.0% 0	100% 359	1.09	.32
(3-42)	Understanding the specific method used by government surveyors in subdividing townships and sections in that part of Michigan where you work	87.7% 315	11.7% 42	0.3% 1	0.3% 1	0.0% 0	100% 359	1.13	.37
(3-43)	Understanding the specific method used by government surveyors in subdividing townships and sections in any part of Michigan	53.9% 193	40.2% 144	3.6% 13	2.0% 7	0.3% 1	100% 358	1.54	.69
(3-44)	Human relations skills (Public relations)	36.2% 130	56.5% 203	5.6% 20	1.7% 6	0.0% 0	100% 359	1.73	.64
(3-45)	Office management	28.8% 103	56.1% 201	10.3% 37	4.5% 16	0.3% 1	100% 358	1.91	.77
(3-46)	Accounting procedures	19.5% 70	57.8% 207	15.1% 54	7.0% 25	0.6% 2	100% 358	2.11	.82
(3-47)	Business law	16.5% 59	58.9% 211	17.9% 64	6.4% 23	0.3% 1	100% 358	2.15	.78
(3-48)	Contract law	22.8% 81	56.2% 200	14.0% 50	7.0% 25	0.0% 0	100% 356	2.05	.80
(3-49)	Mechanics lien	25.4% 90	57.2% 203	11.5% 41	5.9% 21	0.0% 0	100% 355	1.98	.78
(3-50)	Workmans compensation	21.4% 76	53.2% 189	16.4% 58	7.6% 27	1.4% 5	100% 355	2.14	.89
(3-51)	English - Composition and report writing	41.2% 147	50.2% 179	3.6% 13	5.0% 18	0.0% 0	100% 357	1.73	.76

Table 17. (Cont.)

Item #	Subject	Number and percent of responses expressing opinion to the question: To what extent should a surveyor doing property and boundary surveying know each subject? 1. Absolutely necessary	2. Preferably necessary	3. Undecided (No opinion)	4. Preferably not necessary	5. Absolutely not necessary	Total Responses	Mean	Standard Deviation
(3-52)	Fundamentals of Economics	11.3% 40	49.9% 176	23.8% 84	13.0% 46	2.0% 7	100% 353	2.44	.92
(3-53)	Calculus	5.1% 18	28.4% 100	24.7% 87	29.0% 102	12.8% 45	100% 352	3.16	1.13
(3-54)	Statistics and Probability	5.7% 20	21.7% 76	34.8% 122	25.6% 90	12.2% 43	100% 351	3.17	1.08
(3-55)	Physics - Mechanics	6.3% 22	27.3% 96	27.1% 95	29.0% 102	10.3% 36	100% 351	3.10	1.10
(3-56)	Physics - Heat	3.7% 13	15.5% 54	32.8% 114	31.9% 111	16.1% 56	100% 348	3.41	1.05
(3-57)	Physics - Electricity	2.9% 10	18.6% 65	33.1% 116	29.4% 103	16.0% 56	100% 350	3.37	1.05
(3-58)	Physics - Magnetism	5.4% 19	21.4% 75	28.3% 99	30.0% 105	14.9% 52	100% 350	3.27	1.12
(3-59)	Physics - Sound	3.4% 12	23.1% 81	28.6% 100	29.2% 102	15.7% 55	100% 350	3.31	1.09
(3-60)	Physics - Light	6.3% 22	27.4% 96	24.6% 86	26.8% 94	14.9% 52	100% 350	3.17	1.17

The modes of items # (3-14), (3-15), (3-23), (3-38), (3-39) and (3-42) fell in rank number 1 ("absolutely necessary") with from 80 to 88 per cent of the responses in this category. When combined with the respective frequency percentage from rank number 2 ("preferably necessary"), the sum for each of those six items was greater than 98 per cent.

The modes of items # (3-9), (3-18), (3-28) and (3-37) fell in rank number 1 ("absolutely necessary") with from 70 to 79 per cent of the responses in this category. When the percentage for each item was combined with the appropriate frequency percentage from rank number 2 ("preferably necessary"), the sum yielded a total frequency value of over 90 per cent.

The modes of items # (3-17), (3-29) and (3-35) fell in rank number 1 ("absolutely necessary") with from 61 to 69 per cent of the responses in this category. When the frequency percentages from rank numbers 1 and 2 ("preferably necessary") were combined for any single item, the total frequency value was over 95 per cent for any item.

The modes of items # (3-4), (3-12), (3-20), (3-21), (3-22) and (3-43) fell in rank number 1 ("absolutely necessary") with from 51 to 57 per cent of the responses in this category. When the frequency percentages from rank numbers 1 and 2 ("preferably necessary") were combined for any single item, the total frequency value ranged from 84 to 94 per cent for the six items.

The modes of items # (3-10), (3-26), (3-31), (3-33), (3-34) and (3-36) fell in rank number 1 ("absolutely necessary") with from 45 to 50 per cent of the responses in this category. When the frequency percentages from rank numbers 1 and 2 ("preferably necessary") were combined for any single item, the total frequency value ranged from 84 to 94 per cent.

The modes of items # (3-1), (3-3), (3-6), (3-7), (3-11), (3-13), (3-16), (3-19), (3-44), (3-45), (3-46), (3-47), (3-48), (3-49), (3-50) and (3-51) fell in rank number 2 ("preferably necessary") with from 50 to 62 per cent of the responses in this category. When combined with the frequency percentage in rank number 1 ("absolutely necessary"), the sum of the two gave a total frequency value that ranged from 59 to 94 per cent for each of the items. Upon combining the frequency percentage values of ranks number 1 and number 2 for items # (3-16), (3-44) and (3-51), the sum total was a frequency value of over 90 per cent for each item. Similarly, items # (3-3), (3-11), (3-19), (3-45) and (3-49) each yielded a combined total frequency value that ranged from 81 to 85 per cent. Items # (3-1), (3-7), (3-13), (3-46), (3-47), (3-48) and (3-50) each had a rank number 1 and number 2 total frequency value that ranged from 70 to 79 per cent for any item. Item # (3-6) had a combined total frequency value of 59 per cent.

The modes of items # (3-5), (3-8), (3-27), (3-30), (3-40) and (3-52) fell in rank number 2 ("preferably necessary") with from 40 to 50 per cent of the responses in this category. When combined with the frequency percentage of rank number 1 ("absolutely necessary"), the sum total frequency value ranged from 50 to 91 per cent for any of these items. Item # (3-40) had a combined frequency value of 91 per cent. Item # (3-8) had a combined frequency value of 73 per cent. Items # (3-27) and (3-30) had a combined frequency value of 58 and 50 per cent respectively.

Results showed that nearly all sixty subjects were believed to be necessary to the surveyor who practices property or boundary surveying. However, several subjects were not decisively recommended by the respondents and showed greater variation in opinions as to their importance. Those subjects were represented by items # (3-2), (3-53), (3-54), (3-55), (3-56), (3-57), (3-58), (3-59) and (3-60).

The response to item # (3-2), "ability to do computer programming," was a close three-way division. Thirty-eight per cent of the responses indicated a belief that knowledge of the subject was necessary, 39 per cent reported that it was not necessary and 23 per cent were undecided.

Item # (3-53), "calculus," was similar in its results. Thirty-three per cent responding believed that knowledge of the subject was necessary, 42 per cent reported that it was not necessary and 25 per cent were undecided.

Regarding item # (3-54), "statistics and probability," 27 per cent of the respondents believed that the subject was necessary, 38 per cent believed it was not necessary and 35 per cent had no opinion.

Items # (3-55), (3-56), (3-57), (3-58), (3-59) and (3-69) represented various areas of physics. All items showed divided opinions as to the usefulness of the subjects. Items # (3-55) and (3-60) were "mechanics and light." Those items reported a 34 per cent response on the "necessary to know" choice, a 40 per cent response on the "not necessary to know" category and 26 per cent response "undecided." This represented a stronger response on the "necessary to know" side than did the remaining areas of physics. Perhaps this occurred because of a holdover from the strong orientation in civil engineering courses to mechanics and because of the fairly recent development in the use of infrared and laser light beams in EDM (Electronic Distance Measuring) equipment.

Only 19 to 27 per cent of the respondents indicated that knowledge in the remaining areas of physics--heat, electricity, magnetism and sound--was "necessary." Those respondents who believed that knowledge in those subjects was "not necessary" ranged from 45 to 48 per cent. The respondents who abstained with a "no opinion" response varied from 19 to 33 per cent.

Where knowledge should be acquired

Table 18, related to whether subject matter should be learned in a planned educational setting, lists in detail the frequency and percentage of responses of every possible choice in the five-point rating scale for each of the sixty items or subjects. In addition, the total number of responses, the mean value of the five-point rating scale and the standard deviation of the responses was given for each of the sixty items or subjects. The total number of responses varied considerably between the various items. This was expected, as the instructions requested that each person respond to the second question about the item only if choice number 1, "absolutely necessary," or number 2, "preferably necessary," was marked in answer to the previous question about the extent that a surveyor should know that subject. The modes and the sums of the frequency percentages in rank numbers 1 and 2 ("entirely in the classroom" and "3/4 classroom, 1/4 on the job") and rank numbers 4 and 5 ("1/4 classroom, 3/4 on the job" and "entirely by job experience") were used to analyze the data of Table 18.

The modes of items # (3-53), (3-54), (3-55), (3-56), (3-57), (3-58), (3-59) and (3-60) fell in rank number 1 ("entirely in the classroom") with from 64 to 72 per cent of the responses in this category. When combined with the respective frequency percentage from the rank number 2

Table 18. Preferred educational setting.

Item #	Subject	Number and percent of responses expressing opinion to the question: Where should this knowledge be acquired? 1. Entirely in the classroom	2. 3/4 classroom, 1/4 on the job	3. 1/2 classroom, 1/2 on the job	4. 1/4 classroom, 3/4 on the job	5. Entirely by job experience	Total Responses	Mean	Standard Deviation
(3-1)	A basic understanding of electronic computers	18.2% 45	29.4% 73	36.3% 90	12.9% 32	3.2% 8	100% 248	2.54	1.03
(3-2)	Ability to do computer programming	16.3% 22	40.7% 55	31.1% 42	10.4% 14	1.5% 2	100% 135	2.40	.93
(3-3)	Application of computers in surveying problems	8.9% 26	27.8% 81	40.6% 118	18.6% 54	4.1% 12	100% 291	2.81	.98
(3-4)	Taking and computing astronomical observations for true bearing	8.5% 27	29.4% 93	45.1% 143	14.8% 47	2.2% 7	100% 317	2.73	.89
(3-5)	Taking and computing astronomical observations for latitude and longitude position	10.1% 23	30.8% 70	44.1% 100	13.7% 31	1.3% 3	100% 227	2.65	.89
(3-6)	Theory and principles of photogrammetry	31.4% 64	36.3% 74	24.0% 49	7.8% 16	0.5% 1	100% 204	2.10	.95
(3-7)	Application of photogrammetry to surveying	16.4% 41	30.0% 75	36.8% 92	14.4% 36	2.4% 6	100% 250	2.56	1.00
(3-8)	Computation and use of the State Plane Coordinate System	25.8% 66	40.6% 104	26.6% 68	6.6% 17	0.4% 1	100% 256	2.15	.90
(3-9)	Ability to make neat and accurate drawings	11.9% 41	22.5% 78	39.6% 137	22.2% 77	3.8% 13	100% 346	2.84	1.02
(3-10)	Ability in use of ink in drafting	19.3% 57	20.0% 59	30.5% 90	23.1% 68	7.1% 21	100% 295	2.79	1.20
(3-11)	Ability to identify trees	1.7% 5	13.9% 40	32.6% 94	39.6% 114	12.2% 35	100% 288	3.47	.94
(3-12)	Conduct as an expert witness in a court of law	18.7% 62	20.2% 67	28.3% 94	21.7% 72	11.1% 37	100% 332	2.86	1.26
(3-13)	Familiarity with the court system	29.9% 82	31.4% 86	22.3% 61	11.7% 32	4.7% 13	100% 274	2.30	1.15
(3-14)	Familiarity with the liability of the property surveyor	36.7% 129	28.1% 99	26.7% 94	7.1% 25	1.4% 5	100% 352	2.09	1.02
(3-15)	Familiarity with the more common State Laws that pertain to land surveying (eg; Michigan Coordinate System Act, Corner Recordation Act, etc.)	31.1% 109	30.5% 107	24.8% 87	10.5% 37	3.1% 11	100% 351	2.24	1.10
(3-16)	Familiarity with the less known State Laws that may involve land surveying (eg; Malpractice Act, Soil Erosion Act, Mechanics Lien Act, etc.)	31.2% 104	28.2% 94	26.2% 87	10.8% 36	3.6% 12	100% 333	2.27	1.12
(3-17)	Figuring survey costs and professional fees	9.3% 31	12.9% 43	25.1% 84	33.2% 111	19.5% 65	100% 334	3.41	1.20
(3-18)	Professionalism, professional ethics, and relationship with client	12.6% 43	21.8% 74	31.8% 108	24.7% 84	9.1% 31	100% 340	2.96	1.16

Table 18. (Cont.)

Item #	Subject	Number and percent of responses expressing opinion to the question: Where should this knowledge be acquired? 1. Entirely in the classroom	2. 3/4 classroom 1/4 on the job	3. 1/2 classroom 1/2 on the job	4. 1/4 classroom 3/4 on the job	5. Entirely by job experience	Total Responses	Mean	Standard Deviation
(3-19)	Understanding real property interests (Freehold Estates, Leasehold Estates, Life Estates, Fee Simple, etc.)	35.1% 101	26.4% 76	26.4% 76	9.0% 26	3.1% 9	100% 288	2.19	1.11
(3-20)	Understanding the written transfer of real property (Deeds, Wills, etc.)	31.7% 103	28.3% 92	28.6% 93	8.3% 27	3.1% 10	100% 325	2.23	1.08
(3-21)	Understanding the transfer of real property not in writing (Adverse Possession, Oral Agreement, Accretion, etc.)	29.0% 95	28.7% 94	27.7% 91	12.5% 41	2.1% 7	100% 328	2.30	1.08
(3-22)	Understanding junior and senior property rights	32.3% 96	30.0% 89	25.6% 76	10.4% 31	1.7% 5	100% 297	2.19	1.06
(3-23)	Understanding the priorities of conflicting terms that may be found in boundary descriptions	20.0% 69	29.6% 102	30.7% 106	15.9% 55	3.8% 13	100% 345	2.54	1.09
(3-24)	Ability to evaluate field evidence of property boundaries	2.8% 10	7.9% 28	28.6% 101	44.5% 157	16.2% 57	100% 353	3.63	.94
(3-25)	Ability to write property descriptions	10.3% 36	24.2% 85	40.7% 143	21.1% 74	3.7% 13	100% 351	2.84	.99
(3-26)	Understanding the legal terminology in real estate transactions	26.4% 82	26.8% 83	30.3% 94	13.9% 43	2.6% 8	100% 310	2.39	1.10
(3-27)	Ability to locate, read and understand court cases in a law library	28.9% 59	28.0% 57	31.4% 64	8.8% 18	2.9% 6	100% 204	2.29	1.07
(3-28)	Ability to locate and research public records and documents dealing with real property	7.1% 24	19.6% 66	35.6% 120	27.3% 92	10.4% 35	100% 337	3.14	1.07
(3-29)	Understanding riparian and littoral (water front) property ownership	20.5% 69	29.1% 98	35.3% 119	13.3% 45	1.8% 6	100% 337	2.47	1.02
(3-30)	Understanding the mineral rights of property ownership	35.2% 62	23.3% 41	27.3% 48	12.5% 22	1.7% 3	100% 176	2.22	1.11
(3-31)	Understanding reversion rights and easements in property ownership	25.5% 84	28.3% 93	30.1% 99	14.6% 48	1.5% 5	100% 329	2.38	1.06
(3-32)	Understanding the handling of excesses and deficiencies between recorded and measured distances	10.5% 37	25.4% 89	33.3% 117	25.4% 89	5.4% 19	100% 351	2.90	1.07
(3-33)	Ability to write descriptions for condominiums	16.0% 50	29.1% 91	34.5% 108	17.5% 55	2.9% 9	100% 313	2.62	1.04
(3-34)	Ability to plat condominium projects	11.4% 35	25.6% 79	40.6% 125	19.2% 59	3.2% 10	100% 308	2.77	.99
(3-35)	Familiarity with field safety precautions	5.1%	13.3%	32.6%	35.1%	13.9%	100%	3.39	1.05

Table 18. (Cont.)

Item #	Subject	Number and percent of responses expressing opinion to the question: Where should this knowledge be acquired? 1. Entirely in the classroom	2. 3/4 classroom 1/4 on the job	3. 1/2 classroom 1/2 on the job	4. 1/4 classroom 3/4 on the job	5. Entirely by job experience	Total Responses	Mean	Standard Deviation
(3-36)	Proper dress and conduct in the field	5.4% 17	9.5% 30	25.7% 81	31.8% 100	27.6% 87	100% 315	3.67	1.14
(3-37)	Knowledge of planning and designing subdivisions	8.3% 28	19.6% 66	48.5% 163	20.0% 67	3.6% 12	100% 336	2.91	.93
(3-38)	Knowledge of the procedure for preparing a preliminary plat	9.0% 31	26.7% 92	37.2% 128	22.7% 78	4.4% 15	100% 344	2.87	1.01
(3-39)	Knowledge of the procedure for preparing a final plat	9.0% 31	24.5% 85	38.3% 133	23.9% 83	4.3% 15	100% 347	2.90	1.00
(3-40)	Understanding the duties and operations of the various local government agencies (City Clerk, City Engineer, County Plat Board, County Treasurer, Planning Board, etc.)	12.5% 40	20.0% 64	31.7% 101	24.8% 79	11.0% 35	100% 319	3.02	1.18
(3-41)	Understanding the general principles of how the original sectionalized Government lands were subdivided into townships, sections, and quarter sections	29.6% 104	31.8% 112	24.4% 86	13.1% 46	1.1% 4	100% 352	2.24	1.05
(3-42)	Understanding the specific method used by government surveyors in subdividing townships and sections in that part of Michigan where you work	16.5% 58	27.1% 95	29.1% 102	20.5% 72	6.8% 24	100% 351	2.74	1.16
(3-43)	Understanding the specific method used by government surveyors in subdividing townships and sections in any part of Michigan	26.3% 87	29.9% 99	24.8% 82	16.3% 54	2.7% 9	100% 331	2.39	1.12
(3-44)	Human relations skills (Public relations)	11.9% 39	17.5% 57	35.3% 115	26.4% 86	8.9% 29	100% 326	3.03	1.13
(3-45)	Office management	15.5% 47	24.4% 74	37.3% 113	18.2% 55	4.6% 14	100% 303	2.72	1.08
(3-46)	Accounting procedures	26.1% 72	29.0% 80	30.4% 84	12.3% 34	2.2% 6	100% 276	2.36	1.06
(3-47)	Business law	38.1% 102	27.6% 74	25.0% 67	8.6% 23	0.7% 2	100% 268	2.06	1.02
(3-48)	Contract law	44.0% 121	30.2% 83	20.7% 57	4.7% 13	0.4% 1	100% 275	1.87	.93
(3-49)	Mechanics lien	40.6% 116	31.1% 89	20.6% 59	5.6% 16	2.1% 6	100% 286	1.98	1.01
(3-50)	Workmans compensation	39.3% 101	30.4% 78	20.6% 53	7.4% 19	2.3% 6	100% 257	2.03	1.05
(3-51)	English - Composition and report writing	47.1% 148	33.5% 105	15.9% 50	3.2% 10	0.3% 1	100% 314	1.76	.86

Table 18. (Cont.)

Item #	Subject	Number and percent of responses expressing opinion to the question: Where should this knowledge be acquired? 1. Entirely in the classroom	2. 3/4 classroom 1/4 on the job	3. 1/2 classroom 1/2 on the job	4. 1/4 classroom 3/4 on the job	5. Entirely by job experience	Total Responses	Mean	Standard Deviation
(3-52)	Fundamentals of Economics	50.7% 106	28.2% 59	16.8% 35	3.8% 8	0.5% 1	100% 209	1.75	.90
(3-53)	Calculus	72.4% 84	19.0% 22	6.9% 8	1.7% 2	0.0% 0	100% 116	1.38	.69
(3-54)	Statistics and Probability	69.5% 66	16.8% 16	10.5% 10	3.2% 3	0.0% 0	100% 95	1.47	.81
(3-55)	Physics - Mechanics	70.9% 83	19.7% 23	6.8% 8	2.6% 3	0.0% 0	100% 117	1.41	.73
(3-56)	Physics - Heat	70.1% 47	22.4% 15	4.5% 3	3.0% 2	0.0% 0	100% 67	1.40	.72
(3-57)	Physics - Electricity	68.0% 51	21.3% 16	6.7% 5	3.0% 3	0.0% 0	100% 75	1.47	.79
(3-58)	Physics - Magnetism	63.8% 60	24.5% 23	7.4% 7	4.3% 4	0.0% 0	100% 94	1.52	.81
(3-59)	Physics - Sound	64.1% 59	26.1% 24	6.5% 6	3.3% 3	0.0% 0	100% 92	1.49	.76
(3-60)	Physics - Light	66.7% 78	23.1% 27	6.8% 8	3.4% 4	0.0% 0	100% 117	1.47	.77

column ("3/4 classroom, 1/4 on the job"), the sum total frequency value ranged from 86 to 93 per cent for any of those items. Less than five per cent of the responses to each of those items were marked in the combined ranks number 4 and number 5 category ("1/4 classroom, 3/4 on the job" and "entirely by job experience"). The subjects that corresponded to those item numbers were: calculus, statistics and probability, and the various areas of physics of mechanics, heat, electricity, magnetism, sound and light. Those subjects, on the other hand, were not highly recommended by the total respondents.

The modes of items # (3-48), (3-49), (3-51) and (3-52) fell in rank number 1 ("entirely in the classroom") with from 41 to 51 per cent of the responses in this category. When combined with the frequency percentage of rank number 2 category ("3/4 classroom, 1/4 on the job"), the sum of the two gave a total frequency value that ranged from 72 to 81 per cent for any of those four items. Less than 10 per cent of the responses to each of those items were marked in the combined ranks number 4 and number 5 category ("1/4 classroom, 3/4 on the job" and "entirely by job experience"). The subjects that corresponded to each of those items were: contract law, mechanics lien, english composition and report writing, and fundamentals of economics.

The modes of items # (3-14), (3-15), (3-16), (3-19), (3-20), (3-22), (3-30), (3-47) and (3-50) fell in rank

number 1 ("entirely in the classroom") with from 31 to 39 per cent of the responses in this category. When combined with the frequency percentage from rank number 2 category ("3/4 classroom, 1/4 on the job"), the sum total frequency value ranged from 59 to 70 per cent for any of those items. Less than 15 per cent of the responses to each of those items were marked in the combined rank number 4 and number 5 category ("1/4 classroom, 3/4 on the job" and "entirely by job experience").

The modes of items # (3-2), (3-6) and (3-8) fell in rank number 2 ("3/4 classroom, 1/4 on the job") with from 36 to 41 per cent of the responses in this category. When combined with the frequency percentage of rank number 1 category ("entirely in the classroom"), the total frequency value ranged from 57 to 68 per cent for any of those items. Less than 12 per cent of the responses to each of those items were marked in the combined ranks number 4 and number 5 category ("1/4 classroom, 3/4 on the job" and "entirely by job experience").

The modes of items # (3-13), (3-21), (3-41) and (3-43) fell in the rank number 2 ("3/4 classroom, 1/4 on the job") with from 29 to 32 per cent of the responses in this category. When combined with the frequency percentage of rank number 1 ("entirely in the classroom"), the sum yielded a total frequency value that ranged from 56 to 61 per cent for any of the items. Less than 20 per cent of

the responses to each of those items appeared in the combined ranks number 4 and number 5 category ("1/4 classroom, 3/4 on the job" and "entirely by job experience").

The modes of items # (3-3, (3-4), (3-5), (3-25), (3-34) and (3-37) fell in rank number 3 ("1/2 classroom, 1/2 on the job") with from 41 to 49 per cent of the responses in this category. Each sum of ranks number 1 and number 2 ("entirely in the classroom" and "3/4 classroom, 1/4 on the job") responses to the six items totaled a frequency value that ranged from 28 to 41 per cent. The sum of ranks number 4 and number 5 ("1/4 classroom, 3/4 on the job" and "entirely by job experience") responses gave a frequency value that ranged from 15 to 25 per cent for those items. For each item the sum of the responses in ranks number 1 and number 2 was greater than the sum of the responses in ranks number 4 and number 5 for that item.

The modes of items # (3-1), (3-7), (3-9), (3-29), (3-33), (3-38), (3-39) and (3-45) fell in rank number 3 ("1/2 classroom, 1/2 on the job") with from 35 to 40 per cent of the responses in this category. The sum of ranks number 1 and number 2 ("entirely in the classroom" and "3/4 classroom, 1/4 on the job") responses gave a frequency value that ranged from 29 to 50 per cent for any of those eight items. The sum of ranks number 4 and number 5 ("1/4 classroom, 3/4 on the job" and "entirely by job experience") responses gave a frequency value that ranged from 15 to 28

per cent for any of those items. For each item the sum of the responses of ranks number 1 and number 2 was greater than the sum of the responses of ranks number 4 and number 5.

The modes of items # (3-10), (3-12), (3-18), (3-23), (3-26), (3-27), (3-31), (3-32), (3-42) and (3-46) fell in rank number 3 ("1/2 classroom, 1/2 on the job") with from 28 to 34 per cent of the responses in this category. For each of these ten items the sum of ranks number 1 and number 2 ("entirely in the classroom" and "3/4 classroom, 1/4 on the job") responses gave a frequency value that ranged from 34 to 57 per cent. The sum of the ranks number 4 and number 5 ("1/4 classroom, 3/4 on the job" and "entirely by job experience") responses gave a frequency value that ranged from 11 to 34 per cent for any of those items. For each item the sum of the responses of ranks number 1 and number 2 was greater than the responses of ranks number 4 and number 5.

Three special cases were apparent in items # (3-28), (3-40) and (3-44). The modes for these items fell in rank number 3 ("1/2 classroom, 1/2 on the job") with 35, 32 and 36 per cent responding respectively in this category. The sum of ranks number 1 and number 2 ("entirely in the classroom" and "3/4 classroom, 1/4 on the job") responses gave a frequency value of 27, 32 and 29 per cent respectively for those items. The sum of ranks number 4 and number 5 ("1/4

classroom, 3/4 on the job" and "entirely by job experience") responses gave a frequency value of 38, 36 and 35 per cent respectively for those items. These were the only cases where the mode fell in rank number 3 category and the responses of ranks number 4 and number 5 were greater than the responses of ranks number 1 and number 2. These cases placed more emphasis on job training than on classroom education.

The modes of items # (3-11), (3-17), (3-24), (3-35) and (3-36) fell in rank number 4 ("1/4 classroom, 3/4 on the job") with from 32 to 45 per cent of the responses in this category. The sum of ranks number 4 and number 5 ("1/4 classroom, 3/4 on the job" and "entirely by job experience") responses gave a frequency value that ranged from 49 to 61 per cent for those items. The sum of ranks number 1 and number 2 ("entirely in the classroom" and "3/4 classroom, 1/4 on the job") responses gave a frequency value that ranged from 11 to 18 per cent.

Items # (3-11), (3-17), (3-24), (3-28), (3-35), (3-36), (3-40) and (3-44) represented the only subjects where a stronger response indicated that the knowledge should be acquired mostly by job experience rather than by classroom instruction.

Differences in opinions between engineers and non-engineers

The results from item # (1-4) showed that 32.7 per cent of the responding registered land surveyors were also professional engineers, a fact which allowed for the formation of two groups: those respondents who were registered land surveyors and those who were dually licensed as both registered land surveyors and professional engineers. It was determined whether there was any significant difference in the opinions of the two groups concerning the importance of knowing the sixty listed subjects for land or property surveying purposes. In addition, it was determined if there was any significant difference between opinions of the two groups about where the knowledge of the sixty items should be acquired. The data were obtained from the responses to Part III of the questionnaire.

A null hypothesis was used which stated: there is no significant difference between the replies of the respondents who were registered land surveyors and the replies of the respondents who were dually licensed as both registered land surveyors and professional engineers. A level of significance of .10 was used.

After analyzing the results of the data from Part III of the questionnaire in respect to where the knowledge of the various subjects should be acquired (ranking from

"entirely in the classroom" to "entirely by job experience"), the null hypothesis could not be rejected when applied to each of the sixty subjects.

However, when the data were analyzed from Part III of the questionnaire about the importance of knowing the sixty subjects for land surveying purposes (ranking from "absolutely necessary" to "absolutely not necessary"), the null hypothesis was rejected for five of the subjects at the .10 level of significance. This meant that there was a significant difference in the way the land surveyors, who were also professional engineers, replied to the five items as compared to the land surveyors who were not professional engineers. These five subjects were:

Item # (3-11) - Ability to identify trees

Item # (3-17) - Figuring survey costs and professional fees

Item # (3-22) - Understanding junior and senior property rights

Item # (3-28) - Ability to locate and research public records and documents dealing with real property

Item # (3-32) - Understanding the handling of excesses and deficiencies between recorded and measured distances

The null hypothesis was rejected at the .05 level of significance for items # (3-22) and (3-28). The data failed to reject the null hypothesis for the other fifty-five subjects.

Differences in opinions between business owners and non-owners

The results from item # (1-9) showed that 62.0 per cent of the responding registered land surveyors were also active or retired owners or part owners of surveying and/or engineering firms. This allowed for the formation of two groups: registered land surveyors who had a business interest and registered land surveyors who did not have a business interest. It was determined if there were significant differences between the opinions of the two groups concerning the importance of knowing various subjects for land surveying purposes and about where the knowledge of the various subjects should be acquired. The data were obtained from Part III of the questionnaire.

A null hypothesis was used which stated: there is no significant difference between the responses of the registered land surveyors who had a business interest and the responses of the registered land surveyors who did not have a business interest. A .10 level of significance was used.

After analyzing the results of the data from Part III of the questionnaire about the importance of knowing the various subjects for land surveying purposes (ranking from "absolutely necessary" to "absolutely not necessary"), the null hypothesis could not be rejected or disproved for any of the sixty subjects. In analyzing the results of the

data from Part III of the questionnaire about where the knowledge of the various subjects should be acquired (ranking from "entirely in the classroom" to "entirely by job experience"), the null hypothesis could not be rejected for any of the sixty subjects.

Summary of the educational needs of land surveyors

The educational needs of surveyors doing property or boundary surveying was investigated in Part III of the questionnaire through which information was obtained for two of the objectives of the study: to determine what knowledge is desirable to become a land surveyor and to determine which areas of knowledge and techniques should be learned through formal education versus experience on the job.

The majority of respondents believed that knowledge of nearly all sixty subjects was necessary for the surveyor who practices land surveying. Exceptions to this, where opinions were fairly evenly divided as to being "necessary" or "not necessary," were in the subjects of "computer programming," "calculus," "statistics and probability" and in the "mechanics" and "light" areas of physics. In other areas of physics, the majority of respondents indicated that knowledge of "heat," "electricity," "magnetism" and "sound" was not necessary.

Respondents determined that knowledge about 87 per cent of the sixty subjects should be acquired primarily

through "classroom" education as opposed to "on-the-job experience." The 13 per cent exceptions to this were items # (3-11), (3-17), (3-24), (3-28), (3-35), (3-36), (3-40) and (3-44) which showed a stronger response for acquiring the knowledge by "on-the-job experience."

Comparisons were made to determine if any significant difference existed in the way respondents with differing characteristics replied to Part III of the questionnaire. Firstly, respondents were divided into two groups: those who were professional engineers and those who were not. Then the total group was again divided into two different groups: those who had a business interest and those who did not. A null hypothesis was used for each group comparison on the two aforementioned questions for each of the sixty subjects in Part III of the questionnaire. The null hypothesis was rejected five times out of a total of 240 comparisons at the .10 significance level. Those five rejections of the null hypothesis were interpreted to mean that there was a significant difference between the responses concerning the importance of subjects listed in items # (3-11), (3-17), (3-22), (3-28) and (3-32) from land surveyors who were professional engineers and from land surveyors who were not professional engineers.

Continuing Education Interests of the Respondents

Part IV of the questionnaire dealt with two of the purposes of the study. One purpose was to determine the continuing educational interests or needs of the present land surveyor. The other purpose was to determine where and when the present land surveyor would be willing to participate in certain continuing education programs.

Items # (4-1) and (4-2) determined that of the 361 respondents, 247, or 68.4 per cent, expressed some interest in continuing their education through seminars. The 247 respondents indicated one or more items or subjects that they felt they needed and that they would like offered in a continuing education seminar. The results of these responses to the various items or subjects are shown in Table 19 entitled, "Number of persons expressing interest in a seminar of selected subjects and the preferred locations for these seminars." The table shows the items or subjects arranged in descending order according to the number of respondents expressing an interest in a seminar in that subject. Table 19 also gives the number of responses expressing preference for attending a seminar in each item or subject at certain locations throughout the state of Michigan. Three choices of a preferred location for attending a seminar were to be selected out of a possible eleven listed locations. The number of responses shown for a particular location indicated

Table 19. Number of persons expressing interest in a seminar of selected subjects and the preferred locations for these seminars.

Item #	Number of persons expressing interest	Selected Subject	Number of responses expressing interest at these locations										
			Detroit	Ann Arbor	Saginaw	Flint	Lansing	Kalamazoo	Grand Rapids	Traverse City	Gaylord	Marquette	Houghton
(3-14)	84	Liability of the Property Surveyor	22	29	9	24	52	13	19	27	18	10	7
(3-16)	75	Familiarity with the lesser known State Laws that may involve land surveying (eg; Malpractice Act, Soil Erosion Act, Mechanics Lien Act, etc.)	24	28	5	22	50	13	16	22	15	6	4
(3-8)	63	Computation and use of the State Plane Coordinate System	21	27	4	15	40	9	17	18	12	6	6
(3-29)	61	Understanding riparian and littoral (water front) property ownership	17	21	5	14	39	10	16	22	14	6	2
(3-48)	60	Contract law	21	20	8	25	37	11	13	14	8	6	4
(3-12)	56	Conduct as an expert witness in a court of law	9	15	11	13	36	12	16	22	14	2	4
(3-15)	54	Familiarity with the more common State Laws that pertain to land surveying (eg; Mich. Coordinate System Act, Corner Recordation Act, etc.)	18	25	5	15	36	9	13	13	7	4	2
(3-3)	52	Application of computers in surveying problems	13	19	6	12	33	11	14	12	12	7	6
(3-21)	52	Understanding the transfer of real property not in writing (Adverse Possession, Oral Agreement, Accretion, etc.)	17	20	4	13	26	7	10	20	15	4	5
(3-49)	52	Mechanics lien	14	16	3	18	30	11	13	18	11	4	2
(3-23)	48	Understanding the priorities of conflicting terms that may be found in boundary descriptions	16	19	3	12	34	8	9	13	11	3	4
(3-47)	48	Business law	19	18	6	17	32	5	5	11	10	5	3
(3-45)	47	Office management	9	11	5	15	30	5	11	22	15	4	3
(3-17)	46	Figuring survey costs and professional fees	15	14	3	10	29	6	9	17	11	4	4
(3-46)	45	Accounting procedures	12	12	5	12	26	4	7	19	13	6	6
(3-32)	42	Understanding the handling of excesses and deficiencies between recorded and measured distances	18	20	1	15	25	4	7	12	8	3	3
(3-34)	40	Ability to Plat condominium projects	14	17	3	10	25	9	9	10	7	4	5
(3-19)	39	Understanding real property interests (Freehold Estates, Leasehold Estates, Life Estates, Fee Simple, etc.)	11	14	2	9	22	7	7	13	11	2	3
(3-24)	38	Ability to evaluate field evidence of property boundaries	11	10	2	10	25	4	8	10	11	4	5
(3-4)	36	Taking and computing astronomical observations for true bearing	12	15	3	12	21	9	8	7	3	2	3
(3-20)	35	Understanding the written transfer of real property (Deeds, Wills, etc.)	10	13	1	6	20	6	8	12	9	2	3
(3-22)	35	Understanding junior and senior property rights	11	14	1	8	22	4	6	12	10	3	3
(3-31)	34	Understanding reversion rights and easements in property ownership	12	18	3	11	21	5	5	7	7	3	1
(3-2)	33	Ability to do computer programming	8	11	4	9	21	6	7	7	9	3	3
(3-33)	30	Ability to write descriptions for condominiums	9	12	1	7	21	9	7	6	5	5	4
(3-13)	29	Familiarity with the court system	7	11	1	8	21	8	5	9	7	1	1
(3-5)	29	Taking and computing astronomical observations for latitude and longitude position	9	14	4	7	21	5	5	7	4	2	3

Table 19. (Cont.)

Item #	Number of persons expressing interest	Selected subject	Number of responses expressing interest at these locations										
			Detroit	Ann Arbor	Saginaw	Flint	Lansing	Kalamazoo	Grand Rapids	Traverse City	Gaylord	Marquette	Houghton
(3-1)	29	A basic understanding of electronic computers	6	8	4	8	19	4	8	9	5	2	3
(3-7)	28	Application of photogrammetry to surveying	7	6	2	8	14	4	6	10	7	5	6
(3-37)	28	Knowledge of planning and designing subdivisions	10	7	2	7	20	3	6	9	5	3	5
(3-42)	27	Understanding the specific method used by government surveyors in subdividing townships and sections in that part of Michigan where you work	10	9	2	7	18	4	6	7	3	3	3
(3-43)	24	Understanding the specific method used by government surveyors in subdividing townships and sections in any part of Michigan	8	10	3	6	15	3	6	4	1	4	3
(3-44)	24	Human relations skills- public relations	6	7	2	7	18	4	4	7	6	1	1
(3-26)	24	Understanding the legal terminology in real estate transactions	6	10	1	4	15	5	5	7	8	3	3
(3-27)	23	Ability to locate, read, and understand court cases in a law library	3	6	3	6	13	4	6	10	4	2	2
(3-28)	21	Ability to locate and research public records and documents dealing with real property	5	10	0	6	13	3	6	7	1	2	3
(3-50)	19	Workmans compensation	5	7	1	4	13	7	7	4	2	2	1
(3-11)	18	Ability to identify trees	3	6	2	4	13	3	4	6	2	2	3
(3-18)	18	Professionalism, professional ethics, and relationship with client	7	7	0	4	13	2	4	6	4	2	1
(3-30)	17	Understanding the mineral rights of property ownership	4	10	2	7	14	1	2	4	3	1	1
(3-41)	17	Understanding the general principles of how the original sectionalized Government lands were subdivided into townships, sections and quarter sections	4	4	1	3	10	4	7	5	3	2	1
(3-52)	16	Fundamentals of economics	5	6	1	5	9	3	4	2	1	2	2
(3-6)	16	Theory and principles of photogrammetry	5	6	0	5	8	2	1	5	4	2	2
(3-25)	15	Ability to write property descriptions	3	4	0	4	8	1	2	5	4	2	2
(3-51)	13	English - composition and report writing	3	2	0	4	4	2	4	7	2	3	2
(3-39)	13	Knowledge of the procedure for preparing a final plat	4	3	0	1	9	2	3	2	3	2	2
(3-38)	10	Knowledge of the procedure for preparing a preliminary plat	5	3	0	1	7	1	1	2	2	1	1
(3-35)	9	Familiarity with field safety precautions	2	3	1	2	6	2	1	4	2	1	1
(3-54)	8	Statistics and probability	0	2	1	2	7	2	3	2	1	0	0
(3-40)	8	Understanding the duties and operations of the various local government agencies (City Clerk, City Engineer, County Plat Board, County Treasurer, Planning Board, etc.)	2	3	0	2	5	1	2	3	2	1	1

a preferred location only. It would not necessarily mean that a respondent would attend a seminar only at his preferred location. He might very well attend a seminar at a location other than at his preferred choice.

Subjects of interest for a seminar

Although each item or subject was considered separately, it might be possible to combine several of the items into a single seminar or a series of continuing education programs depending upon the length of session desired and the availability of qualified persons to present the subject matter. As an example, certain subjects that were rated very high in interest by the respondents were in the general area of business. Some of the subjects were: business law, office management, accounting procedures and figuring survey costs and professional fees. Such subjects could possibly be combined into a single seminar presentation or a series of seminars.

The greatest interest was expressed in the subject of "liability of the property surveyor." This was closely followed by other subjects which were allied to the legal aspects of surveying, such as: "familiarity with the more common state laws that pertain to land surveying (e.g., Malpractice Act, Soil Erosion Act, Mechanics Lien Act), familiarity with the more common state laws that pertain to land surveying (e.g., Michigan Coordinate System Act,

Corner Recordation Act), conduct as an expert witness in a court of law, and contract law." Those subjects might be combined into a single seminar session of several days' length or perhaps organized as a series of seminars.

"Computation and use of the state plane coordinate system" rated third highest in interest for a seminar subject with 63 respondents expressing interest.

The fourth highest level of interest was shown in the subject of "understanding the riparian and littoral (waterfront) property ownership" with 61 responses.

Fifty-two respondents expressed interest in "application of computers in surveying problems," 33 were interested in "ability to do computer programming" and 29 were interested in "a basic understanding of electronic computers."

Of the sixty items or subjects that were listed on the questionnaire, fifty are shown in Table 19. The ten not shown in the table had a very small response. This was expected as these were subjects not conducive to a seminar. The subjects were intended primarily for use in other parts of the study. Those subjects and the number of respondents expressing interest in a seminar were as follows: "proper dress and conduct in the field" (seven responses), "ability to make neat and accurate drawings" (five responses), "ability in use of ink in drafting" (two responses) and "calculus" (five responses). The various areas of physics

had three or less responses. Those areas were "mechanics," "heat," "electricity,""magnetism,""sound" and "light."

Preferred location, length and time for continuing education seminars

Item # (4-6) of the questionnaire sought the preferred location for holding a seminar. Eleven cities were arbitrarily selected as the locations from which three preferred choices were made by each respondent. The eleven locations were Detroit, Ann Arbor, Saginaw, Flint, Lansing, Kalamazoo, Grand Rapids, Traverse City, Gaylord, Marquette and Houghton. The total response for each location was combined with the responses from the subjects of interest for a seminar and reported in Table 19 as previously mentioned. The total response for each location was also reported graphically in Figure 1, "Preferred location for a continuing education seminar." This figure was based on 317 respondents to the question. Since three preferred choices of location were asked for, the total number of responses is greater than the 317 respondents to the inquiry. Lansing was by far the most popular location for a seminar. Marquette and Houghton were the least preferred locations. This should not be interpreted to mean that a seminar held in locations other than Lansing would not be well attended. It was not determined in what locations the respondents would not attend a seminar.

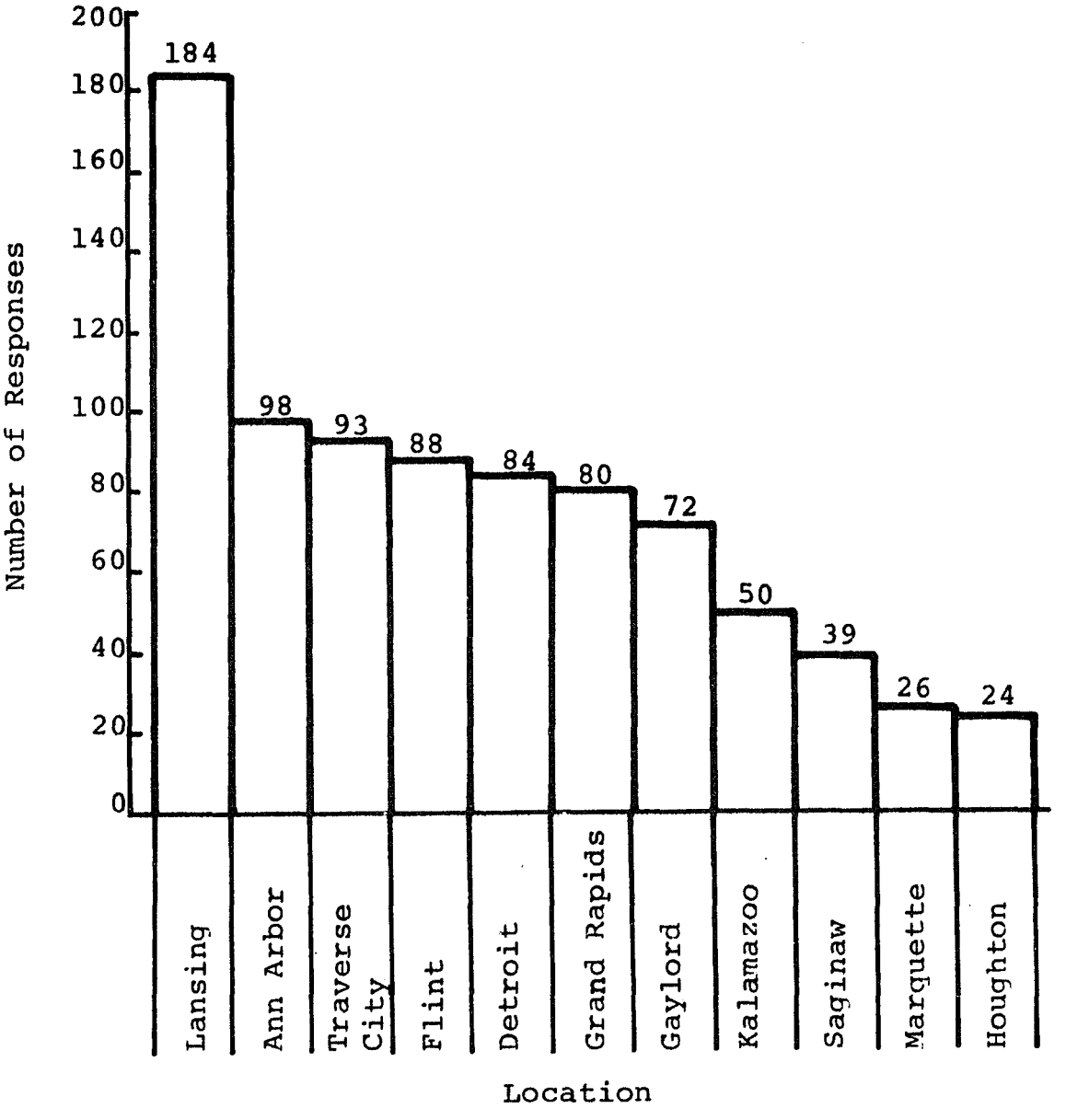

Figure 1. Preferred location for a continuing education seminar.

Item # (4-3) of the questionnaire asked about the preferred length of time for a continuing education seminar. There were 348 responses to the question. The one-day and two-day seminars were by far the most favored. The two-day seminar had 141, or 40.5 per cent, of the respondents in favor. The one-day seminar had 105, or 30.2 per cent, of the respondents preferring it. Figure 2, "Preferred length of continuing education seminar," shows the results from the responses.

Items # (4-4) and (4-5) inquired into the day of the week and the month of the year that the respondent would prefer to attend a continuing education seminar. Three preferences were asked for. Therefore, the number of responses was greater than the number of respondents. There were 309 respondents to the preferred day of the week and 312 respondents to the preferred month of the year. Friday, Thursday and Saturday were the most popular days of the week for attending a seminar, with responses of 179, 163 and 146, respectively. Figure 3, "Preferred day of week for a continuing education seminar," shows the results of the responses. February, January and March were by far the most preferable months for a continuing education seminar with responses numbering 226, 211 and 201, respectively. One should not conclude that a seminar offered in other months would not be attended by those respondents. The

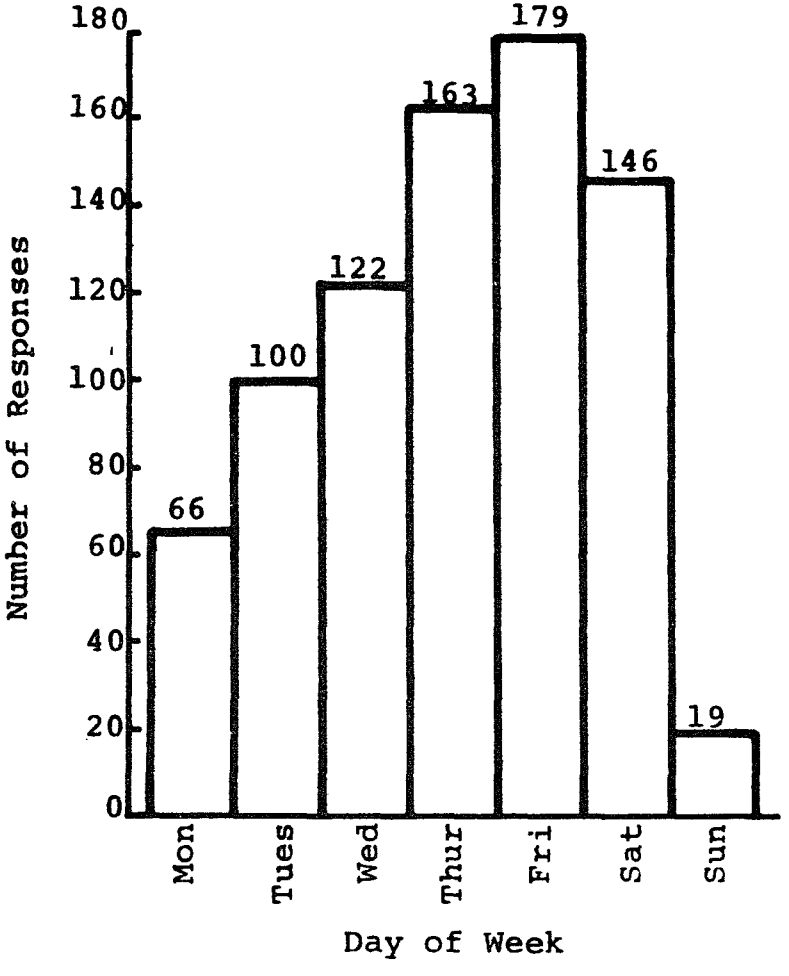

Figure 3. Preferred day of week for a continuing education seminar.

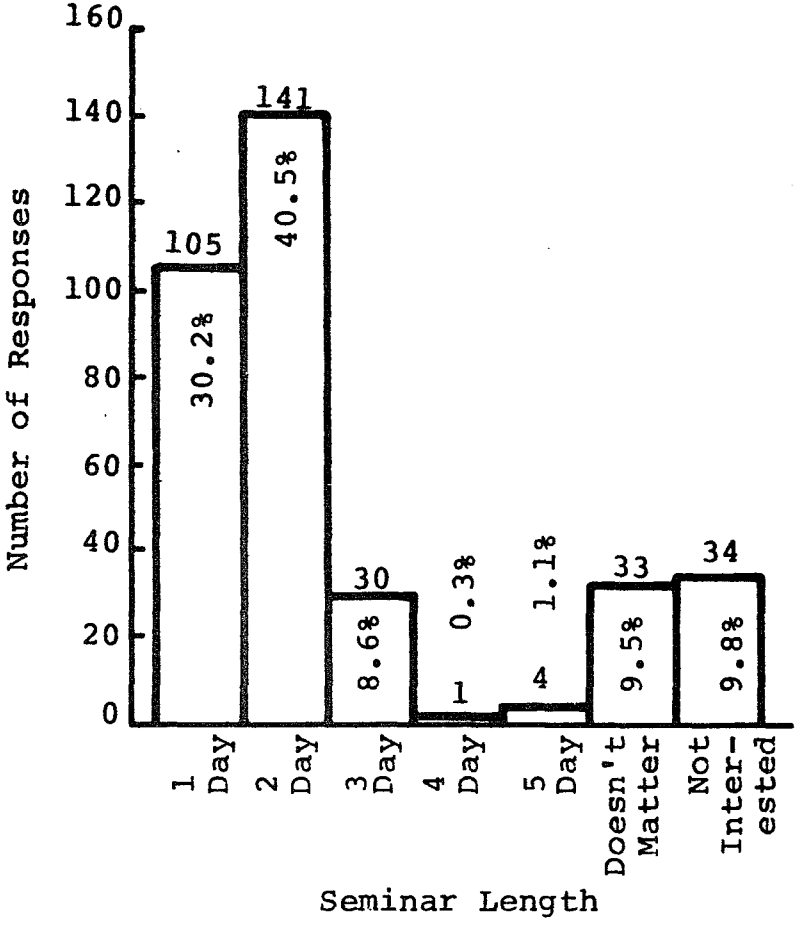

Figure 2. Preferred length of continuing education seminar.

respondents have expressed only their preference. Figure 4, "Preferred month of year for a continuing education seminar," shows the results of the responses.

Miscellaneous information

Item # (4-7) inquired into the number of persons who have attended a seminar related to surveying or the business aspect of surveying. Two hundred fifty-seven, or 76.5 per cent, of the respondents have attended such a seminar. This indicates that there has been a broad interest shown in past seminar offerings. Past seminars were offered on a voluntary attendance basis. Table 20 shows the results of this inquiry.

Items # (4-8), (4-9), (4-10), (4-11) and (4-12) sought to find out to what degree the registered land surveyor was familiar with books that emphasize land surveying. Since these books represent about the only available works solely on land or property surveying, it might be expected that all registered land surveyors would be at least slightly familiar with them. Skelton's book, "The Legal Elements of Boundaries and Adjacent Properties," was "not familiar" to 55.9 per cent of the respondents. The book was directed more toward persons involved in the legal problems of property boundaries rather than for land surveyors. Therefore, unfamiliarity with it might be expected. However, the other four books are oriented toward the land or property surveyor,

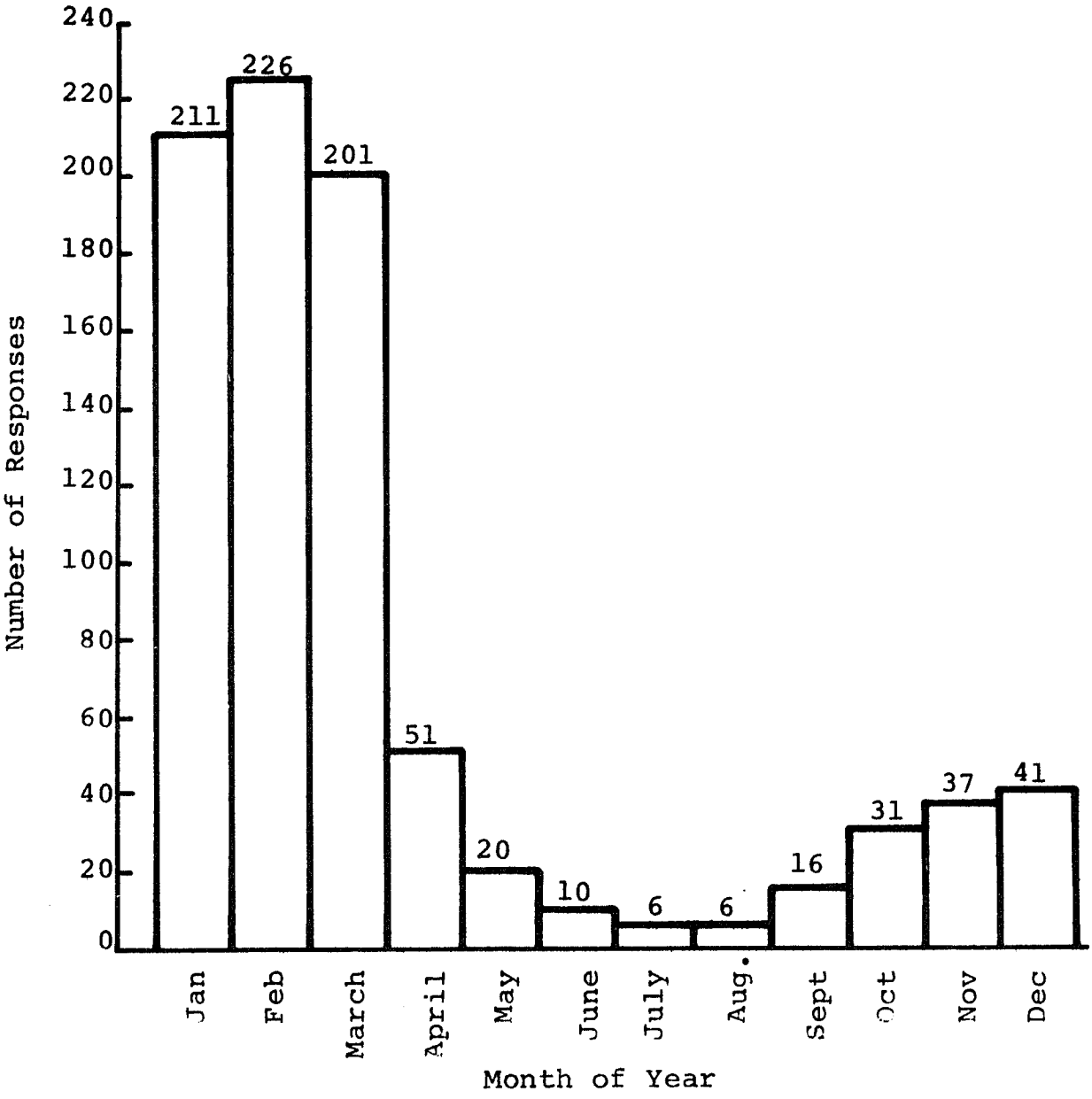

Figure 4. Preferred month of year for a continuing education seminar.

Table 20. Respondents who have attended a seminar related to surveying or the business aspect of surveying.

Status	Number	Percentage
Have attended seminar	257	76.5
Have not attended seminar	79	23.5
Totals	336	100.0

and it might be expected that they would be familiar with them. Perhaps those land surveyors who were not familiar with these books have other sources of reference information or it might be an indication that there is not adequate professional reference material available. Possibly a further investigation into the matter would be desirable. Tables 21, 22, 23, 24 and 25 show the results of the respondent's familiarity with the various books.

Item # (4-13) sought whether the registered land surveyor favored a mandatory periodic updating through some form of continuing education in order to maintain his registration as a land surveyor. The results were fairly well divided between 25 per cent of the respondents favoring a mandatory updating, 37 per cent responding "maybe" and 38 per cent not in favor of a mandatory periodic updating. There was a total of 351 respondents to this question. A conclusion could not be reached from the results. Several

Table 21. Respondents' familiarity with the book, Curtis M. Brown, "Boundary Control and Legal Principles."

Degree of familiarity	Number	Percentage
Very familiar	178	50.9
Slightly familiar	102	29.1
Not familiar	70	20.0
Totals	350	100.0

Table 22. Respondents' familiarity with the book, Brown and Eldridge, "Evidence and Procedures for Boundary Location."

Degree of familiarity	Number	Percentage
Very familiar	90	26.1
Slightly familiar	105	30.4
Not familiar	150	43.5
Totals	345	100.0

Table 23. Respondents' familiarity with the book, Frank Emerson Clark, "Law of Surveying and Boundaries."

Degree of familiarity	Number	Percentage
Very familiar	166	47.7
Slightly familiar	112	32.2
Not familiar	70	20.1
Totals	348	100.0

Table 24. Respondents' familiarity with the book, Ray H. Skelton, "The Legal Elements of Boundaries and Adjacent Properties."

Degree of familiarity	Number	Percentage
Very familiar	63	18.3
Slightly familiar	89	25.8
Not familiar	193	55.9
Totals	345	100.0

Table 25. Respondents' familiarity with the book, U.S. Gov't., "Manual of Instructions for the Survey of the Public Lands of the United States."

Degree of familiarity	Number	Percentage
Very familiar	220	62.7
Slightly familiar	109	31.0
Not familiar	22	6.3
Totals	351	100.0

uncomplimentary remarks were written next to the item on the returned questionnaire indicating a strong "no" response. Apparently this was a sensitive subject to some respondents. Some of the "maybe" responses were noted with an indication that more information was needed to solicit a "yes" or "no" answer. It appeared that a more detailed investigation into this matter would have to be made before any conclusion could be drawn.

Summary of continuing education information

Part IV of the questionnaire answered two of the objectives of the study: to determine the continuing educational interests or needs of the present land surveyor and to determine where and when the present land surveyor would be willing to participate in certain continuing education programs.

Of the 361 respondents, 247, or 68.4 per cent, indicated an interest in at least one item or subject for a continuing education seminar. There was considerable agreement about topics for study, as indicated in Table 19. Over 70 respondents expressed an interest in a seminar in two of the subjects, over 60 respondents expressed an interest in a seminar in five of the subjects, over 50 respondents expressed an interest in a seminar in ten of the subjects, over 40 respondents expressed an interest in a seminar in seventeen of the subjects, over 30 respondents expressed an interest in a seminar in twenty-five of the subjects and over 20 respondents expressed an interest in thirty-six of the subjects. Regarding the other twenty-four subjects, from 0 to 19 respondents expressed an interest in the particular subject. These results showed that there was a definite interest in a continuing education program.

The most frequently selected location for a continuing education seminar was Lansing. The preferred time to hold a seminar was on a Thursday or Friday in January, February or March. A one-day or two-day seminar was preferred.

Of the 336 responses, 257, or 76.5 per cent, of the respondents have attended a seminar related to surveying or the business aspect of surveying. One could conclude that the majority of the members of the Michigan Society of Registered Land Surveyors were familiar with seminars.

Although the majority of the respondents were familiar with the available books on land or property surveying, some respondents were not. Since so few reference books have been written about land or property surveying, it would seem that all registered land surveyors should be familiar with the literature in their profession. An additional investigation might be warranted on the availability and use of reference material in land or property surveying.

The final question on the questionnaire requested an opinion about a mandatory periodic updating through some form of continuing education in order to maintain registration. This brought a fairly even distribution of affirmative and negative responses. No conclusion on this could be drawn. A detailed and separate study could be made concerning the matter.

CHAPTER V

SUMMARY, FINDINGS, DISCUSSION AND RECOMMENDATIONS

Summary

Land surveying is an ancient profession with a tangible legal influence on the ownership of real property, but until 1971 there had never been a four-year baccalaureate program in the United States specifically for surveyors. Earlier, formal education for land surveyors was little more than a side-line, usually an appendage to education for other professions, chiefly civil engineering. Apprenticeship often was substituted because of the lack of educational offerings.

While several studies have suggested a rising demand for land surveyors, there has been a lack of in-depth information about the land surveyor and what his educational needs might be.

Purpose of the study

The purpose of this study was to obtain information about the land surveyor and his lifelong education needs, with six major objectives:

1. To determine the personal characteristics of the present land surveyor.

2. To determine the educational background of the present land surveyor.

3. To determine what subject matter areas are desirable to become a land surveyor.

4. To determine which subject matter areas should be learned through formal education versus experience on the job.

5. To determine the continuing education interests and needs of the present land surveyor.

6. To determine where and when the present land surveyor would be willing to participate in certain continuing education programs.

Methodology

The study was designed primarily on descriptive research methods. A questionnaire (see appendix) was developed which sought answers to the six objectives of the study. The questionnaire was mailed to all 436 registered land surveyors who were members of the Michigan Society of Registered Land Surveyors. Three mailings of the questionnaire produced 371 returns, or 85.1 per cent, of the parameter. Ten replies were unusable, leaving a total of 361, or 82.8 per cent, usable returns.

The data from the questionnaire were analyzed through use of the Control Data Corporation 6500 computer at Michigan State University. Results were presented mostly by frequency and percentage statistics. Comparisons were made between professional engineers, non-professional engineers, business owners and non-business owners on responses to certain parts of the questionnaire by a multivariance analysis.

Findings

Personal characteristics of the respondents

It was found that the responding registered land surveyors were white males with a median age of 43.8 years and a median of 20.1 years of surveying experience. There were 32.7 per cent who were dually licensed as registered land surveyors and professional engineers. Less than two per cent had obtained their registration by the "grandfather's clause" of the Registration Act.

Of the 39.1 per cent who had worked in another profession or job before entering land surveying, 56.7 per cent had been engaged in engineering work. Sixty-two per cent had an interest in a surveying and/or engineering business. Membership in the American Congress on Surveying and Mapping was held by 35.7 per cent of the respondents, while 20.8 per cent belonged to the Michigan Society of Professional Engineers.

Educational background of the respondents

Of the 42.1 per cent of the respondents who held at least a baccalaureate degree, 77.6 per cent of those had received their degree in civil engineering. The median year of receiving the bachelor's degree was 1952. The number who had some college education but less than a

baccalaureate degree was equivalent to 44.9 per cent of the respondents. Of those, 88.9 per cent had been enrolled in a civil engineering or a civil/surveying technology curriculum. The median year of graduation for those respondents who held a two-year associate degree was 1963. Michigan was the state from which 89.1 per cent of the respondents had received their highest education or degree.

Correspondence courses had been taken by 31.6 per cent of the respondents. Of those respondents who had been enrolled in correspondence courses, sixty-eight, or 59.7 per cent, studied surveying and mapping and twenty-six, or 22.8 per cent, had taken civil engineering. Almost thirty-nine per cent had completed the course requirements for a certificate or degree. The majority of 78.9 per cent of those respondents who had taken correspondence courses had been enrolled in the International Correspondence School (I.C.S.).

Educational needs desirable to become a land surveyor

Sixty subjects were suggested as some of the areas of study in preparation for land surveying and opinions were sought from the Society's membership. Respondents rated the sixty items or subjects in relation to their importance to the occupation of land surveying as follows: fifty-one were considered as being necessary, five were evenly divided between being necessary and not necessary, and four were

rated as being not necessary. The five subjects with evenly divided responses were: computer programming, calculus, statistics and probability, and in the light and mechanics areas of physics. The four subjects which were considered as being unnecessary fell into the area of physics and were: heat, electricity, magnetism and sound. Concerning the fifty-one subjects, from fifty to ninety-nine per cent of the respondents agreed that it was necessary to have a knowledge of the particular subject. The results of the responses were found in Table # 17.

A comparison of opinions of those land surveyors who were also professional engineers and those who were not engineers demonstrated that there was a significant difference at the .10 level of significance in their opinions as to the importance of five of the subjects.

A comparison of opinions from owners versus non-owners of a business as to the importance of the subjects was also made. The null hypothesis, which stated that there was no significant difference in the responses of the two groups, could not be rejected at the .10 level of significance when applied to any of the sixty subjects.

Educational setting for acquiring subject knowledge

Respondents believed that knowledge about fifty-two, or 86.7 per cent, of the sixty subjects should be acquired

primarily through a classroom setting as opposed to on-the-job experience. For eight of the sixty subjects, respondents felt that learning through on-the-job experience was of greater importance than through the classroom. The results of the responses were summarized in Table # 18.

A comparison was made by use of a null hypothesis to determine if there were any differences at the .10 level of significance in opinions of land surveyors who were also professional engineers and those who were not engineers in regard to where the knowledge of the sixty subjects should be acquired. The null hypothesis could not be rejected for any of the sixty subjects.

A similar comparison was made, using the null hypothsis that there was no significant difference in responses between land surveyors who had a business interest and those who did not, as to the appropriate setting in which knowledge of the sixty subjects should be acquired. The null hypothesis could not be rejected for any of the sixty subjects at the .10 level of significance.

Continuing education interests

Of 336 respondents, 257, or 76.5 per cent, have attended a surveying seminar sometime in the past. Of 348 respondents, 314, or 90.2 per cent, implied an interest in attending a continuing education seminar in the future.

Of 361 respondents, 247, or 68.4 per cent, showed an interest in one or more subjects for a seminar.

Interest in a continuing education seminar in five of the subjects was expressed by over sixty of the respondents and over fifty respondents were interested in ten of the subjects for a seminar. Interest in a continuing education seminar in seventeen of the subjects was expressed by over forty of the respondents and over thirty respondents were interested in twenty-five of the subjects for a seminar. Results of the responses were shown in Table # 19.

Preferred time and location for a seminar

The preferred day to attend a continuing education seminar was on a Friday, followed by preferences for Thursday and Saturday. January, February or March were equally preferred months for a seminar. A two-day seminar was favored, followed closely by one day. Expressions of interest for Lansing far outnumbered the other ten cities in preference as a location for a seminar.

Miscellaneous information

The replies concerning mandatory updating through some form of continuing education in order to maintain professional licensing brought a fairly even distribution of affirmative and negative opinions.

The degree of familiarity with five available books written on land surveying varied with the individual reference. The majority of respondents were very familiar or slightly familiar with four of the books, but not familiar with one of them. The "Manual of Instructions for the Survey of the Public Lands of the United States" was the most familiar publication. Skelton's "The Legal Elements of Boundaries and Adjacent Properties" was the reference least familiar to the group.

Discussion

It was believed that the purpose and the six objectives of the study were accomplished.

Perhaps there was no startling difference in information gained about the personal characteristics of the respondents than might be hypothesized by those familiar with the land surveyor. However, the information reported was factual.

The seven respondents who gained their registration through the "grandfather's clause" of the Registration Act represented a rather insignificant number. This number will continue to decrease with time.

In this age of specialization and with the new educational curriculum for surveyors, the number of land surveyors who also were licensed as professional engineers might be expected to decrease from the reported 32.7 per

cent of the respondents. Presently, sixty-one per cent of the respondents have entered the land surveying profession without prior work experience in other areas. This number will probably increase due to the new educational requirements for becoming a land surveyor.

The educational background of the respondents was diverse, showing a formal education ranging from less than high school diplomas to master's degrees. Such a difference was expected because there were no educational requirements in the past to become a land surveyor. Changes should be apparent in the future because of the new requirement for a baccalaureate degree after 1977.

The thesis that many surveyors had their formal education in a civil engineering curriculum was supported by the fact that 118, or almost seventy-eight per cent, of those who had a baccalaureate degree received it in civil engineering.

The same lack of formal education programs for surveyors might be reflected in the report that approximately one-third of the respondents had taken correspondence courses. Of those, sixty per cent had taken a surveying and mapping course of study.

It might be assumed that the majority of respondents would believe that many of the sixty subjects were important to surveying. However, it was not expected that the responses

would so strongly support the importance of the subjects which dealt in legal matters and the aspects of business. Some examples of the subjects were: business law, contract law, mechanics lien, office management and accounting procedures. Also, it was believed that calculus, the areas of physics, and statistics and probability would have been supported to a greater extent than the responses indicated.

One could easily have generalized that there would be a difference in the opinions of the respondents who had a business interest as compared to those without a business interest, as to the importance of some of the subjects. Yet, no difference could be proven.

Perhaps the most important fact to emerge from the study was that the respondents believed that knowledge about eighty-seven per cent of the sixty listed subjects should be acquired primarily through classroom education as opposed to on-the-job experience. If the respondents had knowledge of a particular subject, they probably had to learn it on the job because the majority of subjects have not been available through a formal educational setting in the past. Yet the respondents were saying that to a certain degree the subjects should be learned in the classroom. This helps support the thesis of the need for a well planned curriculum in surveying.

The evident strong interest in continuing education seminars might be a reflection of past inadequate educational

preparation for becoming a land surveyor. Again, this would help support the thesis of a need for an appropriate curriculum in surveying. The interest also could reflect concern about the recent changes in land surveying operations because of new laws and new types of equipment.

It was observed that "practice of land surveying" as defined in the Michigan Registration Act for Architects, Professional Engineers and Land Surveyors was not entirely compatible with the definition adopted by the Michigan Society of Registered Land Surveyors. This might present both legal and ethical problems in the future if not resolved.

Recommendations

General recommendations

1. Section 2 of Act No. 240 of the Public Acts of 1937 and as amended, also known as the Registration Act for Architects, Professional Engineers and Land Surveyors, should be amended to redefine the term "practice of land surveying" to a more definitive explanation, and to one more compatible to that definition adopted by the Michigan Society of Registered Land Surveyors.
2. The differences in educational backgrounds among land surveyors should be kept in mind when appropriate; e.g., when planning continuing education

programs. Tables # 7, 8, 10 and 14 show the differences.

Curriculum recommendations

1. When more than fifty per cent of the responses indicated a subject was necessary (absolutely necessary and preferably necessary, as shown in Table # 17), the subject should be included in the course of study in which an objective is the education of land or property surveyors.
2. The extent to which a subject should be covered in a course of study should be governed by the percentage of responses falling in the categories under "where the knowledge should be acquired" in Table # 18.

Continuing education recommendations

1. The Michigan Society of Registered Land Surveyors should continue to conduct seminars or other continuing education programs on topics as suggested by the results in Table # 19 and at the preferred times and locations, as shown in Figures # 1, 2, 3 and 4 and Table # 19.
2. Records should be kept of the seminar topics and descriptions, the number of hours spent on each

topic, the dates of the seminars, and the names of the participants and the instructors.

Recommendations for further research

1. The last question on the questionnaire, "Would you favor a mandatory periodic updating through some form of continuing education in order to maintain your registration?" brought replies that were fairly evenly divided between yes, maybe and no. No conclusion could be reached from the responses. It was felt that the need for periodic updating of information necessary for land surveying was both important and involved enough to warrant its own individual study. An in-depth study could suggest recommendations for setting up a system to measure non-credit continuing education participation, such as the C.E.U. (Continuing Education Unit). Since the respondents showed significant interest in continuing education seminars, a study of this nature might lead to immediate benefits by giving those surveyors formal recognition through the C.E.U. for their participation in the seminars.

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APPENDIX

FIRST COVER LETTER
SECOND COVER LETTER
THIRD COVER LETTER
QUESTIONNAIRE

(1st cover letter for questionnaire)

3417 Cambrey Drive
Lansing, Mich. 48906

December 26, 1974

Dear Member of the Michigan Society
of Registered Land Surveyors:

I am conducting a study of the Michigan land surveyor and his educational needs. Since the M.S.R.L.S. constitutes the professional organization for land surveyors in the state of Michigan, I am asking the members of the Society for their help in making this study a success.

It is hoped that the information from this study will not only be helpful to the M.S.R.L.S. but will also be of value to those involved with the planning for the education of land surveyors.

In order to carry out this study, I need your cooperation. Please fill out the enclosed questionnaire and return it to me in the self-addressed stamped envelope within ten days.

The questionnaire takes approximately thirty minutes to complete. No name is required on the questionnaire, but it is coded for the purpose of a second mailing to those not responding.

Thank you for your consideration.

Sincerely,

Wayne E. Lesher, RLS

Enclosure

(2nd cover letter for questionnaire)

3417 Cambrey Dr.
Lansing, Mich. 48906

January 6, 1975

Dear Member of the Michigan Society
of Registered Land Surveyors:

I recently mailed you a questionnaire asking your opinion on topics relating to the educational preparation of land surveyors. If you have not completed and mailed in the questionnaire, would you please fill it out and return it in the enclosed postage-paid envelope. It takes approximately thirty minutes to complete.

I am not interested in knowing the name of an individual answering any specific question. However, information from you and the other M.S.R.L.S. members is important for a valid study of the land surveyor and his educational needs.

This is the first comprehensive study made on the subject in Michigan and perhaps in the nation. Can you help in making it a success by answering and mailing the enclosed questionnaire today?

Sincerely,

Wayne E. Lesher, RLS

Enclosure

(3rd cover letter for questionnaire)

3417 Cambrey Dr.
Lansing, Mich. 48906

January 18, 1975

Dear Member of the Michigan Society
of Registered Land Surveyors:

If you have previously responded to the questionnaire I sent you, please disregard this letter.

Recently I sent out questionnaires to answer, then a second one because I had not heard from some of you. This questionnaire deals with a study of the Michigan registered land surveyor. The study entails four objectives:

1. to determine general personal characteristics of surveyors;
2. to determine the educational background of surveyors;
3. to determine what the educational needs are for those preparing to be land surveyors;
4. to determine the continuing educational needs of the registered land surveyor.

The only way that these objectives can be met is through the help and cooperation of each of you. To date the cooperation has been good with over sixty per cent of the members responding to the questionnaire.

If there are questions you prefer not to answer, leave them out. On the average, the questionnaire takes about thirty minutes to complete. Your name remains anonymous and is used for mailing purposes only.

Over $300 out of my pocket has been spent on printing and mailing costs to date. Will you help me avoid additional expense and make this a good study by filling in and returning the questionnaire in the enclosed postage-free return envelope?

Thank you for your cooperation.

Very truly yours,

Wayne E. Lesher, RLS

Enclosure

QUESTIONNAIRE

Part I Personal Data

Directions: Please circle the number preceding the appropriate answer.

Example: Are you married?

Item # (1) Yes 2 No

(1-1) What is your sex?

1 Male 2 Female

(1-2) What is your age?

1	Under 25 years	4	35-39 years	7	50-54 years
2	25-29 years	5	40-44 years	8	55-59 years
3	30-34 years	6	45-49 years	9	Over 59 years

(1-3) What is your Ethnic Classification?

1	White	3	American Indian	5	Spanish American
2	Black	4	Oriental	6	Other

(1-4) Are you a Registered Professional Engineer?

1 Yes 2 No

(1-5) How many years of experience have you had in Surveying?

1	Less than 5 years	4	15-19 years	7	30-34 years
2	5-9 years	5	20-24 years	8	Over 34 years
3	10-14 years	6	25-29 years		

(1-6) Did you receive your registration as a Land Surveyor under the "grandfather's clause" of the Registration Act?

1 Yes 2 No 3 Not sure

(1-7) Did you enter Land Surveying after practicing another profession or job?

1 Yes 2 No

(1-8) If yes to item # 7, from what profession or job?

1 Engineering 3 Architecture
2 Forestry 4 Other (Please specify)_____

(1-9) Are you an active or retired owner or part owner of a surveying and/or engineering firm (Includes those in private practice)?

1 Yes 2 No

(1-10) Circle those organizations to which you belong.

1 Michigan Society of Professional Engineers
2 Michigan Engineering Society
3 American Society of Civil Engineers
4 American Congress on Surveying and Mapping
5 American Society of Photogrammetry
6 Consulting Engineers Council of Michigan
7 Michigan Society of Registered Land Surveyors

Part II Educational Background

Directions: Please circle the number preceding the appropriate answer. Leave those questions blank that do not apply to you.

Item #

(2-1) What is the highest level of formal education you have achieved?

1 Less than high school graduate
2 High school graduate
3 Less than two years of college
4 Two year college Associate Degree
5 Two to four years of college
6 Bachelor's Degree
7 Master's Degree
8 Doctor's Degree
9 Other (Please specify) _____

(2-2) If you have a Bachelor's Degree, what was your area of study?

1 Civil Engineering
2 Mining Engineering
3 Other Engineering (Please specify)_____
4 Forestry
5 Architecture
6 Business
7 Other (Please specify) _____

(2-3) If you have a Bachelor's Degree, what year did you graduate?

1 1971-1974
2 1966-1970
3 1961-1965
4 1956-1960
5 1951-1955
6 1946-1950
7 1941-1945
8 1936-1940
9 Prior to 1936

(2-4) If you have had some college education but less than a Bachelor's Degree, what was your major area of study?

1 Civil Engineering
2 Civil/Surveying Technology
3 Other Engineering (Please specify)_____
4 Forestry
5 General (No specific major)
6 Other (Please specify) _____

(2-5) If you have a two year Associate Degree, when did you graduate?

1 1973-1974
2 1971-1972
3 1969-1970
4 1967-1968
5 1965-1966
6 1963-1964
7 1961-1962
8 1959-1960
9 Prior to 1959

(2-6) From which state did you receive your highest education or degree?

1 Michigan 2 Other (Please specify)_____

(2-7) Have you taken any correspondence courses?

1 Yes 2 No

(2-8) If you have taken any correspondence courses, what was your course of study?

1 Surveying and Mapping
2 Civil Engineering
3 Other (Please specify)_____

(2-9) If you have taken any correspondence courses, from what school?

1 I.C.S. (International Correspondence School)
2 C.I.S.T. (Canadian Institute of Science and Technology)
3 Pacific International College of Arts and Science
4 LaSalle Extension University
5 Other (Please specify)_____

(2-10) If you have taken any correspondence courses, did you complete all the required courses for a degree or certificate?

1 Yes 2 No

Part III Educational Needs for Land (Boundary) Surveying

Instructions: This section deals with specific technical and non-technical subjects that may be desirable in order that a Land Surveyor can satisfactorily perform the job of boundary or property surveying, including the process of platting. We wish to draw upon your knowledge and experience as a Registered Land Surveyor to determine the degree of importance of the following various subjects in order that a property surveyor can function in his work with maximum efficiency.

Directions: Using the following scale, please indicate your feelings concerning the degree of knowledge desirable of each item by circling one of the five numbers in the left column.

Please indicate your feelings as to where that knowledge should be learned by circling one of the five numbers in the right column. Only circle a number in the right column when you have circled either #1 (Absolutely Necessary) or #2 (Preferably Necessary) in the left column.

To what extent should a surveyor doing property and boundary surveying know each subject?	Item #		Answer this side only when #1 or #2 on the left side of the page is circled. Where should this knowledge be acquired?
1--Absolutely necessary 2--Preferably necessary 3--Undecided (No opinion) 4--Preferably not necessary 5--Absolutely not necessary			Entirely by job experience---- 5 1/4 Classroom, 3/4 on the job- 4 1/2 Classroom, 1/2 on the job- 3 3/4 Classroom, 1/4 on the job- 2 Entirely in the Classroom----- 1
(1) 2 3 4 5	(3-0)	(EXAMPLE) Plane Trigonometry (EXAMPLE).....	1 (2) 3 4 5
1 2 3 4 5	(3-1)	A basic understanding of electronic computers....	1 2 3 4 5
1 2 3 4 5	(3-2)	Ability to do computer programming.....	1 2 3 4 5
1 2 3 4 5	(3-3)	Application of computers in surveying problems...	1 2 3 4 5
1 2 3 4 5	(3-4)	Taking and computing astronomical observations for true bearing.....	1 2 3 4 5
1 2 3 4 5	(3-5)	Taking and computing astronomical observations for latitude and longitude position.....	1 2 3 4 5
1 2 3 4 5	(3-6)	Theory and principles of photogrammetry.....	1 2 3 4 5
1 2 3 4 5	(3-7)	Application of photogrammetry to surveying.....	1 2 3 4 5
1 2 3 4 5	(3-8)	Computation and use of the State Plane Coordinate System.....	1 2 3 4 5
1 2 3 4 5	(3-9)	Ability to make neat and accurate drawings.....	1 2 3 4 5
1 2 3 4 5	(3-10)	Ability in use of ink in drafting.....	1 2 3 4 5
1 2 3 4 5	(3-11)	Ability to identify trees.....	1 2 3 4 5
1 2 3 4 5	(3-12)	Conduct as an expert witness in a court of law...	1 2 3 4 5
1 2 3 4 5	(3-13)	Familiarity with the court system.....	1 2 3 4 5
1 2 3 4 5	(3-14)	Familiarity with the liability of the property surveyor.....	1 2 3 4 5
1 2 3 4 5	(3-15)	Familiarity with the more common state laws that pertain to land surveying (e.g. Mich. Coordinate System Act, Corner Recordation Act, etc.).....	1 2 3 4 5
1 2 3 4 5	(3-16)	Familiarity with the less known state laws that may involve land surveying (e.g. Malpractice Act, Soil Erosion Act, Mechanics Lien Act, etc.).....	1 2 3 4 5

Part III Cont.

To what extent should a surveyor doing property and boundary surveying know each subject?	Answer this side only when #1 or #2 on the left side of the page is circled. Where should this knowledge be acquired?
1--Absolutely necessary	Entirely by job experience---- 5
2--Preferably necessary	1/4 Classroom, 3/4 on the job- 4
3--Undecided (No opinion)	1/2 Classroom, 1/2 on the job- 3
4--Preferably not necessary	3/4 Classroom, 1/4 on the job- 2
5--Absolutely not necessary	Entirely in the Classroom----- 1

Item #		
1 2 3 4 5	(3-17) Figuring survey costs and professional fees.....	1 2 3 4 5
1 2 3 4 5	(3-18) Professionalism, professional ethics, and relationship with client.....	1 2 3 4 5
1 2 3 4 5	(3-19) Understanding real property interests (Freehold Estates, Leasehold Estates, Life Estates, Fee Simple, etc.).....	1 2 3 4 5
1 2 3 4 5	(3-20) Understanding the written transfer of real property (Deeds, Wills, etc.).....	1 2 3 4 5
1 2 3 4 5	(3-21) Understanding the transfer of real property not in writing (Adverse Possession, Oral Agreement, Accretion, etc.).....	1 2 3 4 5
1 2 3 4 5	(3-22) Understanding junior and senior property rights...	1 2 3 4 5
1 2 3 4 5	(3-23) Understanding the priorities of conflicting terms that may be found in boundary descriptions.....	1 2 3 4 5
1 2 3 4 5	(3-24) Ability to evaluate field evidence of property boundaries.....	1 2 3 4 5
1 2 3 4 5	(3-25) Ability to write property descriptions.....	1 2 3 4 5
1 2 3 4 5	(3-26) Understanding the legal terminology in real estate transactions.....	1 2 3 4 5
1 2 3 4 5	(3-27) Ability to locate, read, and understand court cases in a law library.....	1 2 3 4 5
1 2 3 4 5	(3-28) Ability to locate and research public records and documents dealing with real property.....	1 2 3 4 5
1 2 3 4 5	(3-29) Understanding riparian and littoral (water front) property ownership.....	1 2 3 4 5
1 2 3 4 5	(3-30) Understanding the mineral rights of property ownership.....	1 2 3 4 5

Part III Cont.

To what extent should a surveyor doing property and boundary surveying know each subject?	Answer this side only when #1 or #2 on the left side of the page is circled. Where should this knowledge be acquired?
1--Absolutely necessary	Entirely by job experience---- 5
2--Preferably necessary	1/4 Classroom, 3/4 on the job- 4
3--Undecided (No opinion)	1/2 Classroom, 1/2 on the job- 3
4--Preferably not necessary	3/4 Classroom, 1/4 on the job- 2
5--Absolutely not necessary	Entirely in the Classroom----- 1

	Item #	
1 2 3 4 5	(3-31) Understanding reversion rights and easements in property ownership.....	1 2 3 4 5
1 2 3 4 5	(3-32) Understanding the handling of excesses and deficiencies between recorded and measured distances.....	1 2 3 4 5
1 2 3 4 5	(3-33) Ability to write descriptions for condominiums....	1 2 3 4 5
1 2 3 4 5	(3-34) Ability to plat condominium projects.....	1 2 3 4 5
1 2 3 4 5	(3-35) Familiarity with field safety precautions.....	1 2 3 4 5
1 2 3 4 5	(3-36) Proper dress and conduct in the field.....	1 2 3 4 5
1 2 3 4 5	(3-37) Knowledge of planning and designing subdivisions..	1 2 3 4 5
1 2 3 4 5	(3-38) Knowledge of the procedure for preparing a preliminary plat.....	1 2 3 4 5
1 2 3 4 5	(3-39) Knowledge of the procedure for preparing a final plat.....	1 2 3 4 5
1 2 3 4 5	(3-40) Understanding the duties and operations of the various local government agencies (City Clerk, City Engineer, County Plat Board, County Treasurer, Planning Board, etc.).....	1 2 3 4 5
1 2 3 4 5	(3-41) Understanding the general principles of how the original sectionalized government lands were subdivided into townships, sections, and quarter sections.....	1 2 3 4 5
1 2 3 4 5	(3-42) Understanding the specific method used by government surveyors in subdividing townships and sections in <u>that part of Michigan where you work</u>.....	1 2 3 4 5

Part III Cont.

To what extent should a surveyor doing property and boundary surveying know each subject?

1--Absolutely necessary
2--Preferably necessary
3--Undecided (No opinion)
4--Preferably not necessary
5--Absolutely not necessary

Answer this side only when #1 or #2 on the left side of the page is circled.

Where should this knowledge be acquired?

Entirely by job experience---- 5
1/4 Classroom, 3/4 on the job- 4
1/2 Classroom, 1/2 on the job- 3
3/4 Classroom, 1/4 on the job- 2
Entirely in the Classroom----- 1

	Item #		
1 2 3 4 5	(3-43)	Understanding the specific method used by government surveyors in subdividing townships and sections in <u>any part of Michigan</u>.....	1 2 3 4 5
1 2 3 4 5	(3-44)	Human relations skills (Public relations).....	1 2 3 4 5
1 2 3 4 5	(3-45)	Office management.....	1 2 3 4 5
1 2 3 4 5	(3-46)	Accounting procedures.....	1 2 3 4 5
1 2 3 4 5	(3-47)	Business law.....	1 2 3 4 5
1 2 3 4 5	(3-48)	Contract law.....	1 2 3 4 5
1 2 3 4 5	(3-49)	Mechanics lien.....	1 2 3 4 5
1 2 3 4 5	(3-50)	Workman's compensation.....	1 2 3 4 5
1 2 3 4 5	(3-51)	English - Composition and report writing.....	1 2 3 4 5
1 2 3 4 5	(3-52)	Fundamentals of economics.....	1 2 3 4 5
1 2 3 4 5	(3-53)	Calculus.....	1 2 3 4 5
1 2 3 4 5	(3-54)	Statistics and probability.....	1 2 3 4 5
1 2 3 4 5	(3-55)	Physics - Mechanics.....	1 2 3 4 5
1 2 3 4 5	(3-56)	Physics - Heat.....	1 2 3 4 5
1 2 3 4 5	(3-57)	Physics - Electricity.....	1 2 3 4 5
1 2 3 4 5	(3-58)	Physics - Magnetism.....	1 2 3 4 5
1 2 3 4 5	(3-59)	Physics - Sound.....	1 2 3 4 5
1 2 3 4 5	(3-60)	Physics - Light.....	1 2 3 4 5

Part IV Continuing Education

Instructions: This part deals with your interest in continuing your education through seminars (without college credit) of one or more days in length.

Item #

(4-1) Directions: Please take a moment to look over the items in the preceding part of the questionnaire (Part III) to see if you are interested in a seminar (without college credit) for any of those items. Circle the item number of any of the items in Part III that you feel you need and that you would like to see offered in a continuing education seminar.

EXAMPLE

Item #	
(3-8)	
(3-9)	This would indicate your interest in item # (3-9) as a topic for a seminar.
(3-10)	

(4-2) If there are other subject matter areas that you think should be offered as a continuing education seminar, please state what they are:

1 _____

2 _____

3 _____

(4-3) How long a seminar would you prefer? Circle the number of your choice.

1	One day	3	Three day	5	Five day	7	Not interested
2	Two day	4	Four day	6	Doesn't matter		

(4-4) Which day of the week would you prefer to attend a seminar? Please circle three choices.

1	Monday	3	Wednesday	5	Friday	7	Sunday
2	Tuesday	4	Thursday	6	Saturday		

(4-5) Which month of the year would you prefer to attend a seminar? Please circle three choices.

1	January	4	April	7	July	10	October
2	February	5	May	8	August	11	November
3	March	6	June	9	September	12	December

(4-6) In which location would you prefer to attend a seminar? Please circle three choices.

1	Detroit	5	Lansing	9	Gaylord
2	Ann Arbor	6	Kalamazoo	10	Marquette
3	Saginaw	7	Grand Rapids	11	Houghton (U.P.)
4	Flint	8	Traverse City		

Part IV Cont.

(4-7) Have you ever attended a seminar related to surveying or the business aspect of surveying?

1 Yes 2 No 3 Not sure

(4-8) thru (4-12) To what degree are you familiar with the following books? Circle the number that applies to you in each case.

	Very Familiar	Slightly Familiar	Not Familiar	
(4-8)	1	2	3	Brown, "Boundary Control and Legal Principles"
(4-9)	1	2	3	Brown & Eldridge, "Evidence and Procedures for Boundary Location"
(4-10)	1	2	3	Clark, "Law of Surveying and Boundaries"
(4-11)	1	2	3	Skelton, "The Legal Elements of Boundaries and Adjacent Properties"
(4-12)	1	2	3	U.S. Gov't., "Manual of Instructions for the Survey of the Public Lands of the U.S."

(4-13) Would you favor a mandatory periodic updating through some form of continuing education in order to maintain your registration?

1 Yes 2 Maybe 3 No