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INTRODUCTION

1.1 Scope of the Book

In writing any book, authors should have a goal or philosophy as to what it is they wish to accomplish. We have such a philosophy: It is our desire to help the student and the practicing surveyor, as well as those aspiring young people who wish to enter the surveying profession, appreciate some of what we feel are the finer aspects of surveying, that is, the legal aspects as well as that area of the law that relates to and encompasses evidence in all of its aspects.

This is a book about survey evidence and, as such, it is not a book on "how to survey" but what to do with your survey when it is completed and what your clients can expect from your survey. Many consider the surveyor as the individual standing behind a transit or theodolite turning angles or collecting data for a new road or measuring for a new subdivision. This book will have a double focus: First, it is aimed at those students who wish to enter the surveying profession and at those surveyors who locate boundary lines and land parcels or utilize evidence in searching for and locating the footsteps of the earlier surveyors who originally created the parcels or property.

Second, we wish to provide a reference textbook that future professional land surveyors may use as a study guide to prepare for their Fundamentals, Principles & Practice, and state-specific examinations. In writing this book, the authors have attempted to modernize the format to be more in keeping with the legal texts of today. The authors have attempted to make the references and the terminology consistent with legal courses to be in keeping with the modern approach. In this we have tried to modernize the land surveyor's responsibilities and liabilities.

The functions of land surveyors should be considered as varied and different in each state. For simplicity, boundary surveying can be divided into two general areas

or disciplines: (1) locating or relocating originally described parcels of land; and (2) creating new parcels. In keeping with recent legal decisions, we have somewhat modified some of the terminology. For instance, seldom is the term *property line* or *property boundary* used. It is our belief that property rights, including property boundaries, are legal questions and as such are not addressed by land surveyors. Surveyors locate boundaries, or land boundaries or deed lines. They do not and cannot locate property rights.

Corners and the lines connecting those corners define the extent of property rights that are described in the land description. These lines may coincide with property rights or they may be separate and independent. These originally created lines remain fixed and unalterable except as provided by law, such as the loss or gaining of property rights or the addition or elimination of contiguous parcels of land in the same ownership.

This concept is what gives rise to the phrase "following the footsteps" because a parcel, once established, should remain fixed through any series of conveyances. This phrase is historical in that many earlier decisions coined the phrase, which now has been adopted and adapted by modern-day courts in rendering decisions. A grantee who acquires a parcel owned by a grantor determines the boundaries of his/her purchase at the time that the particular parcel was carved out of some larger tract. He or she takes to the bounds of the estate of his or her grantor, who, in turn, took to the limits of that grantor's estate, to the time of the creation of the boundaries [1].

The first portion of the book (Chapters 1–11) covers resurveys or retracements of former surveys based on the record; the latter part (Chapters 12–19) covers the creation of new parcels or the division of land in which the surveyor may create the record. The importance of evidence in both phases will be stressed in the following pages.

The first problem one encounters is in the definition of *surveying*. No two states or the federal government or the international community describe surveying in the same terms; nor do they have the same requirements for one to become qualified to create, identify, retrace, and then testify in judicial tribunals as to boundaries or to survey real property.

How original surveys are made is subject to control by the legislative branch of the government, and since there are 50 states and the federal government, land subdivision laws and regulations of original surveys are extremely variable and usually are regulated by standards, statutes, rules, and regulations. However, after parcels have been created and the land has been divided and described, it is left to the courts to interpret the position of the original boundaries. Today, practically all original surveys must begin from a survey of an existing parcel. For this reason, the first portion of the book pertains to the location of previously described parcels. It deals with the evidence and methods for locating these corners, lines, and parcels.

In attempting to survey and locate a described parcel of land, the only permanent and correct location of its boundaries is where a court of competent jurisdiction would locate them. To know where a court would locate property boundaries, the surveyor must have expert knowledge and understanding of the laws of boundaries and evidence. Yet regardless of where the surveyor would locate the boundaries of

the parcel, the final location of any boundary is nothing more than an opinion of the evidence recovered, evaluated, and then interpreted, and this is always subject to review by the courts and by other subsequent surveyors.

Once a boundary is questioned or litigated and the parties seek determination by a jury, the trial is usually divided into two parts: It is left to the jury to decide what the facts are and it is left to the judge to apply the law to the facts. This has led many courts to hold to the old saying: "What boundaries are is a matter of law; where boundaries are is a matter of fact."

Thus, in a trial, the jury decides where an original monument position was located based on evidence the surveyor used to formulate an opinion. The judge decides whether the monument or measurement is controlling as a matter of evidence presented at the trial and not necessarily as a matter of law. In a survey based on the record, the surveyor may be asked to determine both of these questions, either knowingly or unknowingly. Chapter 2 examines the laws of evidence necessary to prove facts and the order of importance of discovered evidence.

According to the *Statute of Frauds* first enacted in England in 1677 and later adopted both in statute law and common law in the United States, land ownership must be proven by some form of written evidence. To prove the right of legal possession, a written document must be produced witnessing such right. In early decisions, courts found that the requirement for written deeds sometimes caused an individual to commit fraud; thus, the concept of title passing without a writing was created, yet English courts recognized a concept from Roman law, adverse possession, by calling it an unwritten title. Since a legally created unwritten title is legally superior to a written title, one may say that the written title is either extinguished or reduced in status to a junior interest.

In recent years, a marked change has occurred in the courts' thinking on the subject of professional responsibility and liability. The concepts of privity of contract and the time of commencement of the running of any statute of limitations are vastly different from what they were 50 years ago. Chapter 16 and a portion of Chapter 17 discuss these subjects with the hope that student will be able to limit or possibly escape professional exposure for liability when entering the profession.

According to decisions reported in court cases, surveyors, in retracing old boundary lines, are directed and obligated to follow the "footsteps of the original or creating surveyor"; therefore, it is essential that any surveyor who practices in the area of property or boundary identification has knowledge of the historical background of land surveys in general and the geographic area specifically and that he or she know under which laws they were originally performed. The authors believe that the term *footsteps* equates to a question of *evidence*: evidence created and then evidence recovered. Evidence will be discussed to include many facets. The purpose of discussing surveying history in Chapter 9 is to aid present-day surveyors in understanding why we must follow certain procedures when locating property boundaries. Even this history must be used as a tool for the present and not as a device to present the romance of the past. Exploration of historical background and the study of the development of various survey systems and equipment will provide the needed background of laws and customs governing property owners' rights and privileges.

Although surveying history will be shown to be quite ancient, it does not overlook the fact that the United States is rich in many phases of the history of surveying and law that have widespread application within the individual states, territories, and the United States proper:

1. the English system that gave rise to English common law, which was used in the colonies and now forms many of the fundamental rules, as well as civil law, which evolved from Roman law and was subsequently referred to as the Napoleonic Code and is still found in vestiges in most of the remainder of the United States;
2. the Mexican and Spanish land grant systems;
3. the French system, used in the Louisiana Purchase area and elsewhere;
4. the sectionalized land system of the public domain;
5. land divisions under state laws, especially in Texas and some of the eastern seaboard states; and
6. the various other systems that developed in states such as Georgia and Maine.

The intent and meaning of the words in a deed should always be interpreted in the light of laws, words, and conditions existing at the date of the creation of the document. In New York, under Dutch rule, land dedicated for road purposes passed in fee title to the Crown. New York, on acquiring the streets, retained the fee title; hence vacated, former Dutch streets revert to the state. The same can be said of Texas roads dedicated during Spanish or Mexican control [2]. The ownership of stream beds or bodies of water is often dependent on which nation had jurisdiction at the time of the land's original alienation and on the effect of the laws in force at the time of the grant. An indispensable part of all boundary location is knowledge of the history of the development and settlement of the area. With this idea in mind, Chapter 8, on evidence of water boundaries, has been totally rewritten.

With a foundation of the historical development of real property and surveying, the surveyor or the student will have an opportunity to expand their knowledge by learning the procedures used in locating already described parcels and procedures used to create new parcels, including suggestions as to how to describe parcels in writings. If the reader feels that some of the aspects of property surveying appear to be treated too briefly or are not mentioned at all, it may be because these topics have been adequately discussed in other works previously published and available to the practitioner and student.

1.2 Definitions of Surveys and Surveyors

The terms *survey*, *surveying*, and *surveyor* have broad and possibly confusing connotations; the average citizen becomes confused when a survey is conducted as to public opinion but then sees a surveyor measuring the lot next door. We recognize that the term *survey*, without more exacting words, describes procedures as well as vague studies. Simply stated, the word *surveying* may have numerous implications.

First, being the verb: "I am surveying a description of a parcel of land." Then, going from verb to noun, a surveyor can state, "Here is my survey." Finally, the same word may be used as an adjective with the phrase "Here is my survey plat." When used with other terms, such as *land*, *property*, *boundary*, *geodetic*, or *cadastral*, the term then becomes more definite and can be discussed and is pertinent to the subject of this book. The word *cadastre* is defined as an official register of the quantity, value, and ownership of real estate used in apportioning taxes. *Cadastration* is the act or process of making a cadastre or cadastral survey. Cadastres and cadastral surveys are concerned with land [3], law, and people [4]. In popular use, land surveying is defined as the determination of boundaries and areas of a tract of land.

A *boundary survey* is understood by some as a survey that is conducted for the location and establishment of lines between legal estates, or it may be a physical feature erected to mark limits of a parcel or political units [4] and a *cadastral survey* is confined to the location and subdivision of the public domain [5]. To minimize confusion, the term *property surveying* may be used interchangeably with *boundary surveying* or *boundary line*. As such, the terms may not be considered as denoting property rights but may be employed throughout this book to denote the activity of locating, establishing, and delimiting boundaries of real property. The practice of property surveying is defined in many of the state registration and licensing laws. Such definitions usually include the measurements of area, length, and directions and the correct determinations of descriptions, especially when such property is to be conveyed or when the instrument of conveyance is to become a matter of public record.

Although not applicable here, we must mention that to the general public the term survey may address an opinion poll or political analysis, which may add additional confusion. The National Council of Examiners for Engineering and Surveying (NCEES) defined *land surveying* to mean the performance or practice of any professional service requiring education, training, and experience in the application of special knowledge in the mathematical, physical, and technical arts and sciences to such professional services as the establishment or relocation of land boundaries, the subdivision of land, the determination of land areas, the accurate and legal description of land areas, and the platting of land subdivisions for record [6].

In a model registration law approved by NCEES, the following statement appears [7]:

> The term Land Surveying used in this act shall mean and shall include assuming responsible charge for and/or executing: the surveying of areas for their correct determination and description and for conveyancing; the establishment of corners, lines, boundaries and monuments; the platting of land and subdivisions thereof including as required, the functions of topography, grading, street design, drainage and minor structures, and extensions of sewer and water lines; the defining and location of corners, lines, boundaries and monuments of land after they have been established; and preparing the maps and accurate records and descriptions thereof.

The American Congress on Surveying and Mapping (ACSM), now the National Society of Professional Surveyors (NSPS), jointly published *Terms & Definitions*

of Surveying and Associated Terms in 1978 with the American Society of Civil Engineers (ASCE). The current edition, revised in 2005, provides the following definition of land surveying:

Land surveying is the art and science of

1. retracing cadastral surveys and land boundaries based on documents of record and historical evidence;
2. planning, designing, and establishing property, land, and boundaries; and
3. certifying surveys as required by statute or local ordinance such as subdivision plats, registered land surveys, judicial surveys, and space delineation.

Land surveying can include associated services such as mapping and related data accumulation; construction layout surveys; precision measurements of length, angle, elevation, area, and volume; horizontal and vertical control systems; and the analysis and utilization of survey data. In summary, the term *surveying* can be considered an ambiguous word.

1.3 Activities of Boundary Surveyor

Few other countries rely on the surveyor as people do in America. No other country identifies and applies property rights as we do. Property (boundary) surveyors are found in private practice, are employed by federal, state, county, and local government, and are associated with related business. In the past, those engaged in private practice and especially those in rural areas often had small organizations composed of the surveyor with one or more helpers. As a general rule, most surveyors were sole practitioners or employed by small firms. This still applies today. In larger cities and in densely populated areas it is not uncommon to find large surveying firms preparing subdivisions and locating parcels of land for sale. Many land surveyors have found that a small organization in a country setting is most enjoyable and offers many advantages. In many instances, small surveying firms or organizations have spanned several generations in the same family.

The federal government, through the Bureau of Land Management (BLM), is still engaged in the original subdivision, resurveying, and retracing the public domain; the U.S. Forest Service employs surveyors who are well versed in land surveying, as does the National Park Service, the Fish and Wildlife Service, and military organizations. One of the more important functions of State Departments of Transportation is the location of rights-of-way with respect to adjacent properties. Counties and cities often have similar problems, although confined to a more local area. In a few states, the county surveyor makes private property locations part of his or her official duties; but in other states the county surveyor's responsibility is narrowly confined to county government problems, as defined by the law.

Today many more governmental organizations employ surveyors or survey advisors for geographic information system (GIS), land information system (LIS), and global positioning system (GPS) work. The surveyor may not necessarily confine his or her work to property, boundary, surveys, often mapping topography and staking

the outline of engineering projects such as buildings, sewer lines, water lines, curbs, sidewalks, and paving. Although these are important technical functions, they will not be treated in this book. This textbook will primarily be devoted to the location of boundaries of parcels of land. The modern surveyor will be intimately involved in creating maps or descriptions for GIS–LIS projects or acting as a consultant for the design or such projects. GIS should mean "get it surveyed."

1.4 The Surveyor in Society

History supports the fact that the practice of surveying, including property surveying, is as ancient as property ownership itself. In Babylon, over 3500 years ago, the name of a surveyor was inscribed on a boundary stone, giving testimony to his acts [8]. A visit to the National Museum in Cairo, Egypt, will expose the visitor to a tomb of a surveyor. In the National Museum in Athens, Greece, as well as in Rome, Italy, one can view the tombstone of a surveyor long dead.

It is recorded that for over 1000 years ancient Rome used surveyors to locate boundaries and survey roads and aqueducts. In fact, the Roman *agrimensores*, namely the surveyor, was required to pass an examination for competency. Because of the nature of surveying and the varied needs, Rome separated the "civil" surveyor from the "military" surveyor.

In early times, surveyors possessed special skills and talents that were regarded with almost reverent respect; they filled a necessary need in civilization, and they utilized the most advanced sciences known to the world. The same Roman surveyors were required to receive special training in the varied aspects of leveling and boundary law while in school. They were guided by a series of textbooks titled *The Corpus* [9].

There is little doubt that the practice of surveying today is a profession and should be performed by and through a professional upholding the standards of the higher meaning of the word. Yet as practiced today, surveying is very different from that practiced by Washington, Ellicott, Thoreau, and Lincoln and their contemporaries. The present rapid development of this country's lands and resources has created a need for professional surveyors, a demand much greater than graduates being supplied by the universities with surveying programs. Today, many surveyors have obtained professional status or recognition by apprenticeship, on-the-job training, and self-study programs, without the aid of much formal education. But as the demands of society become more complex, the surveyor of yesterday will be little recognized by the surveyor of the future. Such regeneration probably will not suffice in the future, and the surveyors will have to come from schools and colleges with students earning formal degrees in the various disciplines of surveying.

Technology development has outpaced the development of the law.

Education was and will be the foundation of the surveyor of tomorrow, while experience was the foundation of the immediate past. In the formative years of the world and our nation, the surveyor was perhaps among the more educated individuals. The

surveyor mastered mathematics, instrumentation, astronomy, and cartography, and he was the explorer and the mapmaker of new worlds. Today the new worlds the modern surveyors will conquer are the technical and the legal worlds.

Like all other professions, the demands on surveyors are more complex and have become greater and more differentiated, the practice of property surveying has to consider inexact laws in addition to exact engineering or measurement sciences. Few problems confronting the property surveyor can be solved completely by applying exact sciences only; answers will depend on law, an inexact science. The development of mature judgment, logic, and meaningful experience will be demanded of the student.

There are no known studies as to why young students wish to devote their lives to the profession of surveying. What type of person does this profession appeal to was best explained over nine decades ago by A.C. Mulford who finalized the book *Boundaries and Landmarks* with the following statement [10]:

> Yet it seems to me to a man of an active mind and high ideals the profession is singularly suited; for to the reasonable certainty of a modest income must be added the intellectual satisfaction of problems solved, a sense of knowledge and power increasing with the years, the respect of the community, the consciousness of responsibility met and work well done. It is a profession for men who believe that a man is measured by his work not by his purse, and to such I commend it.

Surveyors look with pride to the many famous men in history, including several presidents, who have been engaged in surveying as a profession during their lifetime. Property surveyors, perhaps more than their associates in engineering, are in constant contact with people. This gives the property surveyor an opportunity to present a professional image as a member of a profession with superior standing, integrity, and knowledge. Awareness of the many responsibilities and a conscientious fulfillment of professional obligations will enable the property surveyor to maintain a status in society.

1.5 Current Need for Surveyors

In the United States and now in other areas of the world there are millions of people with many basic needs that involve land. Food and minerals and fiber and forage are derived from the soil. All substances that go into essential goods are products of the land. Rain must be conserved and controlled as it falls on the earth. Lakes and rivers provide transportation, irrigation, and energy for those who live along their shores. Yet surveying is more than just the surveying of a lot or a subdivision. The various areas of surveying and what they bring to humanity is one of the basic needs of all peoples.

This century has been highlighted by many spectacular advances in technology. Structures, buildings, bridges, and tunnels, as well as dams and highways, all of which are located on land that has been here for millennia, require surveys or measurements. When these structures disappear, the land on which they stood will still be

there. When miles of new highways are constructed, the location will depend on and require miles of new property lines to be located or surveyed and described!

An exploding population is creating demands for more and more residential lots. New land developments containing 50,000 home sites and small subdivisions with only a few lots are being created. For each parcel of land, there are owners' rights and privileges extending to the limits of their property, both skyward and to the depths of the Earth. These requirements are requiring that surveyors identify division lines on, below and above the Earth's surface. With expansion, a community requires additional lands for public and municipal purposes, such as waste disposal, service utilities, parks, schools, and rights-of-way.

In the early years of the country, real property sold for $1.25 per acre or less; today, portions of that same land may have values in excess of $2 million per acre, and some land is valued in terms of thousands of dollars per front-foot or square foot. Even "poor" land in rural areas may bring $1000 per acre or more.

Of the thousands of surveyors in the country today, many are not prepared to cope with these crucial problems, either technically, educationally, legally, or experience-wise, and, even if they were able, the numbers of trained and qualified surveyors are not sufficient to satisfy the needs of the growing population. This book is written with a twofold purpose in mind: first, to help those in practice to better understand the professional problems that are present and, second, to aid the surveying student in preparing for a profession that can be as rewarding as the engineering, medical, or legal profession.

1.6 Future Needs for Surveyors

No one can accurately predict the problems of the future, but some of the needs can be anticipated and prepared for accordingly. Certain needs are obvious. The population will increase, and thus more efficient use of land must be made. As the costs of land spiral upward, the delineation of property lines will become more critical. New divisions of land will continue to be made each day, and the ancient surveys will have to be identified and retraced. These divisions will not only be horizontal but also vertical. We will build upward as well as downward.

Even in the future, the property surveyor must not ignore the past, for a professional's problems go back as far as land ownership itself. If we will not learn from the mistakes of yesterday, we will provoke headaches for tomorrow, and new surveys must be performed more accurately and with greater precision. Rare are the areas where the value of real property has not risen considerably over the years. In addition, now that communism has failed, large areas of once communally held property will be divided and placed into private ownership.

The property or boundary surveyor of tomorrow will need to exercise far more technical skill and more in-depth knowledge of the law and use legal judgment than the professional surveyor of today, yet the modern surveyor must have an understanding and knowledge of the law. Just as the compass and chain are gone, the transit and tape are not sufficient to cope with future problems. Modern technology has developed many marvelous devices and techniques with which to make more

precise surveys and aid in studying and solving property surveying problems. Such tools as photogrammetry, electronic computers, and microdistance devices are now commonplace. The surveyor will use new terms such as GPS, GIS, LIS, and perhaps some that have not yet been coined.

It is hoped the student surveyor will not lose sight of the fact that technology cannot replace hard work and experience that can only be gained from the exposure to field exercises and the necessity of having an understanding of the law. It is possible that the property surveyor of tomorrow will locate title boundaries many fathoms under the sea or meters above the ground. He or she may need to subdivide the Antarctic continent. Whatever are the problems, the property surveyor will need to be armed with all the tools, knowledge, and education of the profession and have the ability to exercise sound and mature reasoning.

One fact is certain: Education is the foundation of tomorrow's surveyors. Today, surveying programs are directed toward two general areas: one predicated on course-oriented subjects in modern aspects and a second directed toward basic education courses supplemented by extensive field training. There is no present answer as to which of the two will produce the better surveyor of tomorrow.

What the authors do see is that the surveyor of tomorrow will be more closely oriented toward the legal aspects. Surveying should be considered to be a combination of three separate and distinct areas: technical, legal, and administrative, professional, or business. Although each of these is separate, they have a common area of overlap in which all three are interrelated. Many textbooks adequately discuss the technical, and in most college courses, the technical aspect is thoroughly taught and examined, but the business or administrative and legal areas have few references to aid the student and surveyor. It is hoped that this book will meet this need for the student and the practicing surveyor (see Figure 1.1).

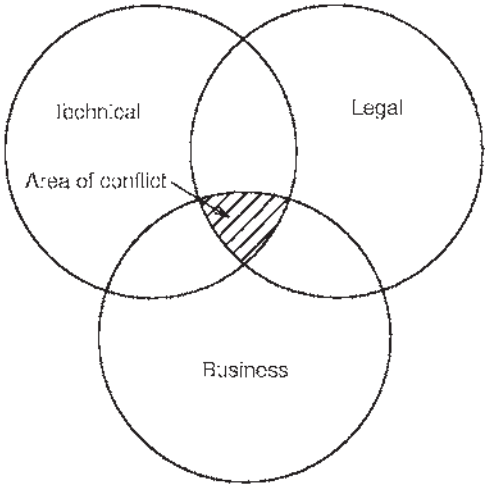

FIGURE 1-1. Three disciplines of surveying.

1.7 Land Data Systems

At this time, the need for restructuring and reorganizing the land data systems existing in most states is urgent. Most, if not all, states employ land systems that are antiquated and cumbersome. In some counties, land records are deplorable. The move toward modernization of land data systems includes pilot projects in various parts of the country, some of which have been in existence for a few years. Although needed, land data will vary from place to place; yet, the systems in general may be similar in many respects.

Geographic information systems are being introduced in many locales, yet few people realize that the basis of any system predicated on measurement requires, first, an adequate survey framework. Systems index parcels of land according to a unique number taken from a cadastral map, which is based on a rigid framework of horizontal and vertical control. Data are computerized and can include not only title information and deed descriptions but also information concerning natural resources, zoning, and the like. Most recording offices now use microfilm as a necessity for saving space.

Most countries are now using some type of computerized system. With advances being made in GISs, LISs, and GPSs, the coordination of land data of any nature is now faster, more accurate, and more readily available to the surveyor and the consuming public. In addition, the retrieval of such data is routine in many offices and governmental agencies and in some areas is available to the consuming public on a 24/7 basis. Sophisticated computer hardware and software are being developed and modified to meet any budget or need.

Surveying and engineering offices are moving rapidly toward computerization, microfilming, and retrieval of records to conserve time and storage space and to increase accuracy of the record. Database management programs are being designed to fit the needs of most offices, no matter how large or small.

The thrust of this book will be in the legal dimensions, along with some of the business aspects of the surveying profession. Surveyors should be an integral part of the development and maintenance of land data records; they should be the ones to see that the evidence of monuments and their position are included with all other information that has become a matter of public record.

The future in the land data systems, in GIS/LIS, and all other new systems will rest on a group of professionals. If surveyors are to lead, they must take the initiative and not let the system pass them by. In the world of tomorrow, there will be no place for the hesitant, for they will be lost. Those who do not look to the future will earn their "Doctorate of Plane Table Technology."

1.8 Global Positioning Systems

Surveyors have found a new useful tool with which to measure lines and locate positions. Like all tools, some believe a new innovation called *global positioning systems*, or GPS, will revolutionize their practice. However, caution is always advised, since all tools have their shortcomings and limitations. Although GPS will permit

long-distance surveying far faster than ever before, and makes distance ties and surveys of six-mile lines practical for small-area surveys, there is still no substitute for ensuring the measurements between points or the occupation of points, or positions. It cannot be overemphasized that there is only one correct point for a corner, whether marked or not, and it is the position where it was originally placed that controls above all.

GPS, being a measurement tool, is subject to the same rules of law and technology as all other measurement tools of the past. For, after all, the GPS unit used today is nothing more than the historical extension of the Roman groma or the dioptra of Heron of Alexandria's era. Courts have always ruled that measurements are the least reliable of all items of evidence, and that they should only be used as a last resort. Measurements contain error; original corners (positions), by law [11], are without error.

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