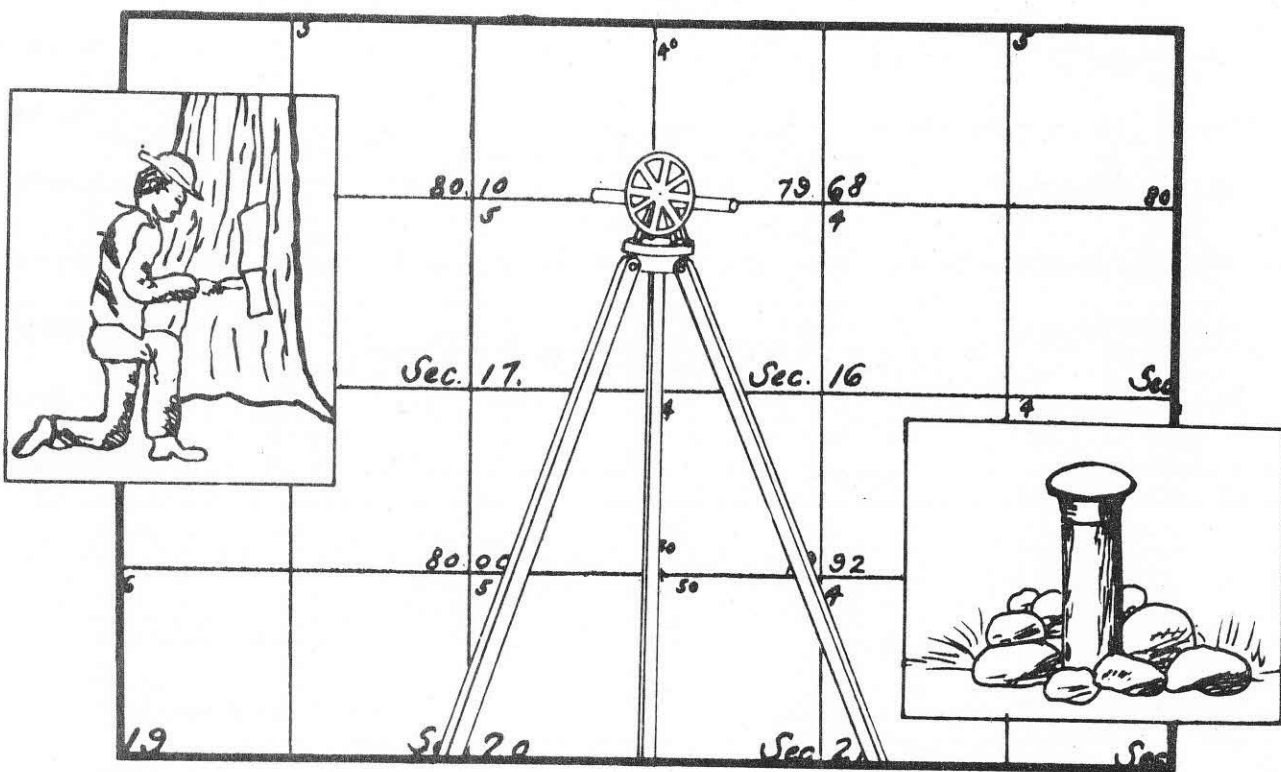


# Handbook for Arkansas Land Surveyors



**Arkansas Geological Commission**  
**Land Survey Division**



STATE OF ARKANSAS

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## PREFACE TO SECOND EDITION

When we published the first 500 copies of this handbook in 1975, it was with some misgivings as to what we would do with all those copies; however the response has been most gratifying and in general complimentary. While the handbook was designed primarily for land surveyors, the response from other sources has been far beyond our expectations.

In an effort to improve this second edition, we have added several items of interest. Prior to publication we asked numerous Arkansas land surveyors for comments and recommendations for incorporation herein.

In the original printing, it was emphasized that the handbook was primarily for Arkansas surveyors and that laws and regulations in other states could and often do vary from those in Arkansas. The wisdom of this statement has been proven many times over and prompts its repetition in this second edition.

  
WILLIAM K. FINEFIELD



This Handbook for Arkansas Land Surveyors

is dedicated to the memory of

**WILLIAM KELLY FINEFIELD**

**1908 -- 1980**



Author of the first edition of this Handbook and a  
charter member of the Land Survey Advisory Board

William Kelly Finefield, P.E. — R.L.S., received numerous awards and citations for his outstanding service to the engineering and land surveying professions and the U. S. Corps of Engineers. He was the author of many technical papers and articles pertaining to land surveying, which have been published both locally and nationally. Some of these papers are included in this Handbook.

His conscientious devotion and untiring efforts toward the objectives of the Arkansas Geological Commission's Land Survey Division and the surveying profession in the State of Arkansas is gratefully acknowledged.



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The purpose of this manual is to supply Arkansas Land Surveyors with a comprehensive source of information which will be useful in the performance of land surveys in the State of Arkansas. While some of the information is appropriate to other states, the principal purpose of this manual is directed towards land surveys within the State of Arkansas, and the manual is not intended to be authoritative in other states. It is highly recommended that the surveyor who uses the information in this manual in connection with surveys not governed by the laws and regulations of the State of Arkansas, carefully check the laws of the state wherein the survey is being made.

There is nothing new or startling in this book, and nearly all of the information contained herein may be found in other sources. New laws and new decisions are being made everyday, and the surveyor is cautioned, particularly in those cases involving the law, to seek legal advice if there is any question as to the legal status of a particular case.

The Arkansas Land Surveyor must concern himself with two primary types of surveys. First and foremost is the retracement of the original land surveys of the General Land Office to define the limits of land as established by the original public land surveys. *Secondly*, to subdivide the land so determined, or to determine ownerships of land which has been previously subdivided. While this may seem to be an oversimplification of what are often very complex problems, all land surveys generally fall within the two categories mentioned above.

By far the most difficult and exacting is the first, i.e., that of retracing and reestablishing the original surveys and monuments set by the public land surveyors. Chapter V deals with this subject. The importance of this function cannot be overstressed, and what may seem to be repetition is done purposefully to emphasize the extreme importance of "following in

the footsteps of the original surveyors." In a paper presented to the Arkansas Association of Registered Land Surveyors Short Course in September of 1971, Mr. Walter Robillard, a regional surveyor for the U. S. Forest Service and who is nationally recognized as an authority on retracement surveys, said as follows:

"The past cannot be altered. In order to have a fair understanding of the investigation, evaluation, and attempted duplication of ancient surveys, the modern surveyor must live vicariously in the boots of the ancient surveyor . . . . today it is with difficulty that we remember the old days. I wonder sometimes do we remember. It stands to reason the better we understand the men who accomplished this job, the instructions they followed, and the equipment used, the better we can today piece together the few remaining bits of information and derive information concerning those men who brought the laws of rectangular order to the wilderness."

Again, quoting from A Summary of Arkansas Survey Law published by the Arkansas Association of Registered Land Surveyors, we read:

"Among surveys, the Government surveys are paramount. A surveyor cannot change the courses established by the Governmental surveys, as such fixed monuments prevail over both courses and distances. A survey made by the Government must be held conclusive against collateral attack in controversies between individuals."

Justice Cooley of the United States Supreme Court, in speaking of surveyors and surveys, made the following statement:

"When a man has the training in one of the exact sciences, where every problem within its preview is supposed to be susceptible to accurate solution, he is



likely to be not a little impatient when he is told that under some circumstances he must recognize inaccuracies and govern his action by facts which lead him away from the results which theoretically he ought to reach. Observation warrants us in saying that this remark may be frequently be made of surveyors."

Thus, the importance of retracement surveys cannot be over emphasized, for in Arkansas where all land is subject to the rectangular system, the retracements are the basis of all land surveys and the origin from which all land subdivision surveys must originate. While it is not intended to detract from the importance of other surveys, (subdivision, property lines, etc.) since their importance is recognized by all, the genesis of all land surveys in Arkansas are the original government surveys. Modern machines, equipment, and technical ability make other surveys susceptible to high degrees of accuracy, but the retracement surveys still require the surveyor to "walk in the footsteps of the ancient surveyor", with his compass, his chain, and retrace the lines established by these ghosts of the past.

In the publication of this manual many organizations and individuals contributed to the data contained herein, and without their assistance this publication would not be possible. Following is a list of these:

The Bureau of Land Management of the United States Department of Interior for permitting the publication from THE MANUAL OF SURVEYING INSTRUCTIONS, the chapters entitled Restoration of Lost and Obliterated Corners, Monumentation, and for other portions of this manual.

The Arkansas Association of Registered Land Surveyors for permitting use of much material published as papers by

the Association and for the book, A SUMMARY OF ARKANSAS LAND SURVEY LAW, and other publications written by Mr. William K. Finefield.

The Little Rock District of the U. S. Army Corps of Engineers for their assistance and guidance in the preparation and publication of the several papers included in this volume which are published under the auspices of the Corps of Engineers.

The American Congress on Surveying and Mapping for the use of material concerning Arkansas surveys published in the publication "Surveying and Mapping."

The estate of the late John Fleming, whose publication, "The Louisiana Purchase from Wilderness to Empire", furnished much valuable material concerning the early history of surveys in Arkansas, and to the Arkansas Gazette under whose auspices the book was published.

The National Geodetic Survey of the United States Department of Commerce, National Oceanic and Atmospheric Administration, for data pertaining to the Arkansas Plane Coordinate System, and for other data published herein.

The United States Forest Service, Department of Agriculture, and particularly Mr. Walter Robillard for his many contributions to this manual.

The Minnesota Land Surveyors Association for their permission to reproduce "Professional Conduct for Land Surveyors", and data relating to uniform plat laws.

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The Arkansas Highway Department and Federal Highway Administration, for their assistance in presenting data on the Arkansas Plane Coordinate System.

The Thomas Law Book Company for permitting publication of parts of THE ARKANSAS LAW OF TITLE TO REAL PROPERTY, by Paul Jones, Jr., and the SUPPLEMENT TO JONES' ARKANSAS TITLES' by D. R. Varn.

The office of the Arkansas State Land Commission - Division of Land Surveys, and the staff for the fine cooperation and assistance during the early stages of preparation of the first edition of

this handbook.

The Arkansas Geological Commission - Land Survey Division staff and particularly to Mrs. Nell Baker and Mr. Adrian Hunter for the composition, format and printing of the second edition, without whose help this publication certainly would not have been possible.

For the logo and art work on the cover and front page, appreciation is given to Mr. Bob Baker, Public Information Officer, Arkansas Insurance Department.

And last, but certainly not least, those intrepid and mostly nameless trail blazers of the past who 145 years ago waded the swamps, tramped the prairies and with sheer force of determination hacked their ways through the forest and climbed the mountains of our state to give us the basis for all surveys in Arkansas, the rectangular system to surveys.



## CHAPTER II – ACTS PERTAINING TO LAND SURVEYORS

### ACT 101 OF 1967 REGISTRATION OF LAND SURVEYORS

Probably no legislation passed in the history of the State of Arkansas has had such a profound effect on land surveying as Act 101 of 1967. This Act which was passed only after long and difficult actions on the parts of a small group of surveyors and engineers who were interested in upgrading the quality of land surveys, raised land surveying to the status of a profession and placed land surveyors in the same category as engineers, doctors, attorneys and other professionals insofar as professional status is concerned. All land surveyors should be thoroughly familiar with the Act and the rules and regulations of the State Board of Registration.

Act 101 is included in its entirety as follows:

*"AN ACT to Regulate the Practice of Land Surveying, to Provide for the Registration of Qualified Persons as Land Surveyors, to Create Additional Duties for the State Board of Registration for Professional Engineers, to Define Additional Powers and Duties, and to Provide for the Enforcement of This Act and the Penalties for Its Violation.*

*Be It Enacted by the General Assembly of the State of Arkansas:*

**SECTION 1. GENERAL PROVISIONS.** In order to safeguard the life, health or property of the public, the practice of land surveying in this State is hereby declared to be subject to regulation in the public interest. It shall be unlawful for any person to practice or offer to practice land surveying in the State, as defined in the provisions of this Act, or to use in connection with his name, or otherwise assume, or advertise any title or description tending to convey the impression

that he is a land surveyor, unless such person has been duly registered under the provisions of this Act. Admission to practice land surveying shall be determined upon the basis of individual, personal qualifications.

**SECTION 2. DEFINITIONS.** (a) The term "Board" as used in this Act shall mean the Arkansas State Board of Registration for Professional Engineers.

(b) The term "land surveying" within the meaning and intent of this Act shall mean any service comprising the determination of the location of land boundaries and land boundary corners; the preparation of plats showing the shape and areas of tracts of land and their subdivision into smaller tracts; the preparation of plats showing the location of streets, roads, and rights-of-way of same to give access to smaller tracts; and the preparation of official plats, or maps, of said land thereof in this State. Provided, that the term "land surveying" shall not include the measure of acreage of timber, cotton, rice or other agricultural crops.

(c) The term "land surveyor" as used in this Act shall mean any person engaged in the practice of land surveying as herein defined.

(d) Practice or offer to practice. A person shall be construed to practice or offer to practice land surveying within the meaning and intent of this Act, who engages in land surveying for others or who by verbal claim, sign, letterhead, card, telephone listing or in any other way represents himself to be a land surveyor, or who represents himself as able to perform land surveying in this State.

(e) The provision of this Act shall not apply to the constitutional office of County Surveyor when acting in his official capacity in the county in which he was elected.

**SECTION 3. RIGHT TO PRACTICE.** The right to engage in the practice of land

surveying shall be deemed a personal right, based upon the qualifications of the individual, evidenced by his registration certificate, and shall not be transferable. Any registered land surveyor may practice his profession through the medium of, or as a member or employee of, a partnership, firm, joint stock association, or corporation, provided all such surveys are signed and stamped with the signature and seal of the registered land surveyor in responsible charge. The registered land surveyor signing and sealing such surveys shall be personally and professionally responsible therefor, and his participation in any form of business organization such as a partnership, firm, joint stock association, or corporation, either as a partner, principal, or employee, shall not limit his individual liability.

**SECTION 4. GENERAL REQUIREMENTS FOR REGISTRATION.** Any person who shall show, to the satisfaction of the Board, that he is a person of good character and reputation and over the age of twenty-one (21) years of age shall be eligible for registration as a land surveyor, provided he qualifies under one of the following provisions:

(a) **Comity or Registration by Endorsement.** A person holding a certificate of registration to engage in the practice of land surveying issued to him on the basis of a written examination by proper authority of a state, territory, possession of the United States, the District of Columbia or any foreign country, based on requirements and qualifications, as shown on his application, which, in the opinion of the Board, are equal to or higher than the requirements of this Act, may be registered at the discretion of the Board.

(b) **Graduation and Examination.** A graduate from an approved engineering curriculum with sufficient surveying courses, or any surveying technology curriculum of two years or more, approved by the Board,

followed by at least two years of land surveying which must be surveying experience of a character satisfactory to the Board, and who shall have passed a written examination designed to show that he is qualified to practice land surveying in this State, provided he is otherwise qualified. Each year of teaching land surveying in an approved engineering or surveying curriculum may be considered as equivalent to one year of land surveying experience.

(c) **Experience and Examination.** An applicant who cannot qualify under (b) above and who has six years or more of active experience in land surveying of a character satisfactory to the Board, and who shall have passed a written examination designed to show that he is qualified to practice land surveying, may be granted a certificate of registration to practice land surveying in this State, provided he is otherwise qualified. Each year of satisfactory work in an approved engineering or engineering technology curriculum majoring in surveying may be considered as one year of experience in land surveying, but not exceeding two years.

**SECTION 5. REGISTRATION OF PRESENT PRACTITIONERS.** Any person eligible for registration, who is a resident of the State of Arkansas and who within one year after the effective date of this Act, files with his application for registration as a land surveyor his affidavit stating that he was actively engaged in the practice of land surveying in this State for one year prior to the effective date of this Act, and includes in the affidavit the names and addresses for five references, may be eligible for registration as a land surveyor, without written examination, and may be registered by the Board provided the references are satisfactory and he presents satisfactory evidence proving that he is competent, and he is otherwise qualified. It shall be shown on the registration certificate issued that the said applicant has complied with the requirements of this

Section. This Section shall expire and be of no effect on and after one year next following the effective date of this Act.

#### SECTION 6. APPLICATIONS — FEES.

Application for registration as a land surveyor shall be made on forms provided by the Board, to be signed and sworn to by the applicant. They shall contain statements made under oath, showing the applicant's education, experience record and any other pertinent information. All applicants, except those being registered under Section 5, shall furnish references from five persons having knowledge of work done by the applicant. Applications shall be filed with the Secretary of the Board and shall be accompanied by an application fee of not more than thirty-five dollars (\$35.00). Should the Board deny the issuance of a certificate of registration to any applicant, one-half (1/2) the fee paid shall be retained as an examination fee.

#### SECTION 7. RENEWALS — FEES. (a)

Certificates of registration for land surveyors shall expire on the last day of June each year and the Board shall give 30 days written notice prior to the expiration of the certificate of registration. All certificates shall be renewed on payment of a renewal fee of not more than fifteen dollars (\$15.00). If not renewed on or before the first day of August next following, the registration shall be suspended. Any registered land surveyor whose registration has expired or has been suspended may be reinstated under rules promulgated by the Board regarding requirements for re-examination and penalty fees.

(b) All fees shall be **deposited** in a bank in this State designated by the Board and the officer or employee who collects such fees and disburses the same shall be required to execute a corporate surety bond for the proper accounting thereof.

SECTION 8. POWERS OF THE BOARD. (a) The Board shall have the power to adopt and amend all by-laws and rules of

procedure, not inconsistent with the constitution and laws of this State or this Act, which may be reasonably necessary for the proper performance of its duties and the regulations of its proceedings, meetings, records, examinations and the conduct thereof.

(b) The Board is hereby authorized to engage such technical advice and counsel as necessary to review application, conduct interviews, prepare and give examinations, grade examinations, as required by this Act, and to pay for such services.

(c) In carrying into effect the provisions of this Act, the Board, under the hand of its President and the seal of the Board, may subpoena witnesses and compel their attendance, and also may require the submission of books, papers, documents, or other pertinent data, in any disciplinary matter, or in any case wherever a violation of this Act is alleged. Upon failure or refusal to comply with any such order of the Board, or upon failure to honor its subpoena, as herein provided, the Board may apply to a court of any jurisdiction to enforce compliance with same.

(d) The Board is hereby authorized in the name of the State to apply for relief by injunction in the established manner provided in cases of civil procedure, without bond, to enforce the provisions of this Act, or to restrain any violation thereof. In such proceedings it shall not be necessary to allege or prove, either that an adequate remedy at law does not exist, or that substantial or irreparable damage would result from the continued violation thereof. The members of the Board shall not be personally liable under this procedure.

SECTION 9. DISCIPLINARY ACTION — REVOCATIONS. If the Board finds, after a hearing, that any registered land surveyor secured his registration through the practice of fraud or deceit, or through false statement made in his application for registration,



or in any document subsequently filed, or in any oral testimony subsequently given in support of such application, or that he has been guilty of any gross negligence, incompetence or misconduct in the practice of land surveying, or has been convicted of any felony or crime involving moral turpitude, the Board shall revoke the registration of the accused.

**SECTION 10. USE OF SEAL.** Each registered land surveyor shall procure a personal seal, in form approved by the Board, and shall affix his signature and the seal upon all maps, plats, surveys, or other documents, before the delivery thereof to any client, or before offering to file a record of any such map, plat, survey, or other document, in the office of the Recorder of Deeds of any County, or with any proper public authority.

**SECTION 11. DUTIES OF RECORDER.** It shall be unlawful, after one year from the date of this Act, for the Recorder of Deeds of any County or any proper public authority to file or record any map, plat, survey, or other document within the definition of land surveying, which does not have impressed thereon, and affixed thereto, the personal signature and seal of a Registered Land Surveyor by whom the map, plat, survey, or other document was prepared.

**SECTION 12. PENALTIES FOR VIOLATION.** Any person who violates any of the provisions of this Act shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by a fine of not less than one hundred dollars nor more than five hundred dollars, or imprisonment in the County jail for a term of not less than thirty days nor more than six months, or by both. It shall be the duty of all duly constituted officers of the State and all of its political subdivisions, to enforce the provisions of this Act and prosecute any persons violating same. The Attorney General of the State or his assistants shall act as legal advisors to the Board and render such legal assistance as may

be necessary. The Board may employ counsel to enforce this Act, the costs to be paid from the funds of the Board.

**SECTION 13. INVALIDITY OF PART.** If any section or sections of this Act shall be declared unconstitutional or invalid, or if any rule, regulation or order issued hereunder, or the application of such provision to any person or circumstance shall be held invalid, it shall not invalidate any other section of this Act.

**SECTION 14. REPEAL OF CONFLICTING LEGISLATION.** Any laws or parts of laws in conflict with the provisions of this Act shall be, and the same are, hereby repealed.

**SECTION 15. EMERGENCY.** It is hereby found and determined by the General Assembly that many persons are engaging in the practice of land surveying in this State without possessing necessary qualifications therefor and that the immediate passage of this Act is to provide for the protection of the public in obtaining the services of qualified land surveyors."

#### ACT 807 OF 1977 LAND SURVEYORS-IN-TRAINING

Also of importance to the land surveying profession was the passage of Act 807 of 1977, which permits the registration of surveyors-in-training. The importance of this Act cannot be over emphasized since it encourages the young surveyor without adequate experience and other training, to enter into the profession as an apprentice and to accumulate the necessary experience and training to qualify him for registration as a professional land surveyor.

"An Act to Amend Act 101 of the Acts of the General Assembly of 1967, to Regulate the Practice of Land Surveying, in Order to Provide for the Registration of

Qualified Persons As Land Surveyors-In-Training; And For Other Purposes.

Be It Enacted By The General Assembly Of The State Of Arkansas:

SECTION 1. Section 3 of Act 101 of the Acts of the General Assembly of 1967, the same being Section 71-2303 of the Arkansas Statutes, is hereby amended as follows:

"Section 3. RIGHT TO PRACTICE. The right to engage in the practice of land surveying shall be deemed a personal right, based upon the qualifications of the individual, evidenced by his registration certificate and shall not be transferable. Any registered land surveyor may practice his profession through the medium of, or as a member or employee of, a partnership, firm, joint stock association, or corporation, provided all such surveys are signed and stamped with the signature and seal of the registered land surveyor in responsible charge. The registered land surveyor signing and sealing such surveys shall be personally and professionally responsible therefor, and his participation in any form of business organization such as a partnership, firm, joint stock association, or corporation, either as a partner, principal, or employee, shall not limit his individual liability. A land surveyor-in-training may engage in the practice of land surveying only as an employee of or under the supervision of a registered land surveyor."

SECTION 2. Section 4 of Act 101 of the Acts of the General Assembly of 1967, the same being Section 71-2304 of the Arkansas Statutes, is hereby amended to read as follows:

"Section 4. GENERAL REQUIREMENTS FOR REGISTRATION. Any person who shall show, to the satisfaction of the Board, that he is a person of good character and reputation and over the age of twenty-one (21) years of age shall be eligible for registration as a land surveyor, provided he

qualifies under one of the following provisions:

(a) Comity or Registration by Endorsement. A person holding a certificate of registration to engage in the practice of land surveying issued to him on the basis of a written examination by proper authority of a state, territory, possession of the United States, the District of Columbia or any foreign country, based on requirements and qualifications, as shown on his application, which, in the opinion of the Board, are equal to or higher than the requirements of this Act, may be registered at the discretion of the Board.

(b) Graduation and Examination. A graduate from an approved engineering curriculum with sufficient surveying courses, or any surveying technology curriculum of two years or more, approved by the Board, followed by at least two years of land surveying which must be surveying experience of a character satisfactory to the Board, and who shall have passed a written examination designed to show that he is qualified to practice land surveying in this State, provided he is otherwise qualified. Each year of teaching land surveying in an approved engineering or surveying curriculum may be considered as equivalent to one year of land surveying experience.

(c) Experience and Examination. An applicant who cannot qualify under (b) above and who has six years or more of active experience in land surveying of a character satisfactory to the Board, and who shall have passed a written examination designed to show that he is qualified to practice land surveying, may be granted a certificate of registration to practice land surveying in this State, provided he is otherwise qualified. Each year of satisfactory work in an approved engineering or engineering technology curriculum majoring in surveying may be considered as one year of experience in land



surveying, but not exceeding two years.

Any person who shall show, to the satisfaction of the Board, that he is a person of good character, shall be eligible for registration as a land surveyor-in-training provided he qualifies under one of the following provisions:

(a) Comity or Registration by Endorsement. A person holding a certificate of registration as a land surveyor-in-training issued to him on the basis of a written examination by proper authority of a state, territory, possession of the United States, the District of Columbia or any foreign country, based on requirements and qualifications as shown on his applications, which, in the opinion of the Board, are equal to or higher than the requirements of this Act, may be registered as a land surveyor-in-training at the discretion of the Board.

(b) Graduation and Examination. A graduate from an approved engineering curriculum with sufficient surveying courses, or any surveying technology curriculum of two years or more, approved by the Board, who shall have passed a written examination designed to show that he is proficient in surveying fundamentals, provided he is otherwise qualified.

(c) Experience and Examination. An applicant who cannot qualify under (b) above who has four years or more of active experience in land surveying of a character satisfactory to the Board, and who shall have passed a written examination designed to show that he is proficient in surveying fundamentals, provided he is otherwise qualified. Each year of satisfactory work in an approved engineering or engineering technology curriculum majoring in surveying may be considered as one year of experience in land surveying, but not exceeding two years.

SECTION 3. Section 6 of Act 101 of

the Acts of the General Assembly of 1967, the same being Section 71-2305 of the Arkansas Statutes, is hereby amended to read as follows:

"Section 6. APPLICATION-FEES. Application for registration as a land surveyor or land surveyor-in-training shall be made on forms provided by the Board, to be signed and sworn to by the applicant. They shall contain statements made under oath, showing the applicant's education, experience record and any other pertinent information. All applicants shall furnish references from five persons having knowledge of work done by the applicant. Applications shall be filed with the Secretary of the Board and shall be accompanied by an application fee of not more than thirty-five dollars (\$35.00) for land surveyor applicants and not more than ten dollars (\$10.00) for land surveyors-in-training applicants. Should the Board deny the issuance of a certificate of registration to any applicant, one-half (1/2) the fee paid shall be retained as an examination fee."

SECTION 4. Section 7 of Act 101 of the Acts of the General Assembly of 1967, the same being Section 71-2306 of the Arkansas Statutes, is hereby amended to read as follows.

"Section 7. RENEWALS - FEES. (a) Certificates of Registration for land surveyors and land surveyors-in-training shall expire on the last day of June each year and the Board shall give 30 days written notice prior to the expiration of the certificate of registration. All certificates shall be renewed on payment of a renewal fee of not more than fifteen dollars (\$15.00) for land surveyors and not more than five dollars (\$5.00) for land surveyors-in-training. If not renewed on or before the first day of August next following, the registration shall be suspended. Any registered land surveyor or land surveyor-in-training whose registration has expired or has been suspended may be reinstated

under rules promulgated by the Board regarding requirements for re-examination and penalty fees.

(b) All fees shall be deposited in a bank in this State designated by the Board and the officer or employee who collects such fees and disburses the same shall be required to execute a corporate surety bond for the proper accounting thereof."

SECTION 5. Section 9 of Act 101 of the Acts of the General Assembly of 1967, the same being Section 71-2308 of the Arkansas Statutes, is hereby amended as follows:

"Section 9. DISCIPLINARY ACTION-REVOCATIONS. If the Board finds, after a hearing, that any registered land surveyor or land surveyor-in-training secured his registration through the practice of fraud or deceit, or through false statements made in his application for his registration, or in any document subsequently filed, or in any oral testimony subsequently given in support of such applications, or that he has been guilty of any gross negligence, incompetence or misconduct in the practice of land surveying, or has been convicted of any felony or crime involving moral turpitude, the Board shall revoke the registration of the accused."

SECTION 6. INVALIDITY OF PART. If any Section or Sections of this Act shall be declared unconstitutional or invalid, or if any

rule, regulation or order issued hereunder, or the application of such provision to any person or circumstance shall be held invalid, it shall not invalidate any other Section of this Act.

SECTION 7. *Section 1 of Act 247 of 1963, the same being Arkansas Statutes Section 41-1976, is hereby amended to read as follows:*

*'Section 1. Any person or persons who shall willfully cut down, destroy, deface, remove or carry off any witness tree, monument or other landmark established by legal survey and used to delineate boundary lines shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not less than Five Hundred Dollars (\$500.00), nor more than One Thousand Dollars (\$1,000.00), or by imprisonment in the county jail for a period of not less than thirty (30) days, or by both such fine and imprisonment.'*

*Furthermore, in any civil suit involving damages to property arising from the removal or destruction of a marker established by a legal survey, the complaining party shall be entitled to recover triple damages.'*

SECTION 8. REPEAL OF CONFLICTING LEGISLATION. Any laws or parts of laws in conflict with the provisions of this Act shall be, and the same are, hereby repealed.



Just as the Act requiring registration of land surveyors enhanced the status of the professional land surveyor in Arkansas, Act 458 of the Sixty-Ninth General Assembly, Regular Session, 1973, provided a means where the professional land surveyor and his client could further improve the profession of land surveying, and to provide him with a means of improving his survey.

Although the Act is still quite young and only a small amount of funds have been made available to the State Land Surveyor, the potential of this Act is enormous for it provides for an agency which can perpetuate the original survey corners either in their original location or as restored, and to preserve and document the original plats and field notes of the General Land Office surveys so as to make them readily available to the surveyor.

At the time of writing this manual there is considerable misunderstanding of the role of the State Land Surveyor. There are some who feel that the Act authorizes the State Surveyor to establish corners, the location of which cannot be contested. Nothing could be further from the truth. The function of the State Land Surveyor is clearly stated in the Act in Section 1 as follows:

"SECTION 1. DIVISION OF LAND SURVEYS CREATED. There is hereby created in the office of State Land Commission a Division of Land Surveys. The primary function of the Division of Land Surveys shall be the establishment, maintenance, and preservation of land monuments, section corners, and other physical accessories of the United State Public Land Survey within the State of Arkansas, the field notes, plats, and other documents relating and evidencing the United States Public Land Survey, and the prescribing of general land survey regulations."

Note that the Act states that the function of the Division of Land Surveys shall be the establishment, maintenance, and preservation of land monuments which are evidence of the original land corners. The Act anticipates that it will be the responsibility of the State Land Surveyor to preserve those corners which are still in existence in the field through proper monumentation and to properly monument other corners restored by land surveyors and determined to be the true original corners as found or restored. Equally as important as the restoration of lost corners and monuments and the monumentation thereof in the field is the function of preservation of the field notes, plats and other documents relating and evidencing the United States Public Land Survey and the prescribing of general land survey regulations. Most of the public land surveys in Arkansas were made from 125 to 150 years ago and the documents and the field notes prepared at that time are very badly aged and weather-beaten in many cases. The State Land Surveyor's function of preserving and maintaining these documents in such condition as to make them readily available to local surveyors is **extremely** important.

Because of the importance of this Act as a whole it is reproduced for the use and benefit of all who utilize this survey manual.

Act 458 of 1973, Act 579 of 1975 which transferred the office of the State Land Surveyor and its functions to the Department of Commerce, and Act 214 of 1977 which retransferred the office to the Arkansas Geological Commission are as follows:

### ACT 458

AN ACT to Create a Division of LAND Surveys in the Office of State Land Commissioner; to Prescribe the Functions and Duties of the Division of Land Surveys; to Provide

that the Head of the Division of Land Surveys shall be Known as the 'State Surveyor' who shall be Appointed by the State Land Commissioner; and for Other Purposes.

Be It Enacted by the General Assembly of the State of Arkansas.

SECTION 1. Division of Land Surveys Created. There is hereby created in the office of State Land Commissioner a Division of Land Surveys. The primary function of the Division of Land Surveys shall be the establishment, maintenance, and preservation of land monuments, section corners, and other physical accessories of the United States Public Land Survey within the State of Arkansas, the field notes, plats, and other documents relating and evidencing the United States Public Land Survey, and the prescribing of general land survey regulations.

SECTION 2. State Surveyor. The Division of Land Surveys shall be headed by and shall be under the direction, supervision and control of the State Surveyor. The State Surveyor shall be a person of proven administrative ability, a registered land surveyor and a resident of the State of Arkansas with training and experience properly qualifying him for the performance of this official duties. He shall be appointed by the State Land Commission from a list of three (3) names submitted to him by the Land Survey Advisory Board and shall serve until dismissed by the Commissioner with the Approval of the Advisory Board. The State Surveyor shall devote his full time to the performance of his official functions and duties as prescribed in this Act and shall hold no other lucrative position while serving as State Surveyor. The State Surveyor shall receive such compensation as may be prescribed by law.

SECTION 3. Authority of State Surveyor. The State Surveyor shall, acting under the supervision and directions and with the approval of the State Land Commissioner, have the following authority and responsibility:

(a) To restore, maintain and preserve the Land Survey monuments, section corners, and quarter section corners established by the United States Public Land Survey within the State of Arkansas, together with all pertinent field notes, plats and documents; and to restore, establish, maintain and preserve other boundary markers as may be determined to be necessary or important in establishing and maintaining accurate land descriptions in this State.

(b) To design and cause to be placed at established public land survey corner sites, where practical, substantial monuments permanently indicating with words and figures, the exact location involved. If such monuments cannot be placed at the exact corner point, then witness corners of similar design shall be placed as near as possible with words and figures indicating the bearing and distance to the true corner.

(c) To establish, maintain, and provide safe storage facilities for a comprehensive system of recordation of information respecting all monuments established by the United States Public Land Survey within this State, and such records as may be pertinent to the Division's establishment or maintenance of other land corners, Arkansas coordinate system stations and accessories, and monuments in general.

(d) To extend throughout the State a triangulation and levelling net of precision, whereby the Arkansas State Coordinate System, already initiated in this State by the United States Coast and Geodetic Survey (Now National Geodetic Survey), may be made to cover to the necessary extent those areas of the State which do not now have enough geodetic control stations to permit the general use of the system by land surveyors and others.

(e) To collect and preserve information obtained from surveys made by those authorized to establish land monuments or land



boundaries, and to assist in the proper recording of the same by the duly constituted county officials or other appropriate officials.

(f) To furnish certified copies of records created or maintained by the division to any person, entity, or agency, upon request therefor and payment of the prescribed fees. All such records when certified by the State Surveyor or a designated assistant, shall be admissible in evidence in any court in this State as the original record filed with this Agency.

(g) To prescribe reasonable rules and regulations, not inconsistent with law, designed to establish uniform professional surveying and mapping methods and standards in this State, and to disseminate such rules and regulations to those engaged in the profession of land surveying; and to administer such regulations by referring evidence of violations to the board as provided below.

(h) To promote the training and the increase in number of quality surveyors in this State.

(i) To receive and investigate complaints against any surveyor and to present the results from the investigation of such complaints to the Arkansas State Board of Registration for Professional Engineers and Land Surveyors, for such action as the Board shall deem appropriate.

(j) To assist the County Assessors in establishing accurate land descriptions of the State-owned or State-claimed lands and to assist the public and private surveyors to obtain land ownership information for surveying purposes.

(k) To accept for the State gifts, grants and donations from any and all persons, corporations, associations, foundations, and from the federal or state government or any agency or program thereof to be deposited in the State Treasury to the credit of the Land

Surveyor's Fund.

(l) To enter into such agreements or contracts with agencies of the United States Government, agencies of the State of Arkansas, other states, and registered land surveyors, as he deems necessary or desirable to properly plan and execute projects within the scope and purpose of this Act.

(m) To employ such surveyors and other professional and non-professional assistants and to take such other reasonable action as may be deemed necessary to carry out the purposes of this Act.

SECTION 4. Land Survey Advisory Board. There is hereby created an advisory board to the Division of Land Surveys. The advisory board shall consist of the following:

(1) One person who is a professional engineer and registered land surveyor, designated by the State Board of Registration for Professional Engineers and Land Surveyors.

(2) One person who is a registered land surveyor, designated by the Arkansas Association of Registered Land Surveyors.

(3) One person designated by the Arkansas Real Estate Association.

(4) One person who is a registered professional engineer and registered land surveyor with the Arkansas Highway Department, designated by the Arkansas Highway Commission.

(5) One person designated by the Arkansas County Judges Association.

(6) One licensed abstractor designated by the Arkansas Abstractors Association.

(7) One *Registered Land Surveyor* designated by the Arkansas Forestry Association.

All members of the Board shall serve for terms of six (6) years. Provided, of the Board members first selected, three (3) shall serve for a term of three (3) years and four (4) shall serve for terms of six (6) years, and thereafter their successors shall be appointed for terms of six (6) years. The initial members of the Board shall determine by lot their respective terms.

SECTION 5. Duties of Board. The Advisory Board shall assist the State Land Commissioner and the State Surveyor in formulating policies of the Division and in promulgating regulations designed to establish uniform professional surveying and mapping methods and standards of the State, and in formulating such other policies, practices, and regulations as the Commissioner or the Land Surveyor shall deem necessary to carry out the purpose and intent of this Act. The Board shall select a Chairman from its membership and shall meet at least quarterly, and at such other times as shall be determined by the Chairman.

SECTION 6. Compensation Of Board Members. Members of the Advisory Board shall serve without compensation but shall be entitled to receive per diem in lieu of expenses at the rate of Thirty Dollars (\$30.00) per day for each day or part thereof during which they shall be in attendance at meetings of the Board. In addition, members of the Board shall be entitled to mileages at the rate of nine cents (9c) per mile traveled in performing their duties under this Act.

SECTION 7. Right To Enter On Private Property. The State Surveyor or any employee of the Division shall have the right to enter upon private property for the purpose of making surveys, or searching for, locating, relocating, or remonumenting land monuments, leveling stations, or section corners. Employees of the Division of Land Surveys and members of the Advisory Board shall be immune from arrests for trespass in performing their duties as prescribed in this Act,

but shall always where practical, announce and identify themselves and their intentions before entering upon the private property, and such employees and board members shall be personally liable for any damage caused to private property by their wantonness, wilfulness or gross negligence.

SECTION 8. Exchange Of Information. When the State Surveyor so requests, the *Public* Recorder of Deeds, mortgages or other instruments dealing with interest in real property, and all state agencies, boards and commissions and all county and municipal officials, shall furnish to the Division of Land Surveys certified copies of records in their custody which are essential for the Division to carry out its duties under the provisions of this Act. Copies of such records shall be furnished free of cost when possible. If a charge is made for such records it shall be a reasonable charge based upon the actual costs of furnishing the records. On request of state agencies and departments, county and municipal officials, the Division of Land Surveys shall furnish to such requesting officials or agencies certified copies of records of the Division. Such records shall be furnished free of cost when possible but if a charge is to be made for furnishing such records, the charge shall be based upon the actual cost of furnishing the records.

SECTION 9. Sale Of Information By Division. The Division of Land Surveys may produce, reproduce and sell maps, plats, and records, and shall prescribe a reasonable charge therefor. All income derived from such sales shall be deposited in the State Treasury to the credit of the "Land Surveys Fund" which is hereby established.

SECTION 10. Employees To Be Registered. Every employee of the Division of Land Surveys who performs any work required by law to be done by a registered land surveyor shall be a registered surveyor. The *State Surveyor* and no employee of the Division shall engage in private land surveying

or consultation while so employed by the Division.

**SECTION 11.** Cooperation with Surveyors. The State Surveyor and employees of the Division of Land Surveys shall cooperate with and assist county surveyors in performing their duties as prescribed by law and shall cooperate with and assist *other* surveyors in locating or establishing section corner markers and other land description markers and monuments.

**SECTION 12.** *Assistance of Surveyors. In performing the duties and responsibilities provided in this Act, the State Surveyor and employees of the office of State Surveyor may solicit the advice and assistance of the county surveyor in each county and other surveyors in the county. If there are no registered surveyors in a particular county, the Division may employ qualified registered surveyors from other areas of the State to assist the Division in carrying out its duties and responsibilities under this Act.*

**SECTION 13.** Repealer. All laws and parts of laws in conflict with this Act are hereby repealed.

*THIS BILL having remained with the Governor five (5) days, Sunday excepted, and the General Assembly being in session, became a law, the (27th) day of March, 1973.*

KELLY BRYANT  
Secretary of State

#### ACT 579

AN ACT to Transfer the Division of Land Surveys Created in the Office of the State Land Commissioner by Act 458 of 1973, to The Department of Commerce; To Provide that the State Surveyor Shall Hereafter Be Appointed By and Serve at the Pleasure of the Director of the Department of Commerce; To Provide that the Land Survey Advisory Board Created by Act 458

of 1973 Shall Continue to Function in an Advisory Capacity to the Director of the Department of Commerce and the State Surveyor; To Provide for the Transfer of All Files Established and Maintained for the Use of the State Surveyor from the Office of State Land Commissioner to the Department of Commerce; And for Other Purposes.

Be It Enacted by the General Assembly of the State of Arkansas:

**SECTION 1.** Effective July 1, 1975, the Division of Land Surveys created in the office of State Land Commissioner by Act 458 of 1973, is hereby transferred to and shall hereafter be under the supervision and direction of the Department of Commerce.

**SECTION 2.** The State Surveyor shall hereafter be appointed by and serve at the pleasure of the Director of the Department of Commerce. Provided, the Director of the Department of Commerce shall appoint the State Surveyor after consulting with the State Board of Registration for Engineers and Land Surveyors and with the Arkansas Association of Registered Land Surveyors.

**SECTION 3.** The Land Survey Advisory Board created by Act 458 shall be continued and such board shall act in an advisory capacity to the Director of the Department of Commerce and the State Surveyor in all matters relating to formulating policies of the Division of Land Surveys and in promulgating the regulations designed to establish uniform professional surveying and mapping methods and standards for the State and in formulating such other policies, practices and regulations as the Director of the Department of Commerce and the Land Surveyor shall deem necessary to carry out the purposes and intent of Act 458 of 1973.

**SECTION 4.** All files and records developed and maintained by the Division of Land and now held in the Office of State Land



Commissioner shall be transferred to the Department of Commerce. Provided, none of the files and records maintained in the Office of State Land Commissioner prior to the establishment of the Division of Land Surveys and none of the files and records developed and maintained in the Office of State Land Commissioner after the establishment of the Division of Land Surveys, except those records and files developed and maintained specifically for the Division of Land Surveys, shall be transferred or removed from the Office of the State Land Commissioner.

SECTION 5. Nothing in this Act shall prohibit abstractors from preparing legal land descriptions.

SECTION 6. It is the purpose and intent of this act that the Division of Land Surveys and the State Surveyor shall, effective July 1, 1975, be transferred to an thereafter administered under the direction and supervision of the Department of Commerce. It is further the intent of this Act that when reference is made in Act 458 of 1973 to the Office of State Land Commissioner, or the State Land Commissioner or Commission, it shall on and after July 1, 1975, be deemed to mean and refer to the Director of the Department of Commerce. It is also the intent of this Act to permit and authorize the Director of the Department of Commerce to delegate any function, power and duty transferred to the Department of Commerce under the provisions of this Act to any division within the Department of Commerce as he shall deem necessary or desirable for the effective and efficient operation of the Department.

SECTION 7. All laws and parts of laws in conflict with this Act are hereby repealed.

#### ACT 214

AN ACT TO TRANSFER THE DIVISION OF LAND SURVEYS, CREATED IN

THE OFFICE OF THE STATE LAND COMMISSION BY ACT 458 OF 1973 AND TRANSFERRED TO THE DEPARTMENT OF COMMERCE BY ACT 579 OF 1975, TO THE ARKANSAS GEOLOGICAL COMMISSION; TO PROVIDE THAT THE STATE SURVEYOR SHALL HEREAFTER BE APPOINTED BY AND SERVE AT THE PLEASURE OF THE STATE GEOLOGIST; TO PROVIDE THAT THE LAND SURVEY ADVISORY BOARD CREATED BY ACT 458 OF 1973 SHALL CONTINUE TO FUNCTION IN AN ADVISORY CAPACITY TO THE STATE GEOLOGIST AND THE STATE SURVEYOR; TO PROVIDE FOR THE TRANSFER OF ALL FILES ESTABLISHED AND MAINTAINED FOR THE USE OF THE STATE SURVEYOR FROM THE DEPARTMENT OF COMMERCE TO THE GEOLOGICAL COMMISSION; AND FOR OTHER PURPOSES.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF ARKANSAS:

SECTION 1. Effective July 1, 1977, the Division of Land Surveys, transferred to the Department of Commerce by Act 579 of 1975, is hereby transferred to and shall hereafter be under the supervision and direction of the State Geologist in the Arkansas Geological Commission.

SECTION 2. The State Surveyor shall hereafter be appointed by and serve at the pleasure of the State Geologist, provided, the State Geologist shall appoint the State Surveyor after consulting with the State Board of Registration for Engineers and Land Surveyors and the Arkansas Association of Registered Land Surveyors.

SECTION 3. The Land Survey Advisory Board created by Act 458 of 1973 shall be continued and such board shall act in a advisory capacity to the State Geologist and the State Surveyor in all matters relative to formulating policies of the Division of

Land Surveys and in promulgating the regulation designed to establish uniform professional surveying and mapping methods and standards for the State and in formulating such other policies, practices and regulations as the State Geologist and the State Surveyor shall deem necessary to carry out the purpose and intent of Act 458 of 1973.

SECTION 4. All files and records developed and maintained by the Division of Land Surveys and now held in the Department of Commerce shall be transferred to the Geological Commission.

SECTION 5. Nothing in this Act shall

prohibit abstractors from preparing legal land descriptions.

SECTION 6. It is the purpose and intent of this Act that the Division of Land Surveys and the State Surveyor shall, effective July 1, 1977, be transferred to and thereafter administered under the direction and supervision of the Arkansas Geological Commission. It is furtherwith intent of this Act that when reference is made in Act 458 of 1973 to the Office of State Land Commission, it shall on and after July 1, 1977, be deemed to mean and refer to the State Geologist of the Geological Commission.

SECTION 7. All laws and parts of laws in conflict with this Act are hereby repealed.



## CHAPTER IV – THE ORIGINAL GOVERNMENT SURVEYS IN ARKANSAS

### The Louisiana Purchase

The history of the United States is spotted with spectacular real estate transactions, in fact, the desire to find new land and new fortunes played a major role in the development of this country. One of the first and most spectacular of the land deals occurred in 1626 when Peter Minuet bought the island which is now known as Manhattan from the Indians for strings of beads, cloth and trinkets worth approximately twenty-four dollars, or a little over one dollar a square mile.

In 1867 Secretary of State William H. Seward purchased what is now the State of Alaska from Russia for \$7,200,000.00, or about five cents per acre. The opposition to the "deal" was very great, and during the debate and controversy which accompanied this purchase it was called "Seward's Folly", and a great uproar was raised over the wasteful purchase of 586,000 square miles of "Icebergs and Polar Bears." Time, of course, has proven the wisdom and astuteness of Seward's purchase.

But of all the land deals which have accompanied the growth of this country, none was to be so important and to affect the lives and welfare of the people of Arkansas and the great midwest as the Louisiana Purchase. Appreciation is given to the late John Fleming who spent much time and study in the preparation of his book entitled, *"The Louisiana Purchase - From Wilderness to Empire."* It was John Fleming's interest and efforts which led to the restoration of the Louisiana Purchase Monument, the origin of all land surveys in the Louisiana Purchase area, an area which covers all or part of 13 states and encompasses more than 825,000 square miles in the heartland of America. Of the purchase Mr. Fleming says:

"This was the territory of Louisi-

ana, better known as the Louisiana Purchase, the biggest, cheapest, and craziest real estate deal in the history of civilization."

No effort was made to survey the new territory until after the War of 1812, when P. K. Robbins and Joseph C. Brown, both deputy land surveyors, were commissioned to begin surveys of the new territory. When they reached the mouth of the St. Francis River, Brown disembarked and began to survey the base line west. Robbins continued south to the mouth of the Arkansas River where he commenced to survey north along what is now the Fifth Principal Meridian. On November 10, 1815, Robbins intersected the base line, and here established the initial survey point on which all land surveys and descriptions in Arkansas are referred.

While it is not the purpose of this manual to go deeply into the history of land surveys in Arkansas, this brief review of the beginning of the rectangular system of surveys in Arkansas should be of interest to all land surveyors. To those who would like to know more, the book by John Fleming is highly recommended.

It is most helpful to the modern day surveyor to be aware of the problems encountered by these early surveyors who cut and hacked their way across the State, laying out the townships and sections which are still the foundation of all land surveys. Considering the many problems these surveyors encountered, the hardships they endured, and the instruments and tools which were available for them to accomplish their work, the wonder is that their surveys and the corners thus established are as accurate as they are.

By the time Robbins and Brown began their surveys in Arkansas, surveys of public lands had been in existence for some time. Surveys of land have been conducted since

1785 when the first surveys were made in Ohio. The Act of May 18, 1796, provided for the appointment of a Surveyor General who was to survey the public lands northwest of the Ohio River. Subsequent authorizations and changes finally resulted in the system of rectangular surveys used today. Not all states have this system.

In 1831 the Commissioner of the General Land Office issued detailed instructions to the surveyors general concerning surveys and plats. (Note: these first instructions were issued more than 15 years after the Fifth Principal Meridian and base line were surveyed and the initial point was established by Brown and Robbins.) From these instructions evolved the *Manual of Surveying Instructions* which was to become the bible for all surveyors of the public land.

#### Authority for Surveys

While the Arkansas land surveyor is no longer involved in original surveys of the public domain, the "*Manual of Surveying Instructions*" is an important document which should be a familiar item of each surveyor's equipment, for it gives the modern surveyor an insight into the regulations and instructions by which the original surveys were performed. For example, under "Rules of Survey" the following is found:

LAWS RELATING TO SURVEYS - Revised Statutes and United States Code (1-18) - "*Rules of Survey*. The public lands shall be divided by north and south lines run according to the true meridian, and by others crossing them at right angles, so as to form townships of six miles square, unless where the line of an Indian reservation, or of tracts of land surveyed or patented prior to May 18, 1796, or the course of navigable rivers, may render this impracticable; and in that case this rule must be departed from no further than such particular circumstances require.

"*Second*. The corners of the townships must be marked with progressive numbers from the beginning; each distance of a mile between such corners must be also distinctly marked with marks different from those of the corners.

"*Third*. The township shall be subdivided into sections, containing, as nearly as may be, six hundred and forty acres each, by running parallel lines through the same from east to west and from south to north at the distance of one mile from each other, and marking corners at the distance of each half mile. The sections shall be numbered, respectively, beginning with the number one in the northeast section and proceeding west and east alternately through the township with progressive numbers, until the thirty-six be completed.

"*Fourth*. The deputy surveyors, respectively, shall cause to be marked on a tree near each corner established in the manner described, and within the section, the number of such section, and over it the number of the township within which such section may be; and the deputy surveyors shall carefully note, in their respective field books, the names of the corner trees marked and the numbers so made.

"*Fifth*. Where the exterior lines of the townships which may be subdivided into sections or half-sections exceed, or do not extend six miles, the excess or deficiency shall be specially noted, and added to or deducted from the western and northern ranges of sections or half-sections in such township, according as the error may be in running the lines from east to west, or from north to south; the sections and half-sections bounded on the northern and western lines of such townships shall be sold as containing only the quantity expressed in the returns and plats respectively, and all others as containing the complete legal quantity.

*"Sixth.* All lines shall be plainly marked on trees, and measured with chains, containing two perches of sixteen and one-half feet each, subdivided into twenty-five equal links; and the chain shall be adjusted to a standard to be kept for that purpose.

*"Seventh.* Every surveyor shall note in his field book the true situations of all mines, salt licks, salt springs, and mill seats which come to his knowledge; all watercourses over which the line he runs may pass; and also the quality of the lands.

*"Eight.* These field books shall be returned to the Secretary of the Interior or such officer as he may designate, who shall cause therefrom a description of the whole lands surveyed to be made out and transmitted to the officers who may superintend the sales. He shall also cause a fair plat to be made of the townships and fractional parts of townships contained in the lands, describing the subdivisions thereof, and the marks of the corners. This plat shall be recorded in books to be kept for that purpose; and a copy thereof shall be kept open at the office of the Secretary of the Interior or of such agency as he may designate for public information, and other copies shall be sent to the places of the sale, and to the Bureau of Land Management. (R.S. 2395; March 3, 1925, 43 Stat. 1144; 43 U.S.C. 751.)

**"BOUNDARIES AND CONTENTS OF PUBLIC LANDS; HOW ASCERTAINED.** The boundaries and contents of the several sections, half-sections, and quarter-sections of the public lands shall be ascertained in conformity with the following principles:

*"First.* All the corners marked in the surveys, returned by the Secretary of the Interior or such agency as he may designate, shall be established as the proper corners of the sections, or subdivisions

of sections, which they were intended to designate; and the corners of half-and quarter-sections, not marked on surveys, shall be placed as nearly as possible equidistant from two corners which stand on the same line.

*"Second.* The boundary lines, actually run and marked in the surveys returned by the Secretary of the Interior or such agency as he may designate, shall be established as the proper boundary lines of the sections, or subdivisions, for which they were intended, and the length of such lines as returned, shall be held and considered as the true length thereof. And the boundary lines which have not been actually run and marked shall be ascertained, by running straight lines from the established corners to the opposite corresponding corners; but in those portions of the fractional townships where no such opposite corresponding corners have been or can be fixed, the boundary lines shall be ascertained by running from the established corners due north and south or east and west lines, as the case may be, to the watercourse, Indian boundary line, or other external boundary of such fractional township.

*"Third.* Each section or subdivision of section, the contents whereof have been returned by the Secretary of the Interior or such agency as he may designate, shall be held and considered as containing the exact quantity expressed in such return; and the half-sections and quarter-sections, the contents whereof shall not have been thus returned, shall be held and considered as containing the one-half or the one-fourth part, respectively, of the returned contents of the section of which they may make part. (R.S. 2396; March 3, 1925, 43 Stat. 1144; 43 U.S.C. 752.)



**"LINES OF DIVISION OF HALF-QUARTER SECTIONS, HOW RUN.** In every case of the division of a quarter-section the line for the division thereof shall run north and south, and the corners and contents of half-quarter sections which may thereafter be sold shall be ascertained in the manner and on the principles directed and prescribed by the section preceding, and fractional sections containing one hundred and sixty acres or upwards shall in like manner, as nearly as practicable, be sub-divided into half-quarter sections, under such rules and regulations as may be prescribed by the Secretary of the Interior, and in every case of a division of a half-quarter section, the line for the division thereof shall run east and west, and the corners and contents of quarter-quarter sections, which may thereafter be sold, shall be ascertained, as nearly as may be, in the manner and on the principles directed and prescribed by the section preceding; and fractional sections containing fewer or more than one hundred and sixty acres shall in like manner, as nearly as may be practicable, be subdivided into quarter-quarter sections, under such rules and regulations as may be prescribed by the Secretary of the Interior. (R.S. 2397; 43 U.S.C. 753).

**"RIVERS AND STREAMS.** All navigable rivers, within the territory occupied by the public lands, shall remain and be deemed public highways; and, in all cases where the opposite banks of any stream not navigable belong to different persons, the stream and the bed thereof shall become common to both. (R.S. 2476; 43 U.S.C. 931).

**"EXTENSION OF PUBLIC SURVEYS OVER MINERAL LANDS.** The public surveys shall extend over all mineral lands; and all subdividing of surveyed lands into lots less than one hundred and sixty acres may be done by county and

local surveyors at the expense of claimants; but nothing in this section contained shall require the survey of waste or useless lands. (R.S. 2406; 43 U.S.C. 766).

**"SURVEY OF PRIVATE LAND CLAIMS.** The Secretary of the Interior or such officer as he may designate shall cause to be surveyed all private land claims after they have been confirmed by authority of Congress, so far as may be necessary to complete the survey of the public lands. (R.S. 2223; March 3, 1925, 43 Stat. 1144; 43 U.S.C. 52).

**"PENALTY FOR INTERRUPTING SURVEYS.** Whoever, by threats or force interrupts, hinders, or prevents the surveying of public lands, or of any private land claim which has been or may be confirmed by the United States, by the persons authorized to survey the same in conformity with the instructions of the Director of the Bureau of Land Management, shall be fined not more than \$3,000 or imprisoned not more than three years, or both. (R.S. 2412; June 25, 1948, ch. 645, 62 Stat. 789; May 24, 1949, ch. 139, sec. 42 63 Stat. 95; 18 U.S.C. 1859).

**"PROTECTION OF SURVEYOR BY MARSHALL OF DISTRICT.** Whenever the President is satisfied that forcible opposition has been offered, or is likely to be offered, to any surveyor or deputy surveyor in the discharge of his duties in surveying the public lands, it may be lawful for the President to order the marshal of the State or district, by himself or deputy, to attend such surveyor or deputy surveyor with sufficient force to protect such officer in the execution of his duty, and to remove force should any be offered. (R.S. 2413; March 3, 1925, 43 Stat. 1144; 43 U.S.C. 774)."

Thus were the instructions laid down for the ancient surveys and in subsequent years given full force of law. It is impossible to enumerate in this small book all of the legislation which has effected the public surveys and it is not the intention to do so. However, it is important to the land surveyor to realize the position of the original land surveyors and the great weight which was attached to their surveys. In the latest volume of the Manual of Surveying Instructions, dated 1973, the Bureau of Land Management gives the following synopsis of congressional legislation:

#### GENERAL RULES (1-20).

*"First.* That the boundaries and subdivisions of the public lands as surveyed under approved instructions by the duly appointed surveyors, the physical evidence of which survey consists of monuments established upon the ground, and the record evidence of which consists of field notes and plats duly approved by the authorities constituted by law, are unchangeable after the passing of the title by the United States.

*"Second.* That the original township, section, quarter-section and other monuments as physically evidenced must stand as the true corners of the subdivisions which they were intended to represent, and will be given controlling preference over the recorded directions and lengths of lines.

*"Third.* That the quarter-quarter section corners not established in the process of the original survey shall be placed on the line connecting the section and quarter-section corners, and midway between them, except on the last half mile of section lines closing on the north and west boundaries of the township, or on other lines between fractional or irregu-

lar sections.

*"Fourth.* That the center lines of a regular section are to be straight, running from the quarter-section corner on one boundary of the section to the corresponding corner on the opposite section line.

*"Fifth.* That in a fractional section where no opposite **corresponding** quarter-section corner has been or can be established, the center line of such section must be run from the proper quarter-section corner as nearly in a cardinal direction to the meander line, reservation, or other boundary of such fractional section, as due parallelism with lines will permit.

*"Sixth.* That *lost or obliterated corners of the approved surveys must be restored to their original locations whenever this is possible.*

#### GENERAL RULES (1-21).

The basic provisions require that public lands "shall be divided by north and south lines according to the true meridian, and by others crossing them at right angles, so as to form townships six miles square;" that "the townships shall be subdivided into sections, containing as nearly as may be, six hundred and forty acres each;" and that "the excess or deficiency shall be specially noted, and added to or deducted from the western and northern ranges of sections or half-sections in such townships, according as the error may be in running the lines east to west, or from south to north." The system of rectangular surveys fits the basic requirements to the curved surface of the globe.

In this rectangular plan the township boundaries are intended to be due north and south or due east and west. The boundaries running north and south are termed "range



lines." The boundaries running east and west are called "township lines."

The range lines are great circles of the earth that, if extended, would intersect at the north pole. This convergency becomes apparent in the measurement of the township lines. The convergency is taken up at intervals by the running of standard parallels, on which the measurements are again made full. On the standard parallels (first named "correction lines") there are offsets in the range lines and two sets of corners, standard corners for the lines to the north and closing corners for lines to the south. The usual interval between the standard parallels is 24 miles, but there were many exceptions in the old surveys.

In order to make the sections represent "square miles" as nearly as may be, the meridional lines are run from south to north and parallel to the east boundary of the township for a distance of five miles from the south boundary. These are run and monumented as true lines. The remainder of the section lines are all run by random and true between the established section corners. This produces the rectangular sections, 25 of which contain 640 acres each, within allowable limit. The sections along the north and west boundaries are subdivided on a plan for certain lottings to absorb the convergency and the excess or deficiency in the measurements. These sections provide a maximum number of aliquot parts (160-, 80-, and 40-acre units) or regular subdivisions of a section, the remainder being shown as lots whose contents are computed according to the field measurements."

The above have become official instructions for the survey of the public lands. The 1973 edition of the Manual of Surveying Instructions of the Bureau of Land Management contains a total of 324 pages of instructions including the appendices. The ancient surveyor, could he read the modern version, would be amazed and confused by such paragraphs as "Electronic Telemetry", "Aerial

Surveys", "Aerial Photogrammetry", "Analytical Phototriangulation", etc., but it must be remembered that the surveys of the public land are still going on and the need to keep up to date in this field is just as important as in any other branch of surveying.

It must be remembered that the original surveys in Arkansas were commenced in the early 1800's, and the surveyors of those days relied on their compasses, chains, and native ingenuity to lay out the checkerboard of townships and sections within the state. The surveyor who attempts to restore and re-establish these lines must always keep this fact in mind.

In the introduction to a very fine book on surveying, written by Mr. Ira M. Tillotson, P.E.-R.L.S., Mr. Koehler Stout, Chairman of the Engineering Division, Montana College of Mineral Sciences and Technology at Butte, Montana, College of Mineral Sciences and Technology at Butte, Montana, poses an interesting question which has plagued every surveyor who has been involved in retrace-ment surveys. Mr. Stout refers to the fact that there are many manuals and instructions concerning rules and regulations which suggest actions to take in some surveying problems, but much is left unsaid, and many problems, face the surveyor where no instructions or rules and regulations fit the situation. It is here that the surveyor must use his ingenuity and judgement. It is in these conditions where the surveyor must literally place himself in the footsteps of the ancient surveyor and say, "Where do I go from here?" Unfortunately, there is no book or easy solution to this problem, and the results will depend on the individual surveyor and his ability to put all the pieces together and come up with a solution which is based on experience, knowledge, and good judgement, for the answers cannot be found in any book, but must come from the mind of the surveyor himself.

### Location of Original Corners and Lines

Of all the problems encountered by the Arkansas land surveyor, there is little doubt that the most difficult and often the most frustrating are the problems encountered in retracement of the original land surveys and the location and/or restoration of the corners originally set by the surveyors who established the rectangular system of surveys in Arkansas.

In an earlier chapter the problems involved in the original surveys and the effects on retracements were discussed. In this chapter, Mr. Walter Robillard, Regional Surveyor for the U. S. Department of Agriculture, U.S. Forest Service, was quoted from a paper presented at the Land Surveyors Short Course conducted by the University of Arkansas and the Arkansas Association of Registered Land Surveyors in September, 1971. Mr. Robillard is a nationally recognized authority on retracement surveys. In his paper on retracement, Mr. Robillard says:

"In order to approach any research in the past you, the surveyor, must have a full and clear understanding of the varied facets of how to do the job. I envision a man capable only when he has masterfully accomplished the following:

1. Knowledge of the instructions and methods in effect at the time of the original survey. These have changed periodically throughout the years. When the South was surveyed many of the methods were brought down from the Survey of the Seven Ranges in Ohio.
2. An adequate job of record research before field work is attempted. Many are too busy to commence field work where in order to do so would involve a large amount of background research into the field notes of the government survey,

resurveys and all allied materials that can aid as tools in the total job.

3. A knowledge of local conditions prevalent at the time of the original survey was made. We must understand how the local surveyor progressed daily and the trials and tribulations he was subjected to daily. This will lead to an understanding of poor closures, errors and omissions.
4. He must have a knowledge of instruments used by the early surveyors. Their capabilities, shortcomings and methods of employment must be known before he can take the first steps to relate his survey on the ground. I would like to discuss item 4 right now, and more particularly the compass and updating it today.

The Staff compass has been the work horse of the surveyor since 1785. We have little valid information as to what it was and how constructed. Tiffen in 1815 directed his deputy surveyors to equip themselves with a good compass of Rittenhouse's construction, having a nonious division, in order to compensate for declination. David Rittenhouse of Pennsylvania developed his compass sometime about 1760 and this compass was in all probability manufactured of wood and brass. It was not until later years that the brass compass was developed. Rittenhouse's compass was designed with a nonious to set off declination.

The compass was accepted as the universal surveying equipment. Although theodolites had been in use in Europe years before, a few had been brought to America. They found little acceptance because of their weight and they lacked a needle. Very little information relative to the compasses used exists today. We do know they were told to carefully check their compass and to allow for the

variation or declination. But over and above that little is known.

Little was actually known about the compass. I seriously doubt if they realized many of the finer points. They may have compensated for local anomalies and what we would call local attraction, they knew it existed but, little did they realize that instruments differ. Today we have proof that two new compasses, mounted, will not read the same bearing on the same line. Recent checks of early equipment found discrepancies of 1/4 to 2 degrees. I'm certain that the deputy surveyors did not realize this.

These men were instructed to faithfully observe declination. Little has passed on to us in, except that many references are made to 'observing the declination' in the field notes. As a matter of interest here are several methods employed to determine the declination."

In his paper, Mr. Robillard goes into considerable detail explaining the method to find the true meridian with a compass. Essentially, it is a set up to observe the polestar at the time of elongation and to compare the compass with the true north based on the elongation and by this method to determine the true declination of the compass. Anyone who is interested in looking into this further may read more in Mr. Robillard's paper found in the Land Surveyor's Short Course, September 23, 24, 25, 1971, in the book published by the University of Arkansas Division of Continuing Education. Mr. Robillard continues in his article as follows:

"About 1835 when most of the surveyors were still using staff compasses, William Austin Burt, a Deputy Surveyor in Michigan, developed the solar compass. Burt was surveying in Northern Michigan and encountered large disturbances of magnetic anomalies. He devised a system which mechanically resolved the astronomical triangle of the sun, zenith and the pole to determine a true meridian. This

resembled a large Rittenhouse compass with the addition of various arcs, a solar far on top and a horizontal plate. The solar compass was perhaps the most significant development in surveying equipment for 100 years.

Basically the three arcs are used to place the latitude, the sun's declination, and the time. This resolves the astronomical triangle when the sun's image is reflected on a silver mirror and automatically orients the instrument due South. Years of experience have proven this equipment was accurate to within a minute, with a minute random error. This instrument was much like a solar shot. It was inaccurate very early, at noon, and very late in the day. The use of this equipment eliminated backsights, reduced brushing, required no correction for curvature of the earth and isolated bearing errors to a single station.

We have no idea just how many of these instruments were used for local surveys, but we do know that they were available and were used. I suspect that a few of these were used in the later years of the Arkansas surveys."

It is interesting to note that at a much later date surveys made by the Corps of Engineers in north Arkansas and southern Missouri, used an instrument similar to the solar compass known as the Smith solar attachment with a transit. The solar attachment worked in much the same manner as the solar attachment for the compass; eliminated the use of a backsight and gave fairly good accuracy in the running of random lines in the retracement surveys conducted in the early 1940's. In his article Mr. Robillard continues:

"As a companion to the angular measurement is that of surface or horizontal measurement as produced by the chain. The chain used by the government surveyors was developed by Edmund

Gunter, an English mathematician, in the early 1600's. Gunter is credited with establishing the values of the pole, the rod, the chain, the statute mile and the acre. The chain was 66 feet long as represented by 100 units or links, each 66/100 feet long. Each chain was made of No. 12 gauge wire held together by small loops. Each chain has six times the wearing surfaces as it had links. If a one chain tape wore 1/100 of an inch at each point the chain would actually increase six inches in length. In actual use the chain had a bad habit of picking up debris in these joints, resulting in shortening the chain.

The link value is taken from the junction of one pair of connecting rings to the next. The handles formed part of the end links. On some of the newer chains, a screw arrangement permitted the adjustment of the chain, but earlier ones required the bending of the loops. At every ten links there is a brass indicator tab, with the number of points showing tens of links toward the center. The center a fifty link tab was round.

The first instructions called for a chain. No specific length was indicated it was just understood. Later instructions called for a chain of two poles. It was believed that the shorter length would permit a more true horizontal measurement. Using a fifty link chain the basic measurement was five chains, or an "out" or tally. Usually the compass was equipped with a tally counter numbered to sixteen or the number of outs in the distance of one mile. Many of the old notes reflect this in that distances are reflected by 160 chains to the mile.

This system permitted both random or gross errors and systematic errors. Gross blunders could occur in multiple of five chains, or ten links. As a result

the way the chain was marked, 30 links could be recorded as 70 or vice versa. Eighty-three links could very reasonably be 77, 17, or 23, depending upon how the observation was made.

How does all of this background fit into our work today? In order to conduct successful retracements, a working knowledge of how the original work was conducted is a must. This includes a working knowledge of the compass as an instrument and of the earth's magnetism. We must accept the fact that an original compass survey is better investigated using compass methods. Many of the original compass surveys were carefully and faithfully performed.

Early surveyors had little knowledge of fluctuations of the compass needle. Today we realize that retracing old compass surveys is not easy. We must approach any retracement cautiously, lest our survey inflict new problems into an area. Today we realize that the difference between the observed declination at the time of the original survey and our survey is not all due to secular change, daily variation, errors in instruments, and local disturbance all play a part in the understanding. As the surveys progressed and additional instructions were issued, the problems were gradually eliminated.

Today the start of any retracement is a proven corner. A corner that cannot be disputed as being GLO. From that point we can then start. In many retracements we talk to surveyors who start from an unproven corner, run an undetermined bearing, for an indefinite length and then wonder why they are unable to prove anything. Once you, as a retracement surveyor, have a starting point then the fun and enjoyment of retracement surveys begins.

We understand that the original



surveys were run with the compass adjusted to the meridian. But also we now realize the crude methods involved in determining this meridian and the many minor problems that could arise. Now we begin at our corner. With our compass adjusted to what the original was supposed to read, a line is run in the direction of the next corner. If at the next point a corner is found and it proves to be GLO, your problem is simple, because a true correlation between what was run and your retracement can be gained by adjusting your line to what was run, and for lines in that vicinity this correlation should hold.

At the time of the original survey, field notes indicate a line run N-S with a declination  $5^{\circ}$  east, or a change of  $2^{\circ}$ . With  $7^{\circ}$  placed in our compass we retrace a line between two known corners and find we miss the second corner by  $1/2^{\circ}$ . This does not mean that the original was in error. We are in error because we did not use the same equipment, with the same declination and use the same methods. What we have done is in the true sense a retracement in which we refined the original survey. The original bearing is now S-O-30E. But because of the methods employed at that time they could not read that close. We must realize that in determining the declination for a new survey and that of a retracement must be approached then with two different ideas in mind.

If we are to lay out true N-S lines then it behooves us to accurately determine declination in order that we can overcome the inadequacies with which we worry today. The better condition the instrument and the more accurate declination determined, the more precise a line can be laid out.

On the other hand, we should duplicate the original survey as closely as

possible and once that is done, this will result in the same answers. Let's look at a situation where an original line was run by the magnetic meridian. Our problem today is to reconstruct the magnetic survey to today's meridian. We have the old records such as agonic charts and secular change tables. These charts and tables are not perfect. In making them it is necessary to reconcile all sorts of inadequate data. The differences between two observed declinations is not all secular change. Part may be daily variation, changes in instruments, or local disturbance.

Let's assume a survey was run magnetically in 1820. Our research indicates that declination there was  $11^{\circ}$  East. Today we determine our declination as follows:  $6^{\circ}$  East with an annual change of 4.5 minutes westward. With only one year to apply change for, the difference is negligible. If a line was run N magnetically in 1820, what would we have to run today to duplicate that? In playing around with the compass we would be in a much firmer position if we would realize certain points:

1. Each compass may have appreciable index error; that is, the readings are constantly wrong, neither plus or minus.
2. Magnetic bearings make it difficult to determine the exact time of execution. Compass bearings in one deed are sometimes copied into another deed 50 years later, when bearings may be one degree or more different.
3. Compass bearings are inherently lacking in precision. Uncertainty in reading the needle, effect by daily variation, anomalies. Today practice calls for foresights and backsights, but since it was common to make only one pointing at a station ahead, the various bearings

and angles then reflected any local disturbance of the declination.

I have read that in the early days of the GLO surveys, it was the practice of some surveyors to combine the true bearing of the line with the declination. This combined value was recorded as the variation even though it was not the actual declination at the site.

I don't want to leave you with the idea that retracements are impossible. They aren't. To the trained individual retracements can be rewarding and fun. But they require a discipline on the part of the individual to give and take. A discipline to remain flexible in an approach that may be completely foreign to Engineering surveying.

I would like to quote from Justice Cooley: 'When a man has a training in one of the exact sciences, where every problem within its preview is supposed to be susceptible to accurate solution, he is likely to be not a little impatient when he is told that under some circumstances he must recognize inaccuracies, and govern his action by facts which lead him away from the results which theoretically he ought to reach. Observation warrants us in saying that this remark may frequently be made of surveyors.'

Few surveyors today realize that retracements do not involve the measurement of angles or bearings, but require the measuring and the verifying of distances and the running mostly of straight lines. Under these conditions I see no reason why the surveyor should expect trouble, but there are many "supposedly" intelligent gentlemen who feel that if a surveyor can find but one corner of a survey, he can readily determine the positions of all the rest, for miles around. This is anything but true and

now it is up to us to eliminate this misconception, and then to pass on to the public the fruits of our labor."

As it has been stated several times in this handbook one of the most difficult and oftentimes frustrating tasks confronting the modern-day surveyor is that he must place himself in the footsteps of an ancient surveyor whose instruments were of poor quality, whose knowledge of surveying was much less than at the present time, and he worked under conditions far different than those which we now find in the field. As Mr. Robillard so aptly points out in his paper, the problem is that we oftentimes are unable to put ourselves in the position of the old original surveyor and attempt to retrace his footsteps in the same manner with which he walked them originally.

### Subdivision of Sections

The surveyor who is confronted with the problem of retracements is also confronted with another problem that is the location of fractional section subdivisions which may or may not have been performed by the General Land Office surveys. However, in either case it is extremely important that the retracement surveyor be thoroughly familiar with the methods and procedures used and outlined by the General Land Office, (now the Bureau of Land Management) for the subdivision of sections. The new Manual of Surveying Instructions for 1973 contains a very informative chapter on the rectangular system of surveys and particularly that part dealing with subdivision of sections. It is highly recommended that all surveyors who are dealing with retracement surveys or any surveys involving the subdivision of sections be thoroughly familiar with this chapter in the Manual.

The major portion of the pertinent information is reprinted on the following pages and is contained in sections 3-74 through 3-123.

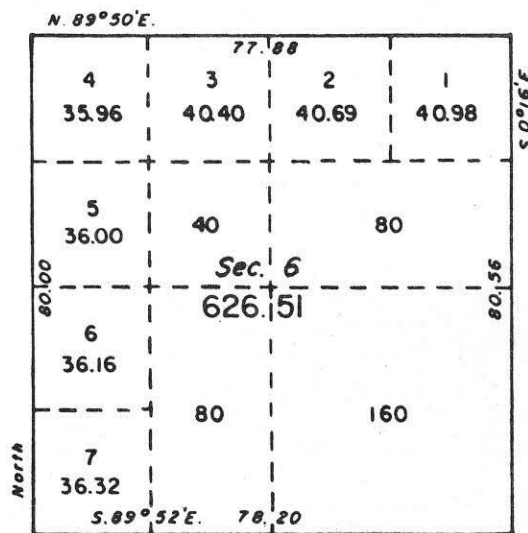
## Manual of Surveying Instructions

## Subdivision of Sections

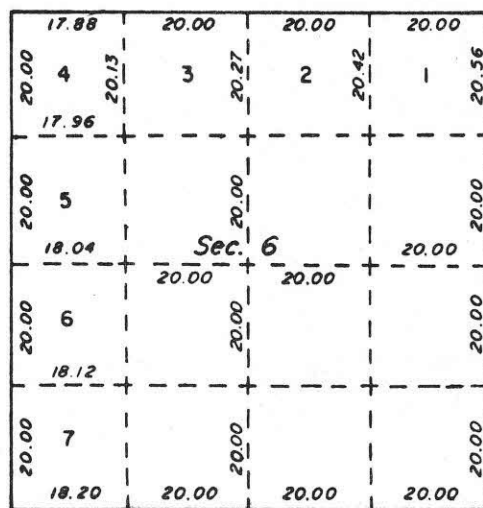
3-74. Revised Statutes, secs. 2396, 2397 (43 U.S.C. 752 and 753), contain the fundamental provisions for the subdivision of sections into quarter sections and quarter-quarter sections. The sections are not subdivided in the field by Bureau of Land Management cadastral surveyors unless provision is made in the special instructions, but certain subdivision-of-section lines are always protracted upon the official plat.

3-75. Under the rectangular system the unit of survey is the township of 36 sections. The unit of subdivision is the section of 640 acres. Under the general land laws, broadly, the unit of administration is the quarter-quarter section of 40 acres. The function of the cadastral surveyor of the Bureau of Land Management has been fulfilled when he has executed and monumented his survey properly and returned an official record in the form of detailed field notes and a plat. The plats are constructed in harmony with the field notes returned by the surveyor. The lands are identified on the ground by fixed monuments established in the survey. A United States patent conveys the title to an area defined by those fixed monuments and related by description and outline to the official plat.

3-76. The local surveyor is employed as an expert to identify lands which have passed into private ownership. This may be a simple or a most complex problem, depending largely upon the condition of the original monuments as affected principally by the lapse of time since the execution of the original survey. The work usually includes the subdivision of the section into the fractional parts shown upon the approved plat. In this capacity the local surveyor is performing a function contemplated by law. He cannot properly serve his client or the public unless he is familiar with the legal requirements concerning the subdivision of sections. In the

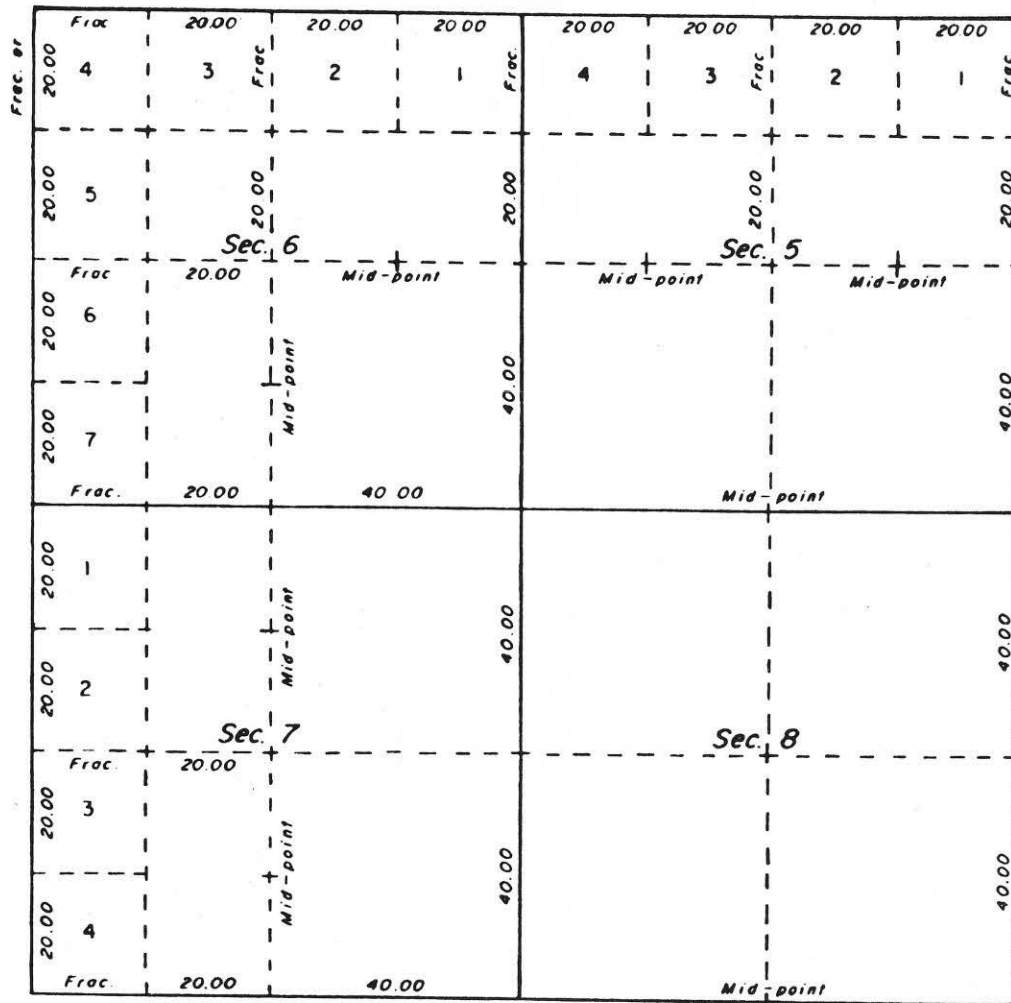


Showing areas.



Showing calculated distances.

Figure 46.  
Examples showing subdivision by protraction.



Showing normal subdivision of sections.



event that the original monuments have become lost, the surveyor needs to be familiar with the scheme of the original survey, the record of the particular survey involved, and the principles upon which the courts have based rulings with regard to corner restorations.

The Bureau of Land Management assumes no control or direction over the acts of local and county surveyors in the matters of subdivision of sections and reestablishment of lost corners of original surveys where the lands have passed into private ownership, nor will it issue instructions in such cases. It follows the general rule that disputes arising from uncertain or erroneous location of corners originally established by the United States are to be settled by the proper local authorities or by amicable adjustment. The Bureau desires that the rules controlling the acts of its own cadastral surveying service be considered by all other surveyors as merely advisory and explanatory of the principles which should prevail in performing such duties.

#### Subdivision by Protraction

3-77. Upon the plat of all regular sections the boundaries of the quarter sections are shown by broken straight lines connecting the opposite quarter-section corners. The sections bordering the north or west boundary of a normal township, excepting section 6, are further subdivided by protraction into parts containing two regular half-quarter sections and four lots. Section 6 has lots protracted against both the north and west boundaries, and so contains two regular half-quarter sections, one quarter-quarter section, and seven lots. The position of the protracted lines and the regular order of lot numbering are shown in figure 46. The lots are numbered in a regular series progressively from east to west or from north to south in each section. The lots in section 6 are numbered commencing with No. 1 in the northeast, thence progressively to No. 4 in the

northwest, and south to No. 7 in the southwest fractional quarter-quarter section.

3-78. The regular quarter-quarter sections are aliquot parts of quarter sections based upon midpoint protraction. These lines are not indicated upon the official plat.

3-79. Sections which are invaded by meanderable bodies of water, or by approved claims at variance with the regular legal subdivisions, are subdivided by protraction into regular and fractional parts as may be necessary to form a suitable basis for the administration of the public lands remaining undisposed of, and to describe the latter separately from the segregated areas.

3-80. The meander line of a body of water and the boundary lines of private claims are platted in accordance with the lines run or connections made in the field. The sections invaded are subdivided as nearly as possible in conformity with the uniform plan. The subdivision-of-section lines are terminated at the meander line or claim boundary, but the position of the subdivision-of-section lines is controlled precisely as though the section had been completed regularly. In the case of a section whose boundary lines are in part within the limits of a meanderable body of water, or within the boundaries of a private claim, the fractional section lines are completed in theory, and the protracted position of the subdivision-of-section lines is controlled by the theoretical points so determined.

3-81. Fractional sections are subdivided so as to contain as many aliquot parts as possible, but a departure from this practice is made where it would result in poorly shaped fractional lots. In the case of fractional lots along the north and west boundaries of a township, and in other similar cases where a lot has a full normal width of 20 chains in one direction, it is generally advisable to avoid areas of less than 10 or more than 50 acres. In the instance of fractional lines along a

meander line or other irregular broken boundary, where the width of the lot in both directions may be considerably less than 20 chains, resulting in tracts of more compact form, it is generally better to avoid an area of less than five or more than 45 acres. Extreme lengths or narrow widths should be avoided. The longer direction should extend back from a meander line or claim boundary rather than along it. It is inconsistent that a fractional lot lie partly in two sections, and it is generally better, when consistent with other rules, to avoid fractional lots extending from one into another fractional quarter section.

3-82. To visualize a uniform system for numbering lots of fractional sections, imagine the section divided by parallel latitudinal lines into tiers, numbered from north to south. Then, beginning with the eastern lot of the north tier, call it No. 1, and continue the numbering west through the tier, then east in the second, west in the third, east in the fourth tier, until all fractional lots have been numbered. These directions are maintained even though some of the tiers contain no fractional lots. A lot extending north and south through two, or part of two tiers, is numbered in the tier containing its greater area. This method of numbering applies to any part of a section. A section that has been partly surveyed at different times should have no duplication of lot numbers.

3-83. When the length or width of a township exceeds 480 chains to such an extent as to require two or more tiers of lots adjoining the north or west boundary, the usual past practice has been to lot all of the area beyond the regular legal subdivisions as shown in figure 48(a) and 49(a). Henceforth, in order to avoid possible confusion of descriptions, the lotting should be extended throughout the fractional half of the section as shown in figures 48(b) and 49(b). This will also apply to the platting of resurveyed sections insofar as public land is involved. In modern practice, sections in excess of 120 chains are avoided by the creation of half-township or half-range numbers. This

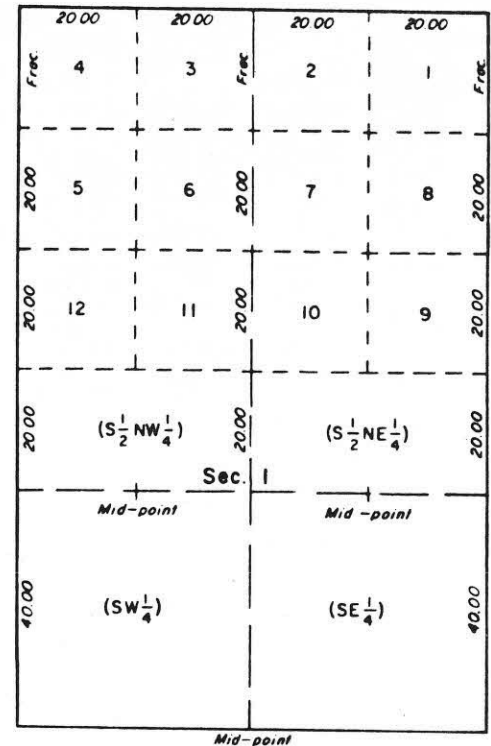


FIGURE 48(a).—Elongated section—subdivision by protraction.

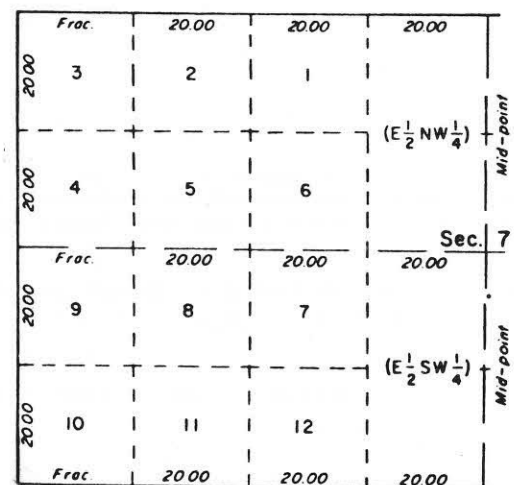
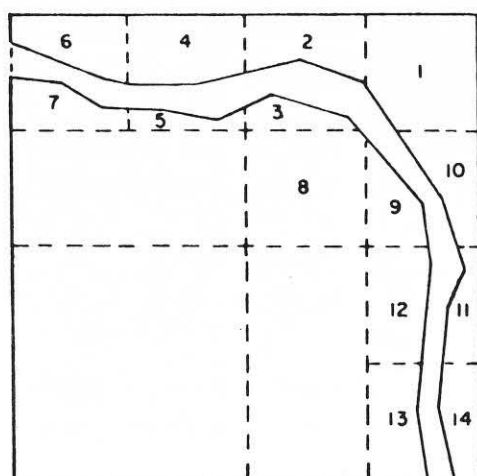
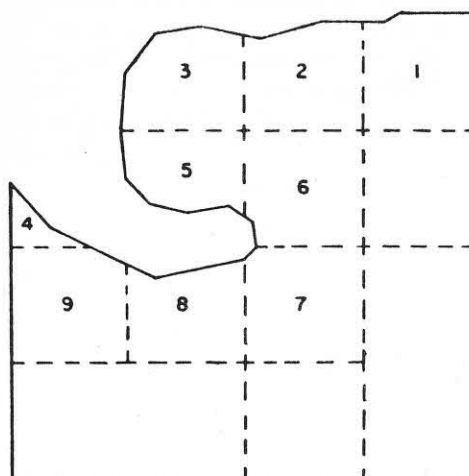


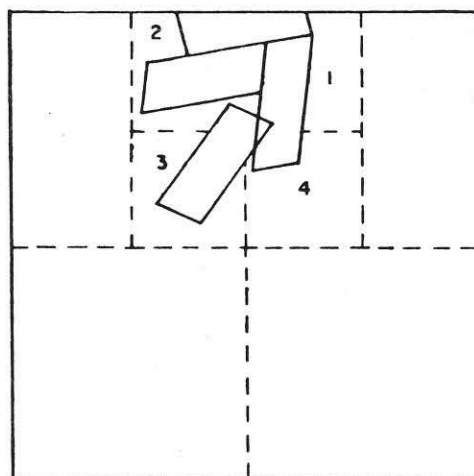
FIGURE 49(a).—Elongated section—subdivision by protraction.



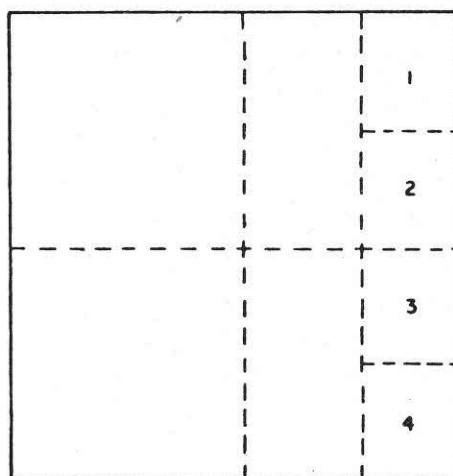
Meanderable River.



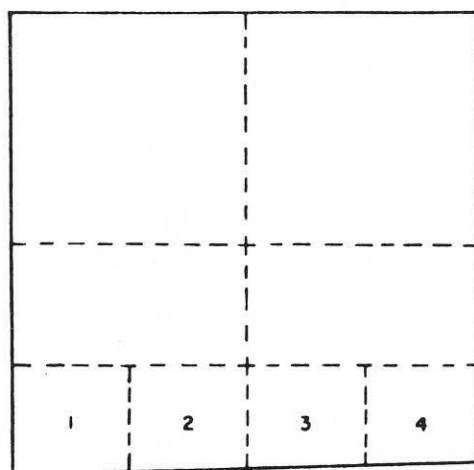
Meanderable Lake.



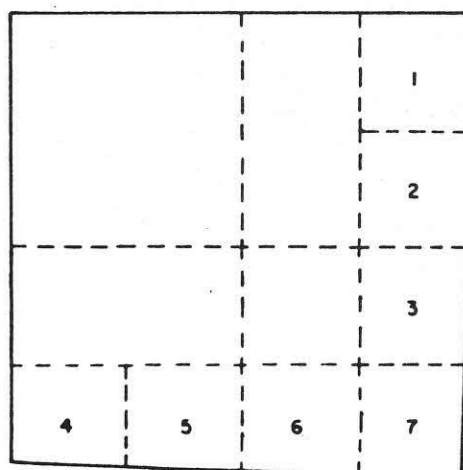
Mineral Claims.



E. bdy. defective in alinement.



S. bdy. defective in alinement.



E. &amp; S. bdrs. defective in alinement.

FIGURE 47.—Examples of subdivision of fractional sections.

cannot be done where the elongated sections are situated in the interior of a township as the result of partially completed but grossly irregular former subdivisions. Lotting will then be extended as necessary.

3-84. If it has been necessary to establish a sectional guide meridian or a sectional correction line, fractional lots may result along the east or south boundary of the township. The sections bordering the defective boundaries are subdivided on the same plan as sections bordering the north and west boundaries of a normal township.

#### Subdivision by Survey

3-85. The rules for subdivision of sections by survey are based on the laws governing the survey of the public lands. Some cases arise, however, which are not covered by these rules and require the advice of the Bureau of Land Management. The letter of inquiry should contain a description of the particular tract or corner, with reference to township, range, and section of the public surveys, together with a diagram showing conditions found.

#### Order of Procedure in Survey

3-86. Since the corners established in the original survey are controlling, it is essential that these corners be found, or properly restored, before the actual field work involving the subdivision of section is undertaken. The section boundaries should be retraced to develop the actual bearings and lengths of the lines between the corners.

The order of procedure is: First, identify or reestablish the corners on the section boundaries, including determination of the points for the necessary one-sixteenth section corners. Next, fix the boundaries of the quarter sections; and then form the quarter-quarter sections or small tracts by equitable and proportionate division. The following methods should be employed:

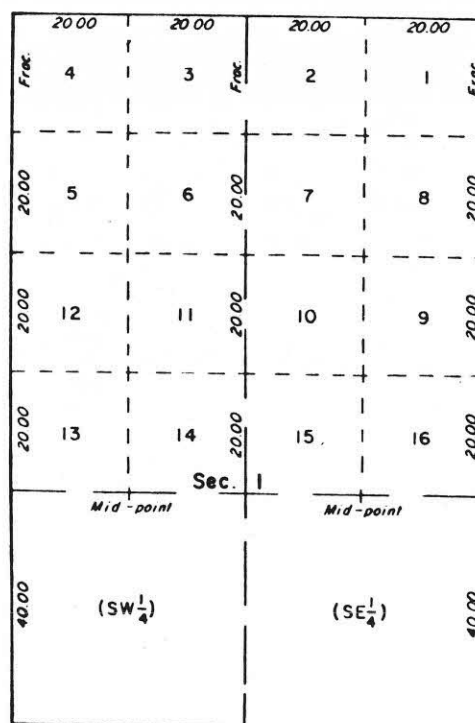


FIGURE 48(b).—Extension of lotting in elongated section.

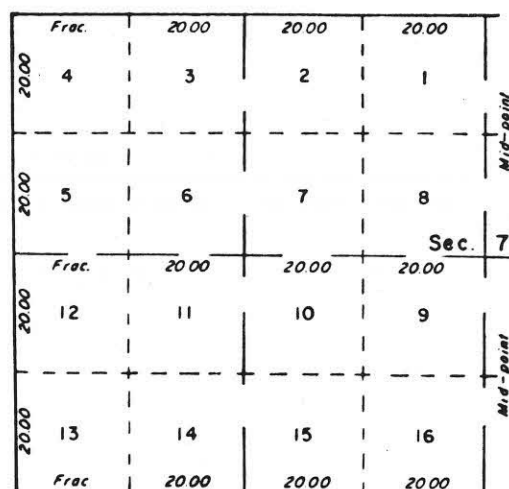


FIGURE 49(b).—Extension of lotting in elongated section.

*Subdivision of Sections Into Quarter Sections*

3-87. To subdivide a section into quarter sections, run straight lines from the established quarter-section corners to the opposite quarter-section corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or the legal center of the section.

Upon the lines closing on the north and west boundaries of a regular township the quarter-section corners were established originally at 40 chains to the north or west of the last interior section corners. The excess or deficiency in measurement was thrown into the half mile next to township or range line, as the case may be. If such quarter-section corners are lost they should be re-established by proportionate measurement based upon the original record.

Where there are double sets of section corners on township and range lines, the quarter-section corners for the sections south of the township line and east of the range of the range line usually were not established in the original surveys. In subdividing such sections new quarter-section corners are required, so placed as to suit the calculations of the areas that adjoin the township boundary, as indicated upon the official plat, adopting proportional measurements where the new measurements of the north or west boundaries of the section differ from the record distances.

*Subdivisions of Fractional Sections*

3-88. The law provides that where opposite corresponding quarter-section corners have not been or cannot be fixed, the subdivision-of-section lines shall be ascertained by running from the established corners north, south, east, or west, as the case may be, to the water course, reservation line, or other boundary of such fractional section, as represented upon the official plat.

In this the law presumes that the section lines are due north and south, or east and west lines, but usually this is not the case. Hence, in order to carry out the spirit of the law, it will be necessary in running the center lines through fractional sections to adopt mean courses where the section lines are not on due cardinal, or to run parallel to the east, south, west, or north boundary of the section, as conditions may require, where there is no opposite section line.

*Subdivision of Quarter Sections*

3-89. Preliminary to the subdivision of quarter sections, the quarter-quarter- or sixteenth-section corners will be established at points midway between the section and quarter-section corners, and between the quarter-section corners and the center of the section, except on the last half mile of the lines closing on township boundaries, where they should be placed at 20 chains, proportionate measurement, counting from the regular quarter-section corner.

The quarter-quarter- or sixteenth-section corners having been established as directed above, the center lines of the quarter section will be run straight between opposite corresponding quarter-quarter- or sixteenth-section corners on the quarter-section boundaries. The intersection of the lines thus run will determine the legal center of a quarter section.

*Subdivision of Fractional Quarter Sections*

3-90. The subdivisional lines of fractional quarter sections will be run from properly established quarter-quarter- or sixteenth-section corners, with courses governed by the conditions represented upon the official plat, to the lake, water-course, reservation, or other irregular boundary which renders such sections fractional.

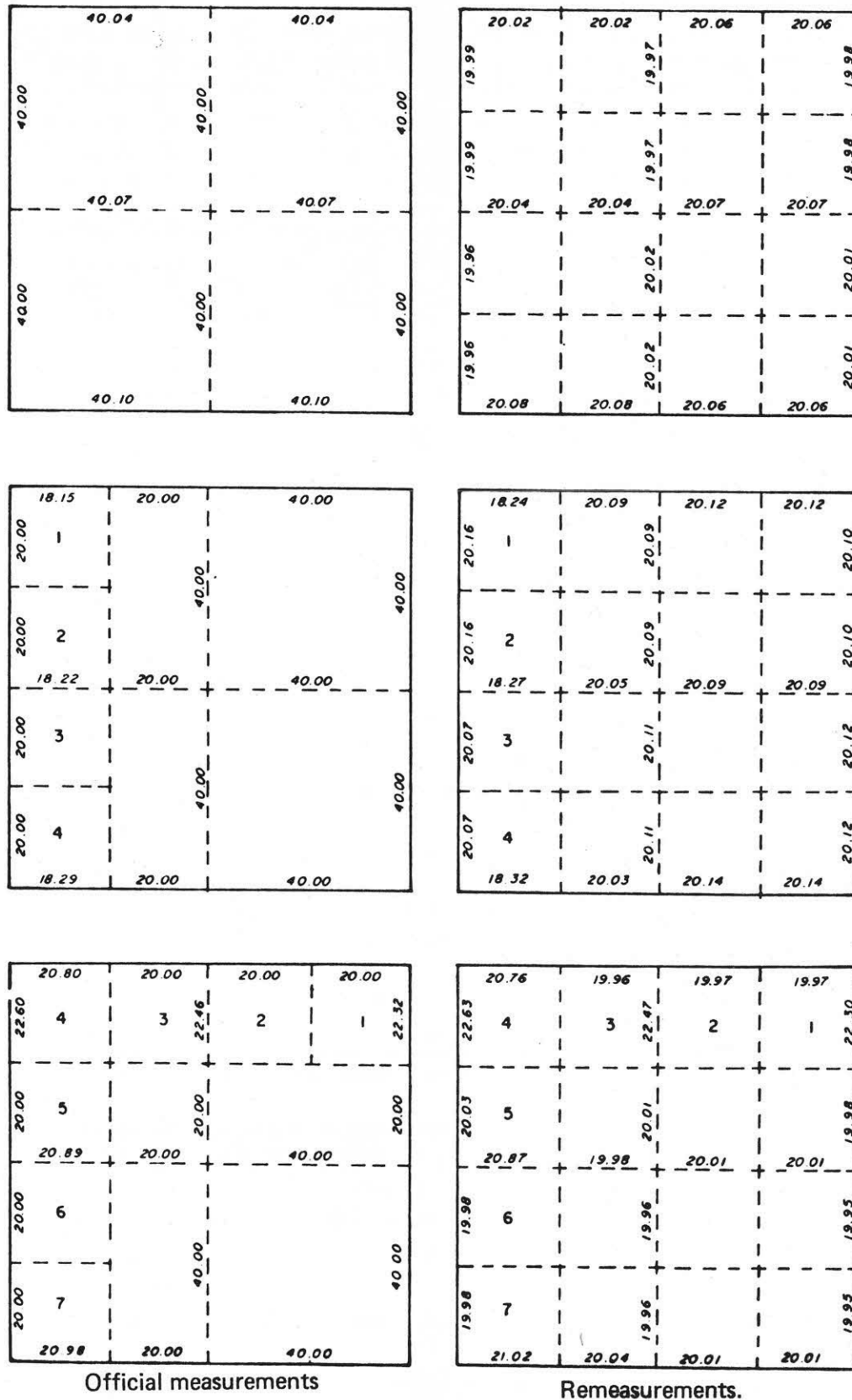


FIGURE 50.—Examples of subdivision by survey showing relation of official measurements and calculated distances to remeasurements, and indicating proportional distribution of differences.



3-91. Reasonable discrepancies between former and new measurements may generally be expected when retracing the section boundaries. The shortage or surplus is distributed by proportion in establishing a sixteenth-section corner. For example: The length of the line from the quarter-section corner on the west boundary of section 2 to the north line of the township, by the official survey was reported as 43.40 chains, and by the county surveyor's measurement was found to be 42.90 chains. The distance which the sixteenth-section corner should be located north of the quarter-section corner would be determined by proportion as follows: As 43.40 chains, the official measurement of the whole distance, is to 42.90 chains, the county surveyor's measurement of the same distance, so is 20 chains, original measurement, to 19.77 chains by the county surveyor's measurement. By proportionate measurement in this case the sixteenth-section corner should be set at 19.77 chains north of the quarter-section corner, instead of 20 chains north of said corner, as represented on the official plat. In this manner the discrepancies between original and new measurements are equitably distributed.

#### *Summary*

3-92. By way of recapitulation it is emphasized that when entrymen have acquired title to certain legal subdivisions they have become the owners of the identical ground area represented by the same subdivisions upon the official plat. It is a matter of expert or technical procedure to mark out the legal subdivisions called for in a patent, and entrymen are advised that a competent surveyor should be employed. The surveyor must identify the section boundaries and locate the legal center of the section in order to determine the boundaries of a quarter section. Then, if the boundaries of quarter-quarter sections, or fractional lots, are to be determined on the ground, the boundaries of the quarter section must be measured, and the sixteenth-section corners fixed in accordance with the proportional distances represented upon the approved plat.

Finally, the legal center of the quarter section may be duly located. Thus will be produced in the field the figure represented upon the plat, every part of the former in true proportion to the latter, where the elements of absolute distance and area have given way to corresponding proportional units as defined by fixed monuments established in the original survey.

#### **Survey of Parts of Sections**

3-93. In rare cases portions of the section boundaries are impassable or so insecure that acceptable monumentation is impracticable, and yet a need exists for survey of the accessible area. Since rules covering every set of conditons cannot be given, the methods ordinarily are carried in the special instructions. Figures 51 and 52 show rectangular boundaries of parts of regular sections. A random subdivision-of-section line is run closing the area to be surveyed, each course parallel to the governing boundary, with lengths in multiples of 20 chains. The closing error is then distributed as provided in section 5-43 and monuments established. Figures 53 and 54 show rectangular boundaries of parts of closing sections. Fractional lottings are indicated. In figure 53 the whole closing error in latitude is placed as normally in the north tier of lots. In figure 54 the whole closing error in departure is placed as normally in the west range of lots. In all cases the interior sixteenth-section corners and the center quarter section corner are monumented at turning points of the lines actually run.

3-94. The field notes show only the true line courses and distances, the usual topography, the description of monuments, and a description of the difficulties which warranted an elimination of parts of the section or sections.

3-95. To subdivide a partly surveyed section, the remaining subdivision-of-section lines within the surveyed area would be determined by running straight lines between the nearest established control for the sectional center lines. The position for the center quarter-section corner is at the intersection of the center lines, unless previously marked. The remaining

interior sixteenth-section corners on the sectional center lines are at midpoints between the exterior quarter-section corners and the center quarter-section corner, except within the sections normally fractional. The center lines of the quarter sections would be completed on a similar plan. In all sections normally fractional the excess or deficiency would be placed in its normal position.

3-96. Although the running of traverse lines on the margin of impassable areas has been largely discontinued, such a survey is sometimes called for where rectangular boundaries cannot otherwise be completed within the section. The method should be authorized in the special instructions only when supported by ample justification. In such surveys the angle points of the traverse line are given serial numbers in each fractional section, and the points are monumented. The sub-division-of-section lines are protracted only, unless a definition upon the ground is justified.

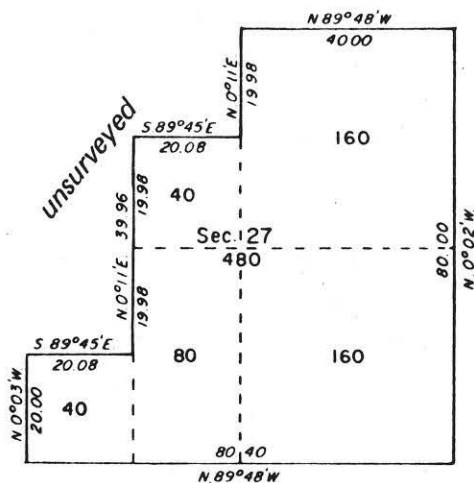


FIGURE 51.—Rectangular boundaries of parts of a regular section.

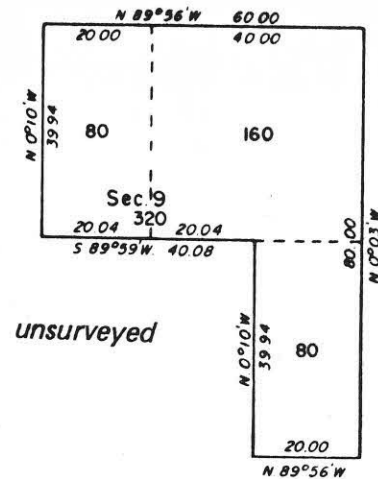


FIGURE 52.—Rectangular boundaries of parts of a regular section.

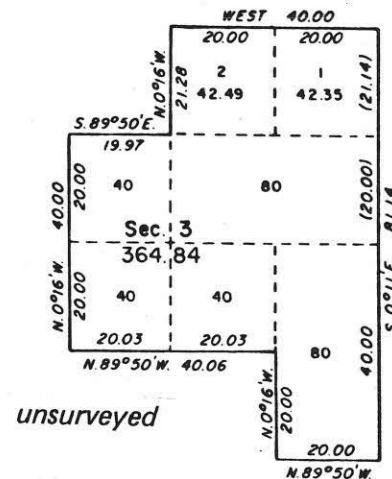


FIGURE 53.—Rectangular boundaries of parts of a section adjoining the north boundary.

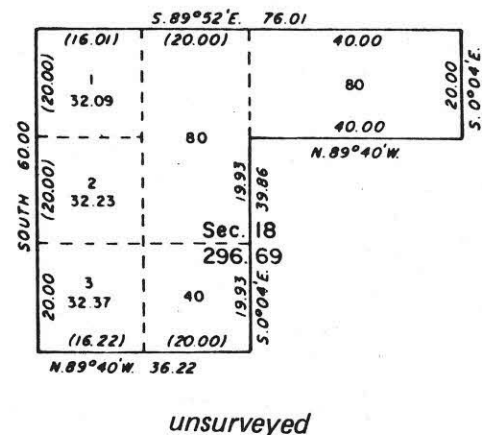


FIGURE 54.—Rectangular boundaries of parts of a section adjoining the west boundary.

### Fractional Townships

3-97. The regular procedures described for subdividing full townships cannot always be adopted. A township invaded by a large meanderable body of water, impassable objects, or a State, reservation or grant boundary may lack a full linear south or east boundary. If it has been found advisable to run section lines as offsets to the township exteriors, the fractional section lines south and east of these controlling lines are projected opposite to the usual directions. The fractional measurements and the resulting fractional lots are placed against the irregular boundary. If only the north or west part of a fractional township is involved, no departure from the regular order of subdivision is necessary, since fractional measurements on the exterior and subdivisional lines, and the resulting fractional lots, will be placed to the north and west against the irregular boundary.

3-98. Where no part of the south boundary of a township can be regularly established, the subdivision may proceed from north to south and from east to west, throwing fractional measurements and areas against the west boundary and the meanderable stream or other boundary limiting the township on the south. If the east boundary is without regular section corners and the north boundary has been run eastwardly as a true line, with section corners at regular intervals of 80 chains, the subdivision of the township may be made from west to east. In that case the fractional measurements and areas are thrown against the irregular east boundary. On the other hand, if the north boundary of section 6 is fractional, a sectional guide meridian, initiated at the easternmost regular section corner on the north boundary, is projected to the south to take the place of a governing east boundary. The subdivisional survey is then projected from north to south and from east to west, with fractional measurements and resulting fractional lots on the east, south and west boundaries of the township. Figures 55 through 58 illustrate the principles which control the subdivision of partial town-

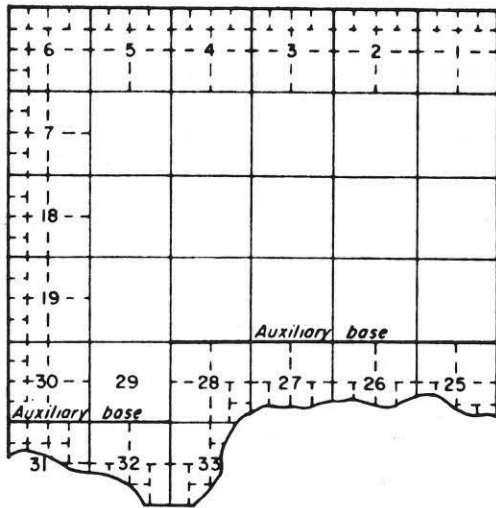
ships.

3-99. In the case of fractional townships the sections bear the same numbers they would have had if the townships were complete. That is, the section numbers are those relating to the governing boundaries.

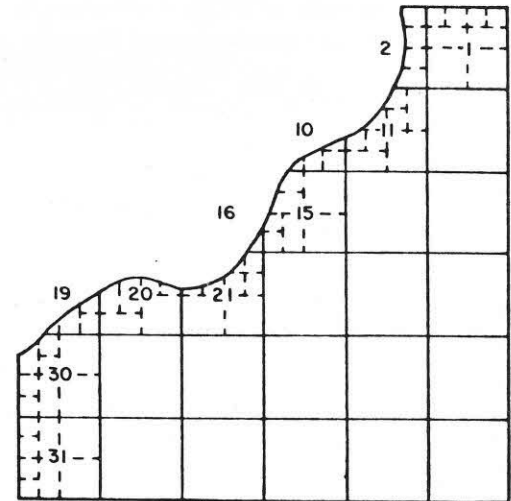
### Extension and Completion Surveys

3-100. Surveys coming before the Bureau of Land Management sometimes involve the continuation of the subdivisional survey of townships previously subdivided in part only. These surveys include the completion of partially surveyed sections or of sections containing outlying areas protracted as surveyed. If defective conditions are encountered in the previously established surveys, the problems concerning the procedure to be adopted multiply rapidly and require the greatest skill on the part of the surveyor. In the construction of new township plats the former practice of platting outlying areas of sections protracted as surveyed has been abandoned as unsatisfactory and inconsistent with the surveying laws.

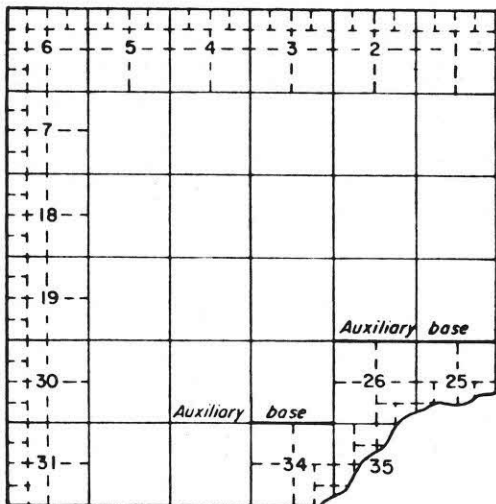
3-101. Most original surveys that are now to be extended were executed many years ago when the remaining areas were considered wastelands. Due to the ravages of time and the inferior monumentation of the early surveys, obliteration may be so far advanced that re-surveys are needed to identify and remonument the limiting boundaries of the area to be surveyed. The surveyor often must retrace additional lines that are not the boundaries of sections containing the new area to be surveyed. The theoretical position of a lost corner on such lines may be at variance with an unofficial corner established by local survey and recognized by the owners of the private lands affected. Controversy is avoided if reestablishments are confined to corners that control the position of the section boundaries or the subdivision-of-section lines of the public lands to be surveyed. Identified original corners adopted as control in reestablishing corners of the public land sections are rehabilitated but



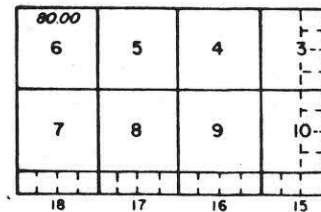
**FIGURE 55(a).—Use of auxiliary base.**



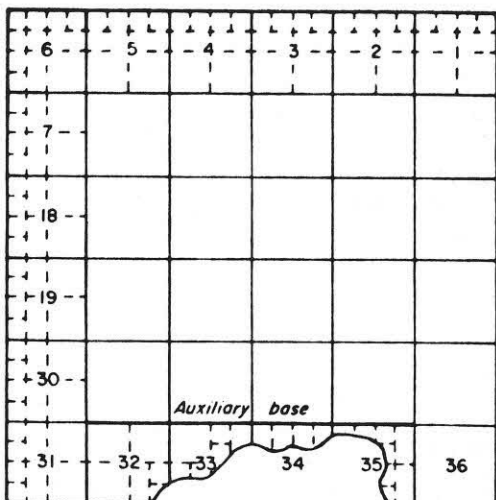
**FIGURE 56.—Regular subdivision of fractional township.**



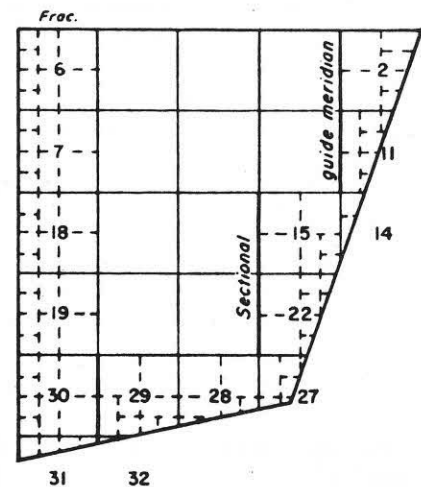
**FIGURE 55(b).—Use of auxiliary base.**



**FIGURE 57.**—Subdivision from north to south, and from west to east.



**FIGURE 55(c).—Use of auxiliary base.**



**FIGURE 58.**—Subdivision from north to south, and from east to west.

not remonumented in such cases. Corner restorations are made in accordance with the provisions of chapter V.

3-102. The field notes of necessary resurveys should include an explanation of their purpose and extent, including all needed historical references to the related prior surveys. The detail is written in the usual field note record form, following the introductory statement.

The plat, in addition to the usual data, may carry a marginal memorandum or diagram that clearly defines what lines of the prior survey have been retraced as a basis for extending the new lines. If no changes are made in the former lottings and areas in the resurveyed portions, it is stated that the lottings and area remain as shown on the plat or plats approved (date or dates).

### Completion of Partially Surveyed Sections

3-103. In extending fragmentary surveys, first consideration is given to the completion of partially surveyed sections. If outlying portions of sections have been returned as surveyed on the previous plat, it is usually necessary to complete the survey of each section in such a way as to protect acquired rights. The procedure adopted must fix the remaining quarter-section corners in a position which will control the center lines as necessary to retain the form of the original areas within reasonable limits.

3-104. The new quarter-section corners are regarded as reasonably fixed when (1) the alignment does not exceed 21' from a cardinal course and (2) the measurement does not exceed 25 links from 40 chains, or in proportion when the opposite portion of the section boundary was returned as more or less than 40 chains. This concession as to limits is made in the interests of simplicity where the rectangularity of both old and new surveys can thus be maintained.

3-105. The position of the quarter-section corner on a new opposite boundary is controlled from only one direction if the old opposite distance was made to count from one direction only. If the old opposite distance was made to count from two directions, the position of the new quarter-section corner is controlled from the two directions. The lengths of the two portions of the new line are made proportional to the two parts of the old opposite boundary.

3-106. Given an original survey which is within rectangular limits, the survey of a fractional section is completed on the same plan begun in the original survey. When irregularity is developed, the simplest method of survey that will correct irregularities and provide an early resumption of regularity in the new subdivisional lines is adopted. The general rule is that each completed section will have four regular boundaries without offsets, with four governing section corners and four controlling quarter-section corners in such position as to maintain the integrity of the fractional areas shown upon the original plat.

3-107. Modification of the general rule is necessary where completing each of two sections in the above manner would cause an overlap or hiatus. In such a case each section is completed theoretically without regard to the other, and the position of each center line is fixed. The most reasonable position for a common boundary between the two sections is then determined, and the new quarter-section corners are established at points which maintain the center lines in their positions. If the theoretical position for each quarter-section corner falls within 25 links of a common point, with allowance for variance in length of the center line, one corner may be established which will secure maximum regularity in both sections.

3-108. The possible combinations of uncompleted sections are too numerous to discuss fully here. Directions will be given in the special instructions for the cases involved in an assignment, and the surveyor should seek ad-



vice from the proper administrative office when irregularities develop. A diagram showing the exact field conditions should always accompany his report.

3-109. A private survey made for the purpose of marking on the ground a theoretical line, platted but not run by the Government, where executed within allowable departure from cardinal course, and relied upon by owner under title passed by the United States in the placing of improvements upon the patented land, will not be disturbed, but it will be adopted by the Government as a boundary for closure of the survey of the adjoining public land. *Algoma Lumber Co. v. Kruger*, 50 L.D. 402 (1923).

3-110. The best test of the fitness of a proposed method for the completion of partially surveyed sections is to plat the subdivisional lines by protraction. Thereupon the regular rules for subdivision of sections should be applicable. The position of the new quarter-section corners, established to control the subdivision of the section in question, must be such as to permit the center lines to the opposite original quarter-section corners to be connected in harmony with conditions shown on the original plat, disregarding the effect upon the subdivision of the newly surveyed land. Likewise, the lines connecting the sixteenth-section corners of the opposite boundaries on a quarter section must conform to the conditions represented on the original plat. When the subdivision-of-section lines are platted, the section is satisfactory if the integrity of the original areas is in no way violated.

3-111. The following guidelines should be followed in platting:

(1) The new areas should be complementary to the original areas by the extension of the subdivision-of-section lines as already protracted upon the original plat, except as poorly shaped lots, or lots of too great or too little area, would result in violation of the regular rules for subdivision of sections.

(2) In the interest of regularity and simplicity of platting, the same meridional limit may be permitted as is ordinarily allowed in latitudinal section lines. A section may be considered regular if its boundaries do not depart more than 21' from a cardinal course in alignment and no more than 25 links from 40 chains in measurement between the section and quarter-section corners. Such regular sections may be subdivided into regular quarter sections and quarter-quarter sections as far as possible. A section having three regular boundary lines may be subdivided in accordance with the usual rules for subdividing sections along the north and west boundaries of a normal township. A section having two adjacent regular boundary lines may be subdivided by the same manner in which section 6 of a normal township is treated. All other sections should be treated as irregular, with subdivision-of-section lines protracted to mid-points on the boundaries of the quarter sections, except as a calculated proportional position for a sixteenth-section corner is made necessary by the showing of the original plat.

(3) All new fractional lots are numbered beginning with the next higher number in the series shown on the previously approved plat, and proceeding in the usual order. The new series may begin with No. 1 if the fractional parts of the original area are not designated by lot number.

### Completion of Township Subdivision

3-112. Only after the partially surveyed sections have been completed should the surveyor proceed with the subdivision of the remaining portions of the township. If no irregularities are found in the previously established lines the new survey may proceed normally. If defective conditions are encountered, the irregularities are not extended into unsurveyed sections any farther than necessary to incorporate the resulting fractional measurements into suitable fractional lots adjoining the former surveys. Preference should be given to extending all surveys from south to north and from



east to west. If a better control is available by reversing the procedure in one or both directions, resulting in a simpler survey by minimizing the number of extra corners as well as fractional lots, reversal of the procedure is warranted.

3-113. In the event that the previously surveyed subdivision lines are defective, the new section lines may serve the function of a sectional guide meridian or a sectional correction line as required. The corners from which the new surveys are initiated are established as corners of four sections, or of two sections as appropriate. Where new section lines cannot be connected regularly with the previously established section corners by random and true line not exceeding 21' from cardinal, a closing section corner is established at intersection with the line of the old survey. The fractional measurements of the closing section lines are placed adjacent to the old surveys. The original lines forming the boundary of the lands to be surveyed are retraced, as already provided and the marks upon the original corners are appropriately modified as necessary. New quarter-section corners marked to control the subdivision of the new sections are established on the original lines at mid-points between the closing section corners, or at 40 chains from one direction, according to the manner in which a new section is subdivided.

3-114. There are often two or more ways in which a fractional subdivision may be completed, but careful study of a sketch plat representing existing conditions will generally reveal the superiority of one method over another.

### MEANDERING

3-115. The traverse of the margin of a permanent natural body of water is termed a meander line. All navigable bodies of water and other important rivers and lakes are segregated from the public lands at mean high-water elevation. In original surveys, meander lines are run

for the purpose of ascertaining the quantity of land remaining after segregation of the water area.

The running of meander lines has always been authorized in the survey of public lands fronting on large streams and other bodies of water. But the mere fact that an irregular or sinuous line must be run, as in the case of a reservation boundary, does not entitle it to be called a meander line except where it closely follows the bank of a stream or lake. The legal riparian rights connected with meander lines, do not apply in the case of other irregular lines, as the latter are strict boundaries.

Low-water mark is the point to which a river or other body of water recedes, under ordinary conditions, at its lowest stage. High-water mark is the line which the water impresses on the soil by covering it for sufficient periods to deprive it of vegetation. The shore is the space between the margin of the water at its lowest stage and the banks at high-water mark. *Alabama v. Georgia*, 64 U.S. 505 (1859).

Numerous decisions in the United States Supreme Court assert the principle that meander lines are not boundaries defining the area of ownership of lands adjacent to the water. The general rule is that meander lines are run not as boundaries, but to define the sinuosities of the banks of the stream or other body of water, and as a means of ascertaining the quantity of land embraced in the survey; the stream, or other body of water, and not the meander line as actually run on the ground, is the boundary. When by action of water the bed of the body of water changes, high-water mark changes, and the ownership of adjoining land progresses with it. *Lane v. United States*, 274 Fed. 290 (1921).

Meander lines will not be established at the segregation line between upland and swamp or overflowed land, but at the ordinary high-water mark of the actual margin of the river or lake on which such swamp or overflowed lands border.

3-116. Practically all inland bodies of water pass through an annual cycle of changes, between the extremes of which will be found mean high water. In regions of broken topography, especially where bodies of water are bounded by sharply sloping lands, the horizontal distance between the margins of the various water elevations is comparatively slight, and the surveyor does not experience much difficulty in determining the horizontal position of mean high-water level with approximate accuracy. Where the meanderable bodies of water are bordered by relatively flat lands, the horizontal distance between the successive levels

is relatively great. The most reliable indication of mean high-water elevation is the evidence made by the water's action at its various stages, which are generally well marked in the soil. In timbered localities a very certain indication of the locus of the various important water levels is found in the belting of the native forest species.

Mean high-water elevation is found at the margin of the area occupied by the water for the greater portion of each average year. At this level a definite escarpment in the soil is generally traceable, at the top of which is the

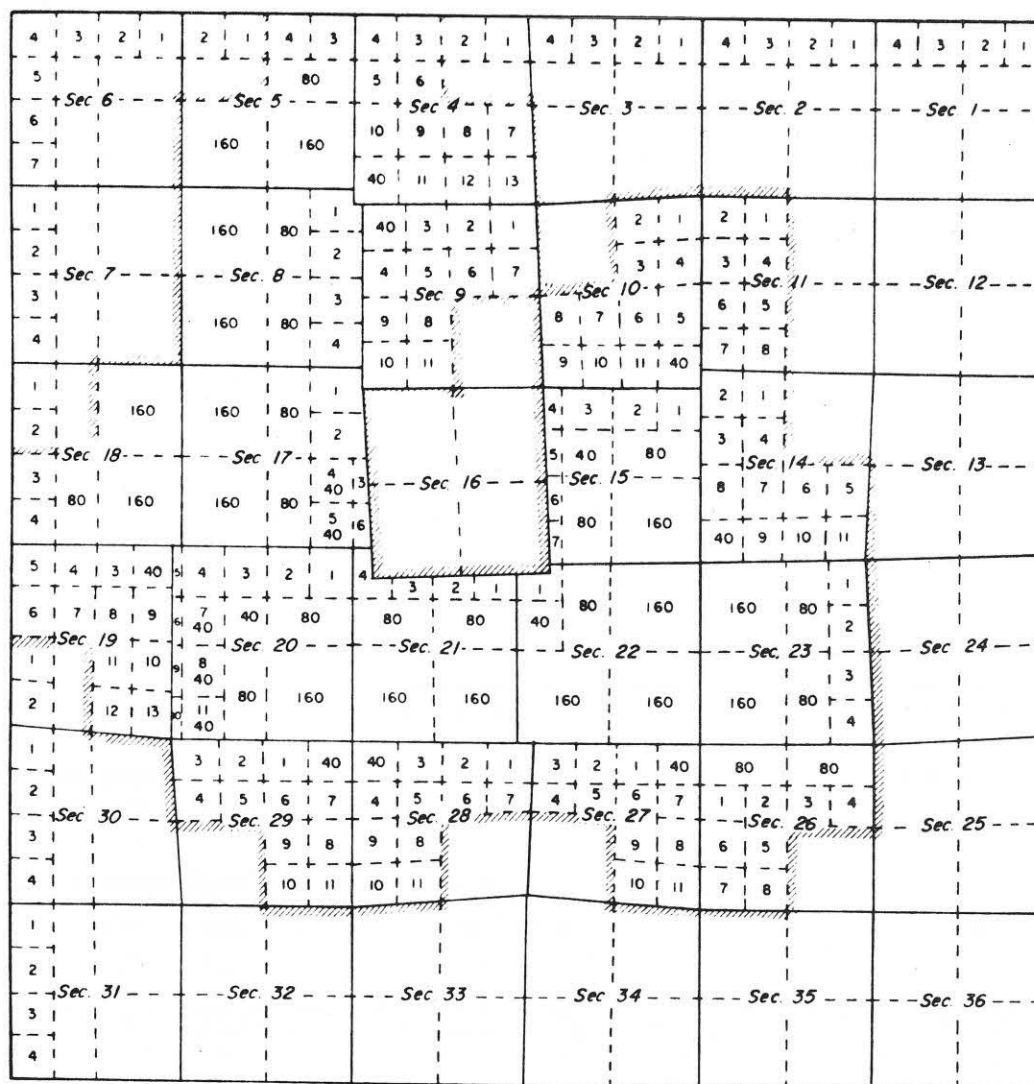


FIGURE 59.—Example showing completion of partially surveyed sections and completion of subdivisional lines of a township with necessary lottings.

true position for the meander line. A pronounced escarpment, the result of the action of storm and flood waters is often found above the principal water level, and separated from the latter by the storm or flood beach. Another, less evident, escarpment is often found at the average low-water level, especially of lakes, the lower escarpment being separated from the principal escarpment by the normal beach or shore. While these questions properly belong to the realm of geology, they should not be overlooked in the survey of a meander line.

Where the native forest trees are found in

abundance bordering bodies of water, those trees showing evidence of having grown under favorable site conditions will be found belted along contour lines. Certain mixed varieties common to a particular region are found only on the lands seldom if ever overflowed. Another group are found on the lands which are inundated only a small portion of the growing season each year, and indicate the area which should be included in the classification of the uplands. Other varieties of native forest trees are found only within the zone of swamp and overflowed lands. All timber growth normally ceases at the margin of permanent water.

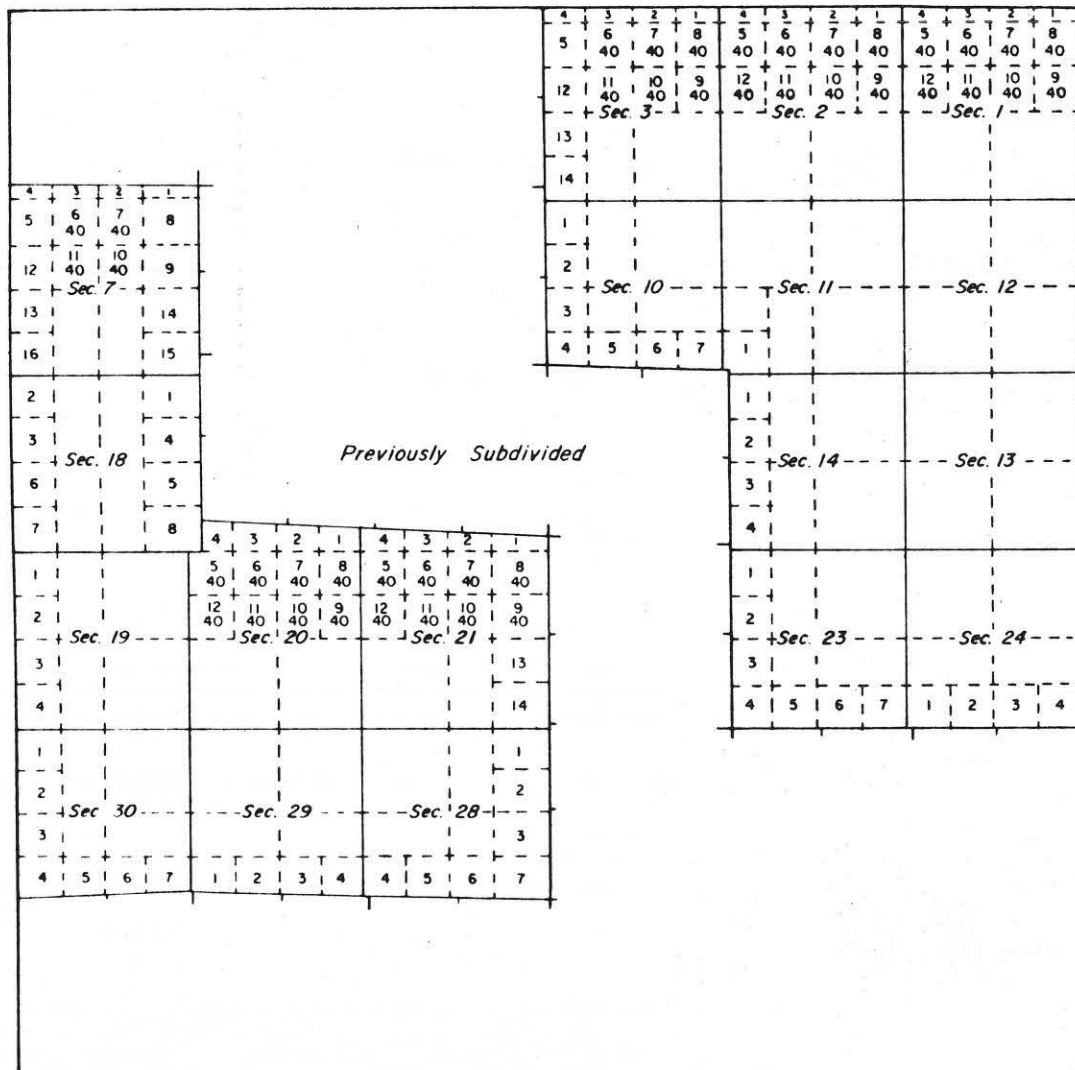


FIGURE 60.—Example showing completion of subdivisional lines of a township where outlying parts of sections returned earlier have been cancelled.

3-117. A meander corner is established at every point where a standard, township, or section line intersects the bank of a navigable stream or other meanderable body of water. No monument should be placed in a position exposed to the beating of waves and the action of ice in severe weather. In such cases a witness corner should be established on the line at a secure point near the true point for the meander corner. The distance across a body of water is ascertained by the triangulation or direct measurement, and the full particulars are given in the field tablets.

3-118. Inasmuch as it is not practicable in public-land surveys to meander in such a way as to follow and reproduce all the minute windings of the high-water line, the United States Supreme Court has given the principles governing the use and purpose of meandering shores in its decision in a noted case as follows:

Meander lines are run in surveying fractional portions of the public land bordering on navigable rivers, not as boundaries of the tract, but for the purpose of defining the sinuosities of the banks of the stream, and as the means of ascertaining the quantity of land in the fraction subject to sale, which is to be paid for by the purchaser. In preparing the official plat from the field notes, the meander line is represented as the border line of the stream, and shows to a demonstration that the watercourse, and not the meander line as actually run on the land, is the boundary. *Railroad Co. v. Schurmeier*, 74 U. S. 272 (1868).

3-119. The surveyor commences at one of the meander corners, follows the bank or shore line, and determines the length and true bearing of each course, from the beginning to the next meander corner. All meander courses refer to the true meridian and are determined with precision. "Transit angles" showing only the amount of deviation from the preceding course are not acceptable in field notes of meanders. Where it is impossible to survey the meander line along mean high-water mark, the notes should state the distance therefrom and the obstacles which justify the deviation. A table of latitudes and departures of the meander

courses should be computed before leaving the vicinity, and if misclosure is found, indicating error in measurement or in reading courses, the lines should be rerun.

The following items will be noted along the meander line: (1) all streams flowing into a river, lake, or meanderable bayou, with the width at their mouths; (2) the position, size, and depth of springs, and whether the water is pure or mineral; (3) the heads and mouths of all bayous; (4) all rapids and bars, with intersections to the upper and lower ends; (5) the elevation of the banks of lakes and streams, the height of falls and cascades, and the length and fall of rapids; and (6) artificial structures in both land and water areas.

The field notes of meanders show the corners from which the meanders commenced and upon which they closed, and exhibit the meanders of each fractional section separately. Following, and composing a part of the notes, should be given a description of the adjoining land, soil and timber, and the estimated depth of inundation to which the bottom land is subject.

## Rivers

3-120. Facing downstream, the bank on the left hand is termed the left bank and that on the right hand the right bank. These terms will be universally used to distinguish the two banks of a river or a stream.

Navigable rivers and bayous, as well as all rivers not navigable, the right-angle width of which is 3 chains and upwards, are meandered on both banks, at the ordinary mean high-water mark, by taking the general courses and distances of their sinuosities. Rivers not classed as navigable are not meandered above the point where the average right-angle width is less than 3 chains, except when duly authorized.

Shallow streams and intermittent streams without well defined channel or banks are not meandered, even when more than 3 chains

wide. Tidewater streams are meandered at ordinary mean high tide as far as navigable, even when less than 3 chains wide. Tidewater inlets and bayous are recorded, and are meandered if more than 3 chains in width, but when non-navigable are not meandered when less than 3 chains wide.

### Lakes

3-121. All lakes of the area of 50 acres and upwards, are meandered.

In the case of lakes which are located entirely within the boundaries of a section, a quarter-section line, if one crosses the lake, is run from one of the quarter-section corners, on a theoretical course to connect with the opposite quarter-section corner, to the margin of the lake, and the distance is measured. At the point thus determined a "special meander corner" is established.

Where one or both of the opposite quarter-section corners cannot be established, and in all cases where the distance across a lake exceeds 40 chains or the physical crossing is difficult, a temporary special meander corner is established at the computed intersection with the center line of the section when surveying the meander line. The temporary point is later corrected to the true center line position for monumentation, at midpoint in departure (or latitude), or at proportionate distance in a fractional section.

If a meanderable lake is found to be located entirely within a quarter section, an "auxiliary meander corner" is established at some suitable point on its margin, and a connecting line is run from the monument to a regular corner on the section boundary. A connecting traverse line is recorded, if run, but it is also reduced to the equivalent direct connecting course and distance, all of which is stated in the field notes. Only the course and length of the direct connecting line are shown on the plat of the survey.

The meander line of a lake lying within a section is initiated at the established special or auxiliary meander corner, as the case may be, and continued around the margin of the normal lake at its mean high-water level, to a closing at the point of beginning. All proceedings are fully entered in the field notes.

Artificial lakes and reservoirs are not segregated from the public lands, unless specially provided in the instructions, but the true position and extent of such bodies of water are determined in the field and shown on the plat.

Other exceptions to the general rule are shallow or poorly defined "lakes" which are actually pools that collect because of permafrost and lack of drainage or which are ephemeral desert palas formed seasonally or in wet years. These "lakes" should not be meandered even when larger than 50 acres.

### Islands

3-122. Every island above the mean high-water elevation of any meanderable body of water, except islands formed in navigable bodies of water after the date of the admission of a State into the Union, is located by triangulation or direct measurement or other suitable process, and is meandered and shown upon the official plat.

Even though the United States has parted with its title to the adjoining mainland, an island is a meandered body of water, navigable or nonnavigable, in continuous existence since the date of the admission of the State into the Union, and omitted from the original survey, remains public land of the United States. As such the island is subject to survey. This is because such islands were not a part of the *bed* of the stream at the date of Statehood, and therefore their title remained in the United States, subject to survey and disposal when identified. The riparian right that attaches to the lottings along the meander line of the mainland pertains only to the bed of the stream, and to such islands as may form within the bed



subsequent to the disposal of the title. The proof of the time of the formation of islands is often difficult. It is the practice to make a careful examination of the history of an island in relation to the question of its legal ownership.

Islands that have been given well-known proper names are so identified, both in the field notes and on the plat. Sometimes there are a number of islands in the same section without proper names. Some may have been surveyed, others omitted. Of the latter, some may rightfully belong to the State, some to a riparian proprietor, so that any system of numbering may be uncertain, and if used may still be confused with a lot number, if and when surveyed. For these reasons their identification may be uncertain unless the following rule is applied:

Where there are several unnamed islands within the same section, these will be referred to in the field notes (when surveyed) according to the lot number (Island designated as lot No.—) that is assigned on the plat, excepting that islands which are crossed by section line boundaries, or by a center line of the section, are readily identified by location.

Any township boundary or section line which will intersect an island is extended as nearly in accordance with the plan of regular surveys as conditions permit, and the usual township, section, quarter-section, and meander corners are established on the island. If an island falls in two sections only, the line between the sections should be established in its proper theoretical position based upon suitable sights and calculations. If an island falls entirely in one section, and is large enough to be subdivided (over 50 acres in area), a suitable sight or calculation is made to locate on the margin of the island an intersection with the theoretical position of any suitable subdivision-of-section line. At the point thus determined a "special meander corner" is established. In the case of an island falling entirely in one section and too small to be subdivided, an "auxiliary

meander corner" is established at any suitable point on its margin, which is connected with any regular corner on the mainland. The direct course and length of the connecting line is given in the field notes and shown on the plat.

The meander line of an island is surveyed in harmony with principles and rules heretofore stated. All township and section lines crossing the island are shown on the plat. If the island is large enough to be subdivided, the subdivision is accomplished by the protraction of suitable subdivision-of-section lines in their correct theoretical position.

Under special circumstances where administration or disposal requires no subdivision, an island is given a tract number within a township. In such cases, the section lines need not be extended to the island.

Agriculture upland within the limits of swamp and overflowed lands should be so classified and shown upon the plat accordingly, but such land is not meandered as an island.

### Use of Photogrammetry

3-123. Where conditions are favorable, meander lines may be surveyed by the process of photogrammetry after the meander corners have been established in the regular manner. The field notes will state what lines were so determined and the date and identification of the photography.

### Surveys of Riparian Lands

The late William K. Finefield, former Chief of the Real Estate Division, Corps of Engineers, Little Rock District, and past president of the Arkansas Association of Registered Land Surveyors, published two papers dealing with survey of riparian lands in the State of Arkansas. Any surveyor who proposes to perform retracement surveys on lands bordering water courses should study these two papers and become familiar with them. Here again we find that statements



previously made concerning the application of this handbook to Arkansas land surveys is evident. The statute in Arkansas which provides for the apportionment of accretions is somewhat different than the common law doctrine and there has been a great deal of confusion within the state of Arkansas and among surveyors concerning the proper method to apportion accretions. The first paper entitled **"The Survey of Riparian Lands"** deals with the subject in considerable detail.

The second paper entitled **"The Avulsion -**

**Nature's Bad Boy"** deals with another problem which is very frequently encountered by the surveyor of riparian lands in Arkansas and cites several well-known lawsuits in which considerable information of value to the surveyor is found. It is felt that a knowledge of these data will assist the surveyor who must make retracements in areas where water-courses have had a serious effect on the original surveys.

Mr. Finefield's two papers are included in their entirety on the following pages.

THE SURVEY OF RIPARIAN LAND

One of the most difficult and oftentimes frustrating problems the land surveyor encounters in his day-to-day activities is the survey of riparian land, that is, land bordering on watercourses.

Some of the most fiercely contested lawsuits we find in the annals of the courts have resulted from disputes over riparian ownership and, through the years, the courts have tried many cases to determine or allocate boundaries of land resulting from actions of rivers or other waters. One case I am familiar with and would like to mention is the case of Ussery vs. Anderson Tully, which may be found in 122 Federal Supplement 115. I mention this case, not because of the outcome or because of the particular situation involved, but rather because in his findings, which are in considerable detail, the late Judge Harry Lemley, District Judge for the Eastern District of Arkansas, Little Rock Division, wrote a very clear and scholarly dissertation on the laws of riparian ownership and a discussion of the evidence presented in the case, together with comments concerning the suitability of the evidence. To any surveyor who is performing this type of surveys, I would recommend highly the reading of this case.

It has often been said that the surveyor who surveys riparian lands must be not only a qualified technician but also a combination of a lawyer, a judge, and a jury. While this may be somewhat of an exaggeration, it is often desirable in cases involving riparian ownerships, and particularly where a dispute may result as the aftermath of a survey, to look for legal

advice and counsel as to the manner in which a riparian survey should be made. The great wealth of information available from lawsuits such as the one mentioned should not be overlooked as a source for guidance, and sound legal advice prior to a survey may avoid embarrassment in court at a later date. It is, of course, impossible to discuss in one paper all of the various types of surveys and the various problems which are involved in these types of surveys. However, I believe that it might be well to review a few of the basic principles involved in this type of survey and, perhaps with a few illustrations, bring out some of the points which are so important.

In order to discuss surveys of riparian land or riparian ownerships, it is highly important to review a few definitions and to refresh our memories as to the meaning and application of these terms. There follow definitions of some of the more frequently used terminology in connection with riparian land surveys:

A. RIPARIAN RIGHTS



PLATE 1

B. WATERCOURSE

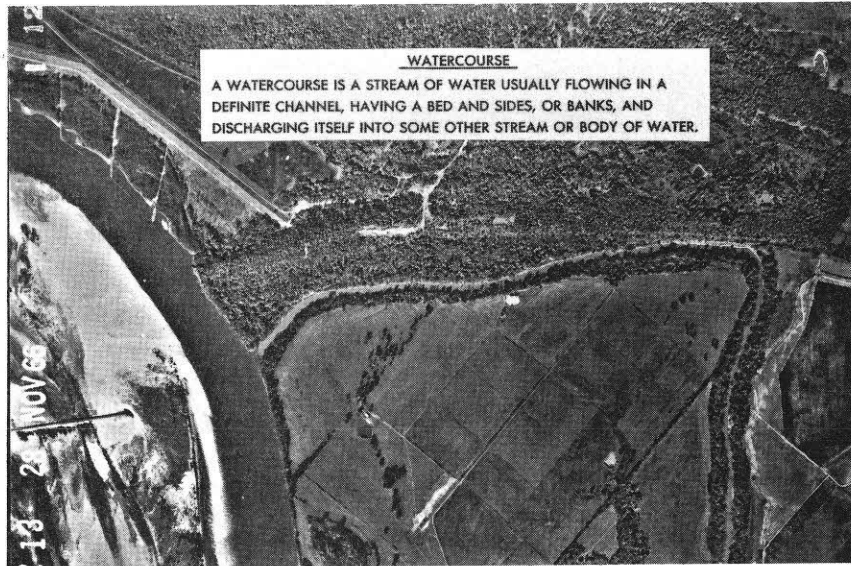


PLATE 2

C. ALLUVIUM

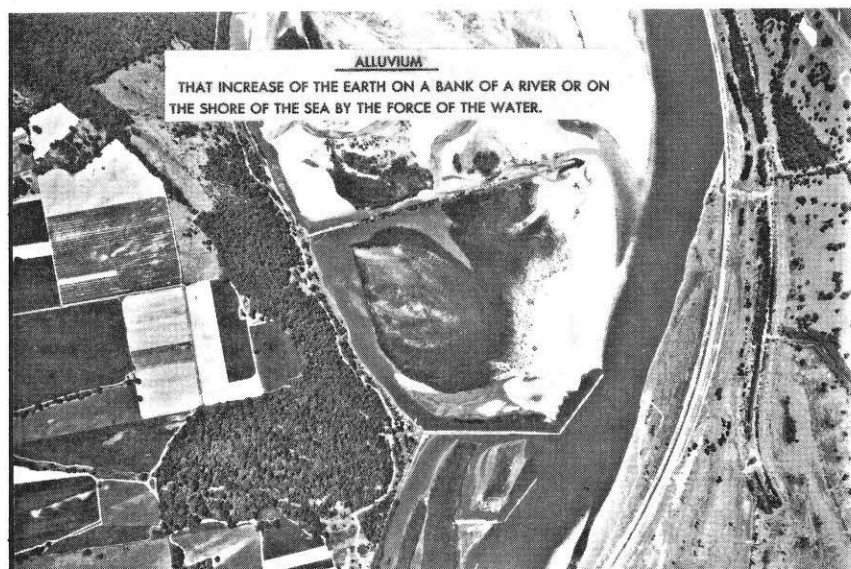


PLATE 3

D. ACCRETION

PLATE 4

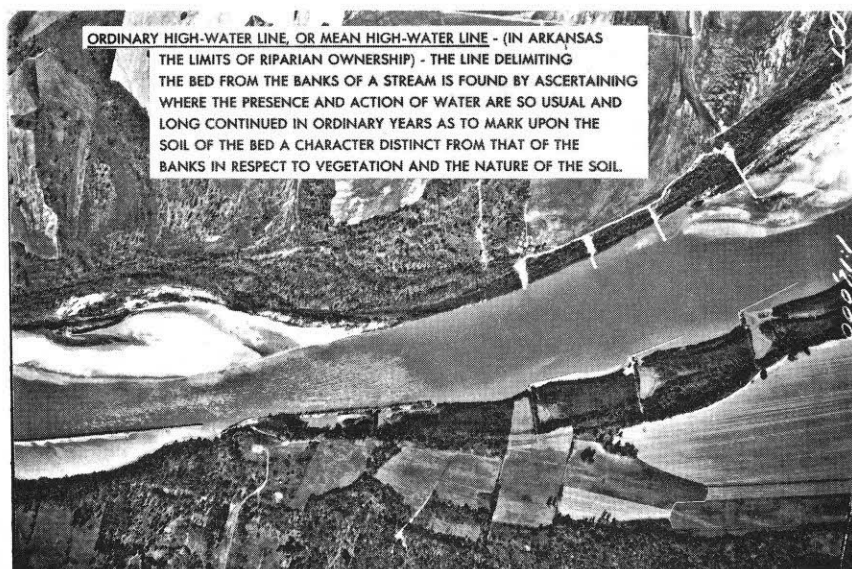
E. ORDINARY HIGH-WATER LINE, OR MEAN HIGH-WATER LINE

PLATE 5

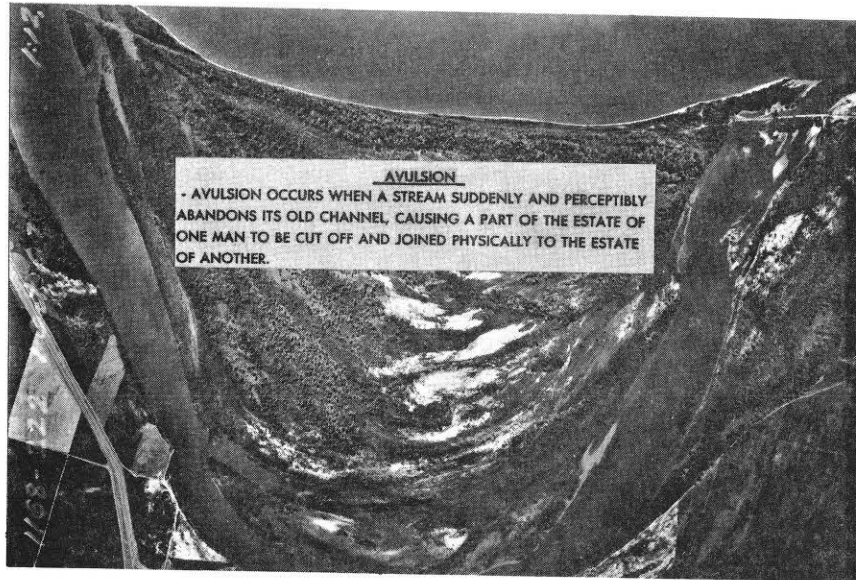
F. AVULSION

PLATE 6

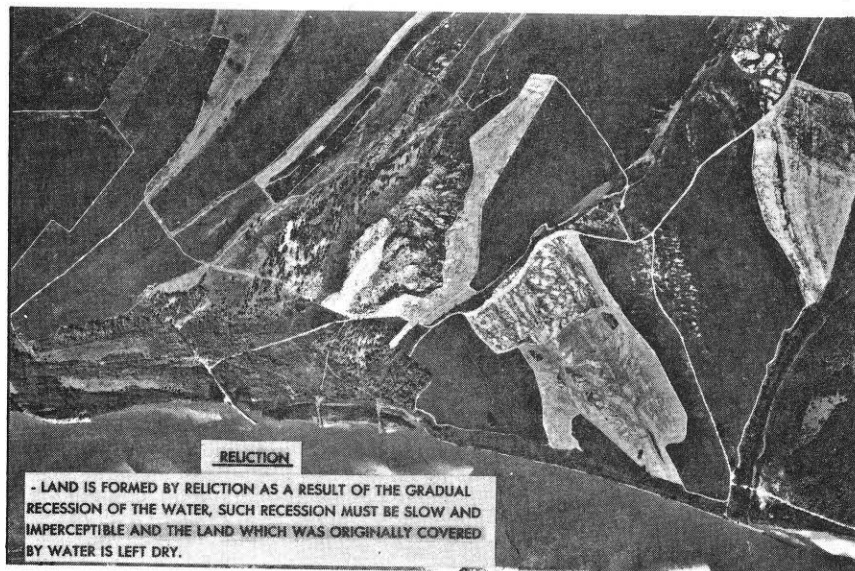
G. RELICION

PLATE 7



H. "EMERGED LAND"

PLATE 8

In the survey of land for the Lower Arkansas River portion of the Arkansas River Multiple-Purpose Plan, we found many occasions not only to use these terms, but a real necessity to know their meanings and their proper use in preparing surveys and legal descriptions. Often only after much difficulty and research of the historical background of the area were we able to determine whether the location of the present watercourse and/or land ownership indicated an accretion or an avulsion, sometimes a reliction, and quite often a combination of one or more. In its meanderings through the flatlands of the lower valley, in the past 150 or so years, the Arkansas River has in many cases wiped out all the original land corners and evidence pertaining thereto; and, after long and careful study and in some cases expensive surveys, were we able to map with a degree of finality the ownerships of the areas. We had our frustrations, as will any land surveyor who

gets involved in this type of survey. Plate No. 9 shows rather clearly one of the major problem areas we encountered and is indicative of some of the problems involved in determining ownerships.

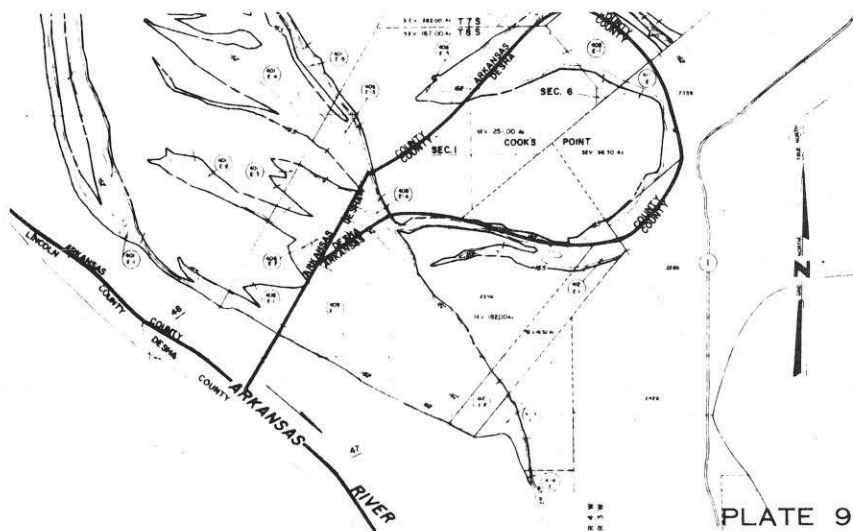


PLATE 9

Note the location of the county line between Arkansas and Desha Counties, as well as the county line between Arkansas and Lincoln Counties. Notice that a portion of Desha County is actually an island completely surrounded by Arkansas County. As a matter of interest, we had to remap this area three times before we finally arrived at these ownerships. This was because of the result of the conclusion of cases involving these lands pending in the courts.

In the course of acquiring and surveying land for the Arkansas River project we ran into several quaint interpretations of the laws and definitions which I have referred to previously. In one instance, a surveyor determined the ordinary or mean high-water level by taking the lowest gage reading of record and the highest and then taking a point halfway between

the two. This he determined to be the ordinary high-water line. This simple solution produced some rather astonishing results, as you can imagine.

The special item I want to discuss has to do with the apportionment of accretions and, strangely enough, the case I will use as an example did not occur on the Lower Arkansas River but considerably upstream. Plate 10 shows the condition of the land at the time of the GLO survey.

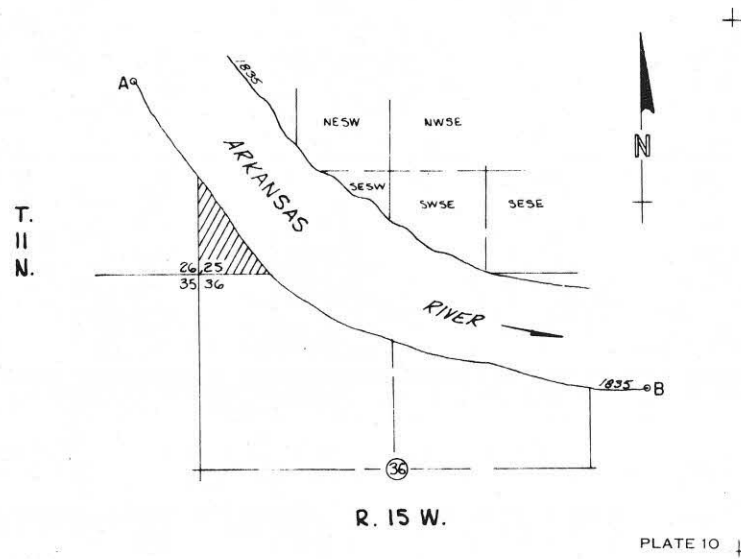
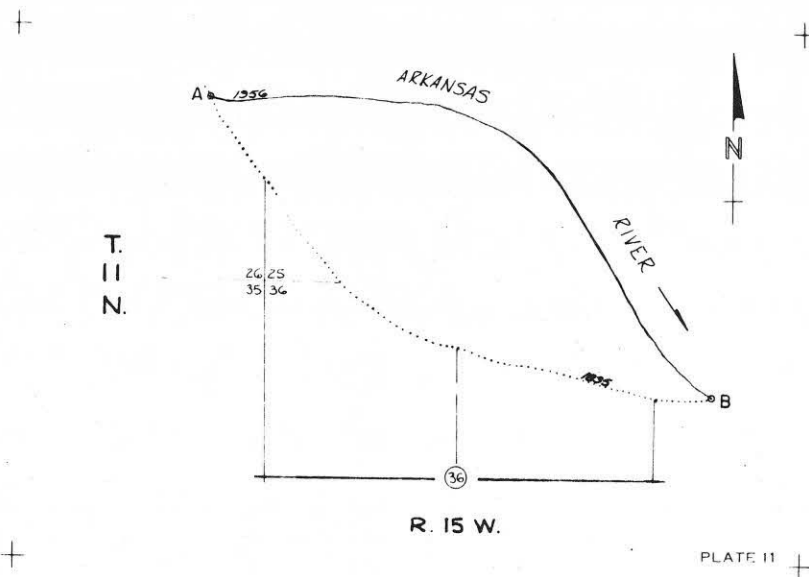


PLATE 10

Notice that in this survey the only part of Section 25 on the west, or right, bank of the river is 7/100ths of an acre designated as the fractional  $SW\frac{1}{4}$  of Section 25.

Now, between 1835 and 1958, a remarkable but not unusual thing happened. The Arkansas River eroded away the left bank and built up accretions to the right bank and, by 1958, the right bank of the river now looked like that shown on Plate 11.



PIATE 11

About this time, a landowner hired a surveyor to survey the boundaries of his ownership, including the accreted land. The surveyor proceeded as follows: from the southwest corner of Section 25, he surveyed a line due north to its intersection with the bank of the river, he then surveyed a line due east to the bank of the river and then, every 1,320 feet in each direction, he set a stake. His survey, when completed, is shown on Plate 12.

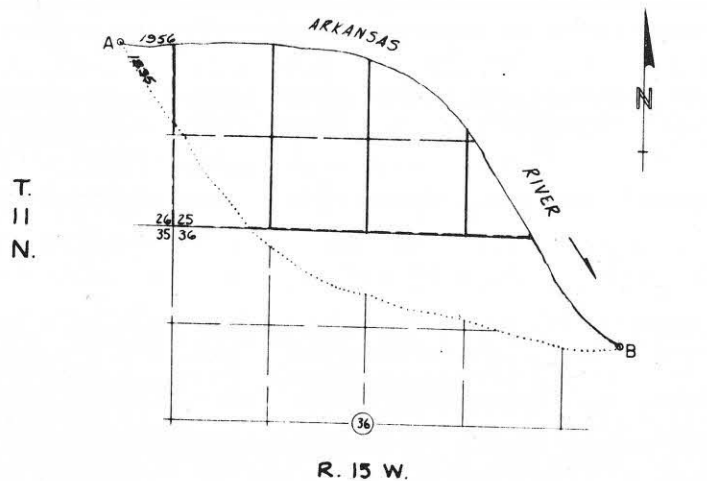


PLATE 12

PIATE 12

Now, as far as convenience and ownership of the land was concerned, there was nothing wrong with this since the landowner had actually taken possession of this land. However, please note that, in plotting the land in this manner, the surveyor established numerous land calls never recorded by the General Land Office and for which, of course, no patents had ever been issued. The existence of these calls made clearing the title to the land impossible and his ownership, which he had perfected by adverse possession, was so clouded with title defects that obtaining a clear title was out of the question.

Now, how should this have been surveyed? Under Arkansas law and based on numerous court decisions the apportionment of accretions must be accomplished so that each riparian owner obtains the same proportionate share of the new shoreline as he held to the old original shoreline. Points A and B are the same at the present time as they were in 1835, and the original distance along the shoreline, as surveyed by the General Land Office, was 6,500 feet (see Plate 13).

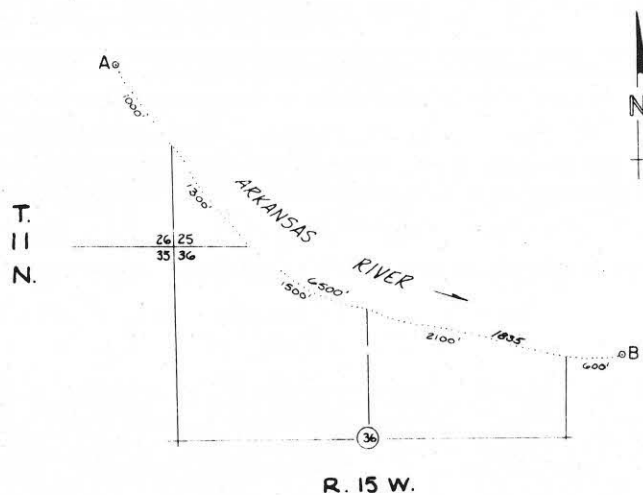


PLATE 13



By 1958, this distance had increased to 6,700 feet. Thus, each owner of land along the new shoreline was entitled to  $\frac{6,700}{6,500}$  feet times the original distance. When the accretion is apportioned as prescribed by law, we find we have the situation shown on Plate 14.

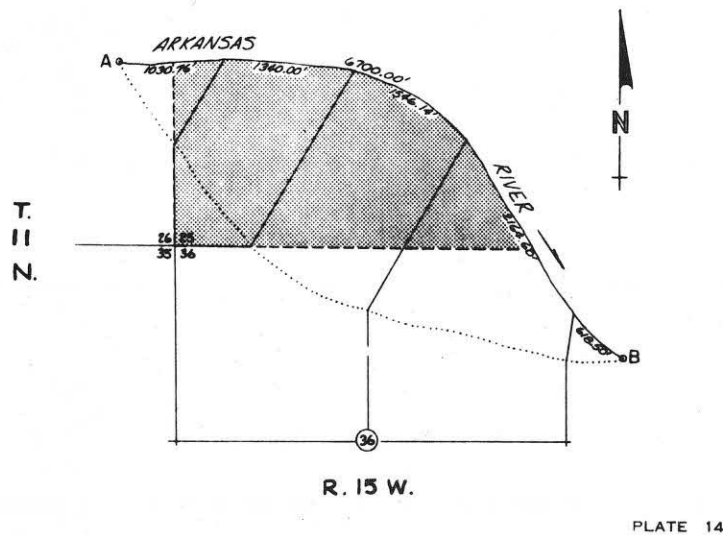


PLATE 14

Note that the ownership in question now looks entirely different and consists of the fractional  $SW\frac{1}{4}$  of Section 25, with accretions thereto; part of the accretions to the fractional  $SE\frac{1}{4}$  of Section 26; and part of the accretions to the  $N\frac{1}{2}$  of Section 36. Of course, the description of the ownership must, of necessity, be described by metes and bounds, but note that we now have a situation where all of the accretion land can be reconciled with the original General Land Office survey and with the chain of title all the way back to the patents.

When the survey was accomplished in this manner, no difficulty in clearing the title to the land was encountered and the Attorney General was able to certify to the title and the title insurance company readily issued title insurance to this land - all because, when the proper analysis of the law of accretions was applied, no difficulty was encountered in preparing a legal description of the land which was factual.

This is only one example of the many problems which face the surveyor who surveys riparian ownerships, but it points up rather dramatically the problems of the surveyor in furnishing his client a survey which is correct, legal, and professional.

THE AVULSION - NATURE'S BAD BOY

When I was trying to think of a title for a paper on avulsions, I started searching in my mind for something that I thought would be appropriate. Figure 1 is a view of the Lower Arkansas River Valley where you can see the many remnants of ancient avulsions. As many surveyors who are familiar with the Lower Arkansas River and other similar rivers are aware, the Arkansas below Little Rock has meandered widely over the alluvial plain, causing many avulsions and cutoffs and, in some places, has traveled as much as 25 miles back and forth across the valley, leaving in its wake the situation that you see in this picture.



FIGURE 1

During the time I was studying and collecting material for this paper I suddenly found out that a certain piece of land on the Arkansas River which we had described as an island and on which the State of Arkansas had issued an Emerged Land Deed, and which we were just about to buy, was not an island at all; but was, in fact, a residual of an accretion which had been severed by an avulsion. I thought back to the days of my childhood when one of the popular novels, which later became a very popular stage play, was a story called "Peck's Bad Boy". The theme of "Peck's Bad Boy" was that the principal character was always getting into something that could cause people all kinds of trouble. Much of the devilment which he carried out in his day caused his parents no end of embarrassment. I could not help but wonder if perhaps many other surveyors had been placed in the same position that I was - that of having an extremely red face due to the fact that I had not recognized an avulsion when I saw one. So - with this in mind - I thought that a very appropriate title might be "The Avulsion - Nature's Bad Boy."

I am fully aware that some of the things discussed in this paper are probably well known to you, and I am sure that many who read this have had much more experience with the problem than I have. However, I would like to discuss this problem a little and perhaps we can uncover a few facts which may be helpful to all of us.

First, let's look at the definition of an avulsion - "An avulsion occurs when a stream suddenly and perceptibly abandons its channel and causes a part of the estate of one man to be cut off and joined to the estate of another." Figure 2 shows the legal definition of an avulsion which appears to be rather widely accepted.

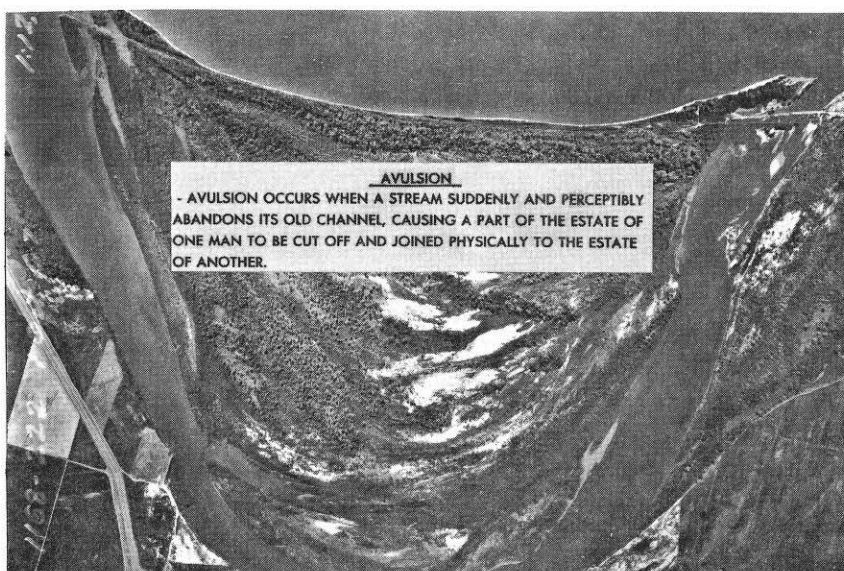


FIGURE 2

This is a typical case where a legal description is sometimes subject to interpretation. Strictly speaking, under this definition unless the land attached to the holdings of another, it would not be an avulsion; however, practically speaking, it may be, and usually is, many years before the attachment actually takes place and becomes factual. Oftentimes it never does. As previously stated - the "island case" that caused my embarrassment was a case where an avulsion had created a typical looking island.



An avulsion can be either natural, as often occurs in times of flood, or it can be man-made. The project for navigation on the Arkansas River resulted in several such man-made avulsions - among them the Boyd Point Cutoff at Pine Bluff, the Brodie Bend Cutoff between Little Rock and Pine Bluff, and numerous others. Also, an avulsion can occur on either a navigable or a non-navigable stream; although we usually think of them in connection with navigable streams.

The principal thing about an avulsion is that it does not change the status of ownership. Unlike the accretion, erosion, reliction, or other changes in land resulting from slow and imperceptible changes, the avulsion, because it is almost instantaneous, changes neither the ownership nor the location of the land in the ownership with reference to section or ownership lines.

Let's look at the history of a typical avulsion which usually causes all the trouble. In Figures 3, 4, 5, and 6 I have tried to sketch a typical situation in which a build-up of land through an accretion followed by an avulsion can cause a great many problems.

In Figure 3 we see a piece of land lying on the right bank descending of a stream which for all practical purposes could be the Arkansas River, or any other rambunctious stream located in an alluvial valley such as the Arkansas.



FIGURE 4

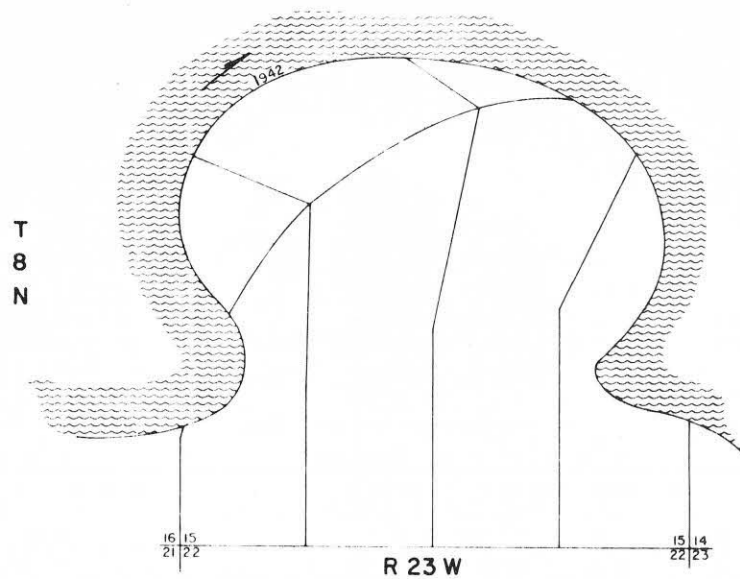


FIGURE 5

Figure 5 shows that the accretion has now grown to a point where the river has started to create prominent bends which become quite susceptible to avulsions, either natural or man-made.

Now, along comes a major flood and everything gets covered with water which is just tearing the heck out of things and, then behold when the water goes down, we find the river back in almost its old channel.

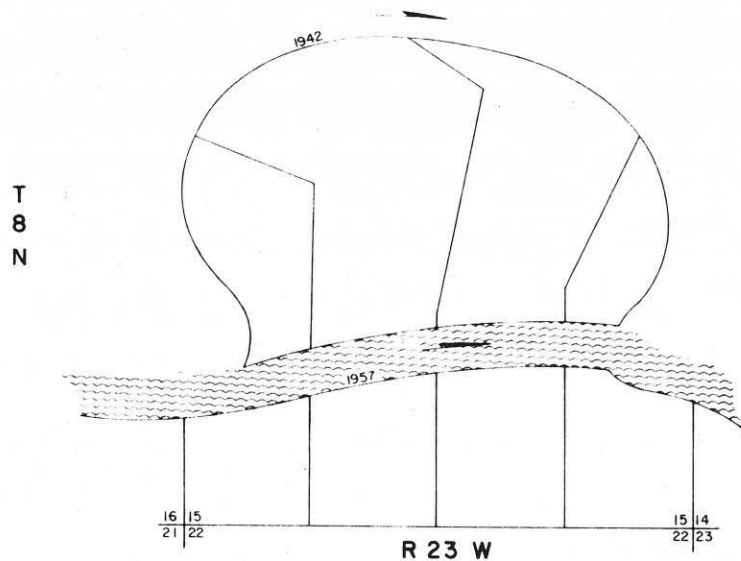


FIGURE 6

As a result of this action a large piece of Mr. Accretion is now on the other side of the river; or, more probably, it looks like an island in the middle of the river with the main stream here and a chute which used to be the river over here. Then, in a few years, the chute fills up and we have all the conditions necessary for a real good lawsuit over the ownership of the land.

Actually, a small part of this area is accretions to the left bank - and the remainder is accretions to land on the other side of the river, which would be described just as though the avulsion had not occurred.

Thus, we see that in the typical avulsion the accretion or land lines do not change, neither does the ownership.

Let's consider a few famous avulsions. When I was a young man just out of college, I worked for the Iowa Highway Commission at Council

Bluffs, Iowa. At that time there was a very well known recreation area in Omaha, Nebraska, known as Carter Lake. Now, in those days, it was always confusing to me why I had to cross the Missouri River from Iowa into Nebraska, go halfway across Omaha to get to Carter Lake, Iowa. I asked my good friend, Dale Kent, who is Chief of the Real Estate Division in the Missouri River Division of the Corps of Engineers, to send me a map of this area to illustrate what Carter Lake, Iowa, looks like many years after the avulsion occurred.

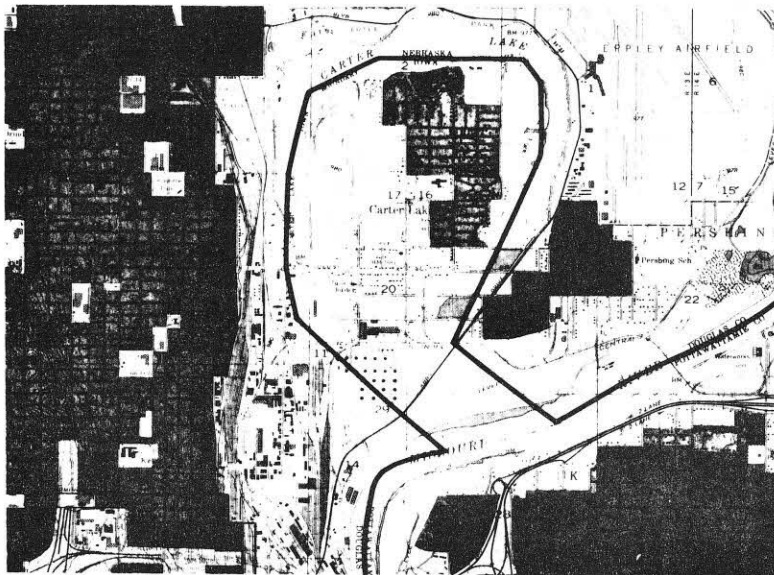


FIGURE 7

There was a landmark lawsuit back in the late 1800's over the ownership of this piece of land. Ultimately the court ruled that, because the land was separated from the mainland of the State of Iowa by an avulsion, it remained a part of the State of Iowa. As you can see, the old lakebed has partially dried up and it is almost impossible at this time to discern



the land on the south side of the area in Nebraska from the land in Iowa. Note that Carter Lake on the north of the area looks very familiar - if it were not for the fact that this is almost downtown in Omaha, it could be any one of a dozen or more lakes in southeastern Arkansas. However, here we have a rather sizeable piece of the State of Iowa completely surrounded by the State of Nebraska and the city of Omaha.

There are several other similar avulsions on the Missouri River. Somewhat closer to home is another avulsion which I have discussed before.

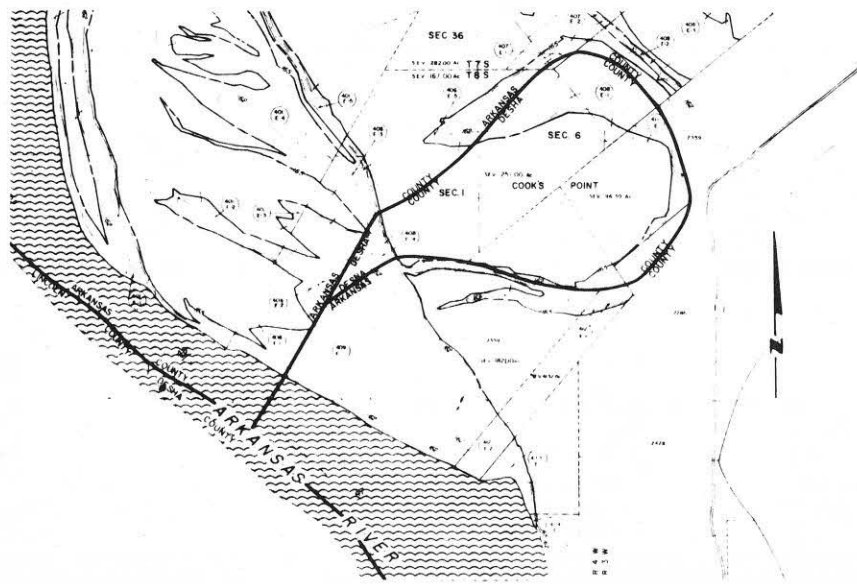


FIGURE 8

Here we find a section on the Arkansas River where a part of Desha County is actually an island surrounded by Arkansas County. Note the similarity between the Carter Lake area and the Desha County area. Here again we see the results of an avulsion in action.





FIGURE 10

Note the typical U-shaped bend with the open end gradually being compressed by the action of the river. As is indicated in this slide, the slow and imperceptible movement has eroded away the land to the south while, at the same time, building up accretions to the land on the left bank. This is the way the land looked in 1942 or early 1943.

During the 1943 flood the river cut off the neck of the bend and, when the flood was over, the area looked like Figure 11.

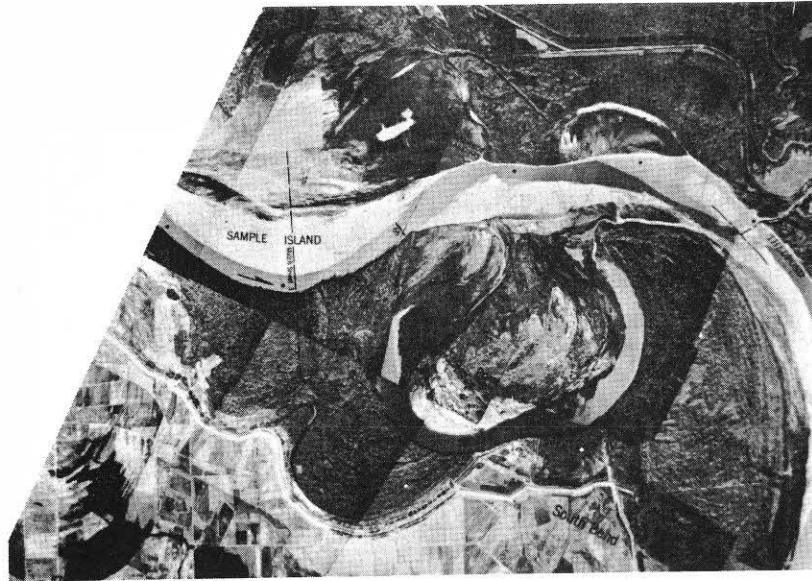


FIGURE 11

When we mapped it for the river project a few years ago, the accretion lines had been laid out and accepted as shown in Figure 12.

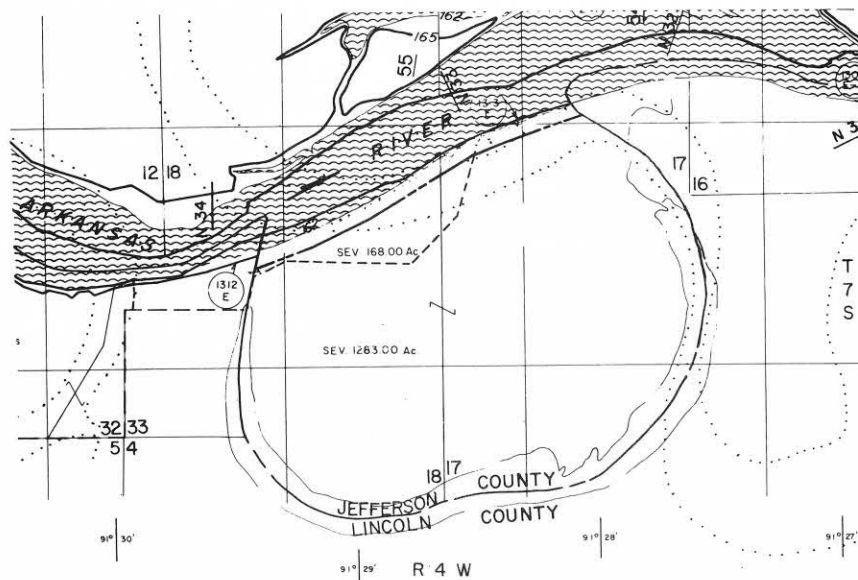


FIGURE 12

Note that all this land was originally in Sections 33, 34, and 35. However, the slow and imperceptible movement of the river had washed away the original landmarks and built up accretions behind its southward movement. This took place over a period estimated as long as 50 years subsequent to a previous avulsion in about 1909. Note that the land in the bendway is now shown as the accretion to Sections 17 and 18, and that the land is actually in Jefferson County rather than in Lincoln County where it was at the time the General Land Office surveys were made.

One of the things about avulsions which entitles it to the name I have selected is that, in most cases, before all the questions of ownership are settled, somebody winds up with a lawsuit. Just a couple of weeks ago I ran into an article in one of our local newspapers which points up rather dramatically what I mean. Here is a question involving the boundary between Arkansas and Mississippi and a question as to the ownership of several thousand acres of land, all hinging on the question - was this an avulsion or an accretion?

As I mentioned, a landmark case is the Iowa-Nebraska case where the Carter Lake avulsion was involved. The area I showed involving land in Desha County was ultimately settled in the Federal Court, and the Diamond Point case is no different. This case was tried in the United States District Court for the Eastern District of Arkansas at Pine Bluff, Arkansas. The Federal Judge who tried the case was the Honorable Gordon Young, now deceased.



This was a well-tried and well-presented lawsuit in which both sides were ably represented and some very knowledgeable witnesses testified both pro and con. For obvious reasons I do not wish to comment in any detail about the case except to say that, if you wish to read it, it can be found in Vol. 241, Federal Supplement, page 300, 1965. For the surveyor who gets involved or is interested in riparian surveys, it is a most interesting case and well worth the reading. Here again you will find that there was a question as to whether this was an island or not. In fact, as was brought out in the testimony, the State Land Office at one time issued an Emerged Land Deed to the area. The principal thing to remember is that, in the case of an avulsion, neither the land lines, the accretion lines, nor the ownership lines change as a result of the avulsion. This is, of course, contrary to the situation found in the case of erosions, accretions, and/or relictions.

In conclusion let me say that I have mentioned the Diamond Point case, the Carter Lake case, and several others where land ownerships were ultimately decided by litigation only after protracted studies and a great deal of testimony was presented by experts in court. In many cases these experts were sincere and well qualified on both sides of the question. If you read these cases, look carefully at the type of testimony presented; this can have a bearing on your surveys and conclusions.

As most of you know, in a lawsuit, particularly where the case is tried to a jury, one of the last actions the Judge takes before he turns the case over to the jury for a decision is to instruct the jury as to the law and how it must be applied to the testimony. Let me read to you from a part of the instructions often given the jury, particularly in the Federal Courts:

"You will recall that some of the witnesses gave testimony concerning their qualifications as experts in the field of potamology, surveying, forestry, etc. When a case involves a matter of science or art requiring special knowledge or skill not ordinarily possessed by the average person, an expert is permitted to state his opinion for the information of the court and jury. The opinion stated by the expert who testified before you was based on particular facts that the expert himself observed and testified to before you. You may reject an expert's opinion if you find the facts to be different from those that form the basis for the opinion. You may also reject his opinion if, after consideration of all the evidence in the case, expert and others, you disagree with the opinion. In other words, you are not required to accept an expert's opinion to the exclusion of the facts and circumstances disclosed by other testimony. Such an opinion is subject to the same rules concerning reliability as the

testimony of any other witnesses, it is given to assist you in reaching a proper conclusion, is entitled to such weight as you find the expert's qualifications in his field warrant, and must be considered by you but is not controlling on your judgment."

As often happens in lawsuits involving surveys, there are differences of opinions by different surveyors or different experts concerning the how and why of their conclusions. Recognizing this fact, the Judge in his instructions to the jury often adds an additional instruction as follows:

"If you find that a conflict exists in the testimony of the expert witnesses, you must resolve that conflict by weighing the various opinions and reasons for such opinions given by each of the experts, as well as the relative credibility and knowledge of the experts who have testified. Thereupon you must find in favor of that expert testimony which in your opinion is entitled the greatest weight."

Let me repeat one sentence: "You must resolve that conflict by weighing the various opinions and reasons for such opinions given by each of the experts, as well as the relative credibility and knowledge of the experts who have testified."

In the study and surveys of avulsions we often find one of the most complex and controversial subjects in which a surveyor is liable to find

himself. Generally this type of a survey and the resolution of the problems involved cannot be solved merely by a survey, but must include a study of the background of the conditions as they existed in the past, the study of the area as to its ecological relationships, the types of soil and vegetation, and any other information that can be obtained. It is often necessary to call in experts other than the surveyor himself to present evidence which the surveyor cannot present as an expert unless he can show that his qualifications are such to lend sufficient weight to his testimony in the eyes of the jury. Many surveyors, because of their long and continued activities and the very nature of their activities, are often qualified in more ways than just in surveying; and, the value of the surveyor as a witness in cases of this kind often depends on his professionalism, his expertise, and his knowledge and background of the situation which he is presenting, as well as his knowledge of the law and its applications.

We have reached the time when the surveyor who takes the witness stand is recognized as a professional and whose testimony is considered that of an expert and not just the opinion of an individual. How well we solve the problem of avulsions or other survey situations will greatly influence the extent to which our profession will be recognized as a "Learned Art".



It is not unusual for the surveyor who is making a retracement to come upon the location of an original corner only to find that it is in the right-of-way of a road, pipeline or some other type of construction. In other cases, the surveyor may find himself in the middle of a deep woods which to all appearances has not been touched for years, and yet all efforts to locate the original corner or any evidence of it fail in spite of the fact that the corner should be there. These are the cases of lost and obliterated corners, and in such cases the surveyor must have some way to replace this corner in the location which will most nearly duplicate the original location. Clark in his book *Surveying and Boundaries* says:

"Where the passage of time has erased the evidence of a missing corner marker it becomes incumbent upon the surveyor to determine exactly where the marker once rested on the ground.

To assist in this locating, the United States Government has set out in its "Manual of Surveying Instructions" as revised from time to time, a series of guides for surveyors to follow.

The surveyor must remember that in following these guides he is merely seeking evidence as to where the corner was placed. The surveyor has no legal authority to make a new corner and his findings are treated merely as evidentiary even though he follows the government regulations unless the laws of the state permit an official surveyor appealing under a legal procedure to re-establish the corner."

The Manual of Surveying Instructions emphasizes that the question is not where a new and exact running of the lines would locate the corner, but where and at what particular location the original corner was established by the original survey.

The manual also emphasizes that the methods described therein are to be used only after it has been definitely determined that no physical evidence exists or can be found. The extent to which the surveyor is expected to rely on evidence is pointed out in Chapter V, paragraph 5, of the manual:

"Even though its physical evidence may have entirely disappeared, a corner will not be regarded as lost if its position can be recovered through the testimony of one or more dependable witnesses who have a dependable knowledge of the original location."

The majority of the expenditure in time, labor, research, etc., to locate, identify or restore the position of corners is wasted if the corner position is not physically marked on the ground, and the proper records prepared and placed in public records for use of the next person who needs the corner. The type of monument used, the materials of which it is made or various methods of placement in order to insure permanency are too extensive for discussion in this volume. The practicing surveyor will determine these items as required by his clients demands. However, all (or at least key corners) should be constructed of permanent type materials and be clearly marked to identify the corner it represents, who placed it and when. Since the Bureau of Land Management (BLM), formerly the General Land Office, has almost 200 years of expertise in the creation and establishment of the public land system, Chapter IV of the manual is included, following Chapter V. Also included is a worksheet which expands on section 4-39 and figures 65 and 66.

The office of the State Surveyor has adopted the BLM system of marking corner monuments in connection with all remonumentation professional services contracts and co-operative agreements under its Corner Restoration Program. The National Forest Service uses this



method. Since this system is uniform in all the rectangular or public land states, all surveyors should become familiar with and use the system whenever appropriate.

### **Manual of Surveying Instructions — Chapter V Restoration of Lost or Obliterated Corners**

5-1. The rules for identifying an approved official survey differ from those under which the survey was originally made. The purpose is not to "correct" the original survey by determining where a new or exact running of the line would locate a particular corner, but rather to determine where the corner was established in the beginning. The methods described here follow leading judicial opinions and approved surveying practice.

5-2. Congress has empowered the Secretary of the Interior, or such officer as he may designate, to perform all executive duties appertaining to the survey of public lands. Where public lands are involved, the final authority to approve or disapprove the procedure for the restoration of a lost or obliterated corner rests with the Secretary, acting through the Director, Bureau of Land Management. If privately owned lands are involved, consideration is given to any protest made by an interested person concerning the work of a surveyor employed by the Bureau of Land Management. However, the Director cannot assume jurisdiction over or responsibility for the acts or results of surveys made by the county, local, or private surveyors, or by surveyors or engineers who may be employed by other branches of the Federal Government.

5-3. A boundary dispute between private landowners may be brought before the local court of competent jurisdiction. The Director, Bureau of Land Management, will not be bound by a court decision if the United States is not a party to a suit affecting public lands when evidence of the official survey was disregarded or there was some other departure from good surveying practice.

### **IDENTIFICATION OF EXISTENT CORNERS**

5-4. The terms "corner" and "monu-

ment" are not interchangeable. A "corner" is a point determined by the surveying process. A "monument" is the object or the physical structure which marks the corner point.

The "corners" of the public land surveys are those points that determine the boundaries of the various subdivisions represented on the official plat — the township corner, the section corner, the quarter-section corner, the subdivision corner, or the meander corner. The "mile corner" of a State, reservation, or grant boundary does not mark a point of a subdivision; it is a station along the line, however, and long usage has given acceptance to the term. An "angle point" of a boundary marks a change in the bearing, and in that sense it is a corner of the survey.

"Monuments" of the public land surveys have included the deposit of some durable memorial, a marked wooden stake or post, a marked stone, an iron post having an inscribed cap, a marked tablet set in solid rock or in a concrete block, a marked tree, a rock in place marked with a cross (X) at the exact corner point, and other special types of markers, some of which are more substantial; any of these is termed a "monument." The several classes of accessories, such as bearing trees, bearing objects, reference monuments, mounds of stone, and pits dug in the sod or soil are aids in identifying the corner position. In their broader significance the accessories are a part of the corner monument.

5-5. *An existent corner is one whose position can be identified by verifying the evidence of the monument or its accessories, by reference to the description in the field notes, or located by an acceptable supplemental survey record, some physical evidence, or testimony.*

*Even though its physical evidence may have entirely disappeared, a corner will not be regarded as lost if its position can be recovered through the testimony of one or more witnesses who have a dependable knowledge of the original location.*

5-6. The recovery of previously established corners is simplified by projecting retracements from known points. The final search for a monument should cover the zone surrounding one, two, three, or four points determined by connection with known corners. These corners will ultimately control the relocation in case the corner being searched for is declared lost.

The search for the original monument should include a simultaneous search for its accessories. The evidence can be expected to range from that which is least conclusive to that which is unquestionable; the need for corroborative evidence is therefore in direct proportion to the uncertainty of any feature in doubt or dispute. The evidence should agree with the record in the field notes of the original survey subject to natural changes. Mounds of stone may have become imbedded, pits may have filled until only a faint outline remains, blazes on bearing trees may have decayed or become overgrown.

5-7. After due allowance has been made for natural changes, there may still be material disagreement between the particular evidence in question and the record calls. The following considerations will prove useful in determining which features to eliminate as doubtful:

(1) The character and dimensions of the monument in evidence should not be widely different from the record.

(2) The markings in evidence should not be inconsistent with the record.

(3) The nature of the accessories in evidence, including size, position and markings, should not be greatly at variance with the record.

Allowance for ordinary discrepancies should be made in considering the evidence of a monument and its accessories. No set rules can be laid down as to what is sufficient evidence. Much must be left to the skill,

fidelity, and good judgment of the surveyor, bearing in mind the relation of one monument to another and the relation of all to the recorded natural objects and items of topography.

5-8. No decision should be made in regard to the restoration of a corner until every means has been exercised that might aid in identifying its true original position. The retracements will indicate the probable position and will show what discrepancies are to be expected. Any supplemental survey record or testimony should then be considered in the light of the facts that developed.

*5-9. An obliterated corner is one at whose point there are no remaining traces of the monument or its accessories, but whose location has been perpetuated, or the point for which may be recovered beyond reasonable doubt by the acts and testimony of the interested landowners, competent surveyors, other qualified local authorities, or witnesses, or by some acceptable record evidence.*

*A position that depends upon the use of collateral evidence can be accepted only as duly supported, generally through proper relation to known corners, and agreement with the field notes regarding distances to natural objects, stream crossings, line trees, and off-line tree blazes, etc., or unquestionable testimony.*

5-10. A corner is not considered as lost if its position can be recovered satisfactorily by means of the testimony and acts of witnesses having positive knowledge of the precise location of the original monument. The expert testimony of surveyors who may have identified the original monument prior to its destruction and recorded new accessories or connections is by far the most reliable, though landowners are often able to furnish valuable testimony. The greatest care is necessary in order to establish the bona fide character of the record intervening after the destruction of an original monument. Full inquiry may

bring to light various records relating to the original corners and memoranda of private markings, and the surveyor should make use of all such sources of information. The matter of boundary disputes should be carefully looked into insofar as adverse claimants may base their contentions upon evidence of the original survey. If such disputes have resulted in a boundary suit, the record testimony and the court's decision should be carefully examined for information which may shed light upon the position of an original monument.

5-11. The testimony of individuals may relate to the original monument or the accessories, prior to their destruction, or to any other marks fixing the locus of the original survey. Weight will be given such testimony according to its completeness, its agreement with the original field notes, and the steps taken to preserve the original marks. Such evidence must be tested by relating it to known original corners and other calls of the original field notes, particularly to line trees, blazed lines, and items of topography.

There is no clearly defined rule for the acceptance or non-acceptance of the testimony of individuals. It may be based upon unaided memory over a long period or upon definite notes and private marks. The witness may have come by his knowledge casually, or he may have had a specific reason for remembering. Corroborative evidence becomes necessary in direct proportion to the uncertainty of the statements advanced. The surveyor should bear in mind that conflicting statements and contrary views of interested parties are fruitful of boundary disputes.

The surveyor will show in the field notes, or in the report of a field examination, the weight given testimony in determining the true point for an original corner. (Section 8-18.) The following points will serve as a guide:

(1) The witness (or record evidence) should be duly qualified: The knowledge or information should be firsthand, not hearsay; it

should be complete; it should not be merely personal opinion.

(2) The testimony (or record statement) should be such as can stand an appropriate test of its bona fide character.

(3) The testimony (or the record) must be sufficiently accurate, within a reasonable limit, for what is required in normal surveying practice.

5-12. Any marks made either before or subsequent to the official survey, or at the time of the survey but not under the direction of the chief of field party, are not to be regarded as evidence of that survey excepting as an appropriate relation is fully authenticated by field notes or qualified testimony. Reference should be made in the field notes, however, if the marks are of a permanent nature. If such marks or monuments are rejected, the reason should be shown by the new record.

5-13. One additional caution, addressed especially to the surveyor employed by the Bureau of Land Management, is to bear in mind that his professional work is technical in character, not legal or judicial. The surveyor is not a referee as to the justice or injustice of a situation, nor is he qualified to act judicially upon the equities or inequities that may appear to be involved.

5-14. The above conditions and procedures are brought out in the leading court opinions in cases available in law libraries. Reference books on the legal elements of surveying and boundaries also cite court opinions and deal with these subjects. The treatment by the authorities of the question of testimony and physical evidence, *as to acceptability*, demonstrates the importance of the principles mentioned: due qualification, bona fide character, accuracy.

5-15. A line tree or a *definite* connection to readily identified natural objects or improve-

ments may fix a point of the original survey. The *mean* position of a blazed line, when identified as the original line, may help to fix a meridional line for departure, or a latitudinal line for latitude. Such blazed lines must be carefully checked, because corrections may have been made before final acceptance of the old survey or more than one line may have been blazed.

5-16. The proper use of topographic calls of the original field notes may assist in recovering the locus of the original survey. Such evidence may merely disprove other questionable features, or it may be a valuable guide to the immediate vicinity of a line or corner. At best, it may fix the position of a line or corner beyond reasonable doubt.

Allowance should be made for ordinary discrepancies in the calls relating to items of topography. Such evidence should be considered more particularly in the aggregate; when it is found to be corroborative, an average may be secured to control the final adjustment. This will be governed largely by the evidences nearest the particular corner in question, giving the greatest weight to those features that agree most closely with the record, and to such items as afford definite connection.

A careful analysis should be made by the surveyor before using topographic calls to fix an original corner point. Indiscriminate use will lead to problems and disputes where two or more interpretations are possible. Close attention should be given to the manner in which the original survey was made. Instructions for chaining in the earlier manuals indicate that memory was an important factor in recording distances to items of topography. Early field notes often appear to have shown distances only to the nearest chain or even a wider approximation.

In comparing distances returned in the original field notes with those returned in the resurveys, gross differences appear in a significant number of instances. In some cases the

original surveyor apparently surveyed a line in one direction, but then reversed the direction in his record without making corresponding changes in distances to items of topography. These facts have sometimes caused distrust and virtual avoidance of the use of topography in corner restoration where proper application might be extremely helpful. Misapplication usually may be avoided by applying the following tests:

(1) The determination should result in a definite locus within a small area.

(2) The evidence should not be susceptible of more than one reasonable interpretation.

(3) The corner locus should not be contradicted by evidence of a higher class or by other topographic notes.

The determination of the original corner point from even fragmentary evidence of the original accessories, generally substantiated by the original topographic calls, is much stronger than determination from topographic calls alone. In questionable cases it is better practice, in the absence of other collateral evidence, to turn to the suitable means of proportionate measurement.

#### 5-17. *Witness Corners*

Ordinarily a witness corner established in the original survey will fix the true point for the corner at record bearing and distance. Where the witness corner was placed on a line of the survey, if no complications arise, it will be used as control from that direction in determining the proportionate position of the true point. Thus the record bearing and distance would be modified, and the witness corner would become an angle point. Unfortunately, the factual statements of the original field notes are not always clear. The record may indicate that the witness corner was established on a random line, or there may be an apparent error of calculation for distance along the true line. The monument may not have been



marked "WC" plainly or at all. In these instances, or where there is extensive obliteration, each corner must be treated individually. The important consideration is to locate the true corner point in its original position.

Since the true point for the corner will usually be of major importance, the surveyor will proceed directly to its determination by the applicable methods if the witness corner is lost. If it is then impracticable to monument the true point, a new witness corner will be established and marked as directed in the sections of chapter IV devoted to corner monuments and accessories.

#### 5-18. *Line Trees*

Under the law, a *definitely identified* line tree is a monument of the original survey. It properly is used as a control point in the reestablishment of lost corners by the appropriate method of proportionate measurement. In this case it is treated just as is a recovered corner, and it becomes an angle point of the line.

A problem arises where, as in some older surveys, line trees were improperly established on a random line (and so recorded in the field notes) rather than on the true line. Each case must be considered on its merits, but such line trees are generally of most value as guides in locating the original corners. It may occasionally be necessary to treat them as control points where there has been extensive obliteration of the corners themselves. The making of proportionate offsets from line trees on the random line to determine angle points of the true line lends the trees more influence than is warranted. In adopting such a scheme the surveyor would be assuming that if the original surveyor had followed the survey of the random line with a survey of the true line he would have created angles at the same points as on the random line. The fact is that there might well have been angles in the true line, but they would be wherever the line struck trees on the true line—not at the same distances at all. The most probable location of the true line would be on a

straight line between the corners, if these corners are recovered, as reported in the record subsequent to the field notes of the random line.

#### 5-19. *State Boundary Monuments*

The Bureau of Land Management has no general authority to survey or resurvey State boundaries. The original survey of certain State boundaries was executed under the former General Land Office when specifically authorized by act of Congress. The resurvey of a State boundary may be made under direction of the Supreme Court or may be authorized by the States involved with the consent of Congress. In connection with the survey or resurvey of public lands it is proper to *retrace* as much of the State boundary as may be needed for a suitable closing. Closing corners are not marked as defining the State boundary. Identified original State boundary corners may properly be remonumented, but lost corners should not be restored unless this is specifically sanctioned by appropriate authority.

### THE RESTORATION OF LOST CORNERS

5-20. *A lost corner is a point of a survey whose position cannot be determined, beyond reasonable doubt, either from traces of the original marks or from acceptable evidence or testimony that bears upon the original position, and whose location can be restored only by reference to one or more interdependent corners.*

5-21. The rules for the restoration of lost corners should not be applied until all original and collateral evidence has been developed. When these means have been exhausted, the surveyor will turn to proportionate measurement, which harmonizes surveying practice with legal and equitable considerations. This plan of relocating a lost corner is always employed unless outweighed by conclusive evidence of the original survey.

5-22. The preliminary retracements show the discrepancies of courses and distances between the original record and the findings of the retracement. The retracement is based upon the courses and distances of the original survey record, initiated and closed upon known original corners. Temporary stakes for future use in the relocation of all lost corners are set when making the retracements.

5-23. Existing original corners may not be disturbed. Consequently, discrepancies between the new measurements and the measurements shown in the record have no effect beyond the identified corners. The differences are distributed proportionally within the several intervals along the line between the corners.

The retracements will show various degrees of accuracy in the lengths of lines, where in every case it was intended to secure true horizontal distances. Until after 1900 most of the lines were measured with the Gunter's link chain. Such a chain was difficult to keep at standard length, and inaccuracies often arose in measuring steep slopes by this method.

All discrepancies in measurement should be carefully verified with the object of placing each difference where it properly belongs. Whenever it is possible to do so, the manifest errors in measurement are removed from the general average difference and placed where the blunder was made. The accumulated surplus or deficiency that then remains is the quantity that is to be uniformly distributed by the methods of proportionate measurement.

5-24. A proportionate measurement is one that gives equal relative weight to all parts of the line. The excess or deficiency between two existent corners is so distributed that the amount given to each interval bears the same proportion to the whole difference as the record length of the interval bears to the whole record distance. After the proportionate difference is added to or subtracted from the record length of each interval, the sum of the several parts will equal the new measurement of the

whole distance.

The type of proportionate measurement to be used in the restorative process will depend on the method which was followed in the original survey. *Standard parallels will be given precedence over other township exteriors, and ordinarily the latter will be given precedence over subdivisional lines; section corners will be relocated before the position of lost quarter-section corners can be determined.*

### Primary Methods

#### *Double Proportionate Measurement*

5-25. *The term "double proportionate measurement" is applied to a new measurement made between four known corners, two each on intersecting meridional and latitudinal lines, for the purpose of relating the intersection to both.*

In effect, by double proportionate measurement the record directions are disregarded, excepting only where there is some acceptable supplemental survey record, some physical evidence, or testimony that may be brought into the control. Corners to the north and south control any intermediate latitudinal position. Corners to the east and west control the position in longitude. One identified original corner is balanced by the control of a corresponding original corner on the opposite side of a particular missing corner which is to be restored. Each identified corner is given a controlling weight inversely proportional to its distance from the lost corner. *Lengths of proportioned lines are comparable only when reduced to their cardinal equivalents.* The method may be referred to as a "four-way" proportion. The method of double proportionate measurement is generally applicable to the restoration of lost corners of four townships and of lost interior corners of four sections.

5-26. *In order to restore a lost corner of four townships, a retracement will first be made between the nearest known corners on*



*the meridional line, north and south of the missing corner, and upon that line a temporary stake will be placed at the proper proportionate distance; this will determine the latitude of the lost corner.*

*Next, the nearest corners on the latitudinal line will be connected, and a second point will be marked for the proportionate measurement east and west; this point will determine the position of the lost corner in departure (or longitude).*

*Then, through the first temporary stake run a line east or west and through the second temporary stake a line north or south, as relative situations may determine; the intersection of these two lines will fix the position for the restored corner.*

Figure 70 illustrates the plan of double proportionate measurement. Points A, B, C, and D represent four original corners which will control the restoration of the lost corner X. On the large scale diagram the point E represents the proportional measurement between A and B, and similarly, the point F represents the proportional measurement between C and D. The point X satisfies the first control for latitude and the second control for departure.

5-27 A lost township corner cannot safely be restored, nor the boundaries ascertained, without first considering the field notes of the four intersecting lines. It is desirable also to examine the four township plats. In most cases there is a fractional distance in the half-mile to the east of the township corner, and frequently in the half-mile to the south. The lines to the north and to the west are usually regular, with quarter-section and section corners at normal intervals of 40.00 and 80.00 chains, but there may be closing-section corners on any or all of the boundaries so that it is important to verify all distances by reference to the field notes.

5-28. *Lost interior corners of four sections, where all the lines therefrom have been run, will also be reestablished by double propor-*

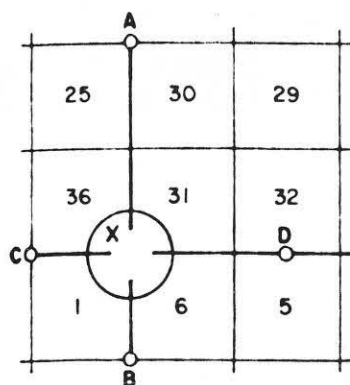
*tionate measurement. The control for such restoration will not extend beyond the township boundary. If the controlling corner on the boundary is lost, that corner must be reestablished beforehand.*

5-29. *Where the line has not been established in one direction from the missing township or section corner, the record distance will be used to the nearest identified corner in the opposite direction.*

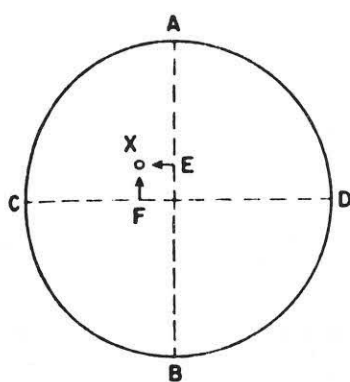
Thus, in figure 70, if the latitudinal line in the direction of the point D has not been established, the position of point F in departure would have been determined by reference to the record distance from the point C; the point X would then be fixed by cardinal offsets from the points E and F as already explained.

*Where the intersecting lines have been established in only two of the directions, the record distances to the nearest identified corners on these two lines will control the position of the temporary points; then from the latter the cardinal offsets will be made to fix the corner point.*

An index correction for average error in measurement, if applicable, should be made in applying these two rules (see section 5-45). What is intended by *record* distance is the measure established in the original survey. Experience and good judgment are required in applying the rules. If the original survey was carelessly executed, no definite standard can be set up as representing that survey. On the other hand, the work may have been reasonably uniform within its own limits, yet inaccurate with respect to exact base standards. It is the consistent excess or deficiency of the original work that is intended here, if that can be determined within practical limits. Otherwise the only rule that can be applied is that a record of 80.00 chains in distance means just that by exact standards, true horizontal measurement.



Lost township corner in vicinity of X

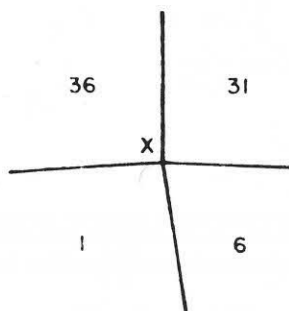


A,B,C,D—Control corners

E—Proportionate point for X in latitude between A and B

F—Proportionate point for X in departure between C and D

Correct position of X is at intersection of lines extended East or West from E, North or South from F.



Restored corner showing true direction of township lines

FIGURE 70.—Double proportionate measurement.

### Single Proportionate Measurement

5-30. The term "single proportionate measurement" is applied to a new measurement made on a line to determine one or more positions on that line.

By single proportionate measurement the position of two identified corners controls the direction of that line. The method is sometimes referred to as a "two-way" proportion, such as a north-and-south proportion or an east-and-west proportion. Examples are a quarter-section corner on the line between two section corners, all corners on standard parallels, and all corners occupying intermediate positions on a township boundary line.

5-31. In order to restore a lost corner on a line by single proportionate measurement, a retracement is made connecting the nearest identified corners on the line. These corners control the position of the lost corner. Control corners are usually corners established in the original survey of the line. The lost corner is then re-established at proportionate distance on the true line connecting the recovered corners. Proper adjustment is made on an east and west line to secure the latitudinal curve. Any number of intermediate lost corners may be located on the same plan.

5-32. Restorations of lost corners of standard parallel are controlled by the regular standard corners. These include the standard township, section, quarter-section, and sixteenth-section corners, and meander corners, and also closing corners which were originally established by measurement along the standard line as points from which to start a survey.

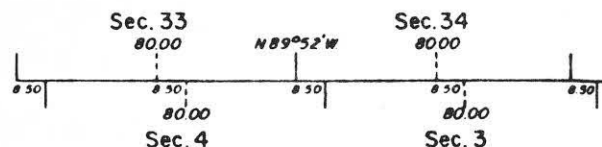
*Lost standard corners will be restored to their original positions on a base line, standard parallel, or correction line, by single proportionate measurement on the true line connecting the nearest identified standard corners on opposite sides of the missing corner or corners, as the case may be.*

5-33. Corners on base lines are regarded the same as those on standard parallels. In the older practice the term "correction line" was used for what has later been called the standard parallel. The corners first set in the running of a correction line are treated as original standard corners. Those that were set afterwards at the intersection of a meridional line are regarded as closing corners.

5-34. All lost section and quarter-section corners on the township boundary lines will be restored by single proportionate measurement between the nearest identified corners on opposite sides of the missing corner, north and south on a meridional line, or east and west on a latitudinal line.

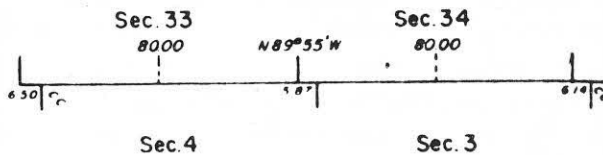
5-35. Two sets of corners have been established on many township lines and on some section lines. Each set applies only to sections on its respective side of the line. Which corners control in the restoration of a lost corner will depend on how the line was surveyed. Three common cases are discussed:

(1) Where both sets of corners have been established by measurement along the line in a single survey, each corner controls equally for both measurement and alignment.

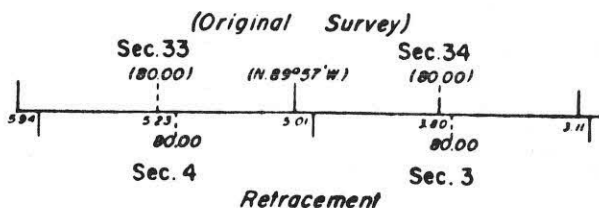


(2) Where a single set of corners was established in the survey of the line and closing corners were subsequently established at intersection of section lines on one side, the corners first established control both the alignment and the proportional measurement along the line. The original quarter-section corners nearly always referred to sections on only one side of the line after the closing corners were established on the other side. The quarter-section corners for sections on the side to which the

closing corners refer were not established in older surveys. The correct positions are as protracted on the plat of those sections. (See also section 5-41. Closing Corners.)



(3) Sometimes one set of corners was established for one side of the line, and a second set of corners was established for the other side in the course of a later retracement.



The line is regarded as having been fixed in position by the senior survey unless that survey was officially superseded. If both sets of corners are recovered, a junior corner lying off the line is treated in the same manner as a closing corner insofar as the alinement is concerned. Since it was established in the course of a retracement reporting the most recent measurement of the line, a junior corner properly can be used for control in restoring a lost corner of the line insofar as measurement is concerned. This procedure is not advisable where the corner is far off line because a bearing in the connecting section line would change its true position relative to other corners of the line. That condition can only be shown by retracing enough of the connecting section line to determine its bearing. Where there has been extensive loss of corners, particularly the senior corners, the existent junior corners may also constitute the best available evidence of the line itself. In such a case they will exercise control for both measurement and alinement.

On rare occasions the second surveyor

patently established a completely separate line and thereby created a hiatus or overlap. Each set of corners would then control only its respective line. Where complications develop, the surveyor should report to his supervising office the identity and correlation of corners or other evidence recovered before restoring the lost corners. Each such case must be considered individually. The same instruction applies to lines on which the original corners have become angle points and which therefore may have three sets of corners.

5-36. Some township boundaries, not established as straight lines, are termed "irregular" exteriors. Parts were surveyed from opposite directions and the intermediate portion was completed later by random and true line, leaving a fractional distance. Such irregularity follows some material departure from the basic rules for the establishment of original surveys. A modified form of single proportionate measurement is used in restoring lost corners on such boundaries. This is also applicable to a section line or a township line which has been shown to be irregular by a *previous* retracement. Figure 71. (Page 94.)

In order to restore one or more corners or angle points on such irregular exteriors, a retracement between the nearest known corners is made on the record course and distances to ascertain the direction and length of the closing distance. A temporary stake is set for each missing corner or angle point. The closing distance is then reduced to its equivalent latitude and departure.

On a meridional line the *latitude* of the closing distance is distributed among the courses in proportion to the *latitude* of each course. The *departure* of the closing distance is distributed among the courses in proportion to the *length* of each course. That is, after the excess or deficiency of latitude is distributed, each temporary stake is moved east or west an amount proportional to the total distance from the starting point.

On a latitudinal line the temporary stakes should be placed to suit the usual adjustments for the curvature. The *departure* of the closing distance is distributed among the courses in proportion to the *departure* of each course. Then each temporary stake is moved north or south an amount proportional to the *total* distance from the starting point.

Angle points and intermediate corners will be treated alike.

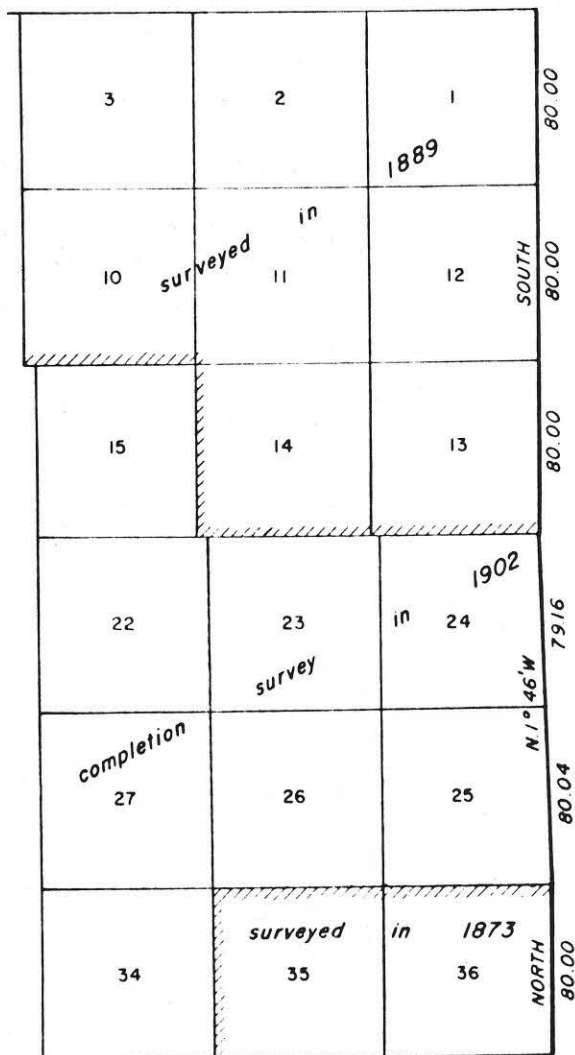


FIGURE 71.—Irregular exterior resulting from the piecemeal survey of a township line.

5-37. Another exception to the usual application of single proportionate measurement is occasionally important. There may be persuasive proof of a deflection in the alignment of the exterior, though the record shows the line to be straight. For example, measurements east and west across a range line, or north and south across a latitudinal township line, counting from a straight-line exterior adjustment, may show distances to the nearest identified subdivisional corners to be substantially long in one direction and correspondingly short in the opposite direction. This condition, when supported by collateral evidence, would warrant an exception to the straight-line or two-way adjustment because the evidence outweighs the record. The rules for a four-way or double proportionate measurement would then apply here, provided there is conclusive proof.

5-38. *All lost quarter-section corners on the section boundaries within the township will be restored by single proportionate measurement between the adjoining section corners, after the section corners have been identified or relocated.*

In those cases where connections from the lost quarter-section corner to other regular monuments of the line nearer than the section corners have been previously noted, these will ordinarily assume control in the restoration. Such monuments may include another quarter-section corner, minor subdivision corners, a meander corner, an angle point, or a line tree, any of which may have been established when the line was previously surveyed or resurveyed. (See also under section 5-41. Closing Corners.)

5-39. *"Half-Mile Posts," Alabama and Florida.*

In the early practice in parts of Alabama and Florida, so-called "half-mile posts" were established at distances of 40 chains from the starting section corner. The term was applied where the line might be more or less than an exact 80 chains in record length, and where by later methods the latitudinal lines have been



run as "random and true." The practice contemplated that in some cases these subdivisional lines be run in cardinal directions to an intersection, where the next section corner would be placed, and either or both lines might be more or less than 80 chains in length. In some cases the section corners were placed across the township at intervals of 80 chains on one of the cardinal lines, and the other lines were run on random only. On the first plan the "half-mile post" would not be at midpoint unless the line turned out to be 80 chains in length. On the second plan the "half-mile post" on the lines first run would be in true position for the quarter-section corner, but on the lines last run they would usually not be on true line, nor at midpoint.

In both cases field notes were written showing a true line direction and midpoint distance for a quarter-section corner. This was done to meet the objection that the "half-mile post" did not satisfy the requirements of law, but the true line was not actually run on the ground, nor was a monument constructed at midpoint. In these cases only the true line field notes need be regarded if the evidence of the "half-mile post" has disappeared; but where the latter can be identified the point must be given proper weight for control. Each set of field notes requires its individual consideration, as the practices were not uniform even in the same surveying district.

The applicable rules for the restoration of the true line midpoint positions for the quarter-section corners in the above practices are derived from the Act of February 11, 1805 (R.S. 2396), which requires that "the corners of half and quarter sections, not marked on the surveys, shall be placed as nearly as possible equidistant from two corners which stand on the same line."

The rules may be stated specifically as follows:

(1) In case the "half-mile post" and quarter section corner are recorded as being

at a common point, the identified "half-mile post" will be restored as the quarter-section corner.

(2) If there is evidence of the position of the section corners in both directions, and if the record *leaves doubt* as to the establishment of the "half-mile post" on the true line, the quarter-section corner will be monumented at midpoint on the true line, disregarding the record of the "half-mile post."

(3) In the absence of evidence at one or both section corners and where the record *leaves doubt* regarding the running and marking of the true line, the "half-mile post" will be employed on a north and south line for the control of the latitude of the quarter-section corner, or on an east and west line for control of its position in departure, using the record correction for distance. The alinement of the section boundary and the position of the quarter-section corner on the true line will be adjusted to the location of the two section corners *after* the double proportionate measurements have been completed.

(4) Where the field notes show proper location for alinement and record correction for distance, the "half-mile post" will be employed for the full control of the position of the quarter-section corner, and for the restoration of the lost section corners. The position of the quarter-section corner in latitude on a north and south line, or in departure on an east and west line, will be ascertained by making use of the record correction for distance from the "half-mile post." The alinement from the position of the "half-mile post" to the point for the quarter-section corner will be determined by the position of the section corner to the south, if the record correction for distance is to be made to the north; the section corner to the north will be used if the record correction for distance is to be measured to the south; and similarly on east and west lines.

(5) The evidence of the "half-mile post"



will not be destroyed.

#### 5-40. Meander Corners

*Lost meander corners, originally established on a line projected across the meanderable body of water usually will be relocated by single proportionate measurement. However the facts must be considered with regard to the specific problem in hand.*

Under favorable conditions a lost meander corner may be restored by treating the shore line as an identified natural feature. In the event of extensive obliteration of the original corners within the locality this position may be preferable to one obtained by proportionate measurement carried from a considerable distance.

In extreme cases restoration by adjustment of the record meander courses to the bank or shore line may be indispensable to the reconstruction of the second boundaries. Granting extensive obliteration, where there has been obvious stability to the bank or shore line, or absence of appreciable changes by erosion or accretion, the record meander courses and distances may be conformed to the salients and angles of the physical bank or shore line. If found satisfactory, that restoration may be regarded as the most suitable position for the meander corner. This may give a location in both latitude and departure, in latitude only, or in departure only.

Occasionally, it can be demonstrated that the meander corners on opposite banks of a wide river were actually established as terminal meander corners even though the record indicates the line was projected across the river. If the evidence outweighs the record, a lost meander corner in such a case will be relocated by single point control. (See section 5-45, Original Control.)

#### 5-41. Closing Corners.

*A lost closing corner will be reestablished*

*on the true line that was closed upon and at the proper proportional interval between the nearest regular corners to the right and left.*

In order to reestablish a lost closing corner on a standard parallel or other controlling boundary, the line that was closed upon will be retraced, beginning at the corner from which the connecting measurement was originally made. A temporary stake will be set at the record connecting distance, and the total distance and falling will be noted at the next regular corner on the line on the opposite side of the missing closing corner. The temporary stake will then be adjusted as in single proportionate measurement.

*A recovered closing corner not actually located on the line that was closed upon will determine the direction of the closing line, but not its legal terminus. The correct position is at the true point of intersection of the two lines.*

The new monument in those cases where it is required will always be placed at the true point of intersection. An off-line monument in such cases will be marked AM (for amended monument) and will be connected by course and distance. The field notes of the closing line will include a full description of the old monument as recovered and a clear statement that the new monument is set at the true point of intersection.

When an original closing corner is recovered off the line closed upon and the new monument is established at the true point of intersection, the *original* position will control in the proportionate restoration of lost corners dependent upon the closing corner. In a like manner the positioning of sixteenth-section corner(s) or lot corner(s) on the closing line, between the quarter-section corner and the closing corner, will be based on the measurement to the closing corner.

A closing corner ordinarily is not used as control corner in restoring a lost corner of the

line closed upon. However, where a previous, obviously careful retracement has explicitly shown the relative positions of all the corners on the line, including the closing corners the latter may exercise control to the same limited extent as corners of a junior survey. Section 5-35 (3).

Closing corners in some cases have been established where a line of the survey crosses previously surveyed claim lines. (See section 3-71. Closing Section Lines.) A crossing closing corner established to mark the intersection of a junior line crossing an existing senior line, if it is not at the true intersection, establishes only the direction of and a joint on the junior line. In effect, such a crossing closing corner has the same standing as an angle point on the junior survey; it has no effect on the senior line.

A closing corner set to mark the intersection of a *resurvey* of a junior crossing line with a senior line has no standing if it does not, in fact, mark the true intersection. The true point remains the actual intersection of straight lines connecting the two pairs of controlling corners. Otherwise, the monument can serve only as a control point for the reestablishment of lost control corners on the junior line.

A different problem must be faced where the record tie from a closing corner to a corner of the line closed upon is fictitious, grossly in error, or in some way irreconcilable. If the closing corner in such a case is recovered, it will normally control the direction of the closing line regardless of its disagreement with the record. If there is no evidence whatever of the closing corner, and ample proof that the closing was not made as called for in the field notes, the closing corner should not be restored without verifying the nearest authentic closing on either side. The restoration will then be made by the method most nearly in harmony with the official plat. No general rule can be advanced. The procedure to be adopted should have official sanction prior to remonumentation of the lines.

5-42. The foregoing are the general rules for the restoration of lost or obliterated corners. The special cases that are hereinafter cited with respect to broken boundary lines and limited control do not have wide application and do not have similar importance excepting under those conditions, and as explained in the succeeding text.

The preceding instructions will be applicable in the large majority of cases. If there seems to be some difficulty or inconsistent result, a careful check should be made of the record data. The special instructions for the original survey, the plat representation, or some call of the field notes may clarify the problem upon further study. This research assumes a large importance in the more difficult problems of the recovery of an old line or boundary.

It is not intended to disturb satisfactory local conditions with respect to roads and fences. The surveyor has no authority to change a property right that has been acquired legally, nor can he accept the location of roads and fences as evidence *prima facie* of the original survey. Something is needed in support of these locations. This will come from whatever intervening record there may be, the testimony of individuals who may be acquainted with the facts, and the coupling of these things to the original survey.

Other factors to be considered are the rules of the State law and the State court decisions, as distinguished from the rules laid down by the Bureau of Land Management (the latter applicable to the public land surveys in all cases). Under State law in matters of agreement between owners, acquiescence, or adverse possession, property boundaries may be defined by roads, fences, or survey marks, disregarding exact conformation with the original section lines. These may limit the rights as between adjoining owners.

In many cases due care has been exercised to place the property fences on the lines of

legal subdivision, and it has been the general practice in the Prairie States to locate the public roads on the section lines. These are matters of particular interest to the adjoining owners, and it is a reasonable presumption that care and good faith would be exercised with regard to the evidence of the original survey in existence at the time. Obviously, the burden of proof to the contrary must be borne by the party claiming differently. In many cases there are subsurface marks in roadways, such as deposits of a marked stone or other durable material, that are important evidence of the exact position of a corner if the proof can be verified.

A property corner should exercise a regular control upon the retracement only when it was placed with due regard to the location of the original survey, or agreement is so close as to constitute the best available evidence.

## Secondary Methods

### Broken Boundaries

5-43. *Angle Points of Nonriparian Meander Lines.* In some cases it is necessary to restore (or possibly to locate for the first time) the angle points, within a section, of the record meander courses for a stream, lake, or tide-water, which may be required under the special rules which are applicable to nonriparian meander lines.

In these cases the positions of the meander corners on the section boundaries are determined first. The record meander courses and distances are then run and temporary angle points are marked. The residual error is shown by the direction and length of the line from the end of the last course to the objective meander corner. The residual is distributed on the same plan as in balancing a survey for the computation of the areas of the lottings as represented on the plat.

The general rule is that the adjustment to be applied to the  $\left\{ \begin{array}{l} \text{latitude} \\ \text{departure} \end{array} \right\}$  of any course is to the resolved  $\left\{ \begin{array}{l} \text{latitude} \\ \text{departure} \end{array} \right\}$  of the closing

error as the length of the course is to total length of all the courses. Each adjustment is applied in a direction to reduce the closure. If the *northings* are to be *increased*, then the *southings* will be *decreased*. A line due *east* would then be given a correction to the *north* (in effect to the *left*); a line due *west*, also to the *north* (in effect to the *right*). Each incremental correction is determined and applied in proportion to the length of the line.

The field adjustments for the positions of the several angle points are accomplished simply by moving each temporary point on the bearing of the closing error an amount that is its proportion of that line, counting from the beginning. The particular distance to be measured at any point is to the whole length of the closing error as the distance of that point from the starting corner is the sum of the lengths of all the course. Figure 72.

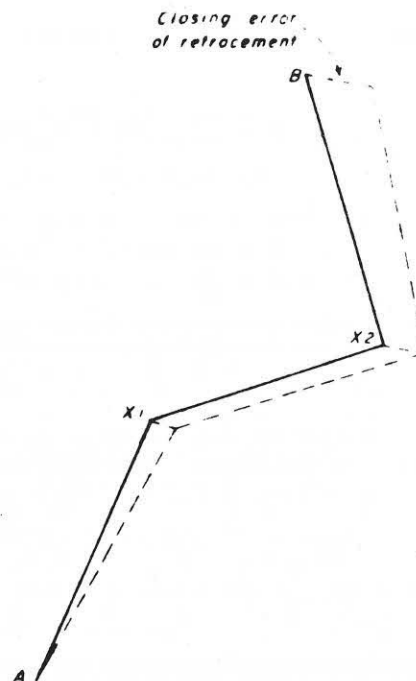


FIGURE 72.—Adjusting angle points on a nonriparian meander line.

The same principle is followed to plot lottings of dependently resurveyed sections in their true relative positions when the record meander line and the true shoreline differ greatly because of distortion.

5-44. *Grant Boundaries.* In many of the States there are irregular grant and reservation boundaries that were established prior to the public-land subdivisional surveys. In these cases the township and section lines are regarded as the closing lines. The grant boundary field notes may call for natural objects, but these are often supplemented by metes-and-bound descriptions. The natural calls are ordinarily given precedence, next the existent angle points of the metes-and-bounds survey. The missing angle points are then restored by uniformly orienting the record courses to left or right and adjusting the lengths of the lines on a constant ratio. Both angular and linear corrections are made in the direction needed to reduce the falling of the trial lines laid down according to the record.

The retracement of the grant boundary is begun at an identified corner. Calls for natural objects are satisfied and the existent angle points are recovered. Then, between the identified or acceptable points, the position of missing angle points is determined by these steps:

- (1) Reduce the *record* courses and distances to the total differences in latitude and departure. Compute the direction and length of a line connecting the identified points.

- (2) Determine the *actual* difference in latitude and departure between the same identified points by retracement. Compute the direction and length of the connecting line based on these figures.

- (3) The angular difference of direction between the connection lines computed in (1) and (2) gives the amount and direction of the adjustment to apply to the *record* bearing of each intermediate course.

- (4) The ratio of the length of the line computed in (2) to that computed in (1) gives the coefficient to apply to the *record* length of each intermediate course.

After the adjustments are completed, additional search for evidence of the record markers should be made. The adjusted locations for the angle points are in the most probable original position, and a better check of collateral evidence is possible. If no further evidence is recovered, the adjusted points are then monumented.

In Figure 73, A and B are identified points of the original boundary. It is desired to restore intermediate points T, S, R, J, I, H, and G, which have been temporarily marked at  $T_t$ ,  $S_t$ ,  $R_t$ ,  $J_t$ ,  $I_t$ ,  $H_t$ , and  $G_t$  in conformance with the original record starting from point A. The record position of point B in relation to point A is designated  $B_t$ . The adjustment has been made in the four steps already described.

The same procedure may be followed whenever it is desired to retain the *form* of the traverse being adjusted, since the interior angles are unchanged and the increase or decrease in lengths of lines is constant. The adjustment may be likened to a photographic enlargement or reduction. Mechanically, this process requires that the record distances of the traverse legs between identified points be reduced or increased simultaneously with the rotation of the record bearing until the two identified points coincide.

#### 5-45. *Original Control*

*Where a line has been terminated with measurement in one direction only, a lost corner will be restored by record bearing and distance, counting from the nearest regular corner, the latter having been duly identified or restored.*

Examples will be found where lines have been discontinued at the intersection with large meanderable bodies of water, or at the border

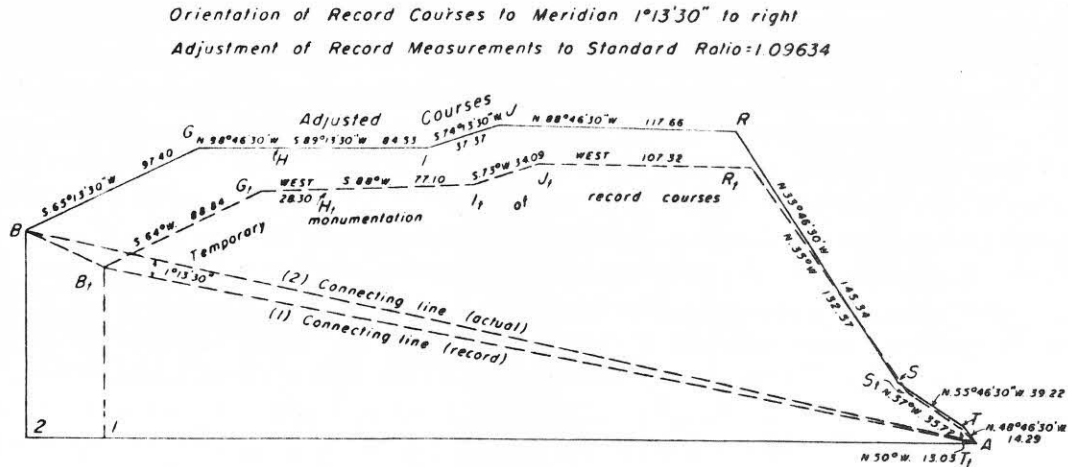


FIGURE 73.—Adjusting a grant boundary.

of what was classed as impassable ground.

An index correction for average error in the original measurement should be used, if appropriate, as discussed in section 5-29. Additionally, in cases where a retracement has been made of many miles of the original lines, between identified original corners, and there has been developed a definite angle from cardinal that characterizes the original survey, it is proper to make allowance for the average difference.

### Special Cases

5-46. Experience, thoroughness, and good judgment are indispensable for the successful retracement and recovery of any survey when it reaches a stage of extensive obliteration. It is an axiom among experienced cadastral surveyors that the true location of the original lines and corners can be restored, if the original survey was made faithfully, and was supported by a reasonably good field-note record. That is

the condition for which the basic principles have been outlined, and for which the rules have been laid down. The rules cannot be elaborated to reconstruct a grossly erroneous survey or a survey having fictitious field notes.

5-47. The records of official resurveys cover many special cases. The records in Washington include the special cases from all public-land States. These plats, field notes, reports of field examinations, office opinions, Departmental decisions, opinions from the Attorney General of the United States, and frequently court opinions and decrees are drawn upon when needed to assist the surveyor in situations that are new to his own experience. When the surveyor encounters unusual situations, or finds it difficult to apply the normal rules for the restoration of lost corners, he should report the facts to the proper administrative office. If it is determined that additional retracements are necessary, these may be provided for by supplemental instructions.



## Manual of Surveying Instructions — Chapter IV Monumentation

4-1. This chapter describes the procedure for monumenting a public land survey. The monumentation is intended to establish a permanent marking of the lines and to fix the corner positions so that the location of the surveyed lands may always be definitely known.

### LEGAL SIGNIFICANCE OF THE MONUMENT

4-2. The law provides that the original corners established during the process of the survey shall forever remain fixed in position, even disregarding technical errors which may have passed undetected before acceptance of the survey.

The courts attach major importance to evidence relating to the original position of the corner, such evidence being given far greater weight than the record relating to bearings and lengths of lines. The corner monument is direct evidence of the position of the corner.

Section 57 of the Criminal Code of 1909, as slightly modified in 18 U.S.C. 1858, provides a penalty for the unauthorized alteration or removal of any Government survey monument or marked trees:

Whoever willfully destroys, defaces, changes, or removes to another place any section corner, quarter-section corner, or meander post, on any Government line of survey, or willfully defaces, changes or removes any monument or bench mark of any Government survey, shall be fined not more than \$250 or imprisoned not more than six months, or both.

The legal importance of the corner makes mandatory the workmanlike construction of lasting monuments skillfully related to natural objects or improvements so that the greatest practicable permanence is secured.

4-3. If it is necessary to alter the condition of a previously established monument, the utmost regard should be shown for the evidence of the original location. The monument should be carefully reconstructed by such additional means as may be appropriate, *without destroying the evidence which served to identify that position*. A complete record will be kept of the description of the old monument as identified, and all alterations and additions will be specifically noted as such.

### GENERAL REQUIREMENTS

4-4. Prescribed monuments are used to mark the position of the quarter-section, section, township, and meander corners; such sixteenth-section corners as the special instructions or exigencies of the survey of fractional sections require; and all angle points and points at intervals of 40 and 80 chains along an irregular boundary. Additionally, when stipulated in the special instructions, monumentation is established as needed down to the corners of 2½-acre aliquot parts as required in the subdivision of sections into units smaller than the regular quarter-quarter section.

When it is necessary or desirable to establish special purpose monuments the regulation post is the first choice under usual conditions.

4-5. The position of a corner monument is evidenced by the best accessories available; if the corner point itself cannot be marked in the usual manner, an appropriate witness corner or reference monument is established. A witness meander corner is established upon secure ground wherever the true position falls at a point where the monument would be liable to destruction.

4-6. The field notes relating to the establishment of a monument are introduced at the logical place where the true position for the corner is indicated.

The description of the monument will embrace: (1) the signifi-ance of its position; (2) its



type and dimensions, including those of any special monumentation; (3) the depth set in the ground, with mention of any additional support, (4) the markings upon the monument; and (5) the nature of the accessories, including character, size, position, and markings.

### CORNER MATERIAL

4-7. The Bureau of Land Management has adopted a regulation post for monumenting the public surveys, which is used generally unless exceptional circumstances warrant the use of other material. Substitutions are premitted only when authorized in the special instructions. In such cases a statement should be given in the field notes explaining why regulation posts were not employed.

The regulation post is made from alloyed iron pipe, zinc-coated, 2½ inches outside diameter, which is cut into lengths of 30 inches. One end of the pipe is split for several inches, and the two halves are spread to form flanges. A brass cap is securely fastened to the top. Brass tablets are supplied for placing in rock outcrop and for imbedding in concrete monuments. The tablet is ¾ inches in diameter and has a stem 3½ inches long. The top bears the same official inscription as that of the cap of the iron post.

4-8. General departures from the use of the regulation monument may be authorized where there is need for more durable monumentation in important areas, where conditions at the time of survey make it impracticable to procure a sufficient number of regulation monuments within the available time limit, or where difficulties of transportation to the point of use make it more practicable to adopt an approved substitute. Trials of experimental monuments are authorized from time to time where this can be done without risk of losing corner point locations. Limited departures because of site conditions may be made as approved by the officer in administrative charge.

Native stone may be substituted for the

iron post, provided it has been authorized, is durable against prolonged weathering, has a volume of at least 1,000 cubic inches, and dimensions suitable for permanent monumentation and appropriate markings. Stone will not be used as a corner monument where its position falls among large quantities of loose surface stone or slide rock.

### CONSTRUCTION OF MONUMENTS

4-9. The caps of the iron posts are marked with steel dies at the time when used. The posts are set in the ground about three-fourths of their length, and earth and stone, if the latter is at hand, are tamped into the excavation to give the post a solid anchorage.

4-10. A stone monument is marked with a steel chisel or punch with such letters, figures, grooves, or notches as may be required, and is firmly set in the ground about three-fourths of its length.

4-11. Both iron posts and stone monuments will always be set a depth of three-fourths their length unless it is impossible to complete the excavation, in which case the monument will be planted as deep as conditions will permit, and the necessary support will be secured by a stone mound.

In loose, wind-blown soil, the monument is much more stable if surrounded with stone, the mound being built with a wide base, and up to the height of the post. This will be even more secure if clay soil can be procured for filling the voids. The location may be of enough importance to justify the construction of a concrete base surrounding the iron post to prevent the blowing of the soil.

Under pinning or other special means for supporting the iron post may be required when constructing a stable monument in marshland. Encasement of the post in concrete to prevent corrosion may be necessary in the case of alkaline soils, salts, salt-water marshes, organic-acid water in swamp areas, or similar situations.

4-12. Where the corner point falls upon surface rock, preventing excavation, a cross (X) is cut at the exact corner point, and, if feasible, the monument is erected in the same position, supported by a large mound of stone with broad base, so well constructed that it will possess thorough stability.

The tablet is used for marking corners which fall upon rock outcrop on slopes where a stable mound would be impracticable. A drill hole is made to receive the stem, and a recess is made for the top so that the tablet may be securely cemented in place and sealed against moisture. To be permanent the cementing must be done with clean first-class materials, carefully proportioned. The tablet is marked in the same manner as the iron-post monument.

On slopes too steep to allow construction

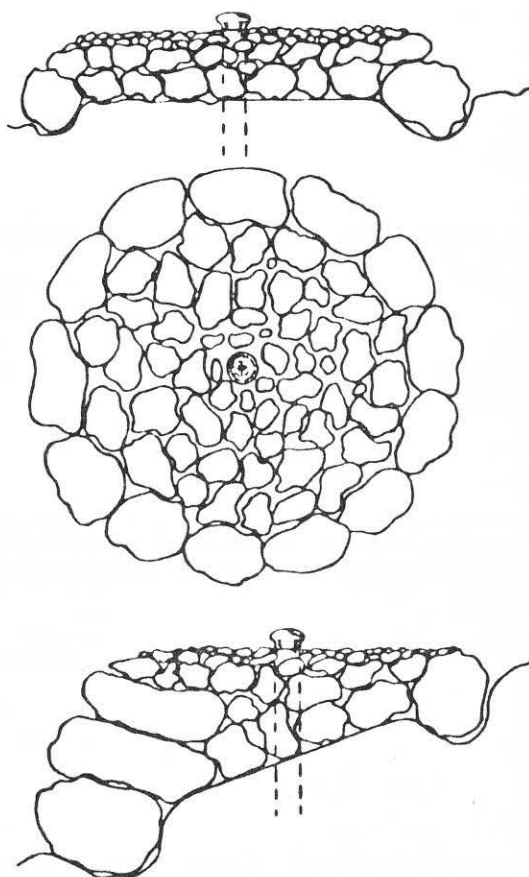


FIGURE 64.—A mound of stone. Base should be not less than 3 ft. diameter.

of a stable mound, but covered with a thin layer of soil which would hide the tablet if it were set directly in the bedrock, a short length of zinc-coated iron pipe of 1-inch outside diameter is forced into the drill hole. The stem of the tablet is then wedged securely into the top of the pipe in a position above the layer of soil.

4-13. Where the corner point falls at the position occupied by a tree, the tree is marked as the corner monument, even if fully matured. The full quota of accessories should be secured, including reference monuments.

A tree too small to receive the usual marks without injury is marked with an "X" only at breast height on the *south* side. The X should be scribed in the bark on smooth-barked trees. On rough-barked trees the X should be made by two axe cuts reaching just into the live wood tissue. It is advantageous to clear out nearby trees of similar size in order that the marked tree will not be smothered by faster growing uninjured trees.

4-14. Monuments marking corners that fall in cultivated fields or meadows are so constructed as to interfere with farming operations as little as possible and conform to the wishes of the owner insofar as practicable.

Generally an iron post, brass tablet in a concrete block, a marked stone, or some suitable article may be buried at the corner point and witnessed by a substantial guard post. Bearing objects or bearing trees within a reasonable distance are employed, and accurate bearing to one or more available distant objects are recorded.

### SPECIAL PURPOSE MONUMENTS

#### Witness Corners

4-15. A *witness corner* is a monumented point usually on a line of the survey and near a corner. It is established only in situations where it is impracticable to occupy the site of a corner.

When the true point for a corner falls at an inaccessible place, such as within an unmeandered stream, lake or pond, or in a marsh, or upon a precipitous slope or cliff where the corner cannot be occupied, a witness corner is established at some suitable point where the monument may be permanently constructed, but preferably on a line of survey.

Usually only one witness corner is established, and it should be located upon one of the lines leading to a corner if a secure place within a distance of 10 chains is available. If there is no place to be found on a surveyed line within that distance, a witness corner may be located in any direction within a distance of 5 chains.

The field notes show the relation of the witness corner to the true point for the corner. The direct connecting course and distance from the true point to the witness corner are shown on the plat. If there are many witness corners, and in cases of difficult plat lettering, where it may interfere with the other showings of the plat, the data relating to the direction and distance may be indicated by marginal memorandum or tabulation.

### Reference Monuments

4-16. A *reference monument* is an accessory and is employed in situations where the site of a corner is such that a regular permanent monument cannot be established or where the monument would be liable to destruction, and bearing trees or a nearby bearing object are not available.

Where the true point for a corner falls within an unimproved roadway in such a place as to interfere with travel, an iron post, a tablet in a concrete block, or a marked (X) stone or some suitable article will be buried in the ground at the true corner point. At least two reference monuments are established at suitable places outside of the roadway, if bearing trees or a nearby bearing object are not available. Allowance should be made for grading,

cuts, fills, or other road improvement when placing the reference monuments.

The surface of gravel, macadam, or bituminous-topped roads should not be dug into without the approval of the proper authority. If permission is granted, a deposit may be made at the true corner point. In the case of a hard surface, a tablet, copper bolt, large nail, or cross (X) may be placed at the true point. In any event the corner point can be occupied and may be marked temporarily by paint or scratching. Two reference monuments, established following the practice for highway surveys to the extent that is feasible, ordinarily suffice in public survey practice, but four may be employed if desirable. When two monuments are used, they are usually placed equidistant and in opposite directions; an acceptable alternative is placement of the monuments so that the lines connecting them with the corner point are approximately perpendicular to each other. Four monuments are placed in opposite directions in the four quadrants.

Reference monuments are described with other accessories to the corner in the field notes but are not shown on the plat.

### Witness Points

4-17. A *witness point* is a monumented station on a line of the survey that is used to perpetuate an important location more or less remote from and without special relation to any regular corner.

The station may be near a road or stream crossing, valuable improvements, the border of a large cultivated field or meadow, an important unmeandered stream or lake, or the border of a reservoir; at the summit of an important slope, ridge, or mountain; or at end stations of a long triangulation, offset, or traverse that passes over the point for a normal corner, where one or both stations are beyond the limiting distance of 10 chains prescribed for setting witness corners.

The establishment of a witness point is described in the field notes but not usually shown on the plat.

### Location Monuments

4-18. A *location monument* is most frequently used as a reference for one or more mineral surveys, and its use is described in detail in sections 10-32 through 10-34. It may also be used in any situation where no corner of an existing survey is available to provide a satisfactory connection for an isolated special survey. The monument is generally established in a conspicuous position with good visibility from every direction. A corner of the special survey may be designated as a location monument if it meets this qualification.

### Control Points

4-19. A *control point* serves a purpose similar to that of a location monument in connection with photogrammetric surveys, electronic surveys, or surveys established by use of airborne control. It may be connected directly to a corner or may be related through coordinates.

## SYSTEM OF MARKING

### Making the Marks

4-20. Monuments are marked in accordance with a system that furnishes a ready identification of the position of the monument which bears the marks. Capital letters and Arabic figures are used to mark iron posts and tree monuments. The letters and figures relate to the township, range and section to which the corner belongs. On stone corner monuments marks termed notches and grooves are used to convey the information. The notches and grooves relate, in the case of an exterior corner, to the number of miles from the monument to the adjoining township corners. In the case of a subdivisional corner, they relate to the normal number of miles from the monument to the east and south boundaries of the

township.

4-21. The marks should be carefully arranged, neat, distinct, and durable. An assortment of steel dies, stone chisels and punches, and timber scribes, in good condition for use, should always be available.

4-22. An index of the ordinary markings common to all classes of monuments and corner accessories is given below.

### Marks To indicate—

A M.....	Amended monument
A M C.....	Auxiliary meander corner
A P.....	Angle point
B O.....	Bearing object
B T.....	Bearing tree
C.....	Center
C C.....	Closing corner
E.....	East
E C.....	Electronic Control
L M.....	Location monument
M.....	Mile
M C.....	Meander corner
N.....	North
NE.....	Northeast
NW.....	Northwest
R.....	Range
R M.....	Reference monument
S.....	Section
S.....	South
S C.....	Standard corner
SE.....	Southeast
S M C.....	Special meander corner
SW.....	Southwest
T.....	Township
TR.....	Tract
W.....	West
W C.....	Witness corner
W P.....	Witness point
1/4.....	Quarter Section
1/16.....	Sixteenth section

## MARKS ON CORNER MONUMENTS

### Marks on Iron Post Monuments and Brass Tablets

4-23. The markings on the brass cap of the regular corner monument are always made to be read from the south side of the monument. The year number of the date when established is placed on the south. If the marks or accessories are changed or added to in the course of a resurvey, the new year number is marked above or below the original number without destroying the former marks.

4-24. *Standard township corners* are marked "S C" and the township on the north half, and the ranges and sections in the proper quadrants:

S C	
T 25 N	
R 17 E	R 18 E
S 36	S 31
1971	

4-25. *Closing township corners* are marked "C C" on the half from which the closing line approaches the monument, with the township (or range) on the same half, and the ranges (or townships) and sections in the proper quadrants; also (as far as known at the time) the township, range, and section, or the initials or abbreviation of the reservation, grant, or private claim upon which the township exterior closes. The name of a State is not placed on the monument of a closing corner even though the monument is intended to be placed on the State boundary. See section 5-19, State Boundary Monuments.

T 25 N R 17 E	
S 36	
S 1	S 6
R 17 E	R 18 E
T 24 N	
C C	
1971	

T 24 N	
T 24 N	R 17 E
S 36	S 31
R 16 E	S 6
T 23 N	
C C	
1971	

T 20 N	
K I R	R 120 W
	S 32
	S 5
	T 19 N
1971	

4-26. *Corners common to four townships* are marked with the townships on the north and south halves, the ranges on the east and west halves, and the sections in the four quadrants:

T 23 N	
R 17 E	R 18 E
S 36	S 31
S 1	S 6
T 22 N	
1971	

4-27. *Corners common to two townships only* are marked with the township (or range) common to both on the proper half, and the ranges (or townships) and sections in the proper quadrants; also (as far as known at the time) the township, range, and section upon the opposite half:

T 3 N	
R 7 W	T 2 N
S 36	R 6 W
S 1	S 6
T 2 N	
1971	

T 14 S	
R 7 W	R 6 W
S 36	S 31
T 15 S R 7 W S 1	
1971	



4-28. *Corners referring to one township only* are marked with the township, range, and section in the particular quadrant which is concerned; also (as far as known at the time) the township, range, and section upon the opposite part:

T 20 N	R 5 W
T 19 N	S 31
R 6 W	
S 1	

1971

T 23 N	
R 19 W	
S 36	
T 22 N	R 19 W
S 1	

1971

	T 35 N
	R 44 E
	S 31
T 34 N	R 43 E
	S 1

1971

4-29. *Standard section corners* are marked "S C" and the township and range on the north half, and the sections in the proper quadrants:

	S C
T 25 N	R 17 E
S 35	S 36

1971

4-30. *Closing section corners* are marked "C C" and the township and range on the half from which the closing line approaches the monument, and the sections in the proper quadrants; also (as far as known at the time) the township, range, and section, or the initials or abbreviation of the reservation, grant, or private claim, upon which the section line closes, with the exception that in the case of an interior closing section corner, the township and range numbers are not repeated.

T 25 N	R 17 E
S 35	
S 2	S 1
T 24 N	R 17 E
	C C

1971

	T R 48
S 26	S 25
T 12 N	R 5 W
	C C

1971

	T 14 N
S 16	S 10
	S 15
	R 16 E

1971

CC

4-31. *Corners common to four sections* are marked: (a) On an exterior, with the township (or range) common to the adjoining townships, the ranges (or townships) upon the opposite sides of exterior, and the sections; and (b) a subdivisational corner, with the township, range and sections:

T 25 N	
R 17 E	R 18 E
S 12	S 7
S 13	S 18

1971

T 26 N	R 17 E
S 35	S 36
S 2	S 1
	T 25 N

1971

T 25 N	R 17 E
S 23	S 24
S 26	S 25

1971

4-32. *Section corners common to two sections only* are marked with the township and range on the half facing the sections to which the corner belongs, and the sections in the proper quadrants; also (as far as known at the time) the township, range, and section upon the opposite half, except that in the case of an interior corner, the township and range numbers are not repeated:



T 14 S	T 14 S
S 12	R 18 E
S 13	
R 17 E	S 7
1971	

T 27 N	R 17 W
S 31	S 32
T 26 N	R 17 W
S 6	
1971	

4-34. *Standard quarter-section corners* are marked with "S C", the township, range, "1/4", and the section, all on the north half:

T 14 S	R 20 W
S 10	S 11
S 14	
1971	

S C	
T 21 N	R 17 W
1/4 S 36	
1971	

4-33. *Section corners referring to one section only* are marked with the township, range, and section in the particular quadrant which is concerned; also (if known at the time) the section upon the opposite part:

4-35. *Quarter-section corners of maximum control* are marked (a) on a meridional exterior, with the township and "1/4" on the north, and the ranges and sections on the east and west halves; (b) on a latitudinal exterior, "1/4" on the west, the range on the north, and the townships and sections on the north and south halves; (c) on a meridional subdivisional line, with the township and range on the north, "1/4" on the north, and the sections on the east and west halves; and, (d) on a latitudinal subdivisional line, with the township and range on the north, "1/4" on the west, and the sections on the north and south halves:

S 10	
T 84 N	
R 73 W	
S 16	
1971	

T 27 N	
R 16 W	
S 17	
S 20	
1971	

T 21 N	
1/4	
R 17 W	R 16 W
S 13	S 18
1971	

T 22 N R 17 W	
1/4 S 36	
S 1	
T 21 N	
1971	

S 28	
T 57 N	
R 63 W	
S 34	
1971	

T 21 N R 17 W	
1/4	
S 14	S 13
1971	

T 21 N R 17 W	
1/4 S 21	
S 28	
1971	

4-36. *Quarter-section corners of minimum control* are marked (a) on a meridional exterior with the township on the north, ranges on the east and west, and "1/4" and the section on the half toward the particular section which is concerned; (b) on a latitudinal exterior, with the township and range on the north and south halves, and "1/4" and the section on the half toward the particular section which is concerned; and (c) on a subdivisional line, with the township and range on the north, and "1/4" and the section on the half toward the particular section which is concerned:

(b) on an exterior, with the township (or range) common to the adjoining townships, the ranges (or townships) upon the opposite sides of the exterior, and the sections; and, (c) on a subdivisional line, with the township, range and sections:

T 25 N  
R 18 W | R 17 W  
1/4 S 7  
1971

T 26 N R 17 W  
1/4 S 4  
T 25 N R 17 W  
1971

T 25 N R 17 W  
1/4 S 28  
1971

T 25 N R 17 W  
1/4 S 16  
1971

T 25 N  
R 17 E  
S 33  
MC  
1971

MC  
S 13 | S 18  
R 17 E | R 18 E  
T 24 N  
1971

T 24 N  
R 17 E | R 18 E  
S 13 | S 18  
MC  
1971

T 23 N  
R 17 W | S 35  
S 2 | MC  
T 22 N  
1971

T 23 N  
MC | S 35  
S 2 | R 17 W  
T 22 N  
1971

MC  
S 26 | S 25  
T 25 N | R 17 E  
1971

T 25 N | R 17 E  
S 26 | S 25  
MC  
1971

T 25 N  
MC | S 23  
S 26 |  
R 17 E  
1971

T 25 N  
S 26 | MC  
S 35 |  
R 17 E  
1971

4-37. *Meander corners* are marked "M C" on the half toward the meanderable body of water, and the additional marks (a) on a standard parallel or other line controlling surveys to one side only, with the township, range, and section toward the surveyed land;

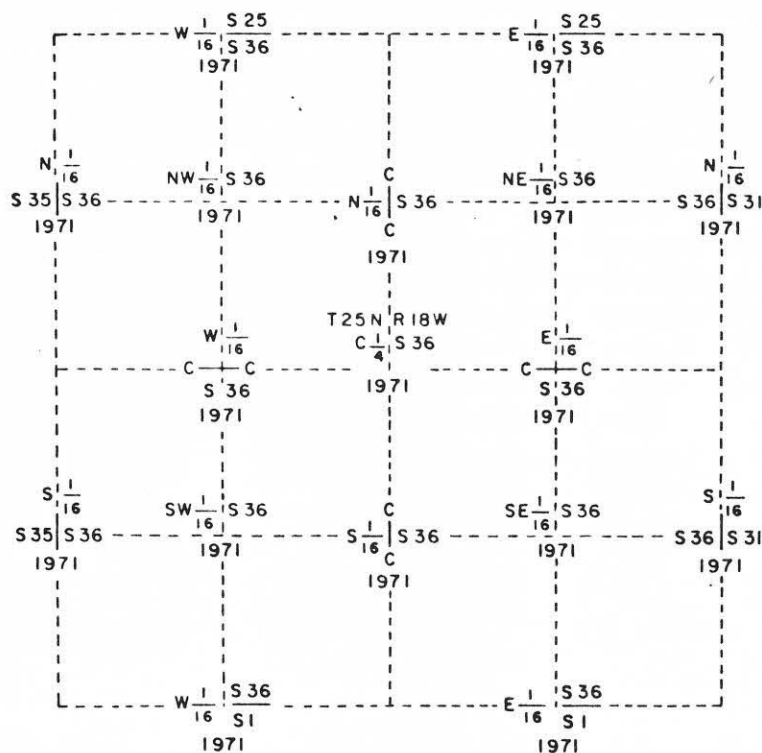


FIGURE 65.—Marks on monuments at interior quarter-section corner and all sixteenth-section corners.

4-38. *Interior quarter-section corners and all sixteenth-section corners*, when required by the special instructions are marked in accordance with the scheme shown in figure 65.

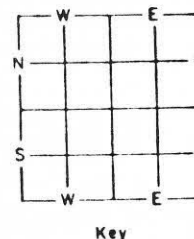
4-39. *Corners of minor subdivisions.* Where a quarter-quarter section is subdivided into quarter-quarter-quarter sections ( $1/64$  or 10-acre units), or aliquot parts as small as  $1/256$  (2.5 acres), the monuments on the boundaries of the quarter-quarter section, and those needed for the perimeter lines within the quarter-quarter section, are marked on the plan indicated in figure 66.

The diagram shows the marking for the monuments at corners of 2.5-acre units within one regular quarter-quarter section. If those units, or any one of them, are quartered, only the fraction  $1/1024$  is used for marking whatever monuments may be required of that order, including also the year number.

Markings on monuments at the corners

of  $1/64$  and  $1/256$  of a section, when subdivided as aliquot parts, for example on the boundaries of and within the  $SE\frac{1}{4} SE\frac{1}{4}$  sec. 36 are shown in figure 66.

4-40. *Sixteenth-section corners of minimum control* are marked with a key letter (N, E, S, or W) to indicate the position of the monument, and " $1/16$ " and the section, all on the half toward the particular section which is concerned:



S 1/16  
S 36  
1971

E 1/6  
S 22  
1971

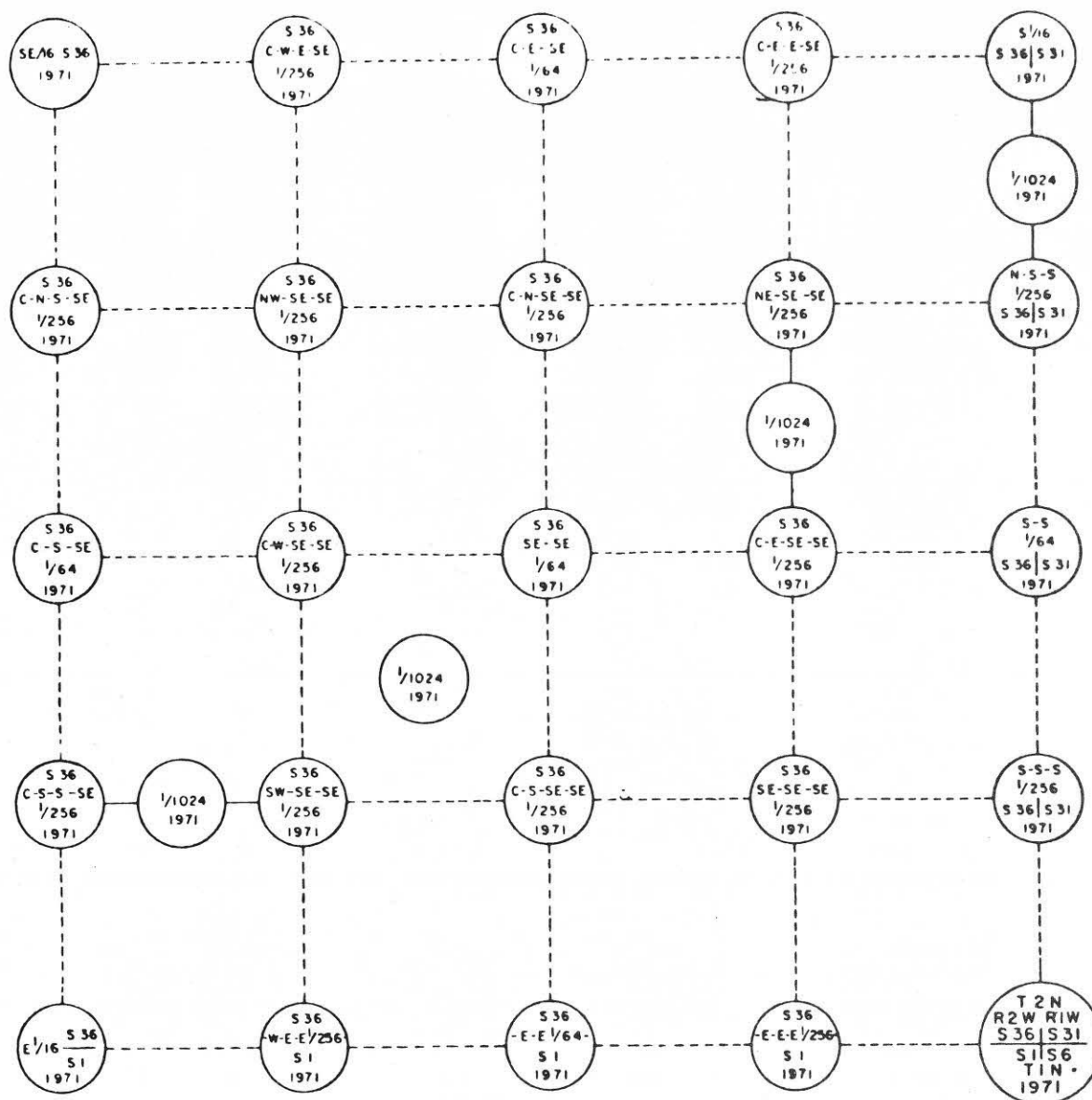


FIGURE 66.—Marks on monuments at corners of minor subdivisions. If 1/1024 section corners are established, only "1/1024" and the date are marked on the brass cap.

4-41. *Corners of Elongated Sections.* Additional monuments are required on section boundaries where the length of the closing line exceeds 85 chains. These are placed at intervals of 40 chains counting from the regular quarter-section corner. The plan for the special marking is based upon the distance each monument is established from the regular governing boundary, generally the south or

east. In cases where special circumstances call for the establishment of corners within the section, the monuments are also marked with reference to the subdivision-of-section lines upon which they are placed. The markings are illustrated by figures 67 and 68. Special attention should be given to whether the markings of monuments on the section boundaries are to show maximum or minimum control.

# Handbook for Arkansas Land Surveyors

## MONUMENTATION

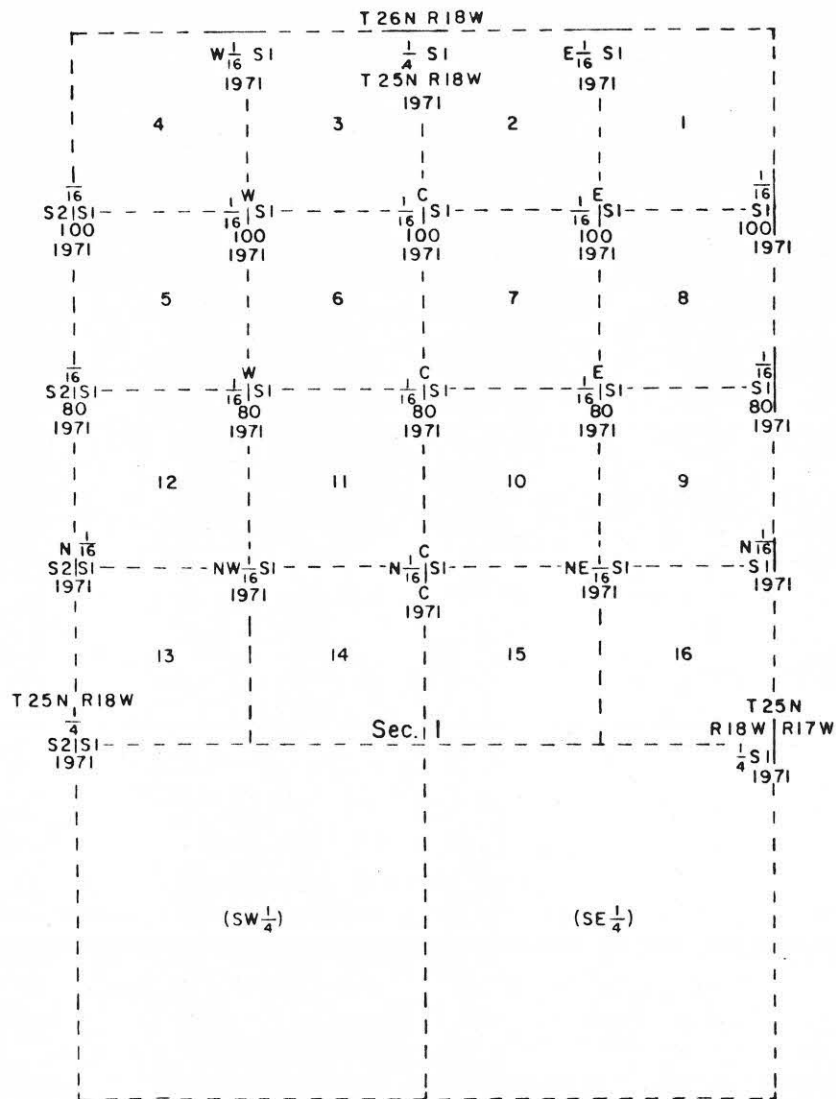
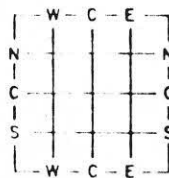


FIGURE 67.—Marks on monuments at corners of an elongated section.

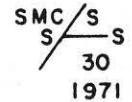
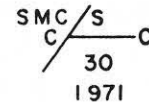
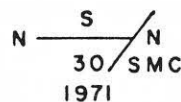
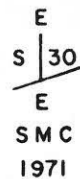
4-42. *Special meander corners* are marked in accordance with the following scheme:

Key letters (N, E, S, W, or C) are used in pairs to indicate the position of the subdivision-of-section line.



Key

The marks "S M C" are placed on the half toward the meanderable body of water, and the section on the opposite half:



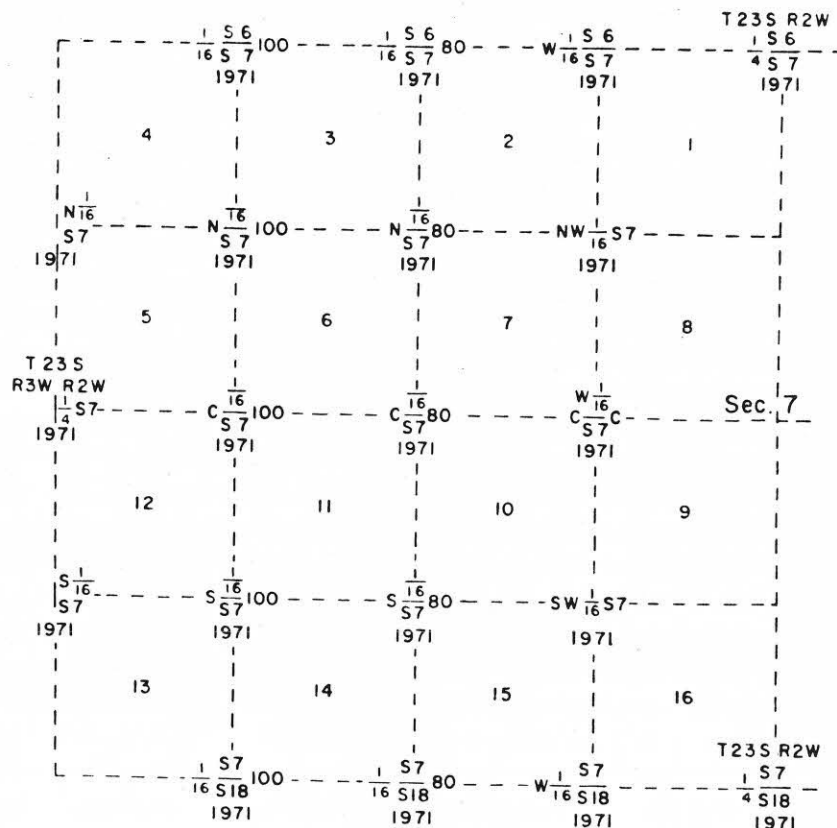


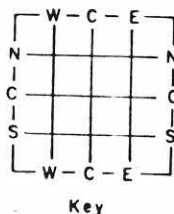
FIGURE 68.—Marks on monuments at corners of an elongated section.

4-43. *Auxiliary meander corners* are marked "A M C" and the township, range, and section:

AMC  
T64N R37W  
S 29  
1971

When *two or more* auxiliary meander corners are required for islands in the same section, they should be identified by lot or tract number, not by serial number.

4-44. *Closing subdivision-of-section corners* are marked in accordance with the following scheme:



Key letters (N, E, S, W, or C) are used in pairs to indicate the position of the subdivision-of-section line.

The marks "C C" and the section are placed on the half from which the closing line approaches the monument.

(The marks "B I R" indicate "Blackfeet Indian Reservation.")

PL  
E  
CC | S 28  
E  
B I R  
1971

PL  
C  
CC | S 28  
C  
B I R  
1971

PL / CC  
C / S 28 C  
B I R  
1971

PL  
W  
CC | S 28  
W  
B I R  
1971

PL / CC  
N / S 28 N  
B I R  
1971

PL / CC  
S / S 28 S  
B I R  
1971



4-45. Markings for *miscellaneous angle points* on irregular boundaries:

For "angle point No. 4" on the boundary of the "Blackfeet Indian Reservation," falling on surveyed land.

For "angle point" on the south boundary of section 33, superseding an old standard corner on a defective line, not subject to rectification.

For "angle point No. 2" on the boundary of a private claim ("Tract No. 37") falling on surveyed land.

For "angle point No. 12" on a reestablished non-riparian meander line; the marks "AP" and the serial number are placed on the half toward the land erroneously omitted from the original survey.

4-46. Markings for *intermediate corners* along boundaries:

For "139th mile corner" on the boundary line between the States of "New Mexico and Texas."

For "3d mile corner" on the boundary of the "Blackfeet Indian Reservation," falling on unsurveyed land.

For "13th mile corner" on the boundary of the "Blackfeet Indian Reservation," falling on surveyed land.

**Marks on Stone Monuments**

4-47. Where a stone monument is established, the letters, figures, and grooves are cut on the exposed faces or sides of the stone, but

not on its top or end; the notches are cut upon the exposed vertical edges. Grooves are employed where the faces of a stone are oriented to the cardinal; notches where the vertical edges are turned to the cardinal. Letters and figures are made 1 to 1½ inches high. Grooves and notches are of comparable size but are always horizontal to the face or edge on which they are made. All marks should be plainly and permanently chiseled into the stone.

4-48. *Standard township corners* (oriented with the faces to the cardinal) are marked "S C" on the north face, with the township on the same face, and the ranges on the adjoining faces:

S C      25 N on N.,  
            18 E on E., and  
            17 E on W. face.

4-49. *Closing township corners* (oriented with the faces to the cardinal) are marked "C C" and with six (or fewer) grooves on the face from which the closing line approaches the monument—the grooves to indicate the normal number of miles (or fractional parts) from the monument to the adjoining township corner—with the township (or range) on the same face, and the ranges (or townships) on the adjoining faces; also the initial or abbreviation of the reservation, grant, or private claim, on the face toward such irregular tract as may be closed upon:

            20 N on N.,  
C C 120 W and 5 grooves (on line between  
            sections 5 and 32) on E., 19 N  
            on S., and  
            B I R on W. face.

4-50. *Corners common to four townships* (oriented with the edges to the cardinal) are marked with the townships on the northeast and southwest faces, and the ranges on the southeast and northwest faces:

23 N on NE.,  
18 E on SE.,  
22 N on SW., and  
17 E on NW. face.

4-51. *Corners common to two townships only* (oriented with the faces to the cardinal) are marked with the township (or range) common to both on the face toward the townships, and the range (or townships) on the adjoining faces:

3 N on N.,  
2 N on S., and  
7 W on W. face.

4-52. *Corners referring to one township only* (oriented with the edges to the cardinal) are marked with the township and range on the face toward the particular township:

23 N 7 W on NW. face.

4-53. *Standard section corners* (oriented with the faces to the cardinal) are marked "S C" on the north face, and with from one to five grooves to indicate, respectively, the number of miles from the monument to the adjoining (regular) township corner:

S C on N.,  
1 groove on E., and  
5 grooves on W. face (standard corner of sections 35 and 36)

4-54. *Closing section corners* (oriented with the faces to the cardinal) are marked "C C" and with from one to six grooves on the face from which the closing line approaches the monument, and from one to five grooves on each of the adjoining faces—the grooves to indicate the number of miles (or fractional parts) from the monument to each of the three (regular) township boundary lines in the same directions, respectively—also the initials or abbreviation of the reservation, grant, or private claim, on the face toward such irregular tract as may be closed upon:

2 grooves on E.,  
C C and 6 grooves on S., and  
4 grooves on W. face (on line between sections 2 and 3 closing on a standard parallel).

4-55. *Corners common to four sections* (oriented with the edges to cardinal) are marked (a) on an exterior, with from one to five notches each on two opposite edges, north and south on a meridional line, and east and west on a latitudinal line, each to indicate, respectively, the number of miles from the monument to the adjoining (regular) township corner; and (b) a subdivisional corner, with from one to five notches on the east and south edges, each to indicate, respectively, the number of miles from the monument to the (regular) east and south township boundary lines. The subdivisional section corners of a fractional township are marked with reference to the theoretical position of normal east and south boundaries, whether surveyed or not:

2 notches on N. and 4 notches on S. edge  
(for corner of sections 7, 12, 13 and 18  
on a range line).

2 notches on E. and 4 notches on W. edge  
(for corner of section 2, 3, 34 and 35 on  
a township line).

2 notches on E. and 4 notches on S. edge  
(for corner of sections 10, 11, 14 and  
15, of a subdivisional survey).

4-56. *Section corners common to two sections only* (oriented with the edges to the cardinal) are marked with the sections on the faces toward the particular sections to which the corner belongs:

S 13 on SW., and  
S 12 on NW. face (for corner of sections  
12 and 13 on the east boundary of a  
township).  
S 11 on NE., and  
S 10 on NW. face (for corner of sections  
10 and 11 of a subdivisional survey  
running north from monument).

4-57. *Section corners referring to one*

*section only* (oriented with the edges to the cardinal) are marked with the section on the face toward the particular section which is concerned:

S 17 on NW. face (for southeast corner of section 17).

4-58. *Standard quarter-section corners* (oriented with the faces to the cardinal) are marked "S C $\frac{1}{4}$ " on the north face.

4-59. *Quarter-section corners of maximum control* (oriented with the faces to the cardinal) are marked (a) on a meridional line, "1/4" on the west face; and (b) on a latitudinal line, "1/4" on the north face.

4-60. *Quarter-section corners of minimum control* (oriented with the faces to the cardinal) are marked "1/4" and the section, all on the face toward the particular section which is concerned:

1/4 S on S. face (for quarter-section on the north boundary of section 4).

4-61. *Meander corners* (oriented with the faces to the cardinal) are marked "M C" on the face toward the meanderable body of water, and with from one to six grooves on each of the other faces, each to indicate the number of miles (or fractional parts) from the monument to the (regular) township boundary line in the same direction, respectively:

M C on N.,  
6 grooves on E.,  
4 grooves on S., and  
6 grooves on W. face (for meander corner of fractional sections 13 and 18, on the south side of a meanderable body of water).

4-62. *Special and auxiliary meander corners* (oriented with the faces to the cardinal) are marked "S M C" or "A M C", as the case may be, on the face toward the meanderable body of water, and the section on the opposite

face:

S M C on N., and  
S 19 on S. face (for special meander corner on a meridional subdivision-of-section line in section 19, on the south side of a meanderable body of water).  
S 20 on E., and  
A M C on W. face (for auxiliary meander corner in section 20, on the east side of a meanderable body of water).

#### Marks on Tree Monuments

4-63. Where the true point for a corner is found to fall in the position occupied by a sound living tree, the tree is made the monument. A tree is removed if it is too small to be marked.

4-64. Where a tree is to be made a monument the species of the tree, its diameter, and breast height are noted. The appropriate marks are made upon the trunk of the tree immediately above the root crown. A series of marks to be made upon a particular side of a tree are scribed in a vertical line reading downward.

If the corner point differs significantly from the center of the tree, the field notes will so state. Consideration will be given to using reference monuments to indicate the corner point exactly.

4-65. In the case of certain trees, including the aspen, beech and locust (smooth and thinbarked), the marks may be made preferably by scribing lightly into the bark without blazing; the marks thus made will remain as long as the tree is sound. On the rough-barked trees, the marks should be scribed into a smooth, narrow, vertical blaze, specially prepared by removing just enough of the outer growth to expose a flat surface of the live wood tissue immediately underneath the bark. The marks thus made will remain as long as the tree is sound, but the blaze and marks will be covered by a gradual overgrowth, showing an outward scar for many years. In regions subject

to heavy snowfall it is desirable to make a small additional blaze at a height of 6 or 8 feet above the ground, which will serve to attract attention to the tree during the winter season. The ends of the blaze should be smoothed off gradually without making a sharp cut into the live wood tissue. The lower end of the blaze upon which the marks are placed should be about 6 inches above the root crown, and its length should be just sufficient to take the marks.

Trees should always be marked in a way that will cause the least possible injury and enable rapid overgrowth. Placing the marks at the bottom ensures that they will remain on the stump if the tree is cut down.

4-66. The above caution applies equally to the marking of bearing trees, and the surveyor should not remove the overgrowth on a tree monument or bearing tree unless it is absolutely necessary to do so in order to identify the tree. The marks on old bearing trees should not be disturbed or added to. New trees may be marked, which will be recorded in the field notes.

In the case of trees which have been blazed before marking, the number of rings contained in the overgrowth (or its equivalent on the adjoining sections of the tree) furnish count of the number of years (one annual ring for each growing season) from the date of original marking to the date when uncovered. Uncovering an old blaze leaves it subject to decay, and the surveyor should adopt additional means to evidence the position of the corner.

4-67. *Standard township corners* are marked "S C" and the township on the north side, and the ranges and sections on the east and west sides:

SC T25N on N.,  
R18E S31 on E., and  
R17E S36 on W. side.

4-68. *Closing township corners* are marked "C C" and the township (or range) on the side from which the closing line approaches the monument, and the ranges (or townships) and sections on the adjoining sides; also the initials or abbreviation of the reservation, grant or private claim, on the side toward any irregular tract which may be closed upon:

R18E S6 on E.,  
CC T24N on S., and  
R17E S1 on W. side.

4-69. *Corners common to four townships* are marked with the township and section on the northeast and southwest sides, and the range and section on the southeast and northwest sides:

T23N S31 on NE.,  
R18E S6 on SE.,  
T22N S1 on SW., and  
R17E S36 on NW. side.

4-70. *Corners common to two townships only* are marked with the township, range, and section on the sides toward the particular townships:

T2N R7W S1 on SW., and  
T3N R7W S36 on NW. side.

4-71. *Corners referring to one township only* are marked with the township, range, and section on the side toward the particular township which is concerned:

T23N R7W S36 on NW. side.

4-72. *Standard section corners* are marked "S C" and the township and range on the north side, and the sections on the east and west sides:

SC T25N R17E on N.,  
S36 on E., and  
S35 on W. side.

4-73. *Closing section corners* are marked

"C C" and the township and range on the side from which the closing line approaches the monument, and the sections on the adjoining sides; also the initials or abbreviation of the reservation, grant or private claim on the side toward any irregular tract which may be closed upon:

S1 on E.,  
CC T24N R17E on S., and  
S2 on W. side.

4-74. *Corners common to four sections* are marked (a) on an exterior, with the township (or townships), ranges (or range) and sections; and (b) a subdivisional corner, with the township, range and section:

- (a) T25N S7 on NE.,  
R18E S18 on SE.,  
R17E S13 on SW., and  
S12 on NW. side.
- (a) T26N S36 on NE.,  
R17E S1 on SE.,  
T25N S2 on SW., and  
S35 on NW. side.
- (b) T25N S24 on NE.,  
R17E S25 on SE.,  
S26 on SW., and  
S23 on NW. side.

4-75. *Section corners common to two sections only* are marked with the township and section, and the range and section, on the sides toward the particular sections to which the corner belongs:

T14S S11 on NE., and  
R20W S10 on NW. side.

4-76. *Section corners referring to one section only* are marked with the township, range and section on the side toward the particular section which is concerned:

T27N R16W S17 on NW. side.

4-77. *Standard quarter-section corners* are marked "SC1/4" and the section, all on the north side:

SC1/4 S36 on N. side.

4-78. *Quarter-section corners of maximum control* are marked (a) on a meridional line, "1/4" and the section on the west side, and the section on the east side; and (b) on a latitudinal line, "1/4" and the section on the north side, and the section on the south side:

- (a) S18 and E., and  
1/4 S13 on W. side.
- (b) 1/4 S21 on N., and  
S28 on S. side.

4-79. *Quarter-section corners of minimum control* are marked "1/4" and the section, all on the side toward the particular section which is concerned:

1/4 S7 on E. side (for quarter-section corner on the west boundary of section 7).

4-80. *Meander corners* are marked "MC" on the side toward the meanderable body of water, and the additional marks (a) on a standard parallel or other line controlling surveys to one side only, with the township, range and section on the side toward the surveyed land; (b) on an exterior, with the township (or range) common to the adjoining townships on the side opposite the meanderable body of water, and the ranges (or townships) and the sections on the adjoining sides; and, (c) on a subdivisional line, with the township and range on the side opposite the meanderable body of water, and the sections on the adjoining sides:

- (a) MC on E., and  
T25N R 17E S33 on NW. side (for meander corner on a standard parallel, on the west side of a meanderable body of water).
- (b) T24N on N.,  
R18E S18 on E.,  
MC on S., and  
R17E S13 on W. side (for meander corner on a range line, on the north side of a



- meanderable body of water).
- (b) T23N S35 on N.,  
MC on E.,  
T22N S2 on S., and  
R17W on W. Side (for meander corner on a township line, on the west side of a meanderable body of water).
  - (c) S23 on N.,  
T25N R17E on E.,  
S26 on S., and  
MC on W. side (for meander corner on a latitudinal section line, on the east side of a meanderable body of water).
  - (c) MC on N.,  
S9 on E.,  
T4N R7W on S., and  
S8 on W. side (for meander corner on a meridional section line, on the south side of a meanderable body of water).

4-81. *Special and auxiliary meander corners* are marked "SMC" or "AMC", as the case may be, on the side toward the meanderable body of water, and the section on the opposite side:

- SMC on E., and  
S14 on W. side (for special meander corner on a latitudinal subdivision-of-section line in section 14, on the west side of a meanderable body of water).
- AMC on N., and  
S9 on S. side (for auxiliary meander corner in section 9, on the south side of a meanderable body of water).

#### MARKS ON SPECIAL-PURPOSE MONUMENTS

4-82. At a witness corner the marks on an iron post monument are arranged as on a regular corner monument with the addition of the letters "W C" on the north and an arrow pointing to the true point for the corner. A stone is marked with the letters "W C" only, on the south face if the true line field notes are to read running north, or on the east face if the

notes are to read running west. On a tree, two hacks are made on the north and south sides on a meridional line or two hacks on the east and west sides on a latitudinal line. The marks are the same as on a line tree, which serves the same purpose.

A reference monument normally is marked the same as a bearing tree located in a similar position with the addition of an arrow pointing to the corner point, and the date, and substituting the letters "R M" for "B T". Where reference monuments are established at corners of minimum control, including corners on standard lines, the monument established in the section to which the corner does not refer is marked only with the letters "R M", and an arrow pointing to the corner point, and the date. If there is sufficient space on the brass cap or tablet, the distance to the true corner may be stamped beside the arrow.

At a witness point the brass cap is marked "W P" at the top, the date at the bottom, and "S" with the section number on each of the halves appropriate for the line of survey. Monuments at witness points situated on subdivision-of-section lines or at other unusual places are marked as provided for in the special instructions. A stone is marked "W P" only on the face as in marking a witness corner monument. A tree intersected by the true line is marked as a line tree, which has the same function as a witness point.

The markings on a location monument are described in section 10-33.

Control point monuments established by electronic methods are marked "E C", with a serial number, the year date, and the group number or survey number in the course of which they are established.

#### CORNER ACCESSORIES

4-83. The purpose of an accessory is to evidence the position of the corner monument.



A connection is made from the corner monument to fixed natural or artificial objects in its immediate vicinity, whereby the corner may be relocated from the accessory. Thus, if the monument is destroyed or removed, its position may be identified by any remaining evidence of the accessories. One or more kinds of accessory are employed at each corner established in the public-land surveys (except for corners of minor subdivisions and where specifically not required by the Manual, or omitted by the special instructions).

Accessories consist of (1) bearing trees or other natural objects such as notable cliffs and boulders, permanent improvements, reference monuments; (2) mounds of stone; or (3) pits and memorials. Aside from availability, selection is based on their order of permanence.

4-84. The surveyor cannot perform any more important service than that of establishing permanent and accurate evidence of the location of the corners in his survey. Where the accessories cannot be employed, other means should be adopted that will best serve the purpose.

#### **Bearing Trees and Bearing Objects**

4-85. Bearing trees are selected for marking when available, ordinarily within a distance of 3 chains of the corner; a greater distance if important. One tree is marked in each section unless a tree in one or more positions may not be available. A full description of each bearing tree is given in the field notes. This includes the species of each tree, its diameter at breast height, the exact direction from the monument, the horizontal distance counting to the center of the tree at its root crown; and the exact marks scribed for the identification of the corner.

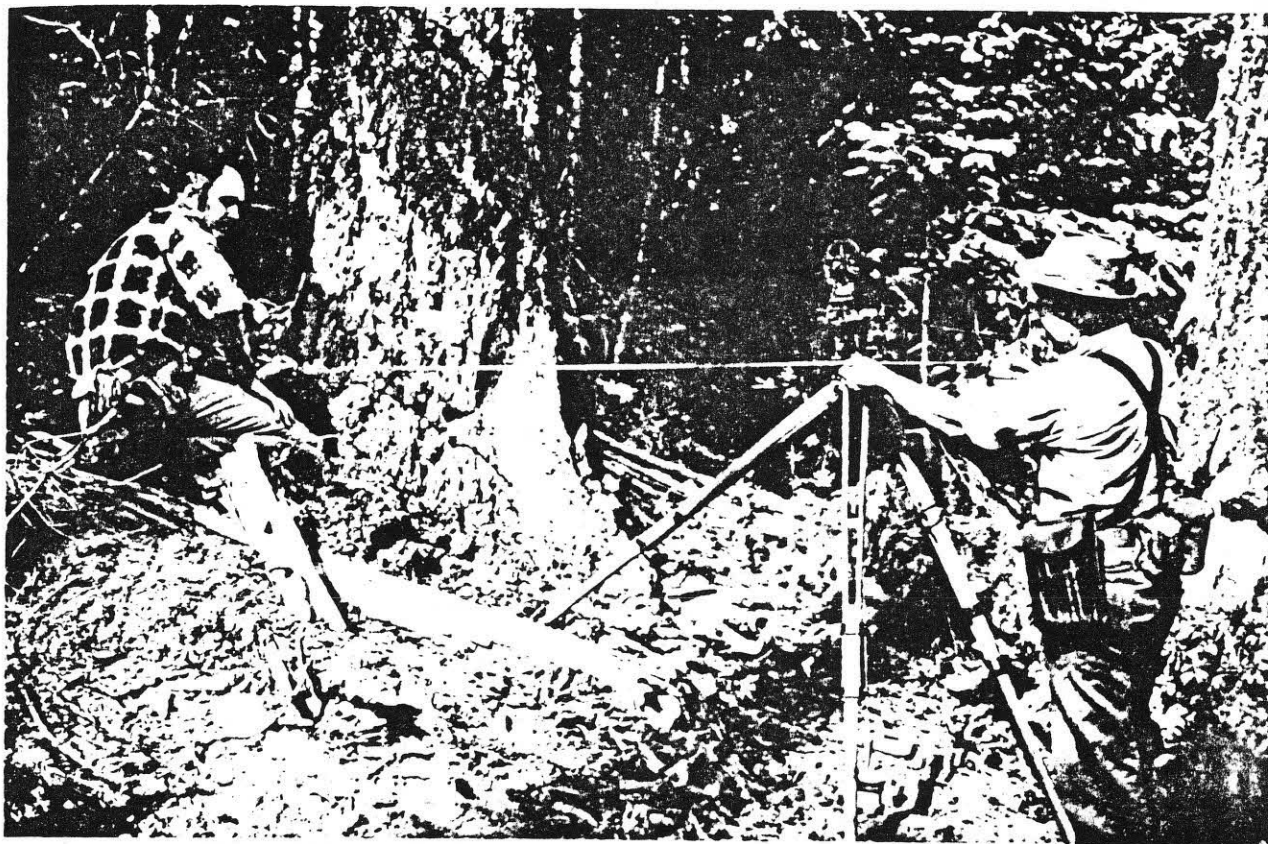
Almost any nearby natural object that can be readily identified should be recorded by description, course, and distance. Such objects may not be of a character that can be marked, excepting in the case of a rock cliff or boulder. These are supplemental to the marking of bearing

trees, or to fill out a quota where trees are not available in some sections. The description of the cliff or boulder should provide ready identification, including the marking of a cross (X) plainly and deeply chiseled at the exact point to which the direction and distance are recorded.

Another desirable accessory, especially where the usual types are not available, nor suitable on account of the site conditions, such as at a corner that falls in cultivated land, is to record accurate bearing to two or more prominent landmarks.

4-86. The marks upon a bearing tree are made upon the side facing the monument, scribed in the manner already outlined for marking tree corner monuments. The marks embrace the information suggested in the schedule hereinafter given, with such letters and figures as may be appropriate for a particular corner, and will include the letters "BT". A tree will always be marked to agree with the section in which it stands, and will be marked in a vertical line reading downward, ending in the letters "BT" at the lower end of the blaze approximately 6 inches above the root crown.

4-87. There is a great difference in the longevity of trees, and in their rate of decay; trees should therefore be selected, if possible, with a view to the length of their probable life, their soundness, favorable site conditions and size. Sound trees, not matured, of the most hardy species, favorably located, are preferred for marking. Trees 5 inches or less in diameter should not be selected for marking if larger trees are available, and it is generally better to avoid marking fully matured trees, especially those showing signs of decay. Trees 4 inches in diameter, or less, if no better trees are available, are marked with the letter "BT" only at the base, and an "X" at breast height, facing the monument. The species, size and exact position of the bearing trees are of vital importance, as this data will generally serve to identify a bearing tree without uncovering the marks, or even to identify two or more stumps after all evidence of the marks has disappeared.



Marking a bearing tree.

4-88. Generally only one tree is marked in each section at a particular corner, but in certain instances two trees are required in a section. In such cases it is better to select trees of different species or of widely different size, direction or distance. If the trees are of the same species, in order that confusion may be avoided in the future identification of a remaining tree where the companion tree has disappeared, one is marked with an "X" only (and "BT" at the base).

4-89. A cross (X) and the letters "BO" are chiseled into a bearing object, if it is a rock cliff or boulder; the record should enable another surveyor to determine just where the marks will be found. The rock bearing object is the most permanent of all accessories; it is used wherever practicable, and within a distance of 5 chains.

4-90. A connection to any permanent artificial object or improvement may be included in this general class of corner accessories. The field notes should be explicit in describing such objects, and should indicate the exact point to which a connection is made, as "southwest corner of foundation of Smith's house," "center of Smith's well," "pipe of Smith's windmill," etc. No marks will be made upon private property without the consent of the owner.

#### Memorials

4-91. Where there is no tree or other bearing object, as above described, and where a mound of stone or pits are impracticable, a suitable memorial is deposited alongside the monument. A memorial may consist of any durable article which will serve to identify the location in case the monument is

destroyed. Such articles as glassware, stoneware, a marked (X) stone, a charred stake, a quart of charcoal, or pieces of metal constitute a suitable memorial. A full description of such articles is embodied in the field notes wherever they are employed as a memorial. When replacing an old monument with a new one, such as substituting an iron post for an old marked stone, the old marker is preserved as a memorial.

### Mound of Stone

4-92. Where native stone is available and the surface of the ground is favorable, a mound of stone is employed as an accessory to a corner monument, or to surround it, even though a full quota of trees or other bearing objects can be utilized. A mound of stone erected as a corner accessory should be built as stable as possible, should consist of not fewer than five stones, and should be not less than 2 feet base and 1½ feet high. Where the ground is suitable, the stone mound is improved by first digging a circular trench, 4 to 6 inches deep, for an outer ring, then placing the base of the larger stones in the trench. In stony ground the size of the mound is sufficiently increased to make it conspicuous. The position of the accessory mound is shown in the schedule following. The nearest point on its base should be about 6 inches distant from the monument. The field notes show the size and position of the mound.

4-93. Where it is necessary to support a monument in a stone mound, and if bearing trees or other objects are not available, a marked (X) stone or other memorial is deposited alongside the monument.

A stone mound accessory, in addition to the mound surrounding a monument, is built wherever this will aid materially in making the location conspicuous.

### Pits

4-94. Where full quota of trees or other bearing objects are unavailable for marking, the position of the monument is, under favorable

conditions, evidenced by pits. No pits should be dug in a roadway, or where the ground is overflowed for any considerable period, or upon steep slopes, or where the earth will wash, or in loose or light soil, or where there is no native sod, or where suitable stone for a mound is at hand.

A firm soil covered with a healthy native sod is most favorable for a permanent pit. Under such conditions the pits will gradually fill with a material slightly different from the original soil, and a new species of vegetation will generally take the place of the native grass; these characteristics, under favorable conditions, make it possible to identify the original location of the pits after the lapse of many years.

4-95. All pits should be dug 18 inches square and 12 inches deep, with the nearest side 3 feet distant from the corner monument, oriented with a square side (and not a corner) towards the monument, arranged as shown in the schedule following. The earth removed is scattered in such a way that it will not again fill the pits. A description of the pits is embodied in the field notes, and should include a statement of their size and position.

### Accessories to Special-Purpose Monuments

4-96. The accessories to special-purpose monuments are selected and marked as follows:

*Witness Corners:* Formerly the accessories for witness corners were the same as though the monument had been established at its true point, but the marks upon the bearing trees or other objects were preceded by the letter "WC", and the section number was made to agree with the section in which the tree or object actually stood. The rule now is that bearing objects, if available, are treated as for a regular corner. Bearing trees, with direction and distance from the monument, are marked with an "X" at breast height, on the side facing the monument, and the letters "BT" at the base. Mounds of stone are treated as though the monument were

located at the true corner.

*Reference Monument:* All bearing objects and bearing trees, including marks, refer to the position of the regular corner, as that location will be occupied as an instrument station.

*Witness Point:* No requirements are set up as to the accessories for a witness point other than to mark a bearing tree or a bearing object, if available, at important locations or to record bearings to more distant natural objects or improvements.

#### ARRANGEMENT AND MARKING OF CORNER ACCESSORIES

##### 4-97. *Standard township corners.* *Standard section corners.*

Two bearing trees, one in each section north of the standard parallel, each marked "SC" and the township, range and section; as

T25N R18E S31 SC BT.

Mound of stone, north of corner.

Three pits, one each on line north, east and west.

##### 4-98. *Closing township corners.* *Closing section corners.*

Two bearing trees, one in each section to the right and left of the closing line, each marked "CC" and the township, range and section; as

T24N R18E S6 CC BT.

Mound of stone, on the closing line.

Three pits, one on the closing line and one each to the right and left on the line closed upon.

##### 4-99. *Corners common to four townships.*

Four bearing trees, one in each section, each marked with the township, range and section: as

T22N R17E S1 BT.

Mound of stone, south of corner.

Four pits, one each on line north, east, south and west.

##### 4-100. *Corners common to two townships only.*

Two bearing trees, one in each section cornering at the monument, each marked with the township, range and section; as

T2N R7W S1 BT.

Mound of stone, on the line between the two townships cornering at the monument.

Three pits, one each on the three lines connecting at the monument.

##### 4-101. *Corners referring to one township only.*

Two bearing trees, both in the township cornering at the monument, each marked with the township, range and section; as

T23N R19W S36 BT.

Mound of stone, in the township cornering at the monument, at 45° from cardinal direction at the monument.

Two pits, one each on the two lines connecting at the monument.

##### 4-102. *Corners common to four sections.* Four bearing trees, one in each section, each marked with the township, range and section; as

T26N R17E S35 BT.

Mound of stone, west of corner.

Four pits, one in each section northeast, southeast, southwest and northwest.

##### 4-103. *Section corners common to two sections only.*

Two bearing trees, one in each section cornering at the monument, each marked with the township, range and section; as

T14S R17E S12 BT.

Mound of stone, on the line between the two sections cornering at the monument.

Two pits, one in each section at 45° from cardinal direction at the monument.



4-104. *Section corners referring to one section only.*

Two bearing trees, both in the section cornering at the monument, each marked with the township, range and section; as

T27N R16W S17 BT.

Mound of stone, in the section cornering at the monument, at  $45^\circ$  from cardinal direction at the monument.

Two pits, one 3 feet and one 6 feet distant, both in the section cornering at the monument, at  $45^\circ$  from cardinal direction at the monument.

4-105. *Standard quarter-section corners.*

Two bearing trees, both north of the standard parallel, each marked " $\frac{1}{4}$ " and "SC" and the section; as

$\frac{1}{4}$  S36 SC BT.

Mound of stone, north of corner.

Two pits, one each on line east and west.

4-106. *Quarter-section corners of maximum control.*

Two bearing trees, one in each section, each marked " $\frac{1}{4}$ " and the section; as

$\frac{1}{4}$  S16 BT.

Mound of stone: (a) on a meridional line, west of corner; and, (b) on a latitudinal line north of corner.

Two pits, one in each direction of the line passing through the monument.

4-107. *Quarter-section corners of minimum control.*

Two bearing trees, both in the particular section which is concerned, each marked " $\frac{1}{4}$ " and the section; as

$\frac{1}{4}$  S7 BT.

Mound of stone, in the particular section which is concerned, in a cardinal direction from the monument.

Two pits, one in each direction on the line passing through the monument.

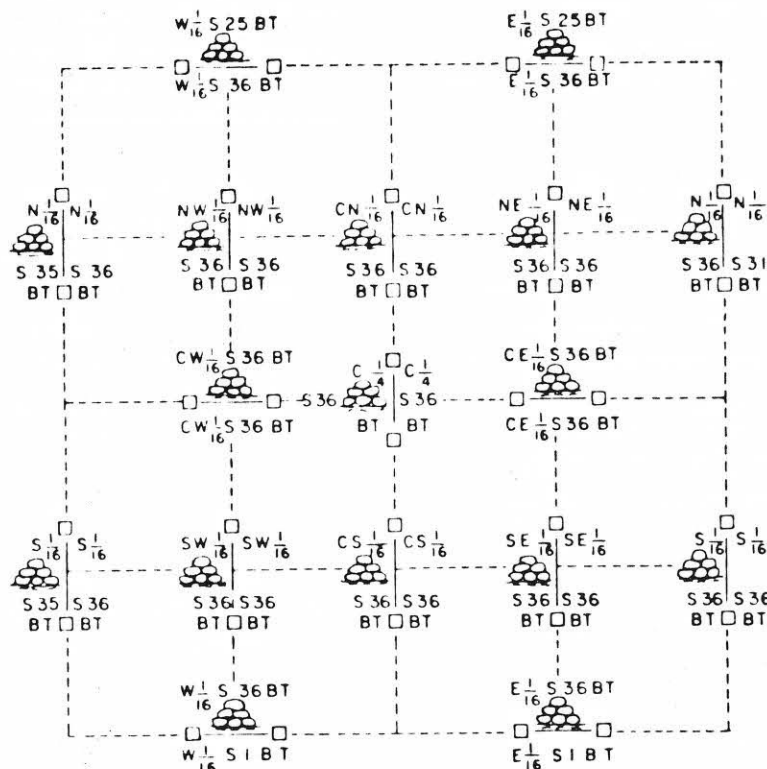


FIGURE 69.—Arrangement and marking of accessories for interior quarter-section and all sixteenth-section corners.

#### 4-108. *Meander corners.*

Two bearing trees: (a) on a standard parallel or other line controlling surveys to one side only, both in the particular section which is concerned; and (b) on all other lines, one in each section to the right and left of the line; all marked "MC" and with the township, range and section; as

T25N R14E S32 MC BT.

Mound of stone, on the surveyed line on the opposite side of the monument from the meanderable body of water.

Two pits, one 3 feet and one 6 feet distant, on the surveyed line on the opposite side of the monument from the meanderable body of water.


4-109. *The interior quarter-section and all sixteenth-section corners*, when required by the written instructions.

Two bearing trees, marked (with letters and figures ending in "BT") as shown in figure 69.

Mound of stone, in a cardinal direction from the monument, as shown (with symbol

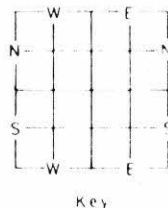


Figure 69.

Two pits, in a cardinal direction from the monument, as shown (with symbol ) in figure 69.

4-110. *Sixteenth-section corners of minimum control.*

Two bearing trees, both in the particular section which is concerned, each marked with a key letter (N, E, S or W) to indicate the position of the monument, and "1/16" and the section; as N 1/16 S18 BT.



Mound of stone, in the particular section which is concerned, in a cardinal direction

from the monument.

Two pits, one in each direction on the section line passing through the monument.

4-111. *Special and auxiliary meander corners.*

Two bearing trees, each marked "SMC" or "AMC", as the case may be, and the section; as

S14 SMC BT or  
S14 AMC BT.

Mound of stone, on the opposite side of the monument from the meanderable body of water.

Two pits, one 3 feet and one 6 feet distant, on the opposite side of the monument from the meanderable body of water.

4-112. *Closing subdivision-of-section corners.*

Two bearing trees, both in the particular section which is concerned, each marked "CC" and the section; as

S9 CC BT.

Mound of stone, on the closing line.

Three pits, one on the closing line and one each to the right and left on the line closed upon.

4-113. *Miscellaneous angle points along irregular boundaries.*

(a) Two bearing trees, where the monuments are less than 1 mile apart, one on each side of the boundary; and (b) four bearing trees, where the monuments are 1 mile or more apart, two on each side of the boundary; each marked "AP" and a serial or section number, or both, also the initials or abbreviation of the State, reservation, grant, private claim or public land, as appropriate; as

AP2 TR37 BT, and

AP S14 BT (for "angle point No. 2" on the boundary of a private claim "Tract No. 37" falling on surveyed land).



Mound of stone, on the medial line between the boundary lines intersecting at the monument, and in the direction toward the reservation, grant or private claim.

The placing of a stone mound on a State boundary is *on the line*, north from the monument if the field notes of the survey or retrace-ment are written to read running north; to the east, if running east, etc. In the boundary surveys, where stone is available, it is good practice to build a substantial stone and earth mound surrounding and to the top of the monument; this will usually be conspicuous without an additional stone mound.

Two pits, one in each direction on the lines intersecting at the monument.

4-114. *Intermediate corners along irregular boundaries.*

(a) Two bearing trees, where the monuments are less than 1 mile apart, one on each side of the boundary; and (b) four bearing trees, where the monuments are 1 mile or more apart, two on each side of the boundary; each marked with the number of the mile or half-mile corner and the letter "M" to (indicate "mile corner"), and the initials or abbreviation of the State, reservation, grant, private claim or public land, as appropriate; as

47 M COLO BT, and

47 M OKLA BT (for "47th mile" corner on the boundary line between the States of "Colorado" and "Oklahoma").

Mound of stone, on a line at right angles to the boundary, and in direction toward the reservation, grant, or private claim.

Two pits, one in each direction on the boundary.

[illegible]



It has often been said that the surveyor must not only be a good technician, but he must also be aware of the laws and statutes which govern his profession and although awareness of the law is essential, the surveyor must carefully avoid making his own interpretations of the law since when he does this he ceases to practice surveying and starts practicing law.

Surveying is one of the oldest of all the professions and evidence of the legal aspects of the profession go back to antiquity. One of the earliest pieces of evidence known to modern man is a monument found in Babylon set up to mark the boundaries and upon which is inscribed a description of the boundary which it established. The Bible contains many references to boundaries such as "After Lot had left, the Lord said to Abram, 'Look about you and from where you are gaze to the north and south, east and west, all the land that you see I will give to you and your descendents forever. I will make your descendants like the dust of the earth. If anyone can count the dust of the earth, your descendants too might be counted. Set forth and walk about in the land through its length and breath, for to you I will give it.'" Genesis, Chapter 13, Verses 14, 15 to 17.

So here in the first book of the Bible and in the earliest verses of this book we find references to descriptions of land and boundaries of land.

Once the boundaries were established, laws were laid down by the Lord governing the use and preservation of the boundaries. In the book of Deuteronomy we find the Lord laying down the laws concerning the use of the land and boundaries, "Thou shalt not remove thy neighbor's landmark, when they of old time have set it in thine inheritance, which thou shalt inherit in the land that the Lord thy God giveth to possess it." Deuternomy, Chapter 19, Verse 14.

And then still another quotation we find the Lord, the voice of Moses laying down the law, "Cursed be he who removes his neighbor's landmark." Deuteronomy, Chapter 27, Verse 17.

In his book on 'Surveying and Boun-aries', Mr. Clark says of the legal concept of boundaries, "The English Common Law placed a very high value on property rights. The law developed in the early Middle Ages when human life was cheap and a much greater price was paid upon the property than life itself. Criminal penalties for injury to, or taking of property were generally more severe than those for taking of life. This policy persisted until fairly modern times. Justice rendered to a cattle rustler or a horse thief was usually quicker and surer in the American west than that suffered by one who killed man in a fair fight. There are areas in the United States today where disputes over a line fence still rank as one of the major causes of homicide. This principle is recognized under the somewhat shop-worn cliché principle that every man's house is his castle, giving the owner the right to defend his premises by force of arms if necessary.

Property rights with individuals are protected by the First and Fourteenth Amendments to the Federal Constitution. The first against invasion by the United States - the fourteenth against the states. When a man holds title to land, that title cannot be taken away from him, nor can any part of it be affected otherwise than by "due process of law", that is by judgement of the court of proper jurisdiction. Such a judgement divesting one of title can only be rendered in cases of judicial sales, such as sales on partition, foreclosures of mortgages or administrator's, or executor's sales on death of the owner; by sheriff sale, an execution to pay the owner's bills in judgment by taking of the state and providing adequate compensation for eminent domain or to carry some public policy

in the exercise of the police power. Otherwise man cannot be forced to involuntarily part with any of his property.

This means that except by one of the methods just mentioned, a boundary line cannot be changed without the consent of the adjoining owner. A court, in a judicial sense, on sale or execution of or by eminent domain or exercise of the police power can establish a new boundary without the consent of either or both of the adjoining landowners. Otherwise the only power that a surveyor or even a court has is to determine what the true boundary between the parties is. A true boundary cannot be changed. This right that the boundary shall remain unaltered is protected both by the Federal and most state constitutions. Any law that attempts to seek otherwise would be unconstitutional and any act of an individual would be void. Nor can adjoining landowners even among themselves consent to a change in the boundary or even determine where the true boundary is without following certain formulae."

Thus we find that from the beginning of civilization as quoted in the early books of the Bible; as quoted in the common law and the Constitution of the United States property rights have been zealously guarded and the right to change property lines is a matter of great concern. In recent times, (i.e. over the last two hundred years) many laws and many court decisions have been rendered concerning the rights of property owners and the manners in which surveys can be made. Many of these laws have been quoted elsewhere in this handbook, as for example in the chapter concerning the subdivisions of public lands, and the public land surveys. It is always important and has been stressed many times, that the land surveyor keep in mind that his job is to survey the boundaries and not to make judicial decisions. Thus the land surveyor often finds himself in a somewhat different position than many other professionals. Since his judgments must often be guided by the precedents set either as a matter of law or an interpretation

of the law. Unlike the architect for example, who may draw on his creativity to design an imposing or unique structure or the engineer who may conceive of a bridge or other structure of a new and unique design governed only by the laws of physics or natural laws, the land surveyor finds himself in a situation where his decisions must be based on laws which are subject to interpretation by the courts. One of the most frequently quoted dissertations on survey law in general is 'The Judicial Functions of Surveyors' by Chief Justice Cooley of Michigan which is an unusually fine dissertation on the general laws of land surveying, and while it is not directly applicable to surveying in the state of Arkansas as a whole, many portions of this fine document do apply in the state of Arkansas. Because of the excellent dissertations on land surveyors and land surveying law in general it is included herein.

"When a man has had a training in one of the exact sciences, where every problem within its purview is supposed to be susceptible of accurate solution, he is likely to be not a little impatient when he is told that under some circumstances he must recognize inaccuracies, and govern his action by facts which lead him away from the results which theoretically he ought to reach. Observation warrants us in saying that this remark may frequently be made of surveyors.

In the State of Michigan all our lands are supposed to have been surveyed one or more, and permanent monuments fixed to determine the boundaries of those who should become proprietors. The United States, as original owner, caused them all to be surveyed once by sworn officers, and as the plan of subdivision was simple, and was uniform over a large extent of territory, there should have been, with due care, few or no mistakes; and long rows of monuments should have been



perfect guides to the place of any one that chanced to be missing. The truth unfortunately is that the lines were very carelessly run, the monuments inaccurately placed; and, as the recorded witnesses to these were many times wanting in permanency, it is often the case that when the monument was not correctly placed it is impossible to determine by the record, with the aid of anything on the ground, where it was located. The incorrect record of course becomes worse than useless when the witnesses it refers to have disappeared.

It is, perhaps, generally supposed that our town plats were more accurately surveyed, as indeed they should have been, for in general there can have been no difficulty in making them sufficiently perfect for all practical purposes. Many of them, however, were laid out in the woods; some of them by proprietors themselves, without either chain or compass, and some by imperfectly trained surveyors, who, when land was cheap, did not appreciate the importance of having correct lines to determine boundaries when land should become dear. The fact probably is that town surveys are quite as inaccurate as those made under authority of the general government.

It is now upwards of fifty years since a major part of the public surveys in what is now the State of Michigan were made under authority of the United States. Of the lands south of Lansing, it is now forty years since the major part was sold and the work of improvement began. A generation has passed away since they were converted into cultivated farms, and few if any of the original corner and quarter stakes now remain.

The corner and quarter stakes were often nothing but green sticks

driven into the ground. Stones might be put around or over these if they were handy, but often they were not, and the witness trees must be relied upon after the stake was gone. Too often the first settlers were careless in fixing their lines with accuracy while monuments remained, and an irregular brush fence, or something equally untrustworthy, may have been relied upon to keep in mind where the blazed line once was. A fire running through this might sweep it away, and if nothing were substituted in its place, the adjoining proprietors might in a few years be found disputing over their lines, and perhaps rushing into litigation, as soon as they had occasion to cultivate the land along the boundary.

If now the disputing parties call in a surveyor, it is not likely that any one summoned would doubt or question stakes which determined the boundary line between the proprietors. However erroneous may have been the original survey, the monuments that were set must nevertheless govern, even though the effect be to make one half-quarter section ninety acres and the one adjoining but seventy; for parties buy or are supposed to buy in reference to those monuments, and are entitled to what is within their lines, and no more, be it more or less. *Melver v. Walker*, 4 Wheaton's Reports, 444; *Land Co. v. Saunders*, 103 U.S. Reports, 316; *Cottingham v. Parr*, 93 Ill. Reports, 233; *Bunton v. Cardwell*, 53 Texas Reports, 408; *Watson v. Jones*, 85 Penn. Reports, 117.

While the witness trees remain there can generally be no difficulty in determining the locality of the stakes. When the witness trees are gone, so that there is no longer record evidence of the monuments, it is remarkable how many there are who mistake altogether the duty that now devolves upon the surveyor. It is



by no means uncommon that we find men whose theoretical education is supposed to make them experts who think that when the monuments are gone, the only thing to be done is to place new monuments where the old ones should have been, and where they would have been if placed correctly. This is a serious mistake. The problem is now the same that it was before; to ascertain, by the best lights of which the case admits, where the original lines were. The mistake above alluded to is supposed to have found expression in legislation; though it is possible that the real intent of the act to which we shall refer is not what is commonly supposed.

An act passed in 1869, Compiled Laws, 593, amending the laws respecting the duties and powers of county surveyors, after providing for the case of corners which can be identified by the original field notes or other unquestionable testimony, directs as follows:

"Second. Extinct interior-section corners must be re-established at the intersection of two right lines joining the nearest known points on the original section lines east and west and north and south of it.

"Third. Any extinct quarter-section corners, except on fractional lines, must be re-established equidistant and in a right line between the section corners; in all other cases at its proportionate distance between the nearest original corners on the same line."

The corners thus determined, the surveyors are required to perpetuate by noting bearing trees when timber is near.

To estimate properly this legislation, we must start with the admitted and unquestionable fact that each purchaser

from government bought such land as was within the original boundaries, and unquestionably owned it up to the time when the monuments became extinct. If the monument was set for an interior-section corner, but did not happen to be "at the intersection of the two right lines joining the nearest known points on the original section lines east and west and north and south of it," it nevertheless determined the extent of his possessions, and he gained or lost according as the mistake did or did not favor him.

It will probably be admitted that no man loses title to his land or any part thereof merely because the evidences become lost or uncertain. It may become more difficult for him to establish it as against an adverse claimant, but theoretically the right remains; and it remains as a potential fact so long as he can present better evidence than any other person. And it may often happen that, notwithstanding the loss of all trace of a section corner or quarter stake, there will still be evidence from which any surveyor will be able to determine with almost absolute certainty where the original boundary was between the government subdivisions.

There are two senses in which the word extinct may be used in this connection: one of the sense of physical disappearance; the other the sense of loss of all reliable evidence. If the statute speaks of extinct corners in the former sense, it is plain that a serious mistake was made in supposing that surveyors could be clothed with authority to establish new corners by an arbitrary rule in such cases. As well might the statute declare that if a man lose his deed he shall lose his land altogether.

But if by extinct corner is meant one in respect to the actual location of which all reliable evidence is lost, then the follo-

wing remarks are pertinent:

(1) There would undoubtedly be a presumption in such a case that the corner was correctly fixed by the government surveyor where the field notes indicated it to be.

(2) But this is only a presumption, and may be overcome by any satisfactory evidence showing that in fact it was placed elsewhere.

(3) No statute can confer upon a county surveyor the power to "establish" corners, and thereby bind the parties concerned. Nor is this a question of merely of conflict between State and Federal law; it is a question of property right. The original surveys must govern, and the laws under which they were made must govern, because the land was bought in reference to them; and any legislation, whether State or Federal, that should have the effect to change these, would be inoperative, because disturbing vested rights.

(4) In any case of disputed lines, unless the parties concerned settle the controversy by agreement, the determination of it is necessarily a judicial act, and it must proceed upon evidence, and give full opportunity for a hearing. No arbitrary rules of survey or of evidence can be laid down whereby it can be adjudged.

The general duty of a surveyor in such a case is plain enough. He is not to assume that a monument is lost until after he has thoroughly sifted the evidence and found himself unable to trace it. Even then he should hesitate long before doing anything to the disturbance of settled possessions. Occupation, especially if long continued, often affords very

satisfactory evidence of the original boundary when no other is attainable; and the surveyor should inquire when it originated, how, and why the lines were then located as they were, and whether a claim of title has always accompanied the possession, and give all the facts due force as evidence. Unfortunately, it is known that surveyors sometimes, in supposed obedience to the State statute, disregard all evidences of occupation and claim of title, and plunge whole neighborhoods into quarrels and litigation by assuming to "establish" corners at points with which the previous occupation cannot harmonize. It is often the case that where one or more corners are found to be extinct, all parties concerned have acquiesced in lines which were traced by the guidance of some other corner or landmark, which may or may not have been trustworthy; but to bring these lines into discredit when the people concerned do not question them not only breeds trouble in the neighborhood, but it must often subject the surveyor himself to annoyance and perhaps discredit, since in a legal controversy the law as well as common sense must declare that a supposed boundary line long acquiesced in is better evidence of where the real line should be than any survey made after the original monuments have disappeared. *Stewart v. Charleton*, 31 Mich. Reports, 270; *Diehl v. Zanger*, 39 Mich. Reports, 601; *Dupont v. Starring*, 42 Mich. Reports, 492. And county surveyors, no more than any others, can conclude parties by their surveys.

The mischiefs of overlooking the facts of possession must often appear in cities and villages. In towns the block and lot stakes soon disappear; there are no witness trees and no

monuments to govern except such as have been put in their places, or where their places were supposed to be. The streets are likely to be soon marked off by fences, and the lots in a block will be measured off from these, without looking farther. Now it may perhaps be known in a particular case that a certain monument still remaining was the starting point in the original survey of the town plat; or a surveyor settling in the town may take some central point as the point of departure in his surveys, and assuming the original plat to be accurate, he will then undertake to find all streets and all lots by course and distance according to the plat, measuring and estimating from his point of departure. This procedure might unsettle every line and every monument existing by acquiescence in the town; it would be very likely to change the lines of streets, and raise controversies everywhere. Yet this is what is sometimes done; the surveyor himself being the first person to raise the disturbing questions.

Suppose, for example, a particular village street has been located by acquiescence and use for many years, and the proprietors in a certain block have laid off their lots in reference to this practical location. Two lot owners quarrel, and one of them calls in a surveyor that he may be sure that his neighbor shall not get an inch of land from him. This surveyor undertakes to make his survey accurate, whether the original was, or not, and the first result is, he notifies the lot owners that there is an error in the street line, and that all fences should be moved, say, one foot to the east. Perhaps he goes on to drive stakes through the block according to this conclusion. Of course, if he is right in doing this, all lines in the village will be unsettled; but we limit our attention to

the single block. It is not likely that the lot owners generally will allow the new survey to unsettle their possessions, but there is always a probability of finding someone disposed to do so. We shall then have a lawsuit; and with what result?

It is a common error that lines do not become fixed by acquiescence in a less time than twenty years. In fact, by statute, road lines may become conclusively fixed in ten years; and there is no particular time that shall be required to conclude private owners, where it appears that they have accepted a particular line as their boundary, and all concerned have cultivated and claimed up to it. *McNamara v. Seaton*, 82 Ill. Reports, 498; *Bunce v. Bidwell*, 43 Mich. Reports, 542. Public policy requires that such lines be not lightly disturbed, or disturbed at all after the lapse of any considerable time. The litigant, therefore, who in such a case pins his faith on the surveyor, is likely to suffer for his reliance, and the surveyor himself to be mortified by a result that seems to impeach his judgment.

Of course nothing in what has been said can require a surveyor to conceal his own judgment, or to report the facts one way when he believes them to be another. He has no right to mislead, and he may rightfully express his opinion that an original monument was at one place, when at the same time he is satisfied that acquiescence has fixed the right of parties as if it were at another. But he would do mischief if he were to attempt to "establish" monuments which he knew would tend to disturb settled rights; the farthest he has a right to go, as an officer of the law, is to express his opinion where the monument should be, at the same time he imparts the information to those who employ him,

and who might otherwise be misled, that the same authority that makes him an officer and entrusts him to make surveys, also allows parties to settle their own boundary lines, and considers acquiescence in a particular line or monument, for any considerable period, as strong, if not conclusive, evidence of such settlement. The peace of the community absolutely requires this rule. *Joyce V. Williams*, 26 Mich. Reports, 332. It is not long since that, on one of the leading cities of the State, an attempt was made to move houses two or three rods into a street, on the ground that a survey under which the street had been located for many years had been found on more recent survey to be erroneous.

From the foregoing it will appear that the duty of the surveyor where boundaries are in dispute must be varied by the circumstances. 1. He is to search for original monuments, or for the places where they were originally located, and allow these to control if he finds them, unless he has reason to believe that agreements of the parties, express or implied, have rendered them unimportant. By monuments in the case of government surveys we mean of course the corner and quarter stakes; blazed lines or marked trees on the lines are not monuments; they are merely guides or finger-posts, if we may use the expression, to inform us with more or less accuracy where the monuments may be found. 2. If the original monuments are no longer discoverable, the question of location becomes one of evidence merely. It is merely idle for any State statute to direct a surveyor to locate or "establish" a corner, as the place of the original monument, according to some inflexible rule. The surveyor, on the other hand, must inquire into all the facts; giving due prominence to the acts of parties concerned, and always keeping in mind, first, that neither

in his opinion nor his survey can be conclusive upon parties concerned; second, that courts and juries may be required to follow after the surveyor over the same ground, and that it is exceedingly desirable that he govern his action by the same lights and rules that will govern theirs. On town plats if a surplus or deficiency appears in a block, when the actual boundaries are compared with the original figures, and there is no evidence to fix the exact location of the stakes which marked the division into lots, the rule of common sense and of law is that the surplus or deficiency is to be apportioned between the lots, on an assumption that the error extended alike to all parts of the block. *O'Brien v. McGrane*, 29 Wis. Reports, 446; *Quinnin v. Reixers*, 46 Mich. Reports, 605.

It is always possible when corners are extinct that the surveyor may usefully act as a mediator between parties, and assist in preventing legal controversies by settling doubtful lines. Unless he is made for this purpose an arbitrator by legal submission, the parties, of course, even if they consent to follow his judgment, cannot, on the basis of mere consent, be compelled to do so; but if he brings about an agreement, and they carry it into effect by actually conforming their occupation to his lines, the action will conclude them. Of course it is desirable that all such agreements be reduced to writing: but this is not absolutely indispensable if they are carried into effect without.

**MEANDER LINES.** The subject to which allusion will now be made is taken up with some reluctance, because it is believed the general rules are familiar. Nevertheless it is often found that surveyors misapprehend them, or err in their application; and as other interesting topics are somewhat connected with this, a little time devoted to it will probably not be



altogether lost. The subject is that of meander lines. These are lines traced along the shores of lakes, ponds, and considerable rivers as the measures of quantity when sections are made fractional by such waters. These have determined the price to be paid when government lands were bought, and perhaps the impression still lingers in some minds that the meander lines are boundary lines, and all in front of them remains unsold. Of course this is erroneous. There was never any doubt that, except on the large navigable rivers, the boundary of the owners of the banks is the middle line of the river; and while some courts have held that this was the rule on all fresh-water streams, large and small, others have held to the doctrine that the title to the bed of the stream below low-water mark is in the State, while conceding to the owners of the banks all riparian rights. The practical difference is not very important. In this State the rule that the centre line is the boundary line is applied to all our great rivers, including the Detroit, varied somewhat by the circumstance of there being a distinct channel for navigation in some cases with the stream in the main shallow, and also sometimes by the existence of islands.

The troublesome questions for surveyors present themselves when the boundary line between two contiguous estates is to be continued from the meander line to the centre line of the river. Of course the original survey supposes that each purchaser of land on the stream has a water front of the length shown by the field notes, and it is presumable that he bought this particular land because of that fact. In many cases it now happens that the meander line is left some distance from the shore by the gradual change of course of the stream or diminution of the flow of water. Now the dividing line between two government subdivisions might strike

the meander line at right angles, or obliquely; and in some cases, if it were continued in the same direction to the centre line of the river, might cut off from the water one of the subdivisions entirely, or at least cut it off from any privilege of navigation, or other valuable use of the water, while the other might have a water front much greater than the length of a line crossing it at right angles to its side lines. The effect might be that, of two government subdivisions of equal size and cost, one would be of very great value as water-front property, and the other comparatively valueless. A rule which would produce this result would not be just, and it has not been recognized in the law.

Nevertheless it is not easy to determine what ought to be the correct rule for every case. If the river has a straight course, or one nearly so, every man's equities will be preserved by this rule: *Extend the line of division between the two parcels from the meander line to the centre line of the river, as nearly as possible at right angles to the general course of the river at that point. This will preserve to each man the water front which the field notes indicated, except as changes in the water may have affected it, and the only inconvenience will be that the division line between different subdivisions is likely to be more or less deflected where it strikes the meander line.*

This is the legal rule, and it is not limited to government surveys, but applies as well to water lots which appear as such on town plats. *Bay City Gas Light Co. v. The Industrial Works*, 28 Mich. Reports, 182. It often happens, therefore, that the lines of city lots bounded on navigable streams are deflected as they strike the bank, or the line where the bank was when the town was first laid out.

When the stream is very crooked, and especially if there are short bends, so that the foregoing rule is incapable of strict application, it is sometimes very difficult to determine what shall be done; and in many cases the surveyor may be under the necessity of working out a rule for himself. Of course this action cannot be conclusive; but if he adopts one that follows, as nearly as the circumstances will admit, the general rule above is indicated, so as to divide as near as may be the bed of the stream among the adjoining owners in proportion to their lines upon the shore, his division, being that of an expert, made upon the ground and with all available lights, is likely to be adopted as law for the case. Judicial decisions, into which the surveyor would find it prudent to look under such circumstances, will throw light upon his duties and may constitute a sufficient guide when peculiar cases arise. Each riparian lot owner ought to have a line on the legal boundary, namely, the centre line of the stream, proportioned to the length of his line on the shore; and the problem in each case is, how this is to be given him. Alluvion, when a river imperceptibly changes its course, will be apportioned by the same rules.

The existence of islands in a stream, when the middle line constitutes a boundary, will not affect the apportionment unless the islands were surveyed out as government subdivisions in the original admeasurement. Whenever that was the case the purchaser of the island divides the bed of the stream on each side with the owner of the bank, and his rights extend above and below the solid ground, and are limited by the peculiarities of the bed and the channel. If an island was not surveyed as a government subdivision previous to the sale of the bank, it is of course impossible to do this for the purposes of government

sale afterwards, for the reason that the rights of the bank owners are fixed by their purchase: when making that, they have a right to understand that all land between the meander lines, not separately surveyed and sold, will pass with the shore in the government sale: and having this right, anything which their purchase would include under it cannot afterward be taken from them. It is believed, however, that the federal courts would not recognize the applicability of this rule to large navigable rivers, such as those uniting the great lakes.

On all the little lakes of the State which are mere expansions near their mouths of the rivers passing through them -- such as the Muskegon, Pere Marquette, and Manistee -- the same rule of bed ownership has been judicially applied, that is, applied to the rivers themselves; and the division lines are extended under the water in the same way. *Rice v. Ruddiman*, 10 Mich., 125. If such a lake were circular, the lines would converge to the centre: if oblong or irregular, there might be a line in the middle on which they would terminate, whose course would bear some relation to that of the shore. But it can seldom be important to follow the division line very far under the water, since all private rights are subject to the public rights of navigation and other use, and any private use of the lands inconsistent with these would be a nuisance, and punishable as such. It is sometimes important, however, to run the lines out for some considerable distance, in order to determine where one may lawfully moor vessels or rafts, for the winter, or cut ice. The ice crop that forms over a man's land of course belongs to him. *Lorman v. Benson*, Mich., 18; *People's Ice Co. v. Steamer Excelsior*, recently decided.



What is said above will show how unfounded is the notion, which is sometimes advanced, that a riparian proprietor on a meandered river may lawfully raise the water in the stream without liability to the proprietors above, provided he does not raise it so that it overflows the meander line. The real fact is that the meander line has nothing to do with such a case, and an action will lie whenever he sets back the water upon the proprietor above, whether the overflow be below the meander lines or above them.

As regards the lakes and ponds of the State, one may easily raise questions that it would be impossible for him to settle. Let us suggest a few questions, some of which are easily answered, and some not:

1. To whom belongs the land under these bodies of water, where they are not mere expansions of a stream flowing through them?

2. What public rights exist in them?

3. If there are islands in them which were not surveyed out and sold by the United States, can this be done now?

Others will be suggested by the answers given to these.

It seems obvious that the rules of private ownership which are applied to rivers cannot be applied to the great lakes. Perhaps it should be held that the boundary is at low-water mark, but improvements beyond this would only become unlawful when they became nuisances. Islands in the great lakes would belong to the United States until sold, and might be surveyed and measured for sale at any time. The right to take fish in the lakes, or to cut ice, is public, like the right of navigation, but is to be exercised in such manner as not to inter-

fere with the rights of shore owners. But so far as these public rights can be the subject of ownership, they belong to the State, not to the United States; and, so it is believed, does the bed of a lake also. *Pollard v. Hagan*, 3 Howard's U. S. Reports. But such rights are not generally considered proper subjects of sale, but, like the right to make use of the public highways, they are held by the State in trust for all the people.

What is said of the large lakes may perhaps be said also of many of the interior lakes of the State: such, for example, as Houghton, Higgins, Cheboygan, Burt's, Mullet, Whitmore, and many others. But there are many little lakes or ponds which are gradually disappearing, and the shore proprietorship advances *pari passu* as the waters recede. If these are of any considerable size — say, even a mile across — there may be questions of conflicting rights which no adjudication hitherto made could settle. Let any surveyor, for example, take the case of a pond of irregular form, occupying a mile square or more of territory, and undertake to determine the rights of the shore proprietors to its bed when it shall totally disappear, and he will find he is in the midst of problems such as probably he has never grappled with, or reflected upon before. But the general rules for the extension of shore lines, which have already been laid down, should govern such cases, or at least should serve as guides in their settlement.

Where a pond is so small as to be included within the lines of a private purchase from the government, it is not believed the public has any rights in it whatever. Where it is not so included, it is believed they have rights of fishery, rights to take ice and water, and rights of navigation for business or pleasure. This is the common belief, and probably

the just one. Shore rights must not be so exercised as to disturb these, and the States may pass all proper laws for their protection. It would be easy with suitable legislation to preserve these little bodies of water as permanent places of resort for the pleasure and recreation of the people, and there ought to be such legislation.

If the State should be recognized as owner of the beds of these small lakes and ponds, it would not be owner for the purpose of selling. It would be owner only as a trustee for the public use: and a sale would be inconsistent with the right of the bank owners to make use of the water in its natural condition in connection with their estates. Some of them might be made salable lands by draining; but the State could not drain, even for this purpose, against the will of the shore owners, unless their rights were appropriated and paid for.

Upon many questions that might arise between the State as owner of

the bed of a little lake and the shore owners, it would be presumptuous to express an opinion now, and fortunately the occasion does not require it.

I have thus indicated a few of the questions with which surveyors may now and then have occasion to deal, and to which they should bring good sense and sound judgment. Surveyors are not and cannot be judicial officers, but in a great many cases they act in a quasi-judicial capacity with the acquiescence of parties concerned: and it is important for them to know by what rules they are to be guided in the discharge of their judicial functions. What I have said cannot contribute much to their enlightenment, but I trust will not be wholly without value."

Recognizing the need for information concerning Arkansas survey laws, the Arkansas Association of Registered Land Surveyors in 1970 published a *Summary of Arkansas Survey Law*. All of the information contained in this booklet is considered appropriate and is included in this handbook for land surveyors.

## A SUMMARY OF ARKANSAS SURVEY LAW

By William K. Finefield

### Preface

This Summary of Arkansas Survey Law is not intended to be a textbook on the subject but more nearly a handbook — a treatise so condensed that it can be quickly read and conveniently used. Its use should be to help the surveyor provide a more substantial service to his employer. Nearly all property has a way of changing hands and when it does — if not before — its boundaries are subject to scrutiny, to question, and often to becoming the subject of a suit at law.

Surveys are quantitative and qualitative. The methods of accurately laying out lines on the ground and accurately describing such lines by courses and distances are well described in textbooks and are basic knowledge of surveyors. This booklet deals primarily with the qualitative or legal significance of the surveyor's work. The quality of a surveyor's work is determined in large measure by how well it is accepted by the owners involved and by others, particularly juries, lawyers, judges, abstractors, title companies, and potential buyers. If it will stand up in the acid test of a court action it is of more value than a survey which carries no weight. In this work, it will be assumed that the quantitative work of the surveyor has been done in the best possible manner and that errors of measurement are at an acceptable minimum. It will further be assumed that the survey is not concerned with questions of ownership except those derived from descriptions, the manner of occupying or holding the land, and questions of boundary. Under special circumstances questions of description, occupancy, and boundary could eliminate entirely the person for whom the survey is being made. These are matters to be discussed between the surveyor and the client. A surveyor who merely surveys a

line without regard to the above questions is apt to mislead his client into costly errors. The client is at least entitled to know the basis on which the line or lines were determined, such as being projected from similar lines in other ownerships. Historical facts, particularly regarding possible adverse possession, can cause later embarrassment.

A survey is often, at the time it is made, a settlement of conflicting claims, evidence, and pre-existing circumstances.

A surveyor should be familiar with these circumstances and legal principles pertaining to them so that he may himself determine the proper line and the proper method of describing it, but also so that he may advise the owner when legal consultation is desirable. The least that can be expected is that the surveyor's description will have to satisfy a title company if the land is sold. Any doubts created in the survey will probably become an exception in the Certificate of Title.

This publication is only a beginning. It is hoped that sufficient additions and corrections will be volunteered as to require rewriting it within a year or two.

In preparing this booklet the author received much help from:

Mr. John M. Shields, PE, RLS, Past Chairman, Arkansas Section, American Congress on Surveying and Mapping, and Executive Secretary, Arkansas Association of Registered Land Surveyors

Mr. John B. Olmsted, Attorney, Real Estate Division, Little Rock District Corps of Engineers

### Introduction

In the early days of Arkansas, thoughts on surveying were taken largely from the Federal

Government's laws and procedures. To illustrate this, Act 25 of 1893, still in effect, requires Arkansas teachers to teach the U. S. Grid System. The Arkansas Constitution, in its only reference to surveying, provides under "Judicial Department" for the election of a County Surveyor. In a sense the County Surveyor is an officer of the court. He may be appointed by the court to make a survey; that is, to make an examination in the field of all the evidence tending to determine the established location which might not be the same as the location he would use if he were locating the boundary for the first time. When this is reported back to the court, together with his platted survey, in the absence of more convincing evidence of a different line, it becomes the law of the case.

However, most surveys do not involve lawsuits and it behooves the surveyor to make a survey which will be legal, which will follow the rules of law as applied to facts which are admitted by both owners, and will obviate future lawsuits and presumably satisfy both owners. If there is any compromising to be done, as opposed to the location of the correct line, it will not best be accomplished by changing the location of the line but by an exchange of money and deeds between the owners.

The Constitution, Act 7, Section 46, provides for the election every two years of a surveyor and that his duties shall be as prescribed by the legislature. Sections 12-1201 through 12-1221 of the Arkansas Statutes provide for most of his duties and privileges. He may be appointed by the court to make a survey for use in a legal proceeding. However, Section 12-1221 makes it clear that Section 12-1220 providing that a certified copy of a County Surveyor's survey may be introduced as prima facie evidence does not intend that such survey shall be conclusive but may be reviewed in any case where the correctness thereof may be disputed. Thus, in the eyes of the law, the County Surveyor has no advantage over any other sur-

veyor as an expert witness. *Mason v. Peck* (1956) 239 Ark 208, 388 SW 2d 84; *Polk v. Willey* (1952) 220 Ark 506, 248 SW 2d 695.

Other duties of the County Surveyor are laid down in both statutes and decision law.

The existing publication by the Arkansas State Board of Act 101 of 1967 which appears as Chapter 23, "Land Surveyors", of Arkansas Statutes 71-2301, with but one change which changes the name of the Board to "Arkansas State Board of Registration for Professional Engineers and Land Surveyors" is still current and up to date.

However, as an additional aid to surveyors, pertinent sections and portions of sections of Arkansas Statutes are included herein by permission of the State of Arkansas which holds the copyright on "Arkansas Statutes Annotated."

In addition to Statutes and the decisions thereunder, the State and Federal Courts have established many principles of law pertaining to surveys and descriptions which it is important for the surveyor to be familiar with. By his knowledge of applicable principles of law and his honest and judicious use of them, he can obviate litigation.

Among surveys, the Government survey is paramount. A surveyor cannot change the corners established by a Governmental survey, as such fixed monuments prevail over both courses and distances. A survey made by the Government must be held conclusive against collateral attack in controversies between individuals. *Burton v. City of Ft. Smith*, 214 Ark 516, 216 SW 2d 884 (1949).

*J. L. McEntire, et al, v. Curtis Robinson*, No. 5-124, 449 SW 2d 395, decided in the Supreme Court of Arkansas on 2 February 1970, focuses attention on the importance of a survey in which the line is marked by

monuments on the ground. In the absence of testimony regarding another survey indicating a different line, such survey will be accepted by the courts to establish the boundary line. It should be noted that an expert witness as to a survey is as important and necessary as an expert in any other type of proceeding.

The precedence of the elements of a description as controls are generally accepted as follows:

- a. Surveyed lines.
- b. Natural monuments.
- c. Artificial monuments.
- d. Maps or plats.
- e. References to adjoining lands.
- f. Metes and bounds.
- g. Courses and distances.
- h. Recital of area.

*Walters v. King*, 55 CCA 290, 118 Fed. 524;  
*U.S. v. Redondo Dev. Co.*, 166 CCA 154,  
 254 F. 656.

The pertinent Statutes not heretofore published in the existing manual are shown below:

#### Act 25 of 1893

AN ACT requiring the method of reading and designating the survey of the lands of this State by sections, parts of sections, townships and ranges to be taught in the common schools of the State.

#### Section

1. County examiners required to

examine teachers on the methods of designating and reading land surveys. License not to be granted to person not proficient in such readings. These methods required to be taught in the schools. Failure to teach same shall be cause for revocation of license.

2. Act in force three months from passage.

Be in enacted by the General Assembly of the State of Arkansas:

Section 1. In addition to the branches now prescribed by law to be taught in the common schools of the State, it is hereby made the duty of the county examiner of the several counties of this State to examine all persons applying for examination and license to teach in such schools as to their knowledge and proficiency in the method of designating and reading the survey of the lands of this State by ranges, townships and sections and parts of sections and surveyed, planted (platted) and designated by the government of the United States, and no such applicant shall be authorized or licensed to teach in any of such schools unless found upon such examination proficient in the method of designating and reading land surveys, as in this act provided, and is hereby made the duty, and specially imposed upon all persons teaching in the public schools of this State, to teach and impart the instructions here provided for whenever practicable to do so, and a willful neglect or failure to discharge the duties by this act imposed shall be deemed sufficient cause for the revocation of license to teach.

Section 2. That this act take effect and be in force three (3) months from and after its passage and publication.

Approved February 16, 1893.



## ARKANSAS COORDINATE SYSTEM

## Section 50-801, et seq.

50-801. *Designation of coast and geodetic system - Counties comprising north and south zones.* - The system of plane coordinates which has been established by the United States Coast and Geodetic Survey for defining and stating the positions or locations of points on the surface of the earth within the State of Arkansas is hereafter to be known and designated as the "Arkansas Coordinate System."

For the purpose of the use of this system the state is divided into a "North Zone" and a "South Zone".

The area now included in the following counties shall constitute the North Zone: Baxter, Benton, Boone, Carroll, Clay, Cleburne, Conway, Craighead, Crawford, Crittenden, Cross, Faulkner, Franklin, Fulton, Greene, Independence, Izard, Jackson, Johnson, Lawrence, Logan, Madison, Marion, Mississippi, Newton, Perry, Poinsett, Pope, Randolph, Scott, Searcy, Sebastian, Sharp, St. Francis, Stone, Van Buren, Washington, White, Woodruff and Yell.

The area now included in the following counties shall constitute the South Zone: Arkansas, Ashley, Bradley, Calhoun, Chicot, Clark, Cleveland, Columbia, Dallas, Desha, Drew, Garland, Grant, Hempstead, Hot Spring, Howard, Jefferson, Lafayette, Lee, Lincoln, Little River, Lonoke, Miller, Monroe, Montgomery, Nevada, Ouachita, Phillips, Pike, Polk, Prairie, Pulaski, Saline, Sevier and Union.

50-802. *Designation as to zones.* As established for use in the North Zone, the Arkansas Coordinate System shall be named, and in any land description in which it is used it shall be designated, the "Arkansas Coordinate System, North Zone."

As established for use in the South Zone

the Arkansas Coordinate System shall be named, and in any land description in which it is used it shall be designated, the "Arkansas Coordinate System, South Zone." (*Acts 1957, No. 424, Sec. 2, p. 1180.*)

50-803. *Coordinates used.* - The plane coordinates of a point on the earth's surface, to be used in expressing the position or location of such point in the appropriate zone of this system, shall consist of two (2) distances, expressed in feet and decimals of a foot. One of these distances, to be known as the "x-coordinate," shall give the position in an east-and-west direction; and the other, to be known as the "y-coordinate", shall give the position in a north-and-south direction. These coordinates shall be made to depend upon and conform to the coordinates, on the Arkansas Coordinate System, of the triangulation and traverse stations of the United States Coast and Geodetic Survey within the State of Arkansas, as those coordinates have been determined by the said Survey. (*Acts 1957, No. 424, Sec. 3, p. 1180.*)

50-804; *Land lying in both zones.* - When any tract of land to be defined by a single description extends from one into the other of the above coordinate zones, the positions of all points on its boundaries may be referred to either of the two (2) zones, the zone which is used being specifically named in the description. (*Acts 1957, No. 424, Sec. 4, p. 1180.*)

50-805. *Technical definition of system - Marking of coordinates on ground.* - (a) For the purpose of more precisely defining the Arkansas Coordinate System the following definition by the United States Coast and Geodetic Survey is adopted:

The Arkansas Coordinate System, North Zone, is a Lambert conformal projection of the Clarke spheroid of 1866, having standard parallels at north latitudes of 34 degrees 56 minutes and 36 degrees 14 minutes, along which parallels the scale shall be exact.



The origin of coordinates is at the intersection of the meridian 92 degrees 00 minutes west of Greenwich and the parallel 34 degrees 20 minutes north latitude. This origin is given the coordinates: x equals 2,000,000 feet and y equals 0 feet.

The Arkansas Coordinate System, South Zone, is a Lambert conformal projection of the Clarke spheroid of 1866, having standard parallels at north latitudes 33 degrees 18 minutes and 34 degrees 40 minutes, along which parallels the scale shall be exact. The origin of coordinates is at the intersection of the meridian 92 degrees 00 minutes west of Greenwich and the parallel 32 degrees 40 minutes north latitude. This origin is given the coordinates: x equals 2,000,000 feet and y equals 0 feet.

(b) The position of Arkansas Coordinate System shall be as marked on the ground by triangulation or traverse stations established in conformity with standards adopted by the United States Coast and Geodetic Survey for first-order and second-order work, whose geodetic positions have been rigidly adjusted on the North American datum of 1927, and whose coordinates have been computed on the system herein defined. Any such station may be used for establishing a survey connection with the Arkansas Coordinate System. (Acts 1957, No. 424, Sec. 5, p. 1180.)

50-806. *Proximity to triangulation station required for use of coordinates.* No coordinates based on the Arkansas Coordinate System, purporting to define the position of a point on a land boundary shall be presented to be recorded in any public land records or deed records unless such point is within one-half ( $\frac{1}{2}$ ) mile of a triangulation or traverse station established in conformity with the standards prescribed in Section 5 (50-805) of this Act; provided that said one-half ( $\frac{1}{2}$ ) mile limitation may be modified by a duly authorized state agency to meet local conditions. Acts 1957, No.

424, Sec. 6, p. 1180.)

50-807. *References to system on maps and surveys.* - The use of the term "Arkansas Coordinate System" on any map, report of survey, or other document, shall be limited to coordinates based on the Arkansas Coordinate System as defined in this Act (50-801 - 50-809). (Acts 1957, No. 424, Sec. 7, p. 1180.)

50-808. *Description by coordinates supplemental to references to public land surveys.* - Wherever coordinates based on the Arkansas Coordinate System are used to describe any tract of land which in the same document is also described by reference to any subdivision, line, or corner of the United States public land surveys, the description by coordinates shall be construed as supplemental to the basis description of such subdivision, line, or corner contained in the official plats and field notes filed of record, and in the event of any conflict the description by reference to the subdivision, line, or corner of the United States public land surveys shall prevail over the description by coordinates. (Acts. 1957, No. 424, Sec. 8, p. 1180.)

50-809. *Reliance on system not required.* - Nothing contained in this act (50-801 - 50-809) shall require any purchaser or mortgagee to rely on a description, any part of which depends exclusively upon the Arkansas Coordinate System. (Acts 1957, No. 424, Sec. 9, p. 1180.)

(NOTE: The meaning of Chapter 8 is self-evident and there has been little litigation as to its application with the possible exception of Section 50-809 which permits other means of determining what land is intended by a description in addition to the coordinate system.)

#### U. S. Field Notes and Records

Section 10-1201 to Section 10-1214

(Only Sections 10-1212 and 1214 are cited)

10-1212. *Copies of notes and maps - Fee of county clerk.* - The said clerk shall issue, when called on, by any person or persons, (for a copy or copies of said notes and maps of the aforesaid county, (and shall) be authorized to charge fifty cents for each copy; Provided, however, that no copy shall contain more than (320) acres, without additional charge of fifty per cent (50%) on such enlargement, on any one copy, to be paid by the applicant. (Act Dec. 6, 1854, Sec. 2, p. 16; C. & M. Dig., Secs. 4750, 4751; Pope's Dig., Secs. 5829, 5830.)

10-1214. *County surveyor entitled to free access to field notes and maps.* - Each county surveyor shall have the liberty of copying any of the said field notes and maps for his own use, without paying for the same. (Act Jan. 7, 1857, Sec. 2, p.67; C. & M. Dig., Sec. 1905; Pope's Dig., Sec. 2422.)

#### County Surveyors

Section 12-1201, et seq

12-1201. *Bond.* - Each county surveyor shall, within fifteen (15) days after he receives his commission, enter into bond, with good and sufficient security, in a sum not less than one thousand (\$1,000) nor more than six thousand dollars (\$6,000), to the State of Arkansas, conditioned for the faithful performance of the duties of his office, according to law, to be approved by the (county court, or the clerk thereof in vacation, subject to the confirmation or rejection of the county court in term time). (Rev. Stat., ch. 40, Sec. 2; C. & M. Dig., Sec. 1844; Pope's Dig., Sec. 2401.)

12-1202. *Failure to enter into bond creates vacancy.* - If any county surveyor shall neglect to enter into bond within the time prescribed in this act, the office shall be deemed vacant, and it shall be the duty of the clerk of the county court, immediately, to inform the governor of the failure of such surveyor to

give bond as required in this act (12-1201). (Rev. Stat., ch. 40, Sec. 3; C. & M. Dig., Sec. 1885; Pope's Dig., Sec. 2402.)

12-1203. *Appointment of deputies.* - Each county surveyor may appoint one or more deputies, to assist in the performance of the duties of his office, and each deputy shall be sworn to perform the duties of his office according to the best of his skill and judgment, without favor or affection. (Rev. Stat., ch. 40, Sec. 16; C. & M. Dig., Sec. 1899; Pope's Dig., Sec. 2416.)

12-1204. *Chainmen.* - The necessary chainmen shall be employed by the person wanting surveying done, but they shall be good and disinterested persons, to be approved by the surveyor, and shall be sworn by the surveyor to measure justly and exactly, according to the best of their abilities. (Rev. Stat., ch. 40, Sec. 17; C. & M. Dig., Sec. 1900; Pope's Dig., Sec. 2417.)

12-1205. *Duties generally.* - It shall be the duty of the county surveyor to execute all orders to him directed by any court of record, for surveying or resurveying any tract of land, the title of which is in dispute or in litigation before such court, and to obey all orders of survey for the partition of real estate, and also to accompany viewers and reviewers of roads, for the purpose of running and measuring any proposed road whenever required by such viewers or reviewers. (Rev. Stat., ch. 40, Sec. 5; C. & M. Dig., Sec. 1888; Pope's Dig., Sec. 2405.)

12-1206. *Interest of surveyor - Appointment of another surveyor - Powers of appointee.* In all cases where the county surveyor may be interested in any survey which is required to be made by any court, such court shall direct such survey to be made by some competent person, and the person so appointed shall have power to administer the necessary oaths to the chainmen, and shall return such survey under oath, and shall be entitled to the same fees for his services as the county surveyor would be entitled to

receive for similar services. (Rev. Stat., ch. 40, Sec. 19; C. & M. Dig., Sec. 1902; Pope's Dig., Sec. 2419.)

12-1207. *Survey of lands sold for taxes.* - It shall be the duty of the county surveyor to survey all lands sold for taxes in his county, on the application of any person producing to him a certificate of purchase from the officer by whom such lands may have been sold. (Rev. Stat., ch. 40, Sec. 4; C. & M. Dig., Sec. 1887; Pope's Dig., Sec. 2404.)

12-1208. *Survey of public land.* - Any person who may have entered any of the public lands of the United States, and having received from the proper officer a certificate of such entry, and desiring his lands surveyed and laid off according to the certificate, may apply to the county surveyor for that purpose, who shall make such survey in accordance with the entry. (Rev. Stat., ch. 40, Sec. 6; C. & M. Dig., Sec. 1889; Pope's Dig., Sec. 2406.)

12-1209. *Notice of public land survey to persons interested.* - Before the county surveyor shall proceed to survey any such tract of land, he shall be satisfied that all persons owning lands adjoining, and who may be, in any manner, affected by such survey, have been notified to attend and be present at the surveying thereof. (Rev. Stat., ch. 40, Sec. 7; C. & M. Dig., Sec. 1889; Pope's Dig., Sec. 2407.)

12-1210. *Subdivisions to conform to original survey.* - It shall be the duty of each county surveyor, in subdividing any section or part of a section of land originally surveyed under the authority of the United States, to make his survey conformably to the original survey. (Rev. Stat., ch. 40, Sec. 8; C. & M. Dig., Sec. 1891; Pope's Dig., Sec. 2408.)

#### Notes to Decisions

*Application.* Where the facts are such

as to lead to the conclusion that the government survey, if made at all, was made on paper only, this section does not apply. *Luther v. Walker* (1927), 175 Ark 846, 1 SW 2d 6.

*Mistake.* Where the official government survey established the section and quarter-section corners, such sections will stand though erroneous, but a deficiency or overplus in a quarter section will be apportioned among the subdivisions of which it is composed. *Tolson v. Southwestern Imp. Assn.* (1911), 97 Ark 193, 133 SW 603.

12-1211. *Establishment of corners.* For the purpose of perpetuating every survey, the surveyor shall establish his corners by taking bearing trees, and noting particularly their course and distance from the corner; and when there are no trees within a reasonable distance, he shall perpetuate his corners by erecting mounds of turf, at least two and a half (2½) feet at the base, and two (2) feet high, or, in lieu of mounds, stones may be planted in the ground, to a depth not less than twelve (12) inches long, eight (8) inches wide, and three (3) inches thick, and such stones shall be described in the field book. (Rev. Stat., ch. 40, Sec. 9; C. & M. Dig., Sec. 1892; Pope's Dig., Sec. 2409.)

12-1212. *Method of calculating contents of tract.* - All calculations to ascertain the content of any tract of land, by any county surveyor, or other person, shall be made by differences of latitude and departure. (Rev. Stat., ch. 40, Sec. 20; C. & M. Dig., Sec. 1903; Pope's Dig., Sec. 2420.)

12-1213. *Expenses of office and instruments may be paid by county - Bond for surrender of instruments.* - Hereafter the county courts of the several counties of this State shall have the power to make such appropriations as are necessary to provide each county with an office for the use of

the County Surveyor, or for the rent of such an office, and also for the purchase and repairs and replenishing of a complete set of surveying instruments, which when bought shall belong to the several counties so purchasing the same, but which shall be kept in the possession of the several county surveyors, and for the proper care of which such surveyor shall give bond in such sum as may be fixed by order of said county courts, and conditioned for the surrender of said instruments to his successor in office. (Act Mar. 15, 1909, No. 68, Sec. 1, p. 180; C. & M. Dig., Sec. 1886; Pope's Dig., Sec. 2403.)

12-1214. *Providing funds for expenses of office and instruments.* - Funds shall be levied and provided by the levying courts of the several counties of this State at the time and in the manner now provided by law for the levying of taxes and raising of revenue for the county general taxes and expenses. (Act Mar. 15, 1909, No. 68, Sec. 2, P. 180; C. & M. Dig., Sec. 1886, Pope's Dig., Sec. 2403.)

12-1215. *Instruments required - Record book.* - It shall be the duty of each county surveyor to furnish himself with a compass of approved construction, having an nonius division; also, a two-pole chain of fifty (50) links, and a well bound book, in which he shall carefully and legibly record and note down every survey made by him, giving the name of the person the survey of whose lands is recorded, and describing, as near as practicable, the metes and bounds of the tract, and noting the date on which the survey was made. (Rev. Stat., ch. 40, Sec. 10; C. & M. Dig., Sec. 1893; Pope's Dig., Sec. 2410.)

(NOTE: A nonius division is a vernier. A compass is now mainly useful in following old erratic compass surveys.)

12-1216. *Record book furnished by county.* - The record book required by this act (12-1215) to be kept by each county surveyor, shall be furnished at the expense of the county. (Rev. Stat., ch. 40, Sec. 21; C. & M.

Dig., Sec. 1904; Pope's Dig., Sec. 2421.)

12-1217. *Inspection of record books.* Such record shall be subject to the inspection of every person who may deem himself interested therein. (Rev. Stat., ch. 40, Sec. 11; C. & M. Dig., Sec. 1894; Pope's Dig., Sec. 2411.)

12-1218. *Delivery of record book to successor.* - It shall be the duty of the county surveyor, or other person having the official record of such surveyor in his possession, to deliver up such record to his successor whenever he may be applied to for that purpose. (Rev. Stat., ch. 40, Sec. 12; C. & M. Dig., Sec. 1895; Pope's Dig., Sec. 2412.)

12-1219. *Penalty for retaining book.* If such surveyor, or the person having the possession of such record, shall refuse to deliver the same to such successor when demanded, he shall forfeit and pay the sum of one dollar (\$1.00) per day for every day he may retain the same after demanded, to be recovered by action (of debt), before any justice of the peace, in the name of any person who may sue for the same, one half ( $\frac{1}{2}$ ) to the use of the person suing, and the other half to the use of the county. (Rev. Stat., ch. 40, Sec. 13; C. & M. Dig., Sec. 1896; Pope's Dig., Sec. 2413.)

12-1220. *Certified copy of records admissible as evidence* - A certified copy of the record of any county surveyor, under the hand of the surveyor, shall be admitted as prima facie evidence in any court of record in this State. (Rev. Stat., ch. 40, Sec. 14; C. & M. Dig., Sec. 1897; Pope's Dig., Sec. 2414.)

#### Notes to Decisions

*Official Survey After Unofficial Survey.* A conviction for the wrongful cutting of timber will be set aside where the evidence showed that an unofficial surveyor had surveyed the land and plainly marked the boundaries, but a subsequent official survey showed that the unofficial survey was less favorable to the



defendant than the official. (Sawyer & Austin Lbr. Co. v. State (1905), 75 Ark 309, 87 SW 431.)

*Official Survey Rebuttable.* A certified copy of an official survey made by a county surveyor is prima facie correct, but any duly qualified surveyor may testify as to its correctness. (Russell v. State, 97 Ark 92 (1910), 133 SW 188.)

Where a party to a controversy over a certain boundary line introduced the surveyor's record in evidence making a prima facie case, it becomes the duty of the other party to show that the location of the true line was otherwise than as shown in the survey thus certified. (Buffalo Zinc & Copper Co. v. McCarty (1916), 125 Ark 582, 189 SW 355.)

*Oral Testimony.* Oral testimony as to location of property line was properly excluded. (Mason v. Mason (1925), 167 Ark 304, 267 SW 722.)

*Testimony of Surveyor.* In case involving dispute over boundary line in which county surveyor testified as to the actual survey line, and instruction by the court, which stated that testimony of surveyor and documentary evidence introduced by him along with stipulation of the parties constituted prima facie evidence of the correct line as it appears from the survey unless the defendant could prove by a preponderance of evidence a different line was not erroneous. (Polk v. Willey (1952), 220 Ark 506, 248 SW 2d 693.)

*Uncertified Plat.* Where plaintiff introduced into evidence a plat with signature of surveyor thereon, defendant did not have burden of proof to show plat was erroneous, since plat introduced was not a certified copy of official record kept by surveyor. (Horn v. Hays (1951), 219 Ark 450, 243 SW 2d 3.)

12-1221. *Conclusiveness of official survey.* No Act or record by any surveyor, or his deputy, shall be conclusive, but may be reviewed

by any competent tribunal, in any case where the correctness thereof may be disputed. (Rev. Stat., ch. 40, Sec. 15; C. & M. Dig., Sec. 1898; Pope's Dig., Sec. 2415.)

*Prima Facie Evidence.* Preponderance of evidence, including survey of a duly qualified surveyor overcomes the prima facie evidence of the correctness of a boundary line established by the introduction of the certificate of survey by the county surveyor. (Mason v. Peck (1965), 239 Ark 208, 338 SW 2d 84.)

12-1222. *Qualifications.* - In order to hold the office of a county surveyor a person must either be registered as a professional engineer by the State Board of Registration for Professional Engineers or he must have had at least two (2) years of experience as a practical surveyor. (Acts 1963, No. 193, Sec. 1, p. 586.)

12-1729. *County Surveyors.* - County Surveyors shall be allowed the following fees:

For each day he may be engaged, either under an order of Court or otherwise:	\$25.00
For each mile traveled from the place of residence to the place where the surveying is to be made and return:	.12
For calculating the amount of land in each tract or division thereof and making the plat thereof:	1.00
For recording Plat and Certificate:	.50
For every copy of Plat and Certificate:	.50

NOTE: Amendment No. 55 to the Arkansas Constitution approved at the general election, November 5, 1974, and Act 911 of 1975 amends this section. This amendment and act are included in this chapter. (See p. 158 and p. and 159.)

17-103. *Boundary lines insufficiently ascertained. - Order for Survey.* Whenever it shall appear to the satisfaction of any county court that the boundaries of the county are not sufficiently special and well ascertained, such court shall issue an order to the county surveyor requiring him, on a day and at a place to be therein specified, to proceed and ascertain, survey and mark such part of such line as may be designated. (Rev. Stat., ch. 37, Sec. 1; C. & M. Dig., Sec. 1861; Pope's Dig., Sec. 2380.)

54-101. *County surveyor to act as timber inspector.* - The county surveyors of each county of the State of Arkansas shall be ex-officio timber inspectors for their respective counties and shall discharge the duties and receive the fees herein provided. (Act Mar. 17, 1883, No. 83, Sec. 9, p. 140; Apr. 27, 1901, No. 130, Sec. 1, p. 202; C. & M. Dig., Sec. 6985; Pope's Dig., Sec. 8965.)

(Note: Before serving as ex-officio timber inspector the county surveyor should consult all of Title 54, Logs and Logging, of Arkansas Statutes.)

#### Act 645, 1969

*For an Act to be Entitled:*

"An Act to Require That all Licensed Engineers and Surveyors File a Copy of Certain Surveys Made by Them in the Office of the Circuit Clerk of the County Wherein the Survey was Made: And for Other Purposes."

*Be it Enacted by the General Assembly of the State of Arkansas:*

*Section 1.* Hereafter, all licensed engineers and surveyors in this State shall file a plat of all surveys of property boundary lines made by them in the office of the circuit clerk of the county wherein such survey was made within thirty (30) days after such

survey is completed. The sole purpose of filing such plat shall be to identify the person or persons who made such plat and survey and placed the survey markers and shall not be used to evidence adverse possession or as evidence in boundary disputes. Provided, however, the provisions of this Act shall not be applicable with respect to surveys hereafter made of subdivided property located in a municipality where such property has previously been surveyed and a plat filed.

*Section 2.* Any licensed engineer or surveyor who shall fail or refuse to file such survey as provided by this Act shall be guilty of a misdemeanor and upon conviction shall be subject to a fine of not less than fifty dollars (\$50.00) nor more than one hundred dollars (\$100.00) or imprisonment for not less than thirty (30) days nor more than six (6) months, or both such fine and imprisonment.

*Section 3.* Act 257 of 1969 and all laws and parts of laws in conflict with this Act are hereby repealed.

#### Establishing Lost Corners

As stated heretofore, in establishing boundaries monuments come first and usually the order of precedence is Natural Objects, Artificial Objects, Adjacent Ownerships.

In a monument such as walls, ditches, trees, and stones, the rule is that in the absence of other indication the boundary is the centerline.

Unfortunately, most corner monuments have been lost or obliterated. The U. S. Department of the Interior publishes a pamphlet for 30 cents which contains instructions for "Establishing Lost Corners". If the Government still owns land in a township, it may, under certain circumstances, re-establish lost corners.



The resurvey shall not impair established "Bona Fide" rights. He should be aware of the distinction between the original establishment and retracement, or dependent resurvey. Government plats referred to in patents and municipal plats under State law with all their notes, lines, descriptions, and landmarks, become as much a part of the grant or deed by which they were conveyed, and control so far as limits are concerned, as if such description features were written upon the face of the deed or grant itself. The Federal notes have been transferred to Arkansas Commissioner of State Lands, State Capitol, Little Rock, Arkansas.

Some excerpts from the Government pamphlet are included for convenience but every surveyor should have a copy of the publication, since the principles established apply also to a resurvey of a private survey.

#### **Excerpts from "Restoration of Lost or Obliterated Corners and Subdivision of Sections"**

*General Rules.* The general rules followed by the Bureau of Land Management, which are controlling upon the location of all public lands, are summarized in the following paragraphs:

*First:* That the boundaries of the public lands, when approved and accepted, are unchangeable.

*Second:* That the original township, section, and quarter-section corners must stand as the true corners which they were intended to represent, whether in the place shown by the field notes or not.

*Third:* That quarter-quarter section corners not established in the original survey shall be placed on the line connecting the section and quarter-section corners, and midway between them, except on the last half mile of section lines closing on the north and west boundaries of the township, or on

the lines between fractional or irregular sections.

*Fourth:* That the center lines of a section are to be straight, running from the quarter-section corner on one boundary to the corresponding corner on the opposite boundary.

*Fifth:* That in a fractional section where no opposite corresponding quarter-section corner has been or can be established, the center line must be run from the proper quarter-section corner as nearly in a cardinal direction to the meander line, reservation, or other boundary of such fractional section, as due parallelism with the section boundaries will permit.

From the foregoing it will be evident that corners established in the public land surveys remain fixed in position and are unchangeable; and that lost or obliterated corners of those surveys must be restored to their original locations from the best available evidence of the official survey in which such corners were established.

#### **Restoration of Lost or Obliterated Corners**

The restoration of lost corners should not be undertaken until after all control has been developed; such control includes both original and acceptable collateral evidence. However, the methods of proportionate measurement will be of material aid in the recovery of evidence.

1. An existent corner is one whose position can be identified by verifying the evidence of the monument, or its accessories, by reference to the description that is contained in the field notes, or where the point can be located by an acceptable supplemental survey record, some physical evidence, or testimony.

Even though its physical evidence may have entirely disappeared, a corner will not be

regarded as lost if its position can be recovered through the testimony of one or more witnesses who have a dependable knowledge of the original location.

2. An obliterated corner is one at whose point there are no remaining traces of the monument, or its accessories, but whose location has been perpetuated, or the point for which may be recovered beyond reasonable doubt, by the acts and testimony of the interested landowners, competent surveyors, or other qualified local authorities, or witnesses, or by some acceptable record evidence.

A position based upon collateral evidence should be duly supported, generally through proper relation to known corners, and agreement with the field notes regarding distances to natural objects, stream crossings, line trees, and off-line tree blazes, etc., or unquestionable testimony.

3. A lost corner is a point of survey whose position cannot be determined, beyond reasonable doubt, either from traces of the original marks or from acceptable evidence or testimony that bears upon the original position, and whose location can be restored only by reference to one or more interdependent corners.

If there is some acceptable evidence of the original location of the corner, that position will be employed.

Decision that a corner is lost should not be made until every means has been exercised that might aid in identifying its true original position. The retracements, which are usually begun at known corners, and run according to the record of the original survey, will indicate the probable position for the corner, and show what discrepancies may be expected. Any supplemental survey record or testimony should then be considered in the light of the facts thus developed. A line will not be

regarded as doubtful if the retracement affords recovery of acceptable evidence.

In cases where the probable position for a corner cannot be made to harmonize with some of the calls of the field notes, due to errors in description or to discrepancies in measurement developed in the retracement, it must be ascertained which of the calls for distances along the line are entitled to the greater weight. Aside from the technique of recovering traces of the original marks, the main problem is one that treats with the discrepancies in alinement and measurement.

4. Existing original corners cannot be disturbed; consequently, discrepancies between the new and the record measurements will not in any manner affect the measurements beyond the identified corners, but the differences will be distributed proportionately within the several intervals along the line between the corners.

#### Function of the Local Surveyor

The function of the original surveyor has been fulfilled when the survey has been completed and monumented properly, and the official plat and field note record has been prepared. The function of the local surveyor begins when he undertakes the identification of lands which have passed from the Government into private ownership, based upon the description derived from the original survey. His work may be simple, or quite complex, depending largely upon the existence of the original corner monuments or acceptable perpetuations of the corner positions.

Since the corners established in the original survey are controlling, it is essential that these corners be found, or properly restored, before the actual field work involving the subdivision-of-section is undertaken. The section boundaries should be retraced to develop the actual bearings and lengths of the lines between

the corners.

### Order of Procedure in Survey

The order of procedure is: First, identify or re-establish the corners on the section boundaries, including determination of the points for the necessary one-sixteenth section corners. Next, fix the boundaries of the quarter sections; and then form the quarter-quarter sections or small tracts by equitable and proportionate division. The following methods should be employed:

#### Subdivision of Sections into Quarter Sections

19. To subdivide a section into quarter sections, run straight lines from the established quarter-section corners to the opposite quarter-section corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or the legal center of the section.

#### Retracements

The matter of boundary disputes should be carefully reviewed, particularly as to whether claimants have based their locations upon evidence of the original survey and a proper application of surveying rules. If there has been a boundary suit, the record testimony and the court's opinion and decree should be carefully examined insofar as these may have a bearing upon the problem in hand.

The law requires that the position of original corners shall not be changed. There is a penalty for defacing corner marks, and for changing or removing a corner. The corner monuments afford the principal means for identification of the survey, and accordingly the courts attach the greatest weight to the evidence of their location. Discrepancies that may be developed in the directions and length of lines, as compared with the original record, do not warrant any alteration of a corner position.

Therefore, whatever the purpose of the retracement may be - if it calls for the recovery of the true lines of the original survey, or for the running of the subdivisional lines of a section, the practices outlined require some or all of certain definite steps, as follows:

- a. Secure a copy of the original plat and field notes;
- b. Secure all available data regarding subsequent surveys;
- c. Secure the names and contact the owners of the property adjacent to the lines that are involved in the retracement.

#### Index Errors

Where the original surveys were faithfully made, generally there will be considerable uniformity in the directions and lengths of the lines. Frequently this uniformity is so definite as to indicate "index errors" which, if applied to the record bearings and distances, will place the trial lines in close proximity to the true positions and aid materially in the search for evidence. With experience, the present surveyor will become familiar with the work of the original surveyor and know about what to expect in the way of such differences.

What has been said above is related particularly to the early needle-compass surveys, and the inaccuracies and errors inherent to the early methods. In the more recent surveys there will be less difficulty in finding abundant evidence of the corners, and less doubt concerning the directions and lengths of lines.

The object sought is to place the temporary lines of the retracement as closely as possible to the probable position of the original survey. This will aid in the search that must be made for the marks of the old bearings trees, line blazes, and to verify the topographic calls of the field notes. It must be emphasized that often there is no hope of

finding obscure marks of the very old surveys except by experienced, intelligent search in the immediate vicinity of the lines.

### **Collateral Evidence**

The identified corners of the original survey constitute the main control for the surveys to follow. After those corners have been located, and before resorting to proportionate measurement for restoration of lost corners, the other calls of the field notes should be considered. The recorded distances to stream crossings or to other natural objects which can now be identified often lead to the position for a missing corner. At this stage, the question of acceptance of later survey marks and records, the location of roads and property fences, and the reliability of testimony are to be considered.

A line tree, or a connection to some natural object, or to an improvement recorded in the original field notes, any of which can be identified may fix a point of the original survey. The calls of the field notes for the various items of topography may assist materially in the recovery of the lines. The mean position of a blazed line, when identified as the original line, will place a meridional line for departure, or a latitudinal line for latitude. These are matters which require the exercise of considerable judgment.

### **Original Marks**

The finding of original scribe marks, line-tree hacks, and off-line tree blazes, furnishes the most convincing identification that can be desired.

It is not intended to disturb satisfactory local conditions with respect to roads and fences. The surveyor has no authority to change a property right that has been acquired legally. On the other hand, he should not accept the location of roads and fences as evidence *prima facie* of the original survey without something to support these locations. This supporting

evidence may be found in some intervening survey record, or the testimony of individuals who may be acquainted with the facts, and the coupling of these things to the original survey.

### **Adequate Monumentation Essential**

The surveyor will appreciate the great extent to which his successful retracements has depended upon an available record of the previous surveys, and upon the markers that were established by those who preceded him. The same will apply in subsequent retracements. It is essential to the protection of the integrity and accuracy of the work in hand, the reputation of the surveyor, and the security of the interested property owners, that durable new corner markers be constructed in all places where required, and that a good record be filed of the survey as executed.

### **Survey of Accretion Lands**

Accretion is so common in Arkansas that this aspect of surveying is given a special chapter in this handbook. The first thing to determine in dealing with accretion is that it is accretion and not avulsion. If the river floods, and after the waters subside, it is found to be in a new channel but the farmland is still identifiable and has not eroded away, this is accretion.

The fact that the riverbank is eroding or falling off in great chunks on one side does not negate that it may have avulsed on the other side. (State of Ark v. State of Tenn, US Sup Ct, Feb 25, 1970, 25 L. Ed 276.) Avulsion does not change the boundary. Accretion moves it out, erosion moves it back.

Long ago the Federal Courts laid down a rule for drawing a boundary between adjoining owners of accretion land and the State of Arkansas has followed it. (Ussery v. Anderson-Tully, 122 F. Supp 115.) The rule of apportionment requires that the line be drawn to the new riverbank so as to give adjoining owners the same proportionate part of the new water front



as they had of the old. In extreme cases of curvature of the river where the rule could not be followed without obvious injustice, it is modified. The question of where to begin the apportioning may be solved by referring it to a reasonable close point where the new riverbank touches or comes close to the former bank or possibly to a point where a reasonable line could be drawn normal to the new ordinary high-water line. It should be pointed out that accretions to land do not create sections and parts of sections which are not shown on the original General Land Office Survey. Actually, the rule for description by sections is to consider the land as accretions to the sections in the same manner as it accretes to the ownership.

### Descriptions

All surveyors should know how to incorporate a survey into a "legal" description. Chapter 9 of Varn's Supplement to "Jones Arkansas Titles" contains a good commentary on land descriptions.

In practice, descriptions used by Tax Assessors are inadequate for use as a basis for surveys. It is safe to say that any description should be as complete as possible and contain a minimum of abbreviation. The Arkansas Statutes require that the description tie in with a monument in turn surveyed in conformity with standards adopted by U. S. Coast and Geodetic Survey for first — and second-order work. (50-805, 50-806).

Where land is erroneously included in a description by mutual mistake of buyer and seller, no title is conveyed.

The principle of estoppel has been applied where the grantor attempts to question the validity of a deed because of a bad description which he made or used in his deed or where he has knowingly permitted an owner to rely on description to his detriment.

The Chancery Court has the power to

correct descriptions so as to identify the land actually owned. (Blackwell v. Heard, 212 Ark 9, 204 SW 2d 790 (1947)).

Whereas the courts apply very strict interpretations as to the validity of tax forfeitures they are not so strict in determining the validity of ordinary deeds. It is safer to put too much in a description rather than too little.

A study of the cases involving descriptions is most helpful in pointing out common errors which are usually inadvertent omissions in preparing the description rather than errors in surveying. It is a safe bet most were prepared by amateurs - not surveyors. The following are errors in descriptions and the cases involving them:

Designating a lot in a Block "B" where there are several Block "Bs" in the city invalidates the deed. (Dodson v. Thomason, 217 Ark 747, 233 SW 2d 395 (1950)).

Abbreviation of corner to "cor." defective in tax description. (Gardner v. Johnson, 220 Ark 168, 246 SW 2d 568 (1952)).

Failing to give direction from the point of commencement to the point of beginning can be corrected if only one direction will meet the corner. (Davis v. Strong, 208 Ark 254, 186 SW 2d 776 (1945)).

Failing to give particular county and state invalidates. (Stephens v. Ledgerwood, 216 Ark 404, 226 SW 2d 587 (1950)).

Omission of designation of direction from base line or range direction not fatal. (Kunze v. Blackwood, 195 Ark 658, 113 SW 2d 705 (1938)).

If the grantor and grantee meant to transfer all of a farm but left out part of farm deed description, it will be corrected. (Smith v. Smith, 218 Ark 228, 235 SW 2d 886 (1951)).

"Fractional" as applied to a section is all right but "part" must identify what part is meant. (Norrell v. Coulter, 218 Ark 870, 239 SW 2d 281 (1951). (Wilson v. Triplett, 204 Ark 902, 165 SW 2d 943 (1942); Sargent v. Citizens Bank, 200 Ark 121, 139 SW 2d 44 (1940).

LBR (Left Bank of River) and RBR (Right Bank of River) are permissible. (Burbridge v. Bradley Lumber Co, 214 Ark 135, 215 SW 2d 710 (1948).

The designation of a correct subdivision but placing it in the city when it is not does not invalidate the description. (Northwest Land Co. v. Sugg, 299 SW 2d 63 (1957).

Designating lots as in a block not existing in the named subdivision invalidates description. (Wilkerson v. Johnston, 211 Ark 170, 200 SW 2d 87 (1947).

The east 20 acres or the east so many feet is good, but so many feet off the east side is bad. (White v. Brown, 206 Ark 410, 175 SW 2d 562 (1943).

An old description of long standing incorporated in preceding deeds which has necessitated a recent survey should not ordinarily be corrected so as to eliminate vagueness by reference to additional monuments without recording a collateral agreement between the adjoiners. Sometimes, however, the addition of evidence stated to be as determined or found by the surveyor is permissible. Brown & Eldridge state that the best way to use a survey for the correction of errors, uncertainties, etc., is to file it in the public records disclosing the evidence found and new points set. Unfortunately, the latest Arkansas Statute, Act 645, 1969, provides that the filing of surveys may not serve this purpose. It provides: "*The sole purpose of filing such plat shall be to identify the person or persons who made such plat and survey and placed the survey markers*

*and shall not be used to evidence adverse possession or as evidence in boundary disputes.*" (Not applicable to municipal subdivision plats.)

A description is a guide to a survey which is a determination on the ground of boundaries of the ownership. "More or less" as commonly used in descriptions is limited by court decisions to mean *a little* more or less. If it were more than 30%, more or less, it would be subject to question.

Where two honest adjoining owners each claims to the true boundary wherever it is the use of an erroneous boundary does not prevent the use of the true one when discovered. (Schroeder Min. & Mfg. Co. v. Packer, 129 US 688, 32 L. Ed 760, 9 S. Ct. 885.)

Where an adjoining owner claims to own to a fence and has exercised sufficient dominion over the land such as cultivating it for a period of seven years, this will be his boundary line even if erroneously placed.

Natural and ascertained objects control courses and distances. (Shipp v. Miller, 2 Wheat 316.)

Distances must be lengthened or shortened and courses varied so as to conform to natural objects called for (McIver v. Walker, 9 Cranch 173, 3 L. Ed 694), unless it appears to have been a mistake or is unreasonably far away. (Security Land & Expl Co. v. Burns, 193 US 167, 48 L. Ed 662; Barclay v. Howell, 6 Pet 498, 8 L. Ed 477.)

In ascertaining the lines of land the tracks of the surveyor, so far as discoverable on the ground with reasonable certainty, should be followed. (Ayers v. Watson, 137 US 584, 11 S. Ct 201, 34 L. Ed 803.)

It is a familiar rule that a meander line is not a line of boundary and that a patent for a tract of land bordering on a river conveys



the land not simply to the meander line but to the water line of the main body of the river. (*Home v. Smith*, 159 US 40, 15 S. Ct 988, 40 L. Ed 68.)

If there is a confusion of boundaries by the nature of interlocking grants, the obliteration of marks, the intermixing of possession under different proprietors, the effects of accident, fraud, or time, or other kindred causes, it is a case appropriate to equity. An issue at law is directed, a commission of boundary awarded; or, if the courts are satisfied without either, they decree what and where the boundary is and shall be. (*Rhode Island v. Massachusetts*, 12 Pet 657, 9 L. Ed 1233.)

#### A standard tract description:

A tract of land situated in the County of Franklin, State of Arkansas, being part of the SE $\frac{1}{4}$  of the SE $\frac{1}{4}$  of Section 5, Township 9 North, Range 28 West of the Fifth Principal Meridian, and being more particularly described as follows:

Beginning on the south line of said SE $\frac{1}{4}$  at a point which is north 87° 24' west 1057 feet, more or less, from the southeast corner thereof; thence north 56° 58' east 25 feet to a point; thence north 02° 37' east 917 feet to a point; thence south 85° 00' east 627 feet to a point; thence south 02° 37' west 649 feet to a point; thence north 70° 40' east 438 feet, more or less, to a point on the east line of the SE $\frac{1}{4}$  of said SE $\frac{1}{4}$ ; thence south 02° 02' west 420 feet along said east line to the southeast corner of said SE $\frac{1}{4}$ ; thence north 87° 24' west 1057 feet along the south line of said SE $\frac{1}{4}$  to the point of beginning, and containing 17.00 acres, more or less.

The bearings used herein are referenced to the Arkansas State Coordinate System, North Zone.

The above-described land is a part of the same land as that described in a deed from Laura A. Wallace to Mary Moore dated Decem-

ber 30, 1911 and filed for record December 30, 1911 in Deed Book JJ, Page 56, in the records of Franklin County, Ozark District, Arkansas.

A centerline description for a right-of-way:

#### Parcel 4

A strip of right-of-way approximately 280 feet in length and 400 feet in width, situated in the County of Johnson, State of Arkansas, being a part of the fractional NW $\frac{1}{4}$  of the fractional NE $\frac{1}{4}$  of the fractional SE $\frac{1}{4}$  of Fractional Section 23, Township 8 North, Range 22 West of the Fifth Principal Meridian, the centerline being more particularly described as follows:

Beginning at a point on the fee acquisition line of Tract No. 412, Dardanelle Reservoir, which is 980 feet west and 100 feet south of the north-east corner of the fractional S $\frac{1}{4}$  of said Fractional Section 23; thence south-westerly approximately 280 feet to the point of termination on the ordinary high-water line, left bank of the Arkansas River, and containing 2.7 acres, more or less.

#### EMERGED LAND DEEDS

The State of Arkansas has title to all islands in navigable streams which did not emerge within the bounds of a description of a former owner. Unless disposed of they remain always the property of the State regardless of subsequent changes. Other types of emerged land belong to the owner to whose land they have accreted or within whose description of record they arose. The State Land Commissioner is authorized to issue emerged land deeds for accretion lands under Arkansas Statutes Annotated 10-203, et seq, upon proper application made by a riparian owner accompanied by a survey. The survey may be based on a recent survey made by the Corps of Engineers.

The commission to the surveyor directs him to "plat the same in reference to the survey of adjacent lands by the Extension of Section, Township and Range lines." This does not mean that such lines are to be extended in the form of a rectangular grid but one to be extended by accretion lines to G.L.O. subdivisions which have not been obliterated by erosion.

#### ISLAND DEEDS FROM STATE

Island deeds are covered by Arkansas Statutes Annotated 10-601, et seq. Under 10-602 they are required to be appraised and sold like land forfeited for taxes. Consequently, if an emerged lands deed were issued by the State it might be set aside. However, until fraud (or mistake) is shown the deed is prima facie good. (*Wunderlich v. Cates*, 213 Ark 695, 212 SW 2d 556.)

Title 10, Par 603 of Arkansas Statutes, provides "that the plat and field notes prepared by the surveyor shall in all respects conform to the rules and regulations as laid down by the Manual of Surveying for the Survey of Public Lands used in the General Land Office of the United States." Said manual provides that "any township, boundary or section line which will intersect an island will be extended as nearly in accordance with the plan of regular surveys as conditions will permit and the usual township, section, quarter section and meander corners will be established on the island." (page 236)

Any surveyor who is engaged in obtaining a State Land Deed will find the Land Commissioner's Office very helpful.

#### DUTIES OF A SURVEYOR IN RESPECT TO LEGAL PRINCIPLES

Title companies are always concerned about possible overlapping rights of adjoiners.

There is no way a surveyor can prevent a boundary dispute but he can minimize it by

doing his job correctly.

It is the duty of the surveyor to locate the lines with respect to existing landmarks, monument them where necessary, describe them, ascertain all possible facts regarding possession and possible overlapping ownerships, and where possible discuss these matters with attorneys and title and abstract company officials in determining the limits of ownership for preparing a description. He should inform the owner regarding possible weaknesses in his boundaries or ownership.

In this connection, accretion land should have a fence or monumented line placed at an agreed location. The agreement should be signed by the parties, notarized and filed in the county records. The line need not always be drawn in accordance with law or pre-existing circumstances but may be located anywhere by agreement in accordance with the adjoining owner's desires and convenience.

In considering the legal effect of the information a surveyor has garnered in the field, he should above all use common sense, remembering the general principle that the law is loathe to upset boundaries that have been established though they may involve minor errors in their location. In the absence of any form of possession what exists in the way of boundaries in the field becomes more dependent on the correct laying out on the ground of recorded descriptions. In evidencing the extent of ownership, what has been claimed in the past, "Senior Rights", and how long it has been claimed becomes important. In Arkansas periods of adverse possession vary with the type of ownership. Payment of taxes (although there are exceptions to every rule) on land described by a good description in a deed of record will create a good title by adverse possession in seven years if no other person is in possession. Actual possession for seven years though no taxes are paid will create a good title to the limits of possession. Where land is wild and unenclosed, payment of taxes for 15 years without color of title will give good title since by Arkansas

Statutes 37-103, a presumption of color of title is created.

Ownership by an infant or an incompetent is protected against adverse possession until three years after he reaches his majority or after his disabilities are removed.

In the location of lost or doubtful boundaries testimony may be given in court regarding statements previously made by former owners and tenants since deceased or as to common repute and general reputation regarding the correct location. The surveyor may testify regarding corrections necessary to make calls close and give explanations regarding apparent mistakes, conflicts in calls, ambiguities and other matters discovered in making a survey such as the identity of roads, railroads, streams and other natural monuments and declarations of owners in possession against their own interests which are admissible against them.

The surveyor will explain how in making a survey based on a description of record he considered the following: (1) Preceding descriptions in abstract of title. (2) All public records of surveys which adjoin or tie in. (3) Existing monuments located by retracing previous surveys, and by interviewing persons who are familiar with the property. When a surveyor testifies, he does so from his survey and field notes enlarged, expounded and explained by his oral or "parole" testimony to whatever extent the opposing attorney and the court may require or permit. There is a wide overlap between "evidence" and "proof" and the two are frequently used interchangeably. In an actual proceeding the surveyor who is best informed and is confident and assured in his manner might well be considered to have proved his case by a preponderance of the evidence. It is best for him to have investigated all facts which might be relevant. During the course of a trial, information may be needed which previously seemed unimportant. The surveyor should while in court make every effort to keep the record clear by saying exactly what he is doing and making maps in accordance

with his testimony. He should discuss his testimony in advance of trial with his client's counsel so as to be sure that matters he regards as important will be brought out.

#### ACT 291

AN ACT to Provide for Creation of an Engineer's or Surveyor's Lien and for the Recording Thereof; and for Other Purposes.

*Be It Enacted by the General Assembly of the State of Arkansas:*

SECTION 1. Every engineer or surveyor who shall do or perform any engineering or surveying work upon any land, building, erection or improvement upon land, under or by virtue of any contract or agreement with the owner thereof, or his agent, shall have a lien upon such land, building, erection or improvement upon land to the extent of the agreed contract price or a reasonable price for those services; provided, However, the lien does not attach to the land, building, erection or improvement upon land unless and until the lien is duly filed of record with the Circuit Clerk and Recorder in the county in which the land, building, erection or improvement is located. This recorded lien will be enforced in the same manner as a mechanic's or contractor's lien.

SECTION 2. All laws and and parts of laws in conflict with this Act are hereby repealed.

APPROVED: March 15, 1971

#### ACT 911

AN ACT to Establish the Compensation of County Surveyors of the Several Counties of This State; and for Other Purposes.

*Be It Enacted by the General Assembly of the State of Arkansas:*

SECTION 1. Effective retroactive to

January 1, 1975 and thereafter, the salary and other allowances of the respective County Surveyors of the counties enumerated in this Section shall be as follows:

(1) Izard County, Surveyor's salary not to exceed \$10.00 per hour, upon approval of the County Court.

(2) Lonoke County, Surveyor's salary not to exceed \$25.00 per hour, upon approval by the Quorum Court.

(3) Nevada County, Surveyor's salary, \$25.00 per hour.

(4) Pike County, Surveyor's salary, \$25.00 per hour.

(5) Sebastian County. The County Surveyor of Sebastian County shall be paid on an hourly basis for services performed, upon proof of charge and reimbursement to the County Treasurer. The Rate per hour shall be \$20.00, as set by the Quorum Court of Sebastian County. Said rate includes all withholdings and fringe benefits, office expense and all additional salaries or any other expense that might occur when performing the duty of County Surveyor.

SECTION 2. In all counties of this State other than the counties enumerated in Section 1 hereof, the Quorum Courts of the several counties shall fix the compensation of the County Surveyor, which shall not exceed \$25.00 per hour for the performance of his official duties.

SECTION 3. All laws and parts of laws in conflict with this Act are hereby repealed.

SECTION 4. If any provision of this Act or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of this Act which can be given effect without the invalid provision or application, and to this end the provisions of this Act are

declared to be severable.

SECTION 5. EMERGENCY. It is hereby found and determined by the General Assembly that Amendment 55 of the Constitution of the State of Arkansas abolished the fee system as a means of compensating county officials, and that the immediate passage of this Act is necessary to establish the compensation and method of payment of compensation of the respective County Surveyors of this State. Therefore, an emergency is hereby declared to exist, and this Act being necessary for the immediate preservation of the public peace, health, and safety, shall be in full force and effect from and after its passage and approval.

APPROVED: April 7, 1975.

#### CONSTITUTIONAL AMENDMENT NO. 55

##### Revision of County Government

*AN AMENDMENT TO THE CONSTITUTION FOR THE REVISION OF COUNTY GOVERNMENT, AND THE ESTABLISHMENT OF SALARIES AND COMPENSATION OF COUNTY OFFICERS.*

SECTION 1. (a) A county acting through its Quorum Court may exercise local legislative authority not denied by the Constitution or by law.

(b) No county may declare any act a felony or exercise any authority not relating to county affairs.

(c) A county may, for any public purpose, contract, cooperate, or join with any other county, or with any political subdivisions of the State or any other states or their political subdivisions, or with the United States.

SECTION 2. (a) No county's Quorum Court shall be comprised of fewer than nine (9) justices of the peace, nor comprised of



more than fifteen (15) justices of the peace. The number of justices of the peace that comprise a county's Quorum Court shall be determined by law. The county's Election Commission shall, after each decennial census, divide the county into convenient and single member districts so that the Quorum Court shall be based upon the inhabitants of the county with each member representing, as nearly as practicable, an equal number thereof.

(b) The Quorum Court may create, consolidate, separate, revise, or abandon any *elective* county office or offices except during the term thereof; provided, however, that a majority of those voting on the question at a general election have approved said action.

SECTION 3. The County Judge, in addition to other powers and duties provided for by the Constitution and by law, shall preside over the Quorum Court without a vote but with the power of veto; authorize and approve disbursement of appropriated county funds; operate the system of county roads; administer ordinances enacted by the Quorum Court; have custody of county property; hire county employees, except those persons employed by other elected officials of the county.

SECTION 4. In addition to other powers conferred by the Constitution and by law, the Quorum Court shall have the power to over-ride the veto of the County Judge by a vote of three-fifths of the total membership;

fix the number and compensation of deputies and county employees; fill vacancies in elective county offices; and adopt ordinances necessary for the government of the county. The Quorum Court shall meet and exercise all such powers as provided by law.

SECTION 5. Compensation of each county officer shall be fixed by the Quorum Court within a minimum and maximum to be determined by law. Compensation may not be decreased during a current term; provided, however, during the interim, from the date of adoption of this Amendment until the first day of the next succeeding month following the date of approval of salaries by the Quorum Court, salaries of county officials shall be determined by law. Fees of the office shall not be the basis of compensation for officers or employees of county offices. Per diem compensation for members of the Quorum Court shall be fixed by law.

SECTION 6. All County Officers shall be bonded as provided by law.

SECTION 7. Sections 1 and 4 of this Amendment shall be effective January 1, 1977, and all other provisions hereof shall be effective when this Amendment is adopted.

SECTION 8. All parts of the Constitution of Arkansas in conflict with this Amendment are repealed.

APPROVED: November 5, 1974.



One of life's most embarrassing moments for a surveyor can occur when he finds that the description he has prepared for a tract of land is in error. Unfortunately this happens more often than one would expect and usually results from blunders in writing the description more than from lack of knowledge. For example, the SW $\frac{1}{4}$  of the SW $\frac{1}{4}$  of a section has been divided by a line running from the NE corner to the SW corner. The common tendency to describe the two tracts of land thus created would be to describe one as the SE $\frac{1}{2}$  of the SW $\frac{1}{4}$  of the SW $\frac{1}{4}$  and the other as the NW $\frac{1}{2}$  of the SW $\frac{1}{4}$  of the SW $\frac{1}{4}$ . However, much to the surprise of the writer the Arkansas courts have ruled that this may be an invalid description.

#### Legal Descriptions

What is a legal description? Simply speaking, it is the description of a parcel of land or more accurately the boundaries of a parcel of land which will meet all the tests of the law. The surveyor must always keep in mind that "to meet the requirements of the law is not often as easy as it sounds". A misplaced comma or other errors in punctuation may render a description void. Typographical errors can completely destroy a description unless detected during proof reading. It is these pitfalls which the surveyor must avoid if his description is to stand up in court and meet the test of the law.

It would be impossible to include in a handbook of this nature all the problems that the surveyor can encounter in preparing an adequate legal description. However, there are many good reference books which are available to the surveyor. The third edition of *Clark on Surveying and Boundaries* by John S. Grimes, contains excellent sources of information concerning descriptions in chapters 16 and 17. Skelton, on *Boundaries and Adjacent Properties*, and a book entitled *Evidence and Procedures for Boundary Loca-*

*tion* by Brown and Eldridge are good references for information on descriptions. Mr. Curtis Brown is well known to Arkansas land surveyors. One of the best sources of information is *Arkansas Titles to Real Property* by Paul Jones, Jr. It should be pointed out that the original version of this book was printed many years ago and was updated in 1959 by the book, *Annotated Supplement to Jones' Arkansas Titles* by D. R. Varn. It is sometimes necessary to refer to the original volume in order to obtain the information desired. Both books are available in almost any law library and are readily available to the land surveyor.

What are the elements of a good description? Some of the principle requirements are listed below:

- a. It must be complete.
- b. It must be accurate.
- c. It should, if at all possible, be concise.
- d. It should be self-explanatory.
- e. It should be unequivocal.
- f. It should be written in such a manner that an accurate plat of the property could be drawn from the description without any additional information. For example, a description which says "thence North" with no other information leaves the reader in doubt as to where the line goes. Is it true North or magnetic North? Even more confusing is the statement "thence in a Northerly direction" without some additional information to clarify the details of the line. There are numerous descriptions of this type which are found in *Arkansas Titles to Real Property*, which is included as a part of this chapter. An example

of a simple and complete legal description follows:

"A tract of land situated in the County of Pulaski, State of Arkansas, being all of the SE¼ of Section 21, Township 2 North, Range 11 West of the 5th Principal Meridian, containing 160 acres more or less. The above described land is the same tract as that conveyed from Sam Smith to Roger Jones by warranty deed, dated 10 January 1918, as recorded in Book 78, Page 362, of the deed records of Pulaski County."

There are, of course, numerous different types of descriptions and as previously stated, it would be impossible in a publication such as this to attempt to list all or even a small number of the problems involved in the preparation of these descriptions. However, the surveyor can obtain much valuable information from the publications listed above and from the excerpts herein.

**The Arkansas Law  
of  
Title to Real Property  
by Paul Jones, Jr.**

**Chapter 8 — Boundaries**

232. *Boundaries of Arkansas.* Arkansas is bounded on the north by the line dividing the State from the State of Missouri; on the east by the center of the navigable channel of the Mississippi and St. Francis rivers, 106 A 286, 153 SW 262, 121 A 460, 181 SW 291, 164 A 195, 261 SW 299, 246 US 158, 269 US 152, see 40 A 501; on the south by the line dividing this State from the State of Louisiana and by the southern bank of Red River, 88 A 311; and on the west by the lines dividing this State from the States of Oklahoma, see CM 9180 (1905, see Const. Art. 1), 89 A 428, 116 SW 896, 93A 168, 129 SW 80, and Texas.

As the determination of State boundaries is a political, rather than a legal, question, it is the duty of the courts to respect the pronounced will of the legislature, 88 A 311, 115 SW 138.

The boundary line may change with the gradual change of the bank by accretion or reliction, but not by avulsion, 88 A 311, 115 SW 138, Chapter 11.

233. *Elements of Description.* The usual terms of description are: (a) quantity, (b) course and distance, and (c) artificial and natural objects and monuments. Where question of description arises, the terms or objects most certain and material will govern. Where there are particulars once sufficiently ascertained which designate the property intended to be conveyed, the addition of a false or mistaken circumstance will not frustrate the grant. But when the description includes several particulars, all of which are necessary to ascertain the estate to be conveyed, no estate will pass except such as agrees with every part of the description. 3 A 18.

Quantity in a description yields to course and distance, and they, in turn, to artificial and natural objects. Quantity is disregarded if it is inconsistent with the actual area when the latter is indicated and ascertained by known monuments and boundaries. 3 A 18.

But there are instances where a description of quantity controls. For example, where land was correctly described in a petition and bond but in report of sale was described as "the undivided half of NE¼ of NE¼ of Sec. 23. Half of the M. Price; and the N. frl. ¼ of NW¼ of Section 23, all in Tp. 3, S. R. 1 W., containing 182.62 acres," it was held that neither parcel was validly described but that the misdescription "could not control the other descriptive particulars and circumstances which indicate, and show with certainty, the land sold." 31 A 74.

In determining boundaries, fixed monuments are to be considered and to govern over courses and distances called for by field notes, 175 A 846, 1 SW (2) 6.

234. *Government Surveys.* "Description of land according to terminology employed in the system of government surveys and plats is necessarily a reference to the plats of those surveys, there being nothing known of townships, sections and parts of sections, except such as are described in the plats of government surveys," 88 A 37, 113 SW 340 (affd 231 US 335), 136 A 524, 203 SW 33; but see 110 A 571, 163 SW 783, as to county surveys extending government lines to cover accretions. A conveyance of a township "according to plats of the surveys" does not include lands which do not appear on the plat of the surveys, 88 A 37, 113 SW 37, and 136 A 524, 203 SW 33. Where the plats and field notes show land as non-navigable lake bed, the burden is upon the one seeking to maintain that the land was not within the lake bed at the time of the survey, 88 A 37, 113 SW 37, see 92 A 30, 121 SW 1066.

The original government plat, which is on file in the U. S. Land Office in Little Rock, is not superceded by later plats on file in the same office, consequently the land may be described according to either plat. So where taxes are paid according to one description, the land is not subject to forfeiture and sale under another permissible description, 178 A 300, 10 SW (2) 885.

An official survey is conclusive until corrected, 88 A 37, 92 A 30, 121 SW 1066, and not open to collateral attack, 88 A 37, 151 A 572, 237 SW 103, 175 A 846, 1 SW (2) 6. Sale before survey is void, but sale after survey, if approved, is valid though survey be defective, if land can be identified, 19 A 70, compare 20 A 359 (affd 73 US 142).

235. *Surveys by County Surveyor.* No survey made by any person except the county surveyor or his deputy shall be considered as

legal evidence, unless made under authority of the U. S., or by the mutual consent of the parties, CM 1901. Construed to mean that such surveys shall not be admissible as documentary evidence of itself, without other proof, 44 A 287. This act makes county surveyor's certificate *prima facie* evidence of its correctness, 50 A 65, 6 SW 328, 53 A 411, 14 SW 652.

A county surveyor, in subdividing any section of land originally surveyed under the authority of the U. S. must make his survey conformably to the original survey, CM 1891, 97 A 193, 133 SW 603.

As to extending government lines to cover accreted lands, see 110 A 571, 163 SW 783.

As to county surveyors in general, see CM 1884-1905.

236. *Original Corners and Lines.* USRS, sec. 2395 et seq., provides in substance that all corners marked in the surveys returned by the Surveyor General shall be established at the proper corners of the sections or quarter sections, which they were intended to designate, and corners of half and quarter sections not marked shall be placed as nearly as possible equidistant from those corners which stand on the same line, and that these boundary lines as actually run and marked shall be established as the proper boundary lines of the section, or subdivisions, for which they were intended, and the length of such lines, as returned by the government surveyors, shall be held to be the true line. The original township, section and quarter-section corners, as so surveyed, must stand established, 97 A 193, 133 SW 603.

237. *Subdividing Quarter Sections.* The U. S. Land Department has sent out the following rule to be observed in the subdivision of quarter sections into quarter-quarters: "Preliminary to the subdivision of quarter sections, the quarter-quarter corners will be established at points midway between the section and quarter section corners and between quarter corners and the center of the

section, except on the last half mile of the lines closing on the north and west boundaries of a township, where they should be placed at 20 chains proportionate measurement to the north or west of the quarter-section corner. By proportionate measurement of a part of a line is meant a measurement having the same ratio to that recorded in the original field notes for that portion as the length of the whole line by actual resurvey bears to its length as given in the record." 97 A 193, 133 SW 603.

**238. Lost Corners: Apportionment.** In establishing lost corners, the unvarying rule is to start at the nearest known point on one side of the lost corner, on the line on which it was originally established; to then measure to the nearest known corner on the other side, on the same line; then, if the length of the line is in excess of that called for by the original survey, to divide it between the tracts connecting such two known points in proportion to the lengths of the boundaries of such tracts on such line as given in such survey. The following method of surveying approved: "I began at the southwest corner of the Thompson land because I knew that corner to be correct. I then ran east 20 chains and 20 links, and set the southeast corner of the Thompson land and the southwest corner of the Darr land, then I ran north 40 chains and 16 lengths to the northeast corner of the Thompson land, which is the northwest corner of the Darr land. Now, I will state that the government field-notes only give one mile even on the south line of section 33, but by actual measurement from corner to corner I find that it is one mile and 80 links. I therefore divided that into 40-acre tracts, giving each forty 20 links on the south boundary of section 33." The surveyor could not change the corners established by the government survey, as such fixed monuments prevail over both courses and distances. 174 A 807, 298 SW 1, and see 97 A 193, 133 SW 603.

The rule of apportionment applies to a deficiency in distance, in checking against the

government survey, as well as to overplus, 175 A 846, 1 SW (2) 6, 97 A 193, 133 SW 603.

**239. Watercourses.** The owner of land on the margin of a navigable stream takes to the highwater mark; on a non-navigable stream, to the center, or "thread," thereof, see Chapter 11.

**240. Highways, Streets and Alleys.** A conveyance of land by lots and blocks carries the fee to the middle of existing streets and alleys upon which they abut, subject to the right of the public to use same as highways, provided there are no specific words describing the property evidencing a different intent, 179 A 705, 17 SW (2) 869, 77 A 570, 92 SW 21. But conveyance without reference to alley shown on a plat, the alley having been inclosed by the grantor's predecessor in title, and continuously held adversely by the grantor for more than 7 years, carries no title or right to such alley, 179 A 705, 17 SW (2) 869.

Purchasers of town lots are presumed to purchase with reference to the platted survey, 15 A 297. Where owners of a tract of land sell the lots, into which it is divided, according to a certain plat, such plat becomes unalterable without the consent of the owners of the lots, and cannot be affected by a subsequent plat containing different descriptions, 82 A 294, 102 SW 190. Where one owning two adjoining 40-acre tracts petitioned county court to lay off a town on the north 40, but the town as actually laid off under the court's direction extended over into the south 40, though the plat showed the town to lie wholly within the north 40, it was held that the lines as run are controlling as against the plat, and a description in a deed by blocks, either in a private sale or in a sale for taxes, will convey the blocks actually surveyed, 158 A 321, 250 SW 15.

A plat of a town, or addition thereto,



"is a subdivision of land into lots, streets, alleys, marked upon the earth, and represented on paper in such a way that the streets, lots and blocks can be identified," and the filing and recording of an addition to a city which fails to describe the land, or locate or show the size of lots, streets or alleys embraced therein, did not constitute a dedication of streets, or establish an easement in such streets for the use of the purchasers of lots, 171 A 878, 286 SW 1025.

A grant of land bordering on a public highway ordinarily carries fee to center of road, as part of the grant; but where the highway is laid off entirely upon one person's land, running along the margin of the tract, he owns and may convey the fee in the entire road or street, 24 A 102.

241. *Establishment of Boundaries by Agreement.* It is the policy of the law to encourage agreements between adjacent landowners as to their boundaries, and to give effect thereto when shown to exist, 143 A 8, 219 SW 348. Boundaries may be established by agreement regardless of the lines of the government survey, 75 A 395, 36 SW 184.

It is only where the true boundary line is unknown or is difficult of ascertainment and adjoining owners establish a line that the agreement is binding, the mutual concessions between the parties in such cases being a sufficient consideration therefor, 94 A 511, 127 SW 723, 87 A 625, 113 SW 639; and where owners agree upon boundary under the belief that it is the true boundary line, when, in fact, it is not and the true line is not incapable of ascertainment, the agreement is not binding, but may be set aside by either party when the mistake is discovered, 94 A 511, 127 SW 723, 105 A 598, 151 SW 1025. Where a dispute arose, not as to location of boundary, but as to substance of the respective conveyances under which the parties claimed, there was

no ground for application of the doctrine of recognition of boundaries settled by agreement of the parties, 139 A 83, 213 SW 8. Where adjoining lot owners tacitly agreed on a division line evidenced by a fence built by one of them, and in reliance on the line as thus established, the other, with the former's acquiescence, built a house and made improvements without his right being questioned for 13 years, the one who built the fence and her privies were held estopped to dispute the boundary thus settled and acquiesced in, 75 A 400, 87 SW 649.

242. *Parol Agreement as to Boundaries.* Where there is uncertainty as to boundary, or there is a dispute as to dividing line, parol agreement as to boundary establishes the line, and when followed by possession with reference thereto, is conclusive upon the parties, 19 A 23, 23 A 704, 71 A 248, 72 SW 571, 99 A 128, 137 SW 574, 143 A 8, 219 SW 348, 171 A 855, 286 SW 1020, and their grantees, 102 A 542, 145 SW 193, 146 SW 143, 104 A 99, 148 SW 513, 105A 598, 151 SW 1025, 182 A 849, 33 SW (2) 710, although their possession under such agreement may not continue for the 7 year statutory period, 75 A 400, 87 SW 649, 96 A 168, 131 SW 463, 102 A 542, 145 SW 193, 146 SW 143, 105 A 598, 151 SW 1025, 110 A 197, 161 SW 175, 182 A 849, 33 SW (2) 710. Agreements as to disputed boundaries do not operate as conveyances so as to pass title from one person to another, but they proceed upon the theory that the true boundary line is in dispute, and that the agreement serves to fix the true line to which the title of each extends. The parties thereafter hold to the line as if by virtue of their respective deeds. They have simply settled their boundary line which was in doubt, instead of having the court settle it for them, 182 A 624, 32 SW (2) 812, citing 143 A 8, 219 SW 348, 139 A 83, 213 SW 8, and see 71 A 248, 72 SW 571.

Parol agreement as to boundaries not within statute of frauds, 71 A 248, 72 SW 571.



243. *Pointing Out Dividing Line.* Where one adjacent owner points out to the other the dividing line between their lands and encourages him to make a permanent settlement, he cannot thereafter claim the indicated land and improvements thereon, even though it should subsequently be proven to be his land, 23 A 704. But estoppel cannot be invoked against an owner because of conversation with an adjoining owner, wherein he pointed out a different line between their lots than that he thereafter claimed, where no action was taken on account of the conversation; the same having been after such adjoining owner's purchase, 112 SW 196. That a vendor pointed out boundary line when executing a deed would not amount to an agreement settling the boundary line, though it might be a misrepresentation entitling purchaser to rescind and to defend against a claim by the vendor for rent of the disputed tract and for timber cut therefrom. The purchaser, however, did not ask for cancellation of deed but for its reformation to include disputed strip. Prayer was denied, and strip awarded to vendor since there had been no conveyance thereof. 182 A 624, 32 SW (2) 812.

244. *Parol Agreement to Divide Lands to be Acquired in Future.* In the absence of a trust relation, a verbal agreement for a division of public land when either party should enter it will not be enforced, 15 A 322. The grantee of timber rights on defendant's land which had been added to by accretions cannot demand that the accretions to which he is entitled (defendant having purchased the adjoining property) shall be determined according to the boundary for such adjoining property fixed by defendant and its then owner by parol at a time prior to the formation of the accretions, 105 A 598, 151 SW 1025.

245. *When Boundaries Settled by Court Action.* Equity will not interpose to settle boundaries unless, in addition to the dispute over boundaries some other peculiar equities

are shown. But equity has jurisdiction to settle disputed boundaries by the reformation of title deeds where possession of the tract has been taken and held by one of the disputants and his predecessors in interest for 13 years, during which time valuable improvements have been made by them, and their rights have been acquiesced in by the predecessors in interest of the other disputant, 75 A 400, 87 SW 649, compare section 243.

Where parties to a suit cannot agree upon location of division line in accordance with court's decree, appellant held entitled to have court appoint a surveyor to establish line, with fixed monuments, in accordance with the decree, 177 A 781, 9 SW (2) 80.

246. *Abandonment of Agreed Boundaries.* Boundaries agreed upon may be subsequently abandoned by mutual consent, 19 A 23.

247. *Evidence.* Certified transcripts from, and copies of, field-notes, maps, records and other papers on file in the office of the State Land Commissioner are admissible in evidence in same manner and with like effect as the originals, CM 4746, 4747.

Certified copy of a county surveyor's record of a survey made by him is admissible as documentary evidence of the correctness of the survey, without other proof, CM 1901, as construed by 44 A 287, 50 A 65, 6 SW 328, 53 A 411, 14 SW 652; but the statute making such certificate *prima facie* evidence does not give such effect to the county surveyor's oral testimony with reference to a survey, 143 A 8, 219 SW 348, nor does it exclude testimony of witnesses in court to establish the true location of boundaries, 44 A 287, 50 A 65, 6 SW 328, see 71 A 248, 72 SW 571. Error to exclude testimony of a witness in whose presence a dispute as to boundary land had been settled by a verbal agreement of the owners establishing the line, 171 A 855,

286 SW 1020. In an action to quiet title, involving a question as to boundaries of blocks in a town, the court properly admitted testimony of a witness as to the directions given to a surveyor by a landowner when the town was laid out, 158 A 321, 250 SW 15.

Ancient public boundaries may be proved by general reputation, by tradition and by hearsay declarations of persons with knowledge, made before the controversy arose. But evidence of a private survey made without authority of either State, was held inadmissible to prove the boundary between Arkansas and Texas. 88 A 311, 115 SW 138.

### LAND DESCRIPTIONS

248. *Reconciliation Between Rules of Construction Applies to Private Conveyances and to Tax Proceedings.* In the course of a review of the many decisions testing the validity of land descriptions, one meets with what may appear to be an irreconcilable conflict of judicial construction. Thus our Supreme Court tells us in one case that the description "the north part of the southwest quarter" of a certain section, containing 30 acres, is valid; whereas, in another case, a like description is held to render a deed void. But this inconsistency is more apparent than real, and reconciliation may be readily found when we call to mind that the court has under consideration, on the one hand, a conveyance between parties voluntarily contracting with one another (hereinafter called "private conveyance"), and, on the other, a tax proceeding. The rule of differentiation may be stated, without grave fear of contradiction, to be: the court will take especial pains to uphold a private conveyance and will strive with the same diligence to invalidate, for faulty description, a title acquired through forfeiture under tax proceedings. "It has sometimes been said that a description that would be sufficient in a conveyance between individuals would generally be sufficient in assessments for taxation. We do not, however, consider that a safe test." 79 A 442, 96 SW 184.

249. *Construction in Private Conveyances.* While the location of the property conveyed by deed or mortgage must be determined by the description of it contained in the instrument itself, still, as between the parties to the instrument, the actual intention of the parties in this respect is the controlling factor, and this may be ascertained by extrinsic evidence for the purpose of identifying the property, 179 A 661, 17 SW (2) 877. A private conveyance will not be held void if by any reasonable construction it can be upheld, 40 A 237, 68 A 544, 60 SW 418, 179 A 661, 17 SW (2) 877. The language of the deed should be considered in the light of surrounding circumstances, 68 A 544, 60 SW 418, 181 A 739, 28 SW (2) 70, and conveyance will be upheld if the general description furnishes a key for identifying the land, 30 A 513, 40 A 237, 85 A 1, 107 SW 160, 88 A 478, 115 SW 379, 95 A 253, 129 SW 84, 159 A 175, 251 SW 377, 163 A 542, 260 SW 411, 167 A 8, 267 SW 561, 168 A 174, 269 SW 567, 170 A 758, 281 SW 17, 177 A 849, 8 SW (2) 440, 181 A 739, 28 SW (2) 70. But if the conveyance fails to describe the thing intended to be conveyed, with sufficient certainty to ascertain its identity, the grantee takes nothing, 3 A 18, 30 A 640.

250. *Construction in Tax Proceedings.* Where an owner's land has been forfeited for non-payment of taxes, "in proceedings that prejudicially affect him," 56 A 161, the land must be described with certainty upon the assessment rolls and in all subsequent proceedings for the enforcement of payment of tax, so that the owner may have information of the charge upon his property. The description must fully apprise the owner, without recourse to the superior knowledge peculiar to him as owner, that the property is sought to be charged with a tax lien. It must be such as will notify the public what lands are to be offered for sale in case the tax be not paid, 79 A 442, 96 SW 184, 129 A 334, 196 SW 118, 143 A 92, 220 SW 660, 169 A 1177, 278 SW 12; and so that the purchaser may be able to obtain a sufficient conveyance, 59 A

460, 27 SW 970. A description which can be understood and made definite only by judicial construction does not accomplish the essential functions of a description in tax proceedings; and, as the law requires one to be made for the practical purpose of protecting the owner, any description that conveys no certain meaning to persons ordinarily versed as to such matters does not answer the requirements, 56 A 172, 19 SW 746. Description must be intelligible, not only to the expert, but also to one who is only ordinarily versed in such matters, 59 A 15, 26 SW 13.

A valid assessment is essential to a valid sale and the description of the property assessed and sold must be definite and certain. 181 A 914, 28 SW (2) 697.

The statutory presumption in favor of a conveyance of land forfeited for taxes, executed by the Commissioner of State Lands, is overcome by proof that the land was not assessed by a description sufficient to identify it, even though the land was correctly described in the State Land Commissioner's deed. No title passed to the State by such forfeiture, and the lands could properly be placed on the tax books. 131 A 273, 199 SW 116. So, a certificate of purchase, under former school laws, of tax-forfeited land, though containing proper description, was held issued without authority where assessment was void for invalid description, and the certificate did not confer color of title, under CM 6947, providing a two-year statute of limitations in favor of a tax purchaser in possession under color of title, 181 A 914, 28 SW (2) 697, 140 A 367, 215 SW 618.

Where two tracts were separately assessed and sold as "pt. W $\frac{1}{2}$  NE . . . 11.48 acres" and "pt. W $\frac{1}{2}$  NE . . . 68.25 acres," respectively, the defective descriptions could not be cured by a showing that the two, when added together, amounted to 80 acres and that therefore the whole half of the NE quarter had been assessed and sold. The owner of land in the NE quarter could not be put on notice from

either description that his land had been assessed or sold. He could not be required to search through assessment books and see if his lands had been assessed and sold, by comparing the description with those of other descriptions in the same governmental subdivision. All he would be required to do was to take notice that his lands were assessed and sold, and, if the description was too vague and indefinite for that purpose, it would be absolutely void on its face, and the tax deed containing the same void description would be equivalent to no deed at all. 179 A 553, 17 SW (2) 281.

251. *Is Evidence Aliunde Admissible to Aid Description in Tax Proceedings?* A study of the cases referred to in the preceding section leads to the conclusion that an indefinite description casts no duty upon the landowner to look beyond that description which *in se* renders void the forfeiture and sale, and that proof *aliunde* cannot be resorted to in order to aid or cure an uncertain description. However, there are cases which point to a contrary conclusion. Upon close analysis, it will be seen that the rule, announced in this latter class of cases to the effect that proof *aliunde* is admissible to aid or cure an uncertain description in tax proceedings, relies for its support upon a citation of certain early cases wherein proof *aliunde* was resorted to, *not* to aid uncertain description, but for other purposes, such, for example, as to show that there had been an assessment under two different descriptions, both of which identified the land, and that a forfeiture was erroneous by reason of the fact that taxes had been paid under one of said descriptions. See 53 A 114, 13 SW 596, 59 A 15, 26 SW 13, 79 A 442, 96 SW 184, 112 A 159, 165 SW 295, 135 A 592, 204 SW 213, 177 A 52, 5 SW (2) 718.

In line with the strict rules of construction announced in the cases in the preceding section is *Walls vs. Mills*, 225 SW 225, which holds that a defective description

of land in a tax deed and in all the tax records cannot be supplemented or cured by proof *aliunde* to show what land was intended to be taxed and sold. The description was "Pt. NW NW section 7 township 12 S. Range 29 W, 11.16 acres." And note the numerous instances of invalid tax deed descriptions in the chapter following:

252. *Evidence of No Other Land Owned In a Certain Subdivision.* Where the owner of land properly described as the N½ of the W½ of a certain quarter section, containing 44 acres, sold it and placed his grantee in possession under a deed describing it as the north part of the west half of such quarter section, "containing 44 acres, more or less," it was held that the deed will be sufficient to convey the land," at least where the grantor owned no other land in the quarter section described," 68 A 544, 60 SW 418.

Regarding tax proceedings, the court, in 143 A 92, 220 SW 660, reviewing 50 A 484, 8 SW 689, says: "Appellant offered to identify the land in controversy as the land purchased by him, and on which he subsequently paid taxes, by showing that it was the only land owned or claimed by Erb in the legal subdivision of which it is a part, but this does not show that the land owned by Erb was assessed or sold. If the appellant had shown that every other portion of the legal subdivision was assessed by proper description, it probably would have been sufficient proof that the land in controversy was the land intended to be sold to appellant. It is impossible to locate the land from the description given ("west part of SW¼ of NE¼ of section 9 west, township 1 south range 10 west, 30 acres"). There is nothing in the record to aid the description or to identify the land sold. The description was void for uncertainty." And in 181 A 914, 28 SW (2) 697, the court says: "Even if such method were permissible, in order to definitely ascertain what particular part of said lots were forfeited in the name of Julia Brown, it would

be necessary to show that the purchasers of the several parcels of said lots assessed and paid taxes for the years 1917 and 1921 be definite and certain descriptions. They did not do so, but, on the contrary, assessed and paid their taxes as parts of lots 3 and 4 in said blocks." See also 59 A 15, 26 SW 13.

253. *Description by Abbreviated Calls.* "NE 10-14-7, in Miller County, Arkansas," is a sufficient description in a private conveyance of the Northeast quarter of Section 10, Township 14 South, Range 7 West of the 5th Principal Meridian, in Miller County, Arkansas, see 76 A 261, 88 SW 992. So, in a mortgage, 157 A 583, 249 SW 32, 170 A 660, 281 SW 1.

"NE SE 24-13-7, 40 acres" is a sufficient description in a tax assessment, 64 A 580, 43 SW 977, and see 59 A 460, 27 SW 970, 66 A 422, 51 SW 71, 79 A 442, 96 SW 184.

"Frl. S½ NW¼, 18-16-14, in Union County, Arkansas, 53 acres," is sufficient description in a tax deed, 128 A 180, 194 SW 21.

See Chapter 10 for various abbreviated calls.

254. *Reference to Other Instruments.* In a private conveyance, identity of land may be established by reference to other instruments, such as to another deed on record, 170 A 758, 281 SW 17, 39 A 57, bond for title, 140 A 512, 216 SW 505, petition for probate sale, 31 A 74.

Mortgage held valid where land was described as lying in Phillips County, Arkansas, and known and designated on survey as the part of the tract originally patented to Sylvanus Phillips, under Silas Bailey, being a Spanish concession for 640 acres (10 acres of said tract belong to Josiah S. McKeil), leaving 630 acres, lying in township 1 N R 4 E, containing in the whole, according to survey,



630 acres of land, 39 A 57.

An assignment of an oil and gas lease which does not describe the lands involved, but refers to a previous recorded lease in which the lands are described, is a sufficient description, 157 A 194, 247 SW 778.

In an action for breach of contract to convey, a writing which described the lands as the property of "the Ross estate upon which Free holds a mortgage now being foreclosed" was held to satisfy the requirement of the statute of frauds, 184 A 737, 43 SW (2) 540, and see 163 A 542, 260 SW 411.

255. *Recordation by Imperfect Description.* The object of recording is to put upon record such description of the property as to identify it, and give notice to all subsequent purchasers or encumbrancers what particular parcel of land has been sold or encumbered, 30 A 657. Description of land must be definite, see section 511.

256. *Liens of Materialmen, Mechanics and Laborers.* See section 1393.

257. *Improvement District Proceedings.* Proceedings creating drainage or levee districts will be held void where the description used does not enclose the property attempted to be described, and where, from the language, there is no way of closing the boundaries without doing violence to the plain and unequivocal words employed, 122 A 491, 184 SW 57, 105 A 380, 151 SW 269. The description used in the published notice must be such that the land owner reading it may easily ascertain whether or not his lands are included, 120 A 230, 179 SW 339, 113 A 566, 168 SW 1088. A district void *ab initio* for uncertainty of description has no *de facto* existence, 126 A 416, 191 SW 24. Where the proceedings are void, the court cannot order a change in the description, 130 A 70, 196 SW 931.

258. *Notice of Execution Sale.* As the

object of giving notice of sales under execution is to inform the debtor that his property is about to be sold, and to inform the public so that there may be competitive bidding, a description of the property is sufficient which identifies it with reasonable certainty so that no one may be misled thereby, 85 A 163, 107 SW 387.

259. *Tax Sale Confirmations.* Confirmation of tax sales affords no protection to purchaser where the land is not sufficiently described in the tax deed so as to be identified, 185 A 1170, 52 SW (2) 46, 182 A 648, 32 SW (2) 1061, 178 A 300, 10 SW (2) 885, see 59 A 460, 27 SW 970.

260. *Reformation.* Where under a deed containing a defective description, grantor has allowed grantee to go into possession, the faulty deed will be held to be a valid contract to convey, if the land can be identified by any competent proof, 68 A 544, 60 SW 418, and such deed may be reformed in chancery, 140 A 512, 216 SW 505.

Where parties to deed believed that it described land south of a river only, though the description included land north of the river, chancery reformed the deed to include the property intended, with proportionate abatement of purchase price, 170 A 58, 278 SW 645.

Where tract is misdescribed in a mortgage, the equity of the mortgagee to have it corrected is equal, and prior of time, to that of a subsequent judgment creditor, 33 A 72. It will be reformed as against all persons except *bona fide* purchasers without notice of the mistake. Purchaser not protected if he knows facts sufficient to put him upon inquiry which would lead to discovery of the mistake. The obligation of the debtor to correct the mistake is such an equity as will bind his heirs, voluntary grantees or purchasers with notice, 51 A 390, 11 SW 580, 60 A 304, 30 SW 34, 120 A 105, 179 SW 185.



These rules are not in conflict with the holding in 41 A 495 wherein the court refused to reform a mortgage by correcting the following descriptions: "A portion of the NE¼ of section 22, in township 6, range 20, containing 20 acres." It was contended that the parties understood and agreed that a particular 20 acres out of the 160 acres described, should be covered by the mortgage; and that they thought this intention might be established by parol evidence. It was not contended that they believed that the terms employed described or ascertained the particular 20 acres covered by the mortgage. That, they thought, could be supplied whenever it became necessary. It was a clear mistake of the law, and not a mistake as to the ordinary meaning of the terms used — a mistake of fact. "That courts of equity will, under proper circumstances, grant relief against the latter and generally refuse it against the former, is a doctrine so well settled that citation of authorities is unnecessary." 51 A 390, 11 SW 580, 179 A 661, 17 SW (2) 877, distinguishing 41 A 495, *supra*. See Section 96.

#### PARTICULAR DESCRIPTIONS ALPHABETICALLY ARRANGED

262. *Acreage*. Ordinarily, description of quantity yields to description of boundaries, and quantity named does not amount to a covenant, unless expressly so declared, 95 A 150, 128 SW 864, 95 A 375, 129 SW 787. The misdescription of acreage does not render deed invalid, and purchaser takes all the land within the calls of his deed, whether acreage be more or less than that stated, 69 A 34, 59 SW 1096, 95 A 375, 129 SW 787, 101 A 95, 141 SW 759, 157 A 181, 247 SW 780, 170 A 58, 278 SW 645, 178 A 300, 10 SW (2) 885. A tax sale of "the NE fractional quarter," etc., "10.88 acres" carried an accretion of 148.91 acres, as the area given did not control the general description, 71 A 390, and see 69 A 34. Where deed conveyed "a tract of land containing 366 acres, being a part of a 640 acre tract," etc., previously con-

veyed by a certain deed, the land conveyed is the same land conveyed in the deed referred to, though it contain less than 366 acres, 3 A 18.

Where description is by definite boundaries, or contains such words of qualification as "more or less" or "approximately," and it thus appears that statement of quantity is a mere matter of description (181 A 739, 28 SW (2) 70,) and not of the essence, the buyer takes the risk of quantity, in absence of fraud, 170 A 58, 278 SW 645. In such case, the sale is in gross, and mention of quantity may be rejected, 95 A 375, 129 SW 787, 101 A 95, 141 SW 759. But equity may grant relief if difference in acreage is so great as to conclusively warrant finding that purchaser would not have bought if the shortage had been known to him, 175 A 1118, 1 SW (2) 823, or contract was procured by misrepresentation, fraud or deceit, 146 A 223, 225 SW 305.

In cases where quantity of acreage becomes an important factor in identifying the land conveyed, the words "more or less" are precautionary, and intended to cover slight or unimportant inaccuracies, but they do not weaken or destroy the indications of quantity, 68 A 544. Where sale is by the acre and statement of quantity is of the essence of the contract, the purchaser, in case of a deficiency, is entitled in equity to a corresponding deduction from the price, on ground of gross mistake, 170 A 58, 278 SW 645. Under a lease which stipulated that tenant should pay "\$160 for rent of 40 acres of land at \$4 per acre, more or less, known as the Dudley Farm," the intention of the parties was to contract for rent at \$4 per acre, and not for a gross price for the whole tract, 94 A 493, 127 SW 957.

Where a deed described a part of the premises as *the SW and the W½ of the SE¼, of a certain section, 240 acres, less 46 acres east of the railroad*, when in fact there were 126 acres east of the railroad in the two tracts described, the exception was void, and the

effect of the deed was to convey the whole of the SW $\frac{1}{4}$  and the W $\frac{1}{2}$  of the SE $\frac{1}{4}$ , 240 acres, 139 A 83, 213 SW 8, citing 30 A 640.

Crop mortgages describing crop as *so many acres of cotton to be planted and grown by the mortgagor on a named person's land* in Poteau bottom in Leflore County, Oklahoma, held not void for uncertainty. Evidence that the mortgagor grew only 15 acres of cotton on a certain farm rendered certain a description in one mortgage as the crop grown on 30 acres of land, and in another mortgage as the crop grown on 15 acres. 172 A 569, 289 SW 766. But a mortgage on cotton described as *"6 acres of cotton grown on the John Moore lease,"* which consisted of 12 acres planted in cotton, was void, since it furnished no description from which it could be ascertained what particular 6 acres of cotton was intended, 153 A 127, 239 SW 728, and cases cited.

263. *All.* See "Balance," "County," "Entire," "Fractional," "Interest," "Part," "Range."

A deed of *"all my estate"* is sufficient to pass title. So, a deed of *"all my lands wheresoever situated."* So, a mortgage of *"all my property."* 181 A 739, 28 SW (2) 70.

A mortgage of *"all property owned by the Nashville Lumber Company, or afterwards acquired by it, in Howard and other counties in Arkansas,"* held definite enough to satisfy our registration laws and give constructive notice to all parties dealing with lands owned by the company in those counties. 167 A 8, 267 SW 561. A deed contained the following description: *"the following described lands lying in the county of Pope, and State of Arkansas, to-wit: All the south half of section 28 that I now own, containing 150 acres, more or less."* The court said: "The township and range are not mentioned, and no boundaries, natural or artificial object, or other means of identifying the lands intended to be conveyed, are given, and it may

be conceded that the deed on its face was bad for uncertainty under our registration laws." 35 A 470.

A mortgage of *"all my crop of corn, cotton or other produce that I may raise, or in which I may in any manner have an interest, for the year 1884, in Faulkner County, Arkansas,"* is not void as to third parties for uncertainty. The description could be made certain by extrinsic evidence, and the record of the conveyance was constructive notice of the mortgagee's lien on the crop mentioned. 51 A 410, 11 SW 585. Compare 43 A 350, 54 A 91, 15 SW 14.

264. *Approximately.* See "Acreage."

265. *Balance.* See "Residue."

A deed describing the land as: *"Balance west of river, fractional N $\frac{1}{2}$  of section 17, T 19 N, R 3 W, in Randolph County, Arkansas, and containing 100 acres, more or less,"* was held properly excluded at the trial, because of insufficient description. "Here we do not have the case of a grantor, who describes his entire tract and makes a reservation of land not intended to be conveyed. There is but a single description and that is the land attempted to be conveyed." Court cannot presume parties meant to define "balance" as "all." 106 A 83, 152 SW 1025, citing 95 A 253, 129 SW 84.

266. *Beginning.* See "Range," "Side."

267. *Belonging To.* Mortgage, conveying a tract of land and reciting parenthetically, that *"10 acres of said land belongs to Josiah S. McKeil,"* held to intend to convey the whole described tract "save the ten acres described, not by metes and bounds, but as belonging to Josiah S. McKeil. The only obscurity left is the exact location of the 10-acre tract. We are aided to find that by the fact that it belongs to Josiah, who must either own it by deed, inheritance or continued adverse possession. Means of ascertaining it being obvious, the mortgage is valid. The intervener

might have had the exception made more certain." 39 A 57.

268. "Black Acre." See "Range."

Parol evidence admissible to show what tract parties intended to convey under description "Black Acre," 30 A 657.

269. Block. See "Lot."

A notice of a judicial sale of lots in a town, which fails to name the block in which the lots are situated is ineffectual. The land cannot be designated without extrinsic aid. Does not apprise general public of the land to be sold and the object of the law to encourage highest possible bids would not be attained. 73 A 37, 83 SW 328.

The description "blocks 73 and 74 of the Town of Brinkley," which had appeared upon the assessment rolls of Monroe County for fourteen years and were commonly so designated, was held sufficient to identify the land, although the blocks did not appear upon any recorded plat, 53 A 114, 13 SW 596.

270. Corner. See "Ex."

A contract for the sale of a tract, "except 5 acres in the southwest corner," is valid. The exception means 5 acres laid off in a square. 45 A 17.

Where part of a tract is sold for taxes due on the whole, it is sufficiently described as so many acres from a given corner of the legal subdivision, 55 A 104, 17 SW 594. Tax deed is sufficient which describes land as "NE corner, SW  $\frac{1}{4}$ , sec. 33, Tp. 1N, R 1 E, 60 acres," 99 A 154, 137 SW 820.

As between parties, the rights of third parties not being involved, parol evidence is admissible to locate a particular "15 acres in the NE corner" of a certain quarter section, so as to carry out the intention of the parties. "It may be that the parties owned no other

land in these subdivisions except the 15-acre tract and the  $5\frac{1}{2}$ -acre tract, and that these two tracts may be located and identified by parol evidence." 179 A 661, 17 SW (2) 877.

In a mechanic's lien notice, "SW corner lot 50 x 140 feet facing 50 feet on Haes Street, all in Block 10, Bradley's Addition to the town of DeQueen, Arkansas," held valid description, 178 A 18, 9 SW (2) 785.

271. County. See "All," "Range."

It has been held that an oil lease describing the land by *section, township and range*, in accordance with the public survey, is sufficient to identify the land without mentioning the county and State in which it is situated, 156 A 103, 245 SW 802. But recordation of deed of trust held to be no notice to third persons where the lands were described by subdivisions of certain sections, omitting reference to township, range, county and State. "If this had been an action brought by" the mortgagee against the mortgagor "to have the omission supplied, a different question as to the admissibility of parol evidence would arise." 30 A 657.

Regarding the omission of reference to county and State, in a mortgage describing the land as "the north 40 acres of land in the W  $\frac{1}{2}$  of the SE  $\frac{1}{4}$ , section 35-13-17, less a 5-acre strip off the west side of the north part of the north part, being 75 acres, in section 35-13-17," the court said; "The description recites that a five-acre strip in the forty was sold to the Ouachita Valley Fair Association. The mortgage recites that the land is the homestead of the mortgagors. It also recites that the cotton to be raised by them in Ouachita County, State of Arkansas, during the year 1914, is included as a part of the security for the debt. It also recites that E. L. Mayweather 'covenants with the trustee that he has already planted (or will plant) in cotton 26 acres, and in corn 22 acres of land, in the county and State aforesaid.' The mortgage was acknowledged before a

notary public in Ouachita County, and recorded in said county. By reading the entire instrument, the conclusion is irresistible that the land in question is located in Ouachita County, State of Arkansas." 170 A 660, 281 SW 1.

272. *E.* See "East of Meridian," "N."

273. *East.* See "East of Meridian," "North 80," "North Part."

274. *East of Meridian.* "All the lands in Crittenden County are in townships north of the base line and east of the fifth principal meridian. Of this the court will take judicial cognizance. It was therefore unnecessary to put the word *north* after the figure designating the township, nor the word *east* after the figure designating the range." 113 A 316, 169 SW 246. The omission of "east" or "west," or their abbreviations "E" or "W," is immaterial where the county and State are named, 64 A 580, 43 SW 977.

275. *Entire.* The mortgage of "my entire crops of cotton and corn, to be raised by me the present year, or contracted by me," and which recites the grantees as "Henderson, Echols & Co.," sufficiently describes both the property conveyed and the mortgagees, and is not invalid, as to third persons, for uncertainty, 52 A 371, 12 SW 780, see also 163 A 88, 259 SW 5. So, entire crop to be raised on mortgagor's farm in Faulkner County, or elsewhere in that county, 109 A 552, 161 SW 183.

276. *Estate.* See "Farm."

In an action for a breach of contract to convey lands, a writing which described the lands as "the property of the Ross estate upon which Free holds a mortgage now being foreclosed," was held to satisfy the statute of frauds, 184 A 737, 43 SW (2) 540.

277. *Ex.*

Following description in tax deed held invalid: "Ex 10 A. Sq. NE Cor. S½ SE 26-11-11, containing 70 acres," 122 A 376, 183 SW 966.

278. *Except.* See "Ex.," "Corner," "Plantation," "Side."

After the lands are described, in a notice of filing of an improvement district petition, as "S½ (except NE¼ NE¼ SE¼) of section 23," etc., it is unnecessary to then enumerate the lots and blocks included in that description, 160 A 391, 254 SW 674.

279. *Farm.*

Description, in land lien note, "N. R. Moore's father's land, known as the Old Marshall Farm, situated on Spring River in the Western District of Lawrence, County, Arkansas," held valid. "If an estate, farm or tract of land is commonly known and called in the vicinity by a popular name, it may be described by that name in a mortgage, provided the exact extent and location of the property can be rendered certain by extrinsic evidence or by reference to the title deeds of the mortgagor or other recorded documents." 163 A 542, 260 SW 411.

Description held sufficient in deed of trust: "164.94, more or less, acres and being further described as the 26, more or less, acres of fractional SW¼ of the SW¼ of sec. 19, tp. 17, range 15, and the 138.94, more or less, acres of fractional NW¼ of sec. 30, tp. 17, range 15, known as the C. A. Ingram Farm, in Union County, Arkansas." The description would be insufficient to identify the land if it were for the clause referring to it as "The C. A. Ingram Farm," since there would be no key or guide to determine the particular part of the fractional calls the trust deed intended to convey. 178 A 699, 11 SW (2) 488.

"A grants or devises to B his home farm. To identify the land, resort may be had to ex-



trinsic evidence, namely the knowledge of witnesses, who are acquainted with the farm upon which A then dwelt. Parol evidence has always been admitted to give effect to a written instrument by applying it to its subject matter, in other words, by proof of the circumstances under which it was made." 40 A 237.

280. *Fractional*. See "North Part," "Part."

"Fractional, when used in connection with a subdivision of a section in describing it, means either that there is more or less land than is usually contained in such subdivision, and generally less, in the sectioning of same by the government survey, 117 A 151, 175 SW 405.

The abbreviations "Frl." and "Fr." are sufficient, 128 A 180, 194 SW 21.

"Frl. NW $\frac{1}{4}$ " is equivalent to "NW frl.  $\frac{1}{4}$ ," 157 A 181, 247 SW 780.

"Fractional" is not synonymous with "part," 128 A 180, 194 SW 21.

If it is in fact a fractional section or subdivision, it is so indicated on the government survey and it is unnecessary to use the word "fractional" as a descriptive word, and, on the other hand, the improper use of the word, when the section is not fractional, does not invalidate the description, 128 A 180, 194 SW 21. "Frl." treated as surplusage in 129A 334, 196 SW 118.

A deed (private) describing the land as "NE fr. quarter of the NE fr. quarter, section 22-8-22W, situated in the county of Johnson in this State" is valid, 76 A261, 88 SW 992.

A sheriff's deed on an execution sale was held valid where the description was "all of Frl. Sec. 36 . . . and except off North side Frl. NW $\frac{1}{4}$  Section 36, Twp. 7 S, R 4 W, 49.26 acres claimed as the homestead of defendant. Anthony White," 146 A 482,

225 SW 646, citing 56 A 44, 19 SW 98.

Where land was forfeited for nonpayment of taxes and sold as "part of the SW $\frac{1}{4}$  of the SW $\frac{1}{4}$  etc., and conveyed by the tax purchaser as "the fractional SW $\frac{1}{4}$  of the SW $\frac{1}{4}$ ," etc., the court said: "It is not claimed here that this was a fractional 40-acre tract, and shown by the government survey, and the fractional southwest quarter, southwest quarter, or the fractional part of the southwest quarter of the southwest quarter in Sevier County, Arkansas, would not be a sufficient description to convey the portion of the particular 40 acres lying west of the Saline River in said county," 117 A 151, 175 SW 405, citing 106 A 83, 152 SW 1025. A tax deed to "fractional SW $\frac{1}{4}$  of the SW $\frac{1}{4}$ , sec. 19, twp. 17, range 15-26 acres," and to "fractional NW $\frac{1}{4}$ , Sec. 30, twp. 17, range 16-138.94," is sufficiently described, since the grantee would take the whole of the fractional call, 178 A 699, 11 SW (2) 488.

The legal effect of the patents to the State of the fractional sections and parts of sections surrounding the meandered lines of a lake, according to the official plats of the public survey, was to convey all riparian rights and by virtue thereof to vest *prima facie* title to the bed of the lake, as shown on the plats from meandered shore lines to center. The conveyance by the State in turn to its grantees had the same effect, 104 A 154, 148 SW 248.

281. *From*.

"The contract and deed designated a certain number of acres to be taken from a certain part of the Brown Place. It was approximately described, so that the lines could be, and they were, laid out in accordance therewith. When located, there was an accretion between the lines thus located and the river. This tract was not described by name or number, like the Keywood place, thereby carrying the boundary to the shifting water line; but this boundary was fixed,



and the acreage determined by the contract and deed." 76 A 43, 88 SW 832.

282. *Graveyard.* As monument, see "Range."

283. *Highway.* As monument, see "Range."

284. *Home.* See "Farm."

285. *Homestead.* See "County," "Fractional," "Side."

"The instruction to the trustee to reserve a homestead, may raise a presumption that the grantor resided upon the land, but nothing more, and we think it did not aid the description given, so as to make it more certain." 30 A 657. But, in a case wherein evidence was adduced to establish the identity of a tract of land, the court took into consideration, as one of several factors, the fact that the land was the homestead of the mortgagors, 170 A 660, 281 SW 1.

286. *House.*

"If a man convey his house in D. which is in the possession of R. C., when in truth and in fact it was in the occupation of P. C., the grant nevertheless shall be good. For it was sufficiently described by declaring that it was in the town of D." 3 A 18, 58, and see 40 A 237.

A description in a chattel mortgage of "12 bales of cotton of the 1920 crop now in my barn one mile west of the town of R," is sufficient, 164 A 460, 261 SW 910.

287. *In.* See "Corner," "County."

288. *Interest.* See "Of."

A mortgage of the owner's *undivided interest in his father's land* includes any and all interest which he owns therein, whether

in possession, reversion or remainder. 179A 661, 17 SW (2) 877. A deed conveying "*all our undivided 1/3 of 1/9 interest as heirs of Samuel Leslie, deceased,*" in certain sufficiently described lands would be a valid conveyance, 120 A 69, 179 SW 331. A mortgage describing property as *one-half interest in a pumping plant and canal with all lands in the section described* was held to convey the mortgagor's interest in the plant and canal and all land owned in the particular section, 181 A 739, 28 SW (2) 70.

A grantor, who owns an undivided four-fifths of a tract and conveys by warranty deed, "*a full half interest in all the right, title and interest in and to*" the land, conveys an undivided half interest in the land, and not in his interest, 55A 104, 17 SW 594.

Where land is assessed against tenants in common, and one of them pays on his undivided share, the interest of the other may be sold to satisfy the residue of the assessment. In such case, the assessment is validly described where, after a proper designation of the land, the tax book contains the entry: "*Moses U. Payne and Bank of Kentucky each owns one undivided half.*" 94 A 306, 126 SW 830, reviewing 18 A 441.

289. *Land Of.* See "Farm."

To locate the calls of a description by metes and bounds reference was made to a certain order of sale in a partition proceeding, wherein the land was described as "*a tract of land of which John Brown died seized and possessed, in the County of Guilford, on the waters of Stinking Quarter, adjoining the lands of -----.*" The description was held sufficient, 40 A 237.

290. "*L. B. R.*" See "North Part."

"*L. B. R. W. Pt. SE quarter, sec. 30, tp. 5 N R 4 E*" held an invalid description in tax deed, 69 A 357, 63 SW 799, ("L.B.R." was intended to signify "Left bank of the

river").

291. *Less.* See "County," "Side."

292. *Lot.*

Where land lies in a city or town, the description is usually by reference to the lots and blocks of a recorded plat, 40 A 237. Where grantor conveyed a described lot as *running 142 feet to an alley*, when in fact lot was only 134 feet long, according to recorded plat, deed should be construed to convey only to the alley. Such deed is inadmissible against a stranger to show that such alley was 142 feet from the street. 64 A 240, 41 SW 853.

Where, by mistake, a power of attorney empowered brokers to sell a *70 x 70 lot*, instead of *70 x 75*, the misdescription was not material if the writing otherwise sufficiently identified the entire tract intended to be sold, 87 A 221, 112 SW 1087.

A tax sale was held void where the lot sold was described as *"lot 12 of Briggs & O'Neill's subdivision of lots 1, 2, and 3, of Block 10,"* whereas the proper description should have been *"lot 12 of Briggs & O'Neill's subdivision of lots 1, 2, 3 and 4 of block 10."* The four lots as originally platted comprised a half block, but the owners subdivided them into 24 lots, and lot 12 of the subdivision is situated wholly in what was originally designated as lot 4. 112 A 159, 165 SW 295.

293. *Meridian.* See "East of Meridian."

294. *Middle Part.*

A tax deed which describes the land as *"Mid. 1/3 pt. SW NE . . . 131 1/3 acres,"* and the *"W½ Mid. 1/3 part SE NE SE . . . 6 acres,"* is void, 85 A 4, 106 SW 1169.

295. *More or Less.* See "Acreage."

296. *N.* See "East of Meridian."

In cases involving tax proceedings, it has been held that the letters "N" and "S" are not recognized as sufficient abbreviations for "North half" and "South half." Thus where land was advertised and sold for delinquent taxes under the description *"N. NE section 2, Tp. 15, Range 6, 87.19 acres,"* the description was held insufficient to identify the land, and the sale was void. "N. NE. . . was not a description by abbreviations the knowledge and use of which was so general as to warrant the court in holding that they sufficiently identified the land to be sold. 59 A 460, 27 SW 970, 69 A 357, 63 SW 799, 83 A 334, 104 SW 128, 122 A 376, 183 SW 966, and see 131 A 273, 199 SW 116, 56 A 172, 19 SW 746, 120 A 528, 180 SW 199. The "N" might have as reasonably been construed as meaning the "North part." The description was not sufficiently certain to protect the interests of the owner, 64 A 580, 43 SW 977.

297. *NE.*

"NE" is a common and sufficient abbreviation of "Northeast quarter," 64 A 580, 43 SW 977, 79 A 442, 96 SW 184. "NE SE" etc., in tax assessment, is valid, 64 A 580, 43 SW 977.

298. *NE 4.* See "N 2."

299. *NE½.*

*"SE¼ of the SW½ of section 32, township 12, range 6 west, containing 40 acres, more or less."* "The above description is an imperfect one and is insufficient as a description of the land in controversy. Therefore the deed is void on its face. The deed is a voluntary gift, and, as there was no delivery made of the possession of the property during the lifetime of the grantor, followed by valuable improvements by or for the grantee, a court of equity will not reform it so as to correctly describe the land." But the court further found that: A had deeded the land to B, giving the deed to C for delivery; C

retained possession of both the deed and the land for many years; upon his deathbed, C delivered the deed to his son to deliver to B, which the son did, the deed being in an old and worn condition; B had the deed recorded but lost the original; upon the record the land was described as "the Southeast  $\frac{1}{4}$  of the Southwest  $\frac{1}{2}$ ," etc. The court held that, under the evidence, the original deed having been in a worn-out condition, and the southeast quarter of the southwest quarter being the only land owned by A at the time of the execution of the deed, and the same having been occupied by C, the court would treat the deed as correctly describing the land, 134 A 161, 203 SW 1042.

### 300. *N* $\frac{1}{4}$ .

"There is no such designation in the public surveys as the *north quarter* of any part of a section." But an order of probate court, directing sale of decedent's estate, in which such description occurred, was held valid where it referred to the petition in which the land was properly described and where it was shown that the tract was the only land owned by decedent. The description containing such "clerical error" was rendered certain by reference and proof *aliunde*. 31 A 74.

### 301. *North 80*. See "County."

Against grantee's contention that grantor intended to convey the north half of the fractional northwest quarter of section 30 (which included only 76.60 acres), by description: "*The north 80 of fractional NW $\frac{1}{4}$ , sec. 30-4-1 — eighty acres,*" the court said that the words used "clearly express an intention to convey 80 acres of the fractional quarter section named, laid off in the shape of a rectangular parallelogram, with the north line of said fractional quarter section as one of its sides. The words used mean the same as 80 acres off the north side of said fractional quarter section." 111 A 220, 163 SW 524, citing 45 A 17, 56 A 44, 19 SW

98, 68 A 544, 60 SW 418.

### 302. *North Part*. See "County," "L.B.R."

A description in a private conveyance, "*North part of the W $\frac{1}{2}$  of the SW $\frac{1}{4}$ , sec. 30-5-3, containing 44 acres, more or less,*" shows *prima facie* an intention to convey 44 acres off the north part of the west half of the quarter section laid off in the shape of a rectangular parallelogram with the north line of the west half of the quarter section as one of its sides, 68 A 544, 60 SW 418.

The parallelogram rule applies even where the section is fractional -- for example, an exception of a homestead from a sheriff's deed, described as "the fractional NE $\frac{1}{4}$ , containing 106.66 acres, and 49.26 acres off north side of NW $\frac{1}{4}$ ." "The section is bounded on the north and east by straight lines. A part of the north and all of the west side of the section is bounded by the Arkansas River, the contours thereof being circular. The land may be definitely located by dropping south a sufficient distance so that, by running a line parallel to the straight line on the north, the boundaries would contain the acreage designated." 146 A 282, 225 SW 613.

But a deed describing the land as *the east part of a certain quarter section (north of bayou), containing 93.74 acres*, was held void where the quarter section appeared on the government survey to be a full one, where there was no bayou running through the land, and there was nothing in the deed which showed what land was intended to be conveyed, 95 A 253, 129 SW 84.

"*Three-fourths of the south part of the NW $\frac{1}{4}$  . . . containing 44.31 acres,*" was held defective and recordation of the deed did not constitute notice to a subsequent mortgagee. "the correct technical description is: 'undivided three-fourths interest in and to the south half of the northwest quarter of section 30, township 1 south, range 10 west.'" 48

A 419, 3 SW 628, citing 34 A 534, 30 A 640.

The following description in a private conveyance was held defective: "*North part of the S $\frac{1}{4}$  of SE $\frac{1}{4}$  of SE $\frac{1}{4}$ , 20 acres, and south part north  $\frac{1}{2}$  of SE $\frac{1}{4}$  of SE $\frac{1}{4}$  of section 3, 4 N, 9 W, 32 acres.*" Patently, the statement of acreage is too great. "The description of land in a deed is an essential part of it. If the description is so indefinite that the land cannot be identified, the deed will not furnish the construction notice necessary to charge innocent purchasers, and will be void as to them," 131 A 335, 198 SW 518.

Where the government survey describes the land as "*East fractional part of SE $\frac{1}{4}$ , section 13, tp. 7 S, R 5 W,*" conveyances may be validly made under the same description, 73 A 221, 83 SW 946.

The parallelogram rule is "often applied by the courts in construing descriptions as between parties to them, where there is a clear intention shown to affect some part of a definite tract, and the parties furnish no other means to identify the part. But this rule is not unbending, even in such cases, and yields to a proper showing that the parties intended otherwise; and proof that the party acting upon the land owned but one tract coming within the description, and it not in a parallelogram, has been permitted to control." 56 A 172, 19 SW 746.

But descriptions similar to those upheld, under the parallelogram rule, in private conveyances, have been held to avoid tax sales. Thus, "*E. Pt. NW SE . . . 27 acres*" held defective. "This court has uniformly held such a description to be insufficient in a tax title." 131 A 273, 199 SW 116. So, the descriptions "*West part SW $\frac{1}{4}$  NW $\frac{1}{4}$  . . . 30 acres,*" 143 A 92, 220 SW 660; "*W. pt. SE. SE. . . . 7.60 acres,*" 120 A 528, 180 SW 199; "*E. part of N $\frac{1}{2}$  of SE $\frac{1}{4}$  of SE $\frac{1}{4}$  . . . 7/54 acres,*" 56 A 172, 19 SW 746; "*east part of SE $\frac{1}{4}$  . . . 60 30/100 acres,*" 76 A 460, 88 SW 1005; "*south part of SE $\frac{1}{4}$  of section 27, tp. 15 north, range 10 west,*

*55 acres*" held not sufficient to designate "*the south 1/5 of the east  $\frac{1}{2}$  of section 27, tp. 15 North, range 10 East,*" 138 A 396, 211 SW 551. See 62 A 188, 35 SW 788.

The rule as to ordinary tax sales is applied to levee tax sales, 76 A 460, 88 SW 1005, 74 A 174, 85 SW 252.

### 303. Northeast Part.

Execution sale of "*the NE part of SE $\frac{1}{4}$  SE $\frac{1}{4}$  . . . 20.36 acres,*" also NE part of SW $\frac{1}{4}$  of SE $\frac{1}{4}$  of said section, township and range, containing 2.95." held void for patent ambiguity, 60 A 487, 30 SW 885.

304. Northwest Part. See "Northeast Part."

### 305. N 2.

It has been held that where "*E2 SE,*" etc., appearing in an advertisement for tax sale was followed by "*80*" in the area column, the sale was valid, "They could designate only one legal subdivision of a section, and that is the east half of the southeast quarter. Then, again, it was assessed, and advertised for sale in the name of A. W. Dinsmore, who was the owner of it at the time it was assessed and advertised, subject to a mortgage. This makes the identification of the land more full and complete. We think the description was sufficient. But we do not mean to hold that it would have been sufficient in the absence of the statement of the number of acres the tract described contained." 66 A 422, 51 SW 71. But in 59 A 460, 27 SW 970, the court reviews with approval a Minnesota case holding "*S2 NE $\frac{1}{4}$ ,*" etc., to invalidate a tax proceeding.

306. Of. See "Farm," "North Part."

"*35 acres of*" a certain section held void tax deed description 34 A 534, 30 A 640; as is "*4/6 of*" a certain quarter section, 94 A 306, 126 SW 830, and "*29/44 of*" a certain quarter section, 161 A 514, 256 SW 868, and "*an*



*undivided 1/3 of* a certain quarter section, 150 A 347, 234 SW 259.

307. *Off.* See "Fractional," "North 80," "North Part," "Side."

308. *Own.* See "All," "County," "Range."

309. *Part.* See "Fractional," "Middle Part," "North Part," "Portion."

A deed to a part of a particular subdivision, without identifying the particular tract, is void both in a private conveyance and a tax proceeding, 3 A 18, 30 A 640, 48 A 419, 3 SW 628, 50 A 484, 8 SW 689, 77 A 570, 92 SW 21, 80 A 458, 97 SW 439, 83 A 334, 104 SW 128, 93 A 176, 124 SW 747, 94 A 180, 126 SW 382, 95 A 253, 129 SW 84, 97 A 176, 133 SW 811, 106 A 83, 152 SW 1025, 120 A 69, 179 SW 331, 131 A 273, 199 SW 116, 164 A 602, 262 SW 653, 225 SW 225, 181 A 739, 28 SW (2) 70, differentiating descriptions "North part" and "all."

*"All our undivided interest in 1/3 of 1/9 interest as heirs of Samuel Leslie, deceased, in the following lands situated in Searcy County, Arkansas, to-wit: Part of the NW¼ of the NW¼ of section 26, tp. 14 N. R 14 W,"* is an invalid description. The word "part" refers to the area, and not to the interest, conveyed. 120 A 69, 179 SW 331. Where the acreage alone of the "part" is set out the description is invalid. Thus *"Part NE SE 15-3-30 . . . 17 acres"* is a void description, and, being a voluntary conveyance founded on love and affection and made without any prior consultation or agreement with the grantor, equity would not reform or enforce it, 69 A 357, 63 SW 799.

Our Supreme Court "has often held that tax deeds conveying lands as part of a particular division or subdivision of a section void for uncertainty, and such a deed containing a description of land so indefinite and uncertain as to be insufficient is not color of title that will extend the possession of one having an enclosure upon the land to

the limit of the land attempted to be described in the deed, because none is sufficiently described therein, 117 A 151, 175 SW 405, see 50 A 484, 8 SW 689, 64 A 432, 43 SW 145, 83 A 196, 104 SW 139, 181 A 914, 28 SW (2) 697.

Tax deed describing land as *'part NE¼ . . . 70 acres'* is insufficient to identify the land, and cannot be aided by parol proof that entire quarter section, since government survey was made, had been reduced by erosion of river to less than 70 acres, and that only 70 acres in such quarter section were assessed for taxes in the year for which it was sold. It is not such color of title as will enable two years' statute of limitations to run in favor of the purchaser, 83 A 334, 104 SW 128, 94 A 180, 126 SW 382.

Tax assessment and all subsequent proceedings pertaining to forfeiture sale were void where land was described as *"pt. W½ NE¼ . . . 11.48 acres,"* 179 A 553, 17 SW (2) 281.

A tax deed and mesne conveyances thereunder were held void where the grants pertained to a portion of a 40 acre tract through which ran the Saline river, the boundary line between Howard and Sevier counties. The land in controversy was described in certain deeds as *"part of the SW SW . . . 38 acres,"* and in others as *"frl. SW SW"* of same acreage. "It is not claimed here that this was a fractional 40-acre tract, and shown to be by the government survey and the fractional SW¼ SW¼, or the fractional part of the SW¼ SW¼ in Sevier County, Arkansas, would not be sufficient description to convey the portion of the particular 40 acres lying west of the Saline River in said county." 117 A 151, 175 SW 405, citing 106 A 83, 152 SW 1025.

310. *Place.* See "From."

311. *Plantation.*

A private conveyance of *"the property*



*known as the J. J. Martin plantation, embracing the east 2/3 of the North fractional half of section 6, township 1 north, range 11 west," and containing certain exceptions and reservations, held to embrace a four acre tract of land which was part of such plantation, though not particularly described, 72 A 496, 82 SW 835. "The words 'the property known as the J. J. Martin plantation,' used in the deed, were sufficient to describe the tract of four acres. The words following, that allege that the J. J. Martin plantation embraces certain lands, do not limit or restrict their meaning, or except any lands save those expressly reserved." 160 A 391, 254 SW 674.*

312. *Popular Name.* See "Farm."

313. *Portion.* See "Part."

314. *Possession of.* See "House," "Land Of."

315. *R.* See "East of Meridian."

"R" is a recognized abbreviation for "Range," 177 A 52, 5 SW (2) 718.

Sale for levee taxes held void where land was described as "West of R NE¼," etc., since "R" is the proper abbreviation for "range," and, when used otherwise in an attempted description of land, it means nothing. Grantee from tax purchaser acquired no title. "R" could refer to ridge, road or river. 177 A 52, 5 SW (2) 718.

316. *Range.* See "All," "East of Meridian," "County."

A deed of trust was held void where the lands were described by subdivisions of certain sections, but neither township, range, county nor state were given. 30 A 657. And a deed was held void where the description was: "The following lands in Pope County, Arkansas, to-wit: all the S½ of section 28 that I now own, containing 150 acres, more or less," because of failure to designate town-

ship, range or other description, 35 A 470, 30 A 640, 3 A 18, see section 262. The recordation of a deed of trust was held not to give constructive notice thereof where the lands were described as "sections 26 and 35 in township 12," without mentioning the range. "There were lands in township 12 north, in addition to those in range 8 east, there being townships numbered 12 north, 9 east; 12 north, 10 east; and 12 north, 11 east; and 12 north, 12 east. The designation of the range was, therefore, essential to a proper description of those sections." 119 A 301, 178 SW 390.

But, in an earlier case, a private conveyance was upheld which, omitting mention of section, township and range, described the tract as "a certain parcel of land in Independence County, commencing at a black-gum tree standing near the road and graveyard, near the residence of Benjamin I. Edwards, running north 40 poles to a stone, thence east 12 poles to a stone, then south 40 poles to the place of beginning, containing 3 acres, including the said schoolhouse and graveyard." "It is in a certain county, and in a certain school district, which has definite boundaries, is parcel of the tract upon which stood the residence of Benjamin I. Edwards; contains 3 acres and is described by visible monuments, to-wit: the graveyard, the schoolhouse, the highway, corner stakes and an initial tree from which to start. And defendant had gone into possession. A competent surveyor could have found the land without much difficulty. In conveyancing, lawyers commonly follow the system of notation established by the general government, distinguishing lands according to their legal subdivisions. This furnished a description at once convenient and accurate. But it is not necessary to mention the section, township and range." 40 A 237, 30 A 513.

Where a notice of execution sale described the land as "3/8 interest in the Cane Spring Mining Claim situated on the S½ of SW¼ of sec. 13, tp. 18 north of range 14 west

in Marion County, Arkansas, " whereas the range should have been described as 15, the court refused to set the sale aside on the ground that no one could have been misled by the description, inasmuch as range 14 west is in Baxter County and the "Cane Spring Mining Claim" was commonly known by that name, 85 A 163, 107 SW 387. But a tax sale was held void where the land was advertised as being in range 3 east whereas the land was in range 3 west, 15 A 363.

317. *Residue*. See "Balance."

Mortgage held void where land described as "*Residue of the W½ Of SW¼*," etc., 134 A 241, 203 SW 584. Tax deed held void for patent ambiguity where description was "*Res. E½ NE¼*," etc., 99 A 154, 137 SW 820.

318. *River*. See "Balance," "L. B. R."

319. *R. R.*

"N. of R. R. frl. SW¼," etc., held an invalid description in tax deed. "Governmental surveys were not made with reference to railroads. The abbreviation 'R. R.' does not necessarily convey the meaning of railroad to one of only ordinary experience in land titles. The letters could have reference to Ridge Road or River Road. It might refer to any natural or artificial monument where such letters were used in spelling the monument in mind. If by general usage the letters have become so definite in meaning that the ordinary man would know that they meant railroad, the question might well arise, what railroad? The description is fatally defective." 129 A 334, 196 SW 118, 135 A 592, 204 SW 213, 177 A 52, 5 SW (2) 718.

320. *S*. See "N."

321. *Schoolhouse*. As monument, see "Range."

322. *Section*. See "Acreage," "County," "Homestead," "Interest," "Range."

Where lien claimant's affidavit described the house into which the materials went as being in a different section from where it was actually situated, which identical description was employed in the original complaint, but, before the final submission, the complaint was amended to describe by metes and bounds the acre of land upon which the house was located, the affidavit was held to sufficiently describe the building upon which the lien was claimed, if there was no uncertainty as to the house on which the lien was claimed, 177 A 39, 5 SW (2) 724.

Record of mortgage describing wrong section is not notice, 174 A 738, 298 SW 10.

323. *Side*. See "County," "Fractional," "North 80," "North Part."

An agreement to convey the north half of a certain quarter section "*less 25 acres off the south side*," manifests, *prima facie* at least, the intention that the land reserved should be laid off in a parallelogram with the whole of the south line of the north half of the quarter section as its base, 56 A 44, 19 SW 98.

A deed was held void for patent ambiguity where the land was described as "*3.05 acres in unplatted lands of Gurdon, situated on the east side of SW¼ of SW¼ of section 28, township 9 south, range 20 west*," 68 A 150, 56 SW 867.

A mortgage was properly reformed to include the phrase "*thence to the place of beginning*," where three sides of the tract were described according to an official town plat and the fourth line was obviously intended to coincide with the street, 135 A 193, 204 SW 845.

324. *South*. See "North 80," "North Part."

325. *SE*. See "NE," "NE4," "NE¼."

326. *Southeast Part.* See "Northeast Part."

327. *SW.* See "NE," "NE4," "NE¼."

328. *Southwest Part.* See "Northeast Part."

329. *Stakes.* Corner stakes as monuments, see "Range."

330. *State.* See "County," "Range."

331. *Stone.* As monument, see "Range."

332. *Subdivision.* See "County," "Homestead," "Range."

Where a 40-acre tract lying in SE¼ SE¼ of section 29 was mortgaged to A under the description "SE¼ NW¼," etc., the recordation of the mortgage did not constitute notice to B to whom the property was subsequently mortgaged under the proper description, 123 A 451, 185 SW 784.

333. *Town.* See "House."

334. *Township.* See "All," "County," "East of Meridian," "Range."

335. *Tree.* As monument and beginning point, see "Range."

336. *Undivided Interest.* See "Interest," "North Part."

337. *Undivided 1/3 of.* See "Of."

338. *W.* See "East of Meridian," "N."

339. *West.* See "East of Meridian," "North 80," "North Part."

340. *West of Meridian.* See "East of Meridian."

341. *Year.* See "Entire."

## Supplement to Jones' Arkansas Titles

### Chapter 9 - Land Descriptions

#### 248. Reconciliation Between Rules of Construction Applied to Private Conveyances and to Tax Proceedings.

It has sometimes been said that a description which would be sufficient in a conveyance between individuals would generally be sufficient on an assessment for taxation. That, however, is not a safe test. The description in tax proceedings must be such as will fully apprise the owner without recourse to the superior knowledge, peculiar to him as owner, that the particular tract of his land is sought to be charged with a tax lien. *Gardner v. Johnson*, 220 Ark. 168, 246 SW2d 568 (1952); *Wilkerson v. Johnston*, 211 Ark. 170, 200 SW2d 87 (1947); *Shelton v. Byrom*, 206 Ark. 665, 177 SW2d 421 (1944).

As between grantor and grantee, evidence *aliunde* the instrument may be introduced in a proper suit to establish what lands were intended to be conveyed. *Thomason v. Abbott*, 217 Ark. 281, 229 SW2d 660 (1950); *Davis v. Burford*, 197 Ark. 965, 125 SW2d 789 (1939).

#### 249. Construction in Private Conveyances.

The office of a description is not to identify the land but to furnish the means of identification. *Sanders v. Baker*, 217 Ark. 521, 231 SW2d 106 (1950).

As between the parties to a conveyance, intention will govern if the general description furnished a sufficient key for identification. *Wood v. Hay*, 206 Ark. 892, 175 SW2d 189 (1943); *Ketchum v. Cook*, 220 Ark. 320, 247 SW2d 1002 (1952); *Turrentine v. Thompson*, 193 Ark. 253, 99 SW2d 585 (1936); *Burns v. Meadors*, . . . Ark. . . ., 287 SW2d 893 (1956).

A deed with indefinite description that

does *not* describe the parcel of land in question is ineffective to convey any title or to create a remainder. *Lathrop v. Sandlin*, 223 Ark. 774, 268 SW2d 606 (1954); *McClelland v. McClelland*, 219 Ark. 255, 241 SW2d 264 (1951).

When there is a mutual mistake in a description and neither party intended to include certain land, no title is acquired to the land erroneously included. A deed is not to be held void, however, for uncertainty if by any reasonable construction it can be made available. A description is sufficient if the land can be located by evidence *aliunde*, from the description itself. *Davis v. Burford*, 197 Ark. 965, 125 SW2d 789 (1939). An indefinite description may be cured by grantee's entry into exclusive possession and occupancy of the premises under the conveyance. *Stephens v. Ledgerwood*, 216 Ark. 404, 226 SW2d 587 (1950).

## 250. Construction in Tax Proceedings.

In order to make a valid sale for taxes, the land must be described with certainty upon the assessment rolls and in all subsequent proceedings for the enforcement of payment of taxes. *Gardner v. Johnson*, 220 Ark. 168, 246 SW2d 568 (1952); *Wilkerson v. Johnston*, 211 Ark. 170, 200 SW2d 87 (1947). The chief reason for this requirement is that the owner may have information of the charge upon his property. *Ibid*.

A description of land in a tax proceeding should be such as will be readily understood by persons even ordinarily versed in such matters. A description which is intelligible only to persons possessing more than average intelligence, or the use or understanding of which is confined to the locality where the land lies, is not sufficient. The description must adequately identify the land so that the owner is given *notice* that his land is being sold. *Toler v. Fischer*, 201 Ark. 1107, 148 SW2d 159 (1941).

Description used on tax books has reference to government surveys. A mere specification of the section or subdivision thereof has been held sufficient. *Alphin v. Banks*, 193 Ark. 563, 102 SW2d 558 (1937). Area does not control the description in a tax deed. *Ibid*.

Where the description of land is given as it appears on the assessment books, with the name of its purported owner and the total amount stated for which the land is to be sold, the statute providing for the publication of delinquent taxes is complied with. *Evans v. F. L. Dumas Store, Inc.*, 192 Ark. 571, 93 SW2d 307 (1936).

The property must be sold under a proper and valid description in order to effect a valid tax sale. Where there is an imperfect or invalid description, there is lack of power to sell. *Moseley v. Moon*, 201 Ark. 164, 144 SW2d 1089 (1940).

A description which is too indefinite to enable the owner or the public to identify the land being sold is void. Extrinsic circumstances do not suffice to validate a tax sale in which the description is incomplete. *Dodson v. Thomason*, 217 Ark. 747, 233 SW2d 395 (1950); *Stout v. Healey*, 216 Ark. 821, 228 SW2d 45 (1950).

A valid assessment is essential to a valid sale. The description of the property assessed and sold must be definite and certain. *Killian v. Lincoln Nat. Life Ins. Co.*, 201 Ark. 1137, 148 SW2d 1085 (1941); *Wilkerson v. Johnston*, *supra*.

Tax deed description "pt NW¼ of Sec. 15, Twp. 16 S., Range 23 W., containing 60 acres," without otherwise identifying the land, is void. *Watson v. Cornish*, 220 Ark. 662, 249 SW2d 123 (1952).

Tax description "Lot 3, Block 24 of Dorris Addition East to the City of Pine Bluff" describes no land that can be located



from the county records by any clue contained in the deed. It is ineffective to convey title. *Clark v. Gridiron*, 222 Ark. 151, 257 SW2d 561 (1953).

Where there has been a separation of accretions from the lands to which they formed, for tax purposes, a sale under an invalid description reading "Accretions, Section 20" (which is not definite inasmuch as assessment should be to two separate quarter sections of that section), conveys no title. Tax sale was void for lack of power to sell. *Sanders v. Plant*, 211 Ark. 913, 204 SW2d 323 (1947).

Tax deed which contains two descriptions of the property -- one by reference to a county surveyor's plat and the other by metes and bounds -- contains a correct description and is valid. *Foster v. Reynolds*, 195 Ar. 5, 110 SW2d 689 (1937).

Property described in tax proceeding as "Lot 5, Block 6, Fishback No. 2 Addition to City of Fort Smith" is insufficient to convey title, for there was a "Fishback Addition" but no "Fishback No. 2 Addition" in Fort Smith. *Masses v. Bickford*, 208 Ark. 685, 187 SW2d 541 (1945).

Invalid description has been held to convey nothing in such cases as *Masses v. Bickford*, 208 Ark. 685, 187 SW2d 541 (1945); *Ferguson v. Van Gundy*, . . . Ark. . . ., 291 SW2d 248 (1956), *Shelton v. Byrom*, 206 Ark. 665, 177 SW2d 421 (1941); *Schuman v. Laser*, 212 Ark. 727, 207 SW2d 308 (1948); *Wilkerson v. Johnson*, *supra*; *Gardner v. Johnson*, *supra*.

One may be estopped by his conduct to deny title of grantee under void deed with defective description. (See Section 1523, *post*.) *Gambill v. Wilson*, 211 Ark. 733, 202 SW2d 185 (1947); *Lacey v. Humphres*, 196 Ark. 72, 116 SW2d 345 (1938).

## 251. Is Evidence Aliunde admissible to Aid

### Description in Tax Proceedings?

Extrinsic evidence is not admissible to cure or perfect a tax deed description which in itself is void and offers no key or suggestion by which the land may be located. *Moseley v. Moon*, 201 Ark. 164, 144 SW2d 1089 (1940).

However, description can be aided by extrinsic evidence to connect the description with the particular tract sought to be charged when facts show the stream, which was a natural boundary between the tracts, in many conveyances had been referred to as "Island Chute" and again as "Boggy Bayou." *Bryant v. Chicago Mill & Lumber Co.*, 216 F2d 727 (1954).

## 252. Evidence of No Other Land Owned in a Certain Subdivision.

In a tax proceeding in which the land involved is described in publication and advertisement as being in "Fulton's, lot 3," the correct description to identify the land would have been Lot 3 located in "Fulton's South Addition." There are in existence both a "Fulton's addition" and a "Fulton's South Addition." The average landowner, or a person of average intelligence, could not identify his property from the advertised description. Since appellees own no property in that addition, the description does not describe their property and is no notice to them. Therefore, the sale is void. *Stout v. Healey*, 216 Ark. 821, 228 SW2d 45 (1950).

"Lots 1 to 12, Block 15, Prairie View Addition" and "Lots 1 to 12, Block 16, Prairie View Addition" are defective, for there is neither a Block 15 nor a Block 16 in Prairie View Addition. No amount of testimony would cure the defect in description. *Wilkerson v. Johnston*, 211 Ark. 170, 200 SW2d 87 (1947).



**253. Description by Abbreviated Calls.**

Description in a tax proceeding as "R.B. R.S.E. Quarter of S. W. Quarter, Section 25 Twp. 18, R 2W. 25.88 acres" is inadequate and void. *Toler v. Fischer*, 201 Ark. 1107, 148 SW2d 159 (1941).

"Fractional southwest quarter of the northeast quarter" of Section 30, in a private conveyance, *prima facie* conveys the entire Southwest quarter of the Northeast quarter. *Wood v. Hay*, 206 Ark. 892, 175 SW2d 189 (1943).

The use of abbreviations in a tax assessment or proceeding must be confined to those commonly used and understood. Tax description "Beg at NW Cor SW $\frac{1}{4}$  7 E 37.17 Ch S Ch W 24.75 Ch S 25 Ch to Cent of Wabb Bayou Th Westerly Along Said Bayou to Intersection of W Line Sec. 7 Th N to Beg." is insufficient. *Shelton v. Byrom*, 206 Ark. 665, 177 SW2d 421 (1944).

**254. Reference to Other Instruments.**

Reference to the official plat in the description used in a deed may be sufficient identification. *Sanders v. Baker*, 217 Ark. 521, 231 SW2d 106 (1950).

Platted lots may be conveyed by numbers corresponding with those of a Township survey or on a recorded plat. *Carney v. Dunn*, 221 Ark. 223, 252 SW2d 827 (1952).

Where the description in a deed is insufficient to identify the premises with the premises in controversy (in an ejectment action), identity may be shown by other evidence. When this is done, the deed is admissible. *Hull v. Hull*, 210 Ark. 539, 196 SW2d 905 (1946).

Where a drainage district deed describes the lands conveyed by metes and bounds and other description that can be made certain by evidence *aliunde*, it is sufficient. *O'kane v.*

*McLean Bottom Levee & Drainage Dist No. 3*, 211 Ark. 938, 203 SW2d 392 (1947).

**255. Recordation by Imperfect Description.**

Land which is misdescribed is subject to reformation. When there is an error by the recording officer but no defect in the instrument, the lienor is not responsible. *Mayfield v. Sehon*, 205 Ark. 1142, 172 SW2d 914 (1943).

Chancery court has the power to correct descriptions in order that the land actually owned would be identified. *Blackwell v. Heard*, 212 Ark. 9, 204 SW2d 790 (1947).

Where an error was made in the description of a lot by beginning the description by metes and bounds at the northeast corner of the lot, when the northwest corner should have been the point of beginning, the description will be corrected. *Tucker v. Davis*, 212 Ark. 1028, 208 SW2d 1003 (1948). An erroneous description of property, into which grantee has entered possession and had paid the consideration, will be reformed correctly to describe the premises. The heirs of vendor cannot recover the land on the ground the description was too vague and uncertain to pass title, for, though the instrument might be denied effect as a deed, it would be good as an executory contract. *Robertson v. Chronister*, 196 Ark. 141, 116 SW2d 1048 (1938).

**256. Liens of Materialmen, Mechanics, and Laborers.**

See Section 1393, Chapter 42.

**257. Improvement District Proceedings.**

Proceedings creating drainage or levee district are void where the petition fails to describe and locate any land sought to be embraced in the district or to set forth the boundaries, such as failure to indicate a definite starting point with a vague reference to

a beginning, which could be anywhere on a line running east and west for one-half mile. *O'Kane v. McLean Bottom Levee & Drainage Dist. No. 3*, 211 Ark. 938, 203 SW2d 392 (1947).

Description in tax deeds being insufficient and vague, they are void and do not convey title. Purchaser at tax sale should require that the evidence of purchase reflect the facts sufficient to identify the acreage which is expected to be bought. *Person v. Davis*, 199 Ark. 1029, 138 SW2d 71 (1940).

A foreclosure sale of a levee district for delinquent taxes of land under description "Pt. Fri. N½ of the SE ¼, 15-18-26" is void for indefiniteness. But, a sale of "Fri. N½ of the SE¼, 15-18-26" is valid in so far as description is concerned. *Killian v. Lincoln Nat. Life Ins. Co.*, 201 Ark. 1137, 148 SW2d 1085 (1941).

#### 258. Notice of Execution Sale.

Where, following a general reference to the land to be sold described as "all and singular other real estate owned" by the debtor, there was the phrase "all of said property being situated in Phillips County, Arkansas," the addition of this geographical limitation furnishes a key by which this property may be identified, and the description is sufficient. *Pekin Wood Products Co. v. Afflick*, 228 F2d 816 (1956).

#### 259. Tax Sale Confirmations.

A void description defeats the power to sell. Confirmation proceedings, then, cannot cure this defect. *Gardner v. Johnson*, 220 Ark. 168, 246 SW2d 568 (1952); *Dansby v. Weeks*, 199 Ark. 497, 135 SW2d 62 (1939); *Powell v. Coggins*, 204 Ark. 739, 164 SW2d 891 (1942); *Lumsden v. Erstine*, 205 Ark. 1004, 172 SW2d 409 (1943).

Advertisement, sale, and confirmation to a Road District of land under an improper

and void description make the deed of the Road District void. An attempted conveyance of such is likewise void and of no effect. *Toler v. Fischer*, 201 Ark. 1107, 148 SW2d 159 (1941).

While a sale *en masse* is such a defect, or irregularity, as would render the sale voidable, however, when the power to sell exists, defense not having been made within a year, the effect of the confirmation decree cures this irregularity, since the power to sell existed. *Moseley v. Moon*, 201 Ark. 164, 144 SW2d 1089 (1940).

Extrinsic evidence cannot be heard to impeach a decree (through which title was acquired) in a collateral attack. The record alone can be considered. *Daniels v. Newsom*, 213 Ark. 736, 213 SW2d 367 (1948). Description being insufficient, deed does not convey title. *Person v. Davis*, 199 Ark. 1029, 138 SW2d 71 (1940).

#### 260. Reformation.

Grantee is not entitled to reformation of deed whose description is insufficient to describe definite lands when his grantor remained in possession and later conveyed to another grantee who was a bona fide purchaser. *McClelland v. McClelland*, 219 Ark. 255, 241 SW2d 264 (1951).

Reformation of deed for mutual mistake, on ground that all land originally contemplated was not included, will not be permitted unless evidence is clear, cogent, and convincing. *Hicks v. Rankin*, 214 Ark. 77, 214 SW2d 490 (1948); *Berk v. Beckett*, 200 Ark. 1189, 137 SW2d 898 (1940); *Burns v. Fielder*, 197 Ark. 85, 122 SW2d 160 (1938).

A deed will be reformed to include all lands actually conveyed when the scrivener made an error in copying the description. *Clinton Special School District No. 1 v. Henley*, 212 Ark. 643, 207 SW2d 713 (1948).

Deeds will be reformed where, through mutual mistake, original plat was not recorded to conform to boundaries intended. *Smotherman v. Blackwell*, 222 Ark. 526, 261 SW2d 782 (1953). Where mutual mistake has been made as to number of acres conveyed, the deed will be reformed. *Gastineau v. Crow*, 222 Ark. 749, 262 SW2d 654 (1953). See Section 158, Chapter 4.

Where, in complaint, "west is intended but "north" is inadvertently used, description will be corrected. *Mays v. C. M. Johnston & Sons Sand & Gravel Co.*, 203 Ark. 779, 158 SW2d 910 (1942).

## 262. Acreage.

When one is granted land by government call, he takes the whole of the call without reference to the amount of acreage added to the description. *Wood v. Hay*, 206 Ark. 892, 175 SW2d 189 (1943).

Area does not control the description in a tax deed. *Alphin v. Banks*, 193 Ark. 563, 102 SW2d 558 (1937).

The acreage mentioned in a government call does not control or dominate the description. *Plant v. Sanders*, 209 Ark. 108, 189 SW2d 720 (1945).

Where a lease describes land as so many acres more or less, it is construed as one not by the acre but in gross. *Young v. Bradshaw*, 224 Ark. 467, 274 SW2d 466 (1955).

Where vendor conveys for a specified price a tract which is described by metes and bounds with words added containing a specified number of acres, more or less, this is a contract in gross, not by the acre, and does not by implication warrant the quantity. *Parker v. Whistle*, . . . Ark. . . . , 301 SW2d 445 (1957).

## 263. All.

For a deed description simply to state it was *all* the land owned by grantor, wherever situated, is too uncertain and indefinite to furnish a key by which the land might be located, but if deed had said it was all the land owned by grantor in a certain county in Arkansas, a sufficient key might have been furnished. *Turrentine v. Thompson*, 193 Ark. 253, 99 SW2d 585 (1936).

## 264. Approximately. See "Acreage."

## 265. Balance. See "Residue."

## 266. Beginning.

A metes and bounds description which does not set out the boundaries of any tract is void for indefiniteness: "*Beginning* 34 rods East of the Northwest (NW) corner of the said NW¼ of SW¼ and running thence East 73.72 rods to the Northeast (NE) corner of said NWFRSW¼; thence East 39.84 rods; thence Northwest (NW) along the Mountain to Point of Beginning and containing 15 acres, more or less." *Bailey v. Martin*, 218 Ark. 513, 237 SW2d 16 (1951).

"Beg" is not a commonly used and understood abbreviation for "beginning" and is insufficient when used in a tax deed. *Shelton v. Byrom*, 206 Ark. 665, 177 SW2d 421 (1944).

When it is impossible to locate the beginning point and there is nothing to show that the land is adjacent to Highway 65, the description is not definite. *Mode v. Henley*, . . . Ark. . . . , 302 SW2d 73 (1957).

## 267. Belonging To. No new decisions.

## 268. "Black Acre." No new decisions.

## 269. Block.

Tax deed describing land as "Lots Seven (7) and Eight (8) in the West Half (W½) of

the East Half (E½) of Block 'B', City of Brinkley" is void, for there are several Block Bs within that city. *Dodson v. Thomason*, 217 Ark. 747, 233 SW2d 395. (1950). See Section *infra*.

#### 270. Corner.

Description "Southwest corner of NE¼ NE¼, Section 1, Township 7 North, Range 4 West, containing 5 acres" is defective. *Gardner v. Johnson*, 220 Ark. 168, 246 SW2d 568 (1952)

"Cor" is not a commonly used and understood abbreviation for "corner" and is insufficient when used in a tax description. *Shelton v. Byrom*, 206 Ark. 665, 177 SW2d 421 (1944).

There is error in the description "Commencing 440 feet from the northeast corner of lot 6, Block 9 of the original survey of the town of Waldo, thence south 300 feet . . . etc." for the description does not designate the direction from the northeast corner of Lot 6, where the lot begins, from which its boundary runs. It must have been east of the corner of Lot 6. Otherwise, it could never have reached the section line referred to which was east of the point of beginning. *Davis v. Strong*, 208 Ark. 254, 186 SW2d 776 (1945).

#### 271. County.

A deed which does not identify land as being in any particular county or state does not furnish a key by which the land may be certainly identified. *Turrentine v. Thompson*, 193 Ark. 253, 99 SW2d 585 (1936).

The Section, with Township and Range directions, constitute a sufficient description of the land without any designation of the County. The following description was held valid, for definite lands were in the contemplation of the parties, even though they could

not be in St. Francis county and also be situated in Township 4 South, Range 3 West "The North Half of the Southeast Quarter (N½ SE¼) of Section Three, Township Four, South, Range Three West, containing one hundred and sixty acres." The Court said it is unnecessary to decide whether the description of the County is inferior or superior to the direction calls for the *Township* and *Range* because the grantee entered into exclusive possession and occupancy of the premises under the conveyance. *Stephens v. Ledgerwood*, 216 Ark. 404, 226 SW2d 587 (1950).

#### 272. E. See "SE" section 325.

When grantor conveys property described as "E½, Lot 2, Block 11," there is a presumption he intended to convey only the property described, and no other. *Mills v. Deniston*, . . . Ark. . . . , 299 SW2d 195 (1957).

#### 273. East.

Omission of the word *north* after the township number and omission of the word *east* after the range number in a tax proceeding description are unimportant and not fatally defective, for the Court takes judicial notice that all lands in Clay County are in townships north of the base line and *east of the fifth principal meridian*. *Kunze v. Blackwood*, 195 Ark. 658, 113 SW2d 705 (1938).

#### 274. East of Meridian.

All the lands in Clay County are in Townships north of the base line and east of the fifth principal meridian. Of this the Court takes judicial notice. It was therefore unimportant that the word *north* was omitted after the township number and that the word *east* was omitted after the range number. *Kunze v. Blackwood*, 195 Ark. 658, 113 SW2d 705 (1938).

#### 275. Entire. See Section 263; and Section 341.

276. Estate. No New decisions.

277. Ex. No new decisions.

278. Except. No new decisions.

279. Farm.

In a description which specifically recites the lands conveyed to be so much of the Goforth farm as lies south of the Illinois River and east of the Highway, the particular description restrains and limits the general description. *Goforth v. Wilson*, 208 Ark. 35, 184 SW2d 814 (1945).

When a grantor intended to convey his farm, which was all the real estate he owned at the time, for certain consideration, and the grantee intended to receive that land, its misdescription will be corrected. *Smith v. Smith*, 218 Ark. 228, 235 SW2d 886 (1951).

280. Fractional.

"Fractional" is not synonymous with "part." Use of "fractional" or "Fri." in land descriptions does not invalidate the description. "Fractional" or "Fri." has reference to a term commonly used indicating a section or part of a section according to the government surveys. *State v. Guthrie*, 203 Ark. 60, 156 SW2d 210 (1941).

A fractional description is good if in fact the designation survey is fractional and the land sold embraces such fraction. *Watson v. Cornish*, 220 Ark. 662, 249 SW2d 123 (1952); *Price v. Price*, 207 Ark. 804, 182 SW2d 879 (1944).

"Fri. 6 Pt." as a description is too indefinite in a tax sale to vest title in a particular property and conveys nothing. *Daniels v. Newson*, 213 Ark. 736, 213 SW2d 367 (1948).

"Part of fractional" is meaningless; but, "fractional" may or may not be sufficient. Standing alone, it is not void. *Norrell v. ,*

*Coulter*, 218 Ark. 870, 239 SW2d 281 (1951).

The word "fractional" as utilized in a land description should not be confused with "part." *Sammons v. Parker*, 203 Ark. 1147, 159 SW2d 468 (1942).

Employment of the description "Fri. NE $\frac{1}{4}$  of SW $\frac{1}{4}$ , containing 39 acres, more or less, all in Section 7, Twp. 17 S., Range 18 W." does not render mortgage foreclosure void when the land is sold *in solido*, even though the official plat shows that it is not a fractional subdivision but contains 40 acres, for it is not alleged that the mortgage was not intended to cover the whole of the NE $\frac{1}{4}$  of SW $\frac{1}{4}$ . Few of the subdivisions of sections of land into supposed 40-acre tracts are exact squares, containing neither more nor less than 40 acres. *Sargent v. Citizens Bank*, 200 Ark. 121 139 SW2d 44 (1940).

281. From. No new decisions.

282. Graveyard.

Inclusion of a cemetery, which is exempt from taxation, in description "W 1/3 Fri. NW 1/4 Sec. 8 containing 49.82 acres" renders tax deed void. The description should have added "less cemetery of one acre in northwest corner." *Ponder v. Richardson*, 213 Ark. 238, 210 SW2d 316 (1948).

283. Highway. No new decisions.

284. Home. See "Farm."

285. Homestead. No new decisions.

286. House. No new decisions.

287. In. No new decisions.

288. Interest. See "Of."

289. Land of. No new decisions.



## 290. "L.B.R."

Clerk's tax deed description "The fractional Southeast quarter of Section Twenty-three in Township Twelve South, Range Nine West, containing 132 acres more or less" with assessment reading "RBR Fri. SE $\frac{1}{4}$ " is sufficient. Government tract books and surveyors' field notes abound with the designations "L.B.R." and "R.B.R." In government surveys, the left bank of a river means the bank corresponding with the left side of a person who is proceeding downstream. *Burbridge v. Bradley Lumber Co.*, 214 Ark. 135, 215 SW2d 710 (1948). In the concurring opinion, there appears the following: "... a majority of the lawyers and real estate men in Arkansas would never surmise that 'L.B.R.' meant 'left bank of river.' It might just as well mean 'lumber.' A person may search all of the library dictionaries, law dictionaries, encyclopedias and law texts, including Corpus Juris, American Jurisprudence and Words and Phrases and will not find 'L.B.R.' listed as uniformly meaning 'left bank of river' and 'R.B.R.' as uniformly meaning 'right bank of river.' I maintain that the letters 'L.B.R.' and 'R.B.R.' have no such generally recognized meaning as that ascribed by the majority." *Ibid.*

291. Less. See Section 282, *supra*.

## 292. Lot.

"Lots," used unqualifiedly, means a lot in a Township, as duly laid out by the original proprietors. Description of the land conveyed as a certain "lot" or "subdivision" generally conveys the whole thereof in the absence of a contrary intent. *Carney v. Dunn*, 221 Ark. 223, 252 SW2d 827 (1952).

State Commissioner's deed describing land: "The following lots situated in the City of Texarkana, County of Miller, in the State of Arkansas . . . No. of Lot 7; No. of Block 9; Addn. or Subdiv. Forest Part Addition" is valid. Description is definite and understandable by any person of ordinary knowledge.

"There is only one Forest Park Addition to Texarkana. It is difficult to see how one could possible be misled as to where lots were located." *Cook v. Langhorne*, 219 Ark. 443, 242 SW2d 838 (1951).

"Lots 1,2,3,4, and 5, Block 10, Hamilton and Brack's Addition to the City of Little Rock, Arkansas" is sufficient description, even though the lots are not in the City of Little Rock. There is only one Hamilton & Brack's Addition in Pulaski County. There could, then, be no confusion in the location of these lots. *Northwest Land Co. V. Sugg*, . . . Ark. . . ., 299, SW2d 63 (1957).

In Improvement District proceeding, "Lot 22, Block 23, Riverside Park" is defective. Sale, then, is void. *Schuman v. Laser*, 212 Ark. 727, 207 SW2d 308 (1948).

"Lots 1 to 12, Block 15, Prairie View Addition" and "Lots 1 to 12, Block 16, Prairie View Addition" are defective, for there is neither a block 15 nor a block 16 in Prairie View Addition. *Wilkerson v. Johnston*, 211 Ark. 170, 200 SW2d 87 (1947).

293. "Meridian." See "East of Meridian," section 274.

294. Middle Part. No new decisions.

295. More or Less. See "Acreage."

296. N.

Tax description "Part N $\frac{1}{2}$  of section 22, township 2 south, range 7 west, containing 200 acres" is void, even though an additional certificate was later issued showing that the land comprising the 200 acres was "South  $\frac{1}{2}$  of the northwest  $\frac{1}{4}$ , 80 acres; west  $\frac{1}{2}$  of the northeast  $\frac{1}{4}$ , 80 acres; southeast  $\frac{1}{4}$  of the northeast  $\frac{1}{4}$ , 40 acres." *Wilson v. Triplett*, 204 Ark. 902, 165 SW2d 943 (1942).

297. NE.

A conveyance of "NE of section 20" means the northeast quarter of said section and would convey all the land in the northeast quarter, whether a whole or a fractional quarter. *Plant v. Sanders*, 209 Ark. 108, 189 SW2d 720 (1945).

298. NE 4. No new decision.

299. NE½. No new decision.

300. N¼. No new decision.

301. North 80. No new decision.

302. North Part. See section 309.

303. Northeast Part. See *McClelland v. McClelland*, 219 Ark. 255, 241 SW2d 264 (1951).

304. Northwest Part.

"The Northwest Quarter of Block 14, of Shiloh, Arkansas, more particularly described as follows: Beginning at a point 165 ft., East of NE corner of Block 14, Town of Shiloh, run West 165 ft., to the NE corner of Block 14 thence South 368 ft., thence E. 60 ft., thence South 90 feet, thence E. 105 ft., thence North 458 feet to beginning" by oral testimony, not objected to, placed this property in Block 13, not Block 14. State Tax deed described the land as "NW¼, Block 14, Shiloh" which did not touch or affect the metes and bounds description and was therefore *res inter alios acta*, so far as the particular property is concerned (in suit to set aside deed). *Bridewell v. Davis*, 206 Ark. 445, 175 SW2d 992 (1943).

305. NW¼.

The description in a mortgage and foreclosure decree "The east 20 acres of the NW¼ or NW¼" means that acreage set off in the shape of a parallelogram across the east side thereof and is valid. *Sargent v. Citizens Bank*, 200 Ark. 121, 139 SW2d 44 (1940).

306. Of. See Section 326.

307. Off.

State Land Commissioner's deed describing land as "22 feet off E. side, Lots 17 and 18, Block No. 2, Flood's Addition to the City of Stuttgart" is void for insufficiency. *White v. Brown*, 206 Ark. 410, 175 SW2d 562 (1943).

308. Own. No new decision.

309. Part.

Use of the word "part" or "Pt." invalidates a description because of indefiniteness. *Killian v. Lincoln Nat. Life Ins. Co.*, 201 Ark. 1137, 148 SW2d 1085 (1941); *Ketchum v. Cook*, 220 Ark. 320, 247 SW2d 1002 (1952); *Price v. Price*, 207 Ark. 804, 182 SW2d 879 (1944); *Watson v. Cornish*, 220 Ark. 662, 249 SW2d 123 (1952); *Sturgis v. Nunn*, 203 Ark. 693, 158 SW2d 673 (1943).

But if the deed then contains a clause "it is my intention to convey all of the real estate belonging to me," the description is good, for no one could be misled about the identity of the property conveyed. *Ketchum v. Cook*, *supra*.

The following descriptions have been held void and insufficient:

(a) "Pt. Fri. N½ of the SE¼, 15-18-26." *Killian v. Lincoln Nat. Life Ins. Co.*, *supra*.

(b) "a part of the East Half of the Southeast Quarter of Section 31 . . . 52.50 acres . . ." *Thomason v. Abbott*, 217 Ark. 281, 229 SW2d 660 (1950).

(c) "pt. of SW¼ of SW¼, Sec. 2, Twp. 7 N, Range 28 West, 3.51 acres." *Clem v. Missouri Pac. R. Co.*, 223 Ark. 887, 269 SW2d 306 (1954).

(d) "Pt. 8, SW SW, Sec. 5 Twp. 3, S, Range 19 W," *Arkansas Trust Co. v. Sims*, 198 Ark. 1143, 133 SW2d 854 (1939). "Hopelessly defective" said the Court. *Ibid*.

310. Place. No new decision.

311. **Plantation.** No new decision.

203 SW 213 (1918).

312. **Popular Name.** No new decision.

313. **Portion.** See "Part."

314. **Possession of.** No new decision.

315. **R.**

The letter "R" or "r" is the proper abbreviation for *range* within the meaning of government surveys when used with reference thereto (quoting from *Simms v. Rolfe*, 177 Ark. 52, 5 SW2d 718, 1928). *Riley v. Eight Mile Drainage Dist. No. 5*, 223 Ark. 533, 267 SW2d 302 (1954).

316. **Range.** See "County."

317. **Residue.** See Section 326 (b) "remaining part."

318. **River.**

When land is along the bank of a river and a description is in reference to the river, in the intervening years the river could have changed its course enough to make a difference in the boundary of the tract as disclosed by a subsequent survey. *Richardson v. Sallee*, 207 Ark. 915, 183 SW2d 508 (1944).

A gradual change in the river changes the boundary line of riparian owners. A proper survey must take these changes into account. *Anderson-Tully Co. v. Chicago Mill & Lumber Co.*, 175 F2d 735 (1949).

319. **R.R.**

The abbreviation "R.R." is not in abbreviation commonly used to designate government subdivisions. Government surveys were not made with reference to railroads. The letters "R.R." do not necessarily convey the meaning of a railroad to one of only ordinary experience in land titles. *Toler v. Fisher*, 201 Ark. 1107, 148 SW2d 159 (1941), quoted from *Haliburton v. Brinkley*, 135 Ark. 592,

In a tax proceeding, the abbreviation "R.R." for railroad is fatally defective as it is not in general use with reference to government surveys. *Irby v. Drusch*, 220 Ark. 250, 247 SW2d 204 (1952).

320. **S.** No new decision.

321. **Schoolhouse.** No new decision.

322. **Section.** See "County."

323. **Side.**

While as a general proposition the word "side" has reference to the longer dimension of a rectangle, a practical view of the obvious in the tax description "Forty-six and two-thirds feet S. Side L. 7-8" etc. is justified. "Side" in this instance is not construed to mean half. A purchaser would be directed either to the southwest corner of Lot Seven, or the northeast corner of Lot Eight. *London v. Montgomery*, 211 Ark. 434, 201 SW2d 760 (1947).

324. **South.** See "N" *supra*.

325. **SE.**

"S.SE of Section 17" and "E.SE of Section 18" are not descriptions by abbreviations generally used and are insufficient to identify the land. *Plant v. Sanders*, 209 Ark. 108, 189 SW2d 720 (1945).

"R.B.R. S.E. Quarter of S.W. Quarter, Section 25 Twp. 18, R.2W. 25.88 acres" is inadequate, and tax deed void. *Toler v. Fisher*, 201 Ark. 1107, 148 SW2d 159 (1941).

326. **Southeast Part.**

Each of the following deeds is void for indefiniteness so far as record title is concerned:

(a) "... a part of the East half of Southeast Quarter ... Section 31 ... 49.50 acres."

(b) "... the remaining part of the said Southeast Quarter of the Southeast Quarter of said Section 31 . . . not formerly sold and owned by . . ., containing 12 acres, more or less."

(c) "... Part E $\frac{1}{2}$  SE $\frac{1}{4}$  Sec. 31 . . . 6 acres" and "... Part SE $\frac{1}{4}$  SE $\frac{1}{4}$  Sec. 31 . . . 7.50 acres . . ." *Thomason v. Abbott*, 217 Ark. 281, 229 SW2d 660 (1950). (For brevity, the Township, Range, etc. were omitted by the Court in its decision).

### 327. SW.

Assessment records showing property described as "SW Quarter section 3" is a sufficient and certain description of all that quarter section lying and being in Arkansas. *Alphin v. Banks*, 193 Ark. 563, 102 SW2d 558 (1937).

The description "SW," and the description "fractional SW," would each cover the whole of the call, and either would be sufficient. *Ibid.* See Section 309 "Part."

### 328. Southwest Part.

"Southwest corner of NE $\frac{1}{4}$  NE $\frac{1}{4}$ , Section 1, Township 7 North, Range 4 West, containing 5 acres" is a defective description. *Gardner v. Johnson*, 220 Ark. 168, 246 SW2d 568 (1952).

"Southwest quarter, section 3, township 20 south, range 18 west, 112.28 acres," being identical with that appearing in the patent to plaintiff's ancestor (except there described as "southwest fractional quarter"), is a sufficient and certain description of all that quarter section lying in this State. *Alphin v. Banks*, 193 Ark. 563, 102 SW2d 558 (1937). Many sections along our southern boundary are fractional. *Ibid.*

### 329. Stakes.

For a description employing stakes, see

*Gardner v. Johnson*, 220 Ark. 168 246 SW2d 568 (1952).

### 330. State.

Deed which does not identify land as being in any particular county or state does not identify the *key* by which the land may be certainly identified. *Turrentine v. Thompson*, 193 Ark. 253, 99 SW2d 585 (1936).

### 331. Street.

The American courts uniformly uphold a description by street number in a contract to sell realty. *Ray v. Robben*, 225 Ark. 824, 285 SW2d 907 (1956); *Creighton v. Huggins*, . . . Ark. . . ., 303 SW2d 893 (1957).

### 332. Subdivision.

A description of land as a certain lot or *subdivision* generally conveys the whole thereof in the absence of showing a contrary intent. *Carney v. Dunn*, 221 Ark. 223, 252 SW2d 827 (1952).

### 333. Town.

Sewer District deed with description "Block 6, Pt. Lot 5 exc. W 35 Ft. & N $\frac{1}{2}$  Lot 6 (Among other lands)" is void for it contains no mention of any Addition or city. *Ferguson v. Van Gundy*, . . . Ark. . . ., 291 SW2d 248 (1956).

### 334. Township. See "County."

Where the exception in a deed contains the correct Township and Range, which are omitted in the grant, it necessarily follows that the land conveyed must be in the same Township and Range as the land which is excepted. *Davis v. Burford*, 197 Ark. 965, 125 SW2d 789 (1939).

### 335. Tree. No new decision.

### 336. Undivided Interest. No new decision.

**337. Undivided 1/3 of.** No new decision.

**338. W.**

The letter "W" is a common abbreviation used in land descriptions generally. "Lots 10, 11, and 12 of Block 21 W of the town of Swifton, Jackson county, Arkansas" is a valid description. There is but one block number 21 in Swifton. This block embraces the three lots in question. "W" adds nothing to this description and takes nothing from it. *Moseley v. Moon*, 201 Ark. 164, 144 SW2d 1089 (1940).

**339. West.**

When description limits a conveyance to lands on the *west* side of Crystal Hill Road, no lands *east* of the Crystal Hill Road are conveyed. *Mode v. Henley*, . . . Ark. . . ., 302 SW2d 73 (1957).

**340. West of Meridian.** See "East of Meridian."

**341. Year.**

A tried and true description employed in this State in chattel mortgages "all crops grown on X. farm in Y. County, or on any other lands in that county" cultivated by the mortgagor during the crop year includes all crops produced in the County by the mortgagor and is not limited to those grown on "X. farm. . . ." But, a mortgage drawn with an irreconcilable conflict between the first portion of the granting clause (which states that all of the crops and chattels covered by the mortgage are located or to be located on "Joe Davis farm or ranch . . .") and the second portion covering all mortgagor's crops on the "lands above described and on any other lands cultivated by the Mortgagor in the same county" limits mortgagee to crops produced on that particular farm during the year 1952, for the general must yield to the specific. *United States v. R. D. Wilmans & Sons, Inc.*, 147 F. Supp. 232 (1956).

\* \* \* \* \*

A surveyor who is preparing a description and who has a question concerning the legality of a call or any problem concerning the legal aspects of the description should use the above information only as a guide. But if there is any question in his mind, he should consult his attorney for a final decision.

### Survey Plats

The only legal requirements for survey plats is contained in Act 645 of 1969 which reads as follows:

"Act 645, 1969. For an Act to be Entitled: 'An Act to Require That all Licensed Engineers and Surveyors File a Copy of Certain Surveys Made by Them in the Office of the Circuit Clerk of the County Wherein the Survey was Made: And for Other Purposes.'

Be it Enacted by the General Assembly of Arkansas:

Section 1. Hereafter, all licensed engineers and surveyors in this State shall file a plat of all surveys of property boundary lines made by them in the office of the circuit clerk of the county where such survey was made within thirty (30) days after such survey is completed. The sole purpose of filing such plat shall be to identify the person or persons who made such plat and survey and placed the survey markers and shall not be used to evidence adverse possession or as evidence in boundary disputes. Provided, however, the provisions of this Act shall not be applicable with respect to surveys hereafter made of subdivided property located in a municipality where such property has previously been surveyed and a plat filed.

Section 2. Any licensed engineer or surveyor who shall fail or refuse to file such survey as provided by this Act shall be guilty of a misdemeanor and upon



conviction shall be subject to a fine of not less than fifty dollars (\$50.00) nor more than one hundred dollars (\$100.00) or imprisonment for not less than thirty (30) days nor more than six (6) months, or both such fine and imprisonment.

Section 3. Act 257 of 1969 and all laws and parts of laws in conflict with this Act are hereby repealed."

At the present time, no uniform plat law has been introduced or passed in Arkansas. At the Annual Convention of the Arkansas Association of Registered Land Surveyors held in April of 1970, Mr. Elmer J. Peterson, Henipan County Surveyor of Minneapolis, Minnesota, and an authority on uniform plat laws spoke to the convention on this subject. In his paper he stated that ten years prior to 1970 the Property Survey Division of the American Congress on Surveying and Mapping established a committee known as the Legal Recording Committee, which later became known as the Model Plat Law Committee. The primary purpose of the initial committee was to study all of the plat laws within the United States and the various aspects pertaining to these laws and their effect upon the land surveying profession throughout the country. After several years of research, the compilation of the subdivision plat laws was brought about and it was found that most states had done very little during the last 15 or 20 years except to add a few amendments to their plat laws. Some of these amendments were good and served to strengthen the laws, but in many instances, the laws were still left without much backbone. Few states could actually claim that they had a really comprehensive plat law. But it was considered at that time that such states as California, Florida, Wisconsin, Michigan, Minnesota and Massachusetts had good plat laws.

In April of 1967, the American Congress on Surveying and Mapping adopted a model plat law. This model plat law was published

in the ACSM Journal of June, 1967, and a copy of it is enclosed herein.

### ACSM MODEL PLAT LAW

Adopted April 1967 by the Board of Direction of the American Congress on Surveying and Mapping.

Chronology of ACSM Activities leading to the adoption of the Model Plat Law.

- 1960 The Legal Recording Committee of the Property Surveys Division of ACSM, under the chairmanship of Elmer J. Peterson, began a compilation of the existing state laws regulating the platting of subdivisions of land.
- 1963 The Legal Recording Study Chart containing a synopsis of the existing state laws, prepared by Committee Chairman Peterson, was copyrighted and published by ACSM.
- 1964 Preliminary work begun toward the construction of a model plat law by the Legislative Committee of the Property Surveys Division under the chairmanship of James A. Thigpenn, III.
- 1965 A preliminary draft of the model plat law was presented at the Annual Meeting of ACSM, March 31, 1965, by Committee Chairman Thigpenn, and copies were distributed to selected organizations and individuals for comments and suggestions. Work on the model continued with the addition of several new sections.
- 1966 On March 8, 1966, a proposed model plat law was presented at the Annual Meeting of ACSM by Committee Chairman Thigpenn. A final review was decided upon and copies of the proposal were distributed in May to every region.

PSD Past Chairman Elmer J. Peterson, who had played such an important role in this undertaking, was appointed Chairman of the Model Plat Law Committee of the Property Surveys Division of ACSM, with instructions to receive and report on the comments returned by the ACSM Sections and affiliated state and regional organizations.

On October 7, 1966, Committee Chairman Peterson reported to the Board of Directors of the Property Surveys Division at the Semi-Annual Meeting of ACSM in Houston, Texas. He had received twenty-one replies containing representative opinions from every region. After reviewing the comments and suggestions, the PSD Board of Directors reviewed each section of the proposed model law and gave instructions to Committee Chairman Peterson including certain changes, deletions and additions, and requested that he prepare a revised proposal to be recirculated in December for further comment and discussion before being submitted in final form for approval at the Annual Meeting of ACSM in March 1967.

The revised model law was approved by the Property Surveys Division at the Annual Meeting in March and was submitted to the ACSM Board of Direction with recommendation for adoption. After careful study by the ACSM Board it was adopted in April 1967 as the ACSM Model Plat Law.

### Controlling Premise

The ACSM Model Plat Law is offered as a guide for use in evaluating existing state laws and in the preparation of new or revised laws relating to the platting of subdivided lands.

It is *not* a "planning act," and is *not* intended to deal with such matters as zoning, or the harmonious development of urban and

suburban areas. Such matters as controls to provide open spaces for traffic, light, air and recreation, and regulations restricting the use of water facilities, the disposal of wastes, and grading and drainage are beyond the scope of the model law offered here. However, it would be suitable for inclusion as a part of a "planning act."

It is *not* a "subdivision control act," which would necessarily require such additional measures as regulations to control lot sizes, building restriction lines, construction and grading plans, and requirements for preliminary maps and topographic studies. However, it would be suitable for inclusion as a part of a "subdivision control act."

It is a model, or sample, of a "subdivision plat act" and, as such, is primarily concerned with matters directly affecting the competency of the work performed by Land Surveyors. Therefore, it is limited in its scope to matters relating to the actual "on-the-ground" survey and the construction of an adequate plat for record.

Terminology and requirements continue to vary from state to state. The substitution of appropriate terms and/or requirements can be made without destroying the context of the model or detracting from its value as a guide.

### PREFACE

The purpose of a model law is not the achievement of standardization, or the erection of barriers against progressive experimentation which could lead to more satisfying relationships between the private individuals and safeguards provided to protect the rights of others and to give stability to the social order.

It is the intention of the AMERICAN CONGRESS ON SURVEYING AND MAPPING that this model law, constructed under its auspices and afforded its official recognition, endorsement, and recommendation to others, shall serve only as a basis for

consideration and as a pattern for comparisons. There is no suggestion that any model law be universally adopted, nor that any limits be established by its format. To the contrary, it is recognized that local needs should be given every preference, and that any law enacted within a particular jurisdiction should be specially tailored to serve the needs of the constituents of that jurisdiction.

Nevertheless, the painstaking construction of a model law, following thorough studies of the existing laws of every state, developed under the scrutiny of numerous authorities, and benefitting from pointed criticisms from every region, gives added weight to the significance of such a document and makes it worthy of general acceptance as a guide in the determination of criteria. We therefore conclude that any use made of such a model law confirms its purpose and that its true value lies as much in its ability to stimulate discussion, or to serve as a point of departure, as it does in its ability to serve as a precise pattern, and this awareness removes any need for an apology for any shortcomings that may seem apparent to those who study its contents.

### Outline

- Section .01. PURPOSE AND SCOPE OF ACT.
- Section .02. DEFINITIONS OF TERMS USED IN THIS ACT.
- Section .03. REQUIREMENT TO FILE FOR RECORD—PENALTY FOR NON-COMPLIANCE.
- Section .04. CONDITIONAL SUBDIVISIONS TO BE PERMITTED.
- Section .05. CERTIFICATE OF OWNERSHIP — DESCRIPTION — ACKNOWLEDGMENT.
- Section .06. TAX AND TITLE CERTIFICATION.
- Section .07. DEDICATION AND ADOPTION.
- Section .08. NAME OF SUBDIVISION.

Section .09. QUALIFICATIONS OF PERSON MAKING SURVEY AND PLAT—CERTIFICATION.

Section .10. EXAMINATION OF PLATS BEFORE RECORDING.

Section .11. MONUMENTATION.

(1) Monuments of Record—Permanent Control Monuments.

(2) Other Monuments of Record.

(3) Monuments Set After Recording of Plat.

(4) Additional Monuments Required.

Section .12. FINAL PLATS MADE FOR RECORD.

Section .13. AFFIDAVIT CONFIRMING ERROR ON RECORDED PLAT.

Section .14. EXISTING PLATS VALIDATED.

Section .15. VACATION OF RECORDED PLATS.

Section .16. LEGAL STATUS OF RECORDED PLATS.

Section .17. PROVISIONS DECLARED TO BE SEVERABLE.

Section .01. Purpose and Scope of Act.

In recognition of the obligation of the State to provide reasonable regulations for the common good and welfare, and of the superior concern of the local governing bodies in effecting such regulations, this Act shall be deemed to establish consistent minimum requirements and to create such additional powers in such local governing bodies as herein provided to regulate and control the subdividing and platting of lands as herein defined, without modifying or supplanting any provision of any existing special or private statute or any existing legal ordinance enacted under the provisions of any prior statute or city charter which such local governing bodies shall desire to continue in force and effect.

## Section .02. Definitions of Terms Used in This Act.

For the purposes of this Act the following definitions of terms used shall apply in all cases:

*Subdivision* means the division of a lot, tract, or parcel of land into two or more lots, sites or other divisions of land for the purpose, whether immediate or future, of sale or building development, and includes addition and resubdivision and, when appropriate to the context, relates to the process of subdividing or to the lands or area subdivided; except that the following divisions shall not be considered subdivisions within the meaning of this Act where no new streets, roads or other areas intended for public use are involved; (a) divisions of land for agricultural purposes, (b) divisions of property by testamentary or intestate provisions, (c) divisions of property upon court order, or (d) divisions of land created by right-of-way acquisitions by a governing body.

*Street* means and includes all access way in common use such as streets, roads, lanes, highways, avenues, boulevards, alleys, parkways, viaducts, circles, courts and cul-de-sacs, and includes all of the land lying between the right-of-way lines as delineated on a plat showing such streets whether improved or unimproved, and whether dedicated for public use or held in trust under the terms of a reservation; but shall not include those access ways, such as easements and rights-of-way intended solely for limited utility purposes, such as for electric power lines, gas lines, telephone lines, water lines, or drainage and sanitary sewers.

*Easement* means any strip of land reserved by the subdivider for public utilities, drainage, sanitation or other specified

uses having limitations, the title to which shall remain in the property owner, subject to the right of use designated in the reservation of the servitude.

*Lot* means the least fractional part of subdivided lands having limited fixed boundaries and being intended for private or individual use, or for such specific designated purposes as those normally associated with parks and other recreational, educational or business areas, and having an assigned number, letter, or other name through which it may be identified.

*Block* means a group of lots existing within well defined and fixed boundaries, usually being an area surrounded by streets or other physical barriers, and having an assigned number, letter, or other name through which it may be identified.

*Plat* means a map or delineated representation of a tract or parcel of land showing the subdivision of such land into lots, blocks and streets, or other divisions, and other information in compliance with the requirements of all applicable sections of this Act and of local ordinances, and may include the terms replat and final plat.

*Preliminary Plat* means a map or delineated representation of a tract or parcel of land showing the salient features of a proposed subdivision of such land submitted to an approving authority for the purpose of preliminary consideration, but otherwise having no official or legal status.

*Municipality* means any incorporated city, town or village.

*Governing Body* means the chief legislative body of any municipality, county, or other body politic.



*Subdivider* means any individual, firm, association, syndicate, partnership, corporation, guardian, attorney, trust, or any other legal entity commencing proceedings under the regulations of this Act to effect a subdivision of land hereunder for himself or herself or for another or for others.

*Proprietor* means any individual, firm, association, syndicate, partnership, corporation, guardian, trust, executor, or other entity having legal title to the subject lands or the right of administration thereof.

*Land Surveyor or Surveyor* means a registered, licensed, certified, or public land surveyor in good standing with the registration board of this State, whose education, training and experience qualify him to perform all of the acts of subdividing required of a surveyor by this Act.

#### Section .03. Requirement To File For Record—Penalty for Non-Compliance.

From and after the effective date of this Act it shall be unlawful for any proprietor or his agent to offer to sell or lease, or to sell or lease any part of any subdivision as defined by this Act before a final plat of the land subdivided, made in accordance with the provisions of this Act and in compliance with local regulations, has been duly filed for record in the office of the (recorder) or the (county) and, if required, of the municipality within which any portion of such subdivision is located. Each and every sale or lease, or offer of sale or lease of lands in violation of the provisions of this section shall be considered a misdemeanor and the guilty party or parties upon conviction shall be fined one hundred (100) dollars for each violation plus costs of court; and any recorder, official, land surveyor, or any other person whose duty it is to comply

with any provisions of this Act, and who shall wilfully violate the same shall be considered guilty of a misdemeanor and shall be fined one hundred(100) dollars for each violation plus court costs.

#### Section .04. Conditional Subdivisions To Be Permitted.

In any case where the subdivider proposes to subdivide a tract of land into less than three lots, and where such subdivision would not violate existing statutes or local ordinances setting forth minimum requirements as to lot sizes, or conflict with zoning regulations, and where no new streets, easements, or other reservations are required, the approving body may waive such provisions of this Act and of local ordinances as seem impractical and permit such conditional subdivision under such terms as seem appropriate and reasonable. In any such instance however, it shall be necessary that a plat be made and legally recorded in accordance with all other provisions of this Act.

#### Section .05. Certificate of Ownership—Description — Acknowledgment.

Every plat of a subdivision filed for record must contain a certificate to the effect that "this subdivision to be known as (*here insert the name of the subdivision*) and described as follows: (*here insert a full and correct description of the lands subdivided*) as it appears on this plat has been made with the free consent and in accordance with the desires of the undersigned owner (or owners)"; said certificate shall be signed and acknowledged by all parties having any record title interest in the lands subdivided and by the spouse of each interested party, if any, before an officer duly authorized to take acknowledgments of deeds in the same manner in which deeds are required to be acknowledged, and if such title interest is vested



in a corporation it shall be likewise signed and acknowledged by two officers of such corporation by and with the authority of its board of directors.

#### Section .06. Tax and Title Certification.

Every final plat of a subdivision submitted to the approving agent, or agency, of the local governing body must be accompanied by an affidavit or title opinion certified to by an attorney at law or a title insurance company confirming that the fee simple absolute title of the lands as described and shown on said plat is in the name of the person, or persons, signing the certificate of ownership as it is shown on said plat, or in the name of the corporation as shown in said certificate of ownership, and that said land is free from encumbrances, and that all taxes, whether assessed against the entire tract or any part of the lands shown on said plat, have been paid, where any person, or persons, holding any mortgage, lien, or other legal claim of record against said lands has not signed the certificate of ownership, such affidavit or title opinion must be accompanied by the written consent of such person, or persons, to the approval of such plat properly signed and acknowledged; when an approved final plat is offered for record, the (recorder) shall enter the affidavit or title opinion, and such written consent, if any, in the proper record book, and the book and page number where such is recorded shall be clearly noted in the margin of the final plat.

#### Section .07. Dedication and Adoption.

When a tract or parcel of land has been subdivided and a plat thereof, bearing the acknowledgment of the owner, or owners, and the approval of the governing body, has been recorded in compliance with this Act, all streets and other public areas shown on such plat shall be deemed to

have been dedicated to the public for the uses and purposes thereon stated or implied, and shall be deemed to have been accepted and adopted by such governing body and to be held in trust by that body for such stated or implied uses and purposes; however, nothing herein shall be construed as creating an obligation upon any governing body to perform any act of construction or maintenance within such dedicated areas except where such obligation is voluntarily assumed by such governing body as an inducement to the subdivider to meet stipulated requirements as to grading, paving, and other constructions considered necessary prerequisites to such acceptance and adoption, or by the acceptance in similar circumstances of a performance bond offered by the subdivider to meet such stipulated requirements. All reservations or restrictive covenants must be clearly stated on the plat, and where any restriction or grant of easement required by the governing body is shown thereon the right to enforce such restrictions or easement shall vest in said governing body.

#### Section .08. Name of Subdivision.

Every subdivision shall be given a name by which it may be legally known; such name shall not be the same as or in any way so similar to any name appearing on any recorded plat in the same county as to confuse the records or to mislead anyone as to the legal identity of such subdivision, except where such subdivision is contiguous and is subdivided by the same party or parties as an additional unit.

#### Section .09. Qualifications of Person Making Survey and Plat---Certification.

Every subdivision of lands within this state shall be made under the supervision of a registered, licensed, certified or public land surveyor who shall certify on the plat

of such subdivision to the effect that the plat is a true and correct representation of the lands surveyed and that compliance has been made with all of the requirements of this Act, and those of local governing bodies relating to the making of the actual survey on the ground and the preparation of the plat; such certification shall bear the signature, registration number, and the impression of the official seal of such surveyor. Nothing in this section shall be construed to prevent the preparation of preliminary plats by any person, except where such preliminary plats are required to be certified by a registered, licensed, certified, or public land surveyor or registered civil engineer for purposes of study and tentative approval by an agent or agency of the state or local governing body in all such cases where any person engaged in activities under the regulations of this Act is both a registered, licensed, certified, or public land surveyor and a registered civil engineer, and in all cases, the certificate required on the final plat must be signed by him as a land surveyor.

#### **Section .10. Examination of Plats Before Recording.**

The governing body, or the agent or agency designated by the governing body, of every municipality, county, or other body politic, shall be entitled to examine the plat of every subdivision offered for record having any part lying within its boundaries, and to compel the subdivider to meet the requirements of this Act and such other reasonable requirements as are prescribed by local ordinances, before approving such plat for record; where such approval is required by local ordinance the (recorder) shall refuse to accept any plat for record that fails to have such approval in proper form, or fails to comply with the provisions of this Act in form or size; how-

ever, such examination and approval by the governing body and the (recorder) shall not include the inspection or verification of survey data as shown on such plats without the further provision that such plats be examined and checked for errors by a qualified registered, licensed, certified, or public land surveyor acting on behalf of such governing body, and that in all such cases where errors are reported by such examining land surveyor, or where the data shown on such plat is deemed by such examining land surveyor to be insufficient to definitely fix all points shown thereon, the plat shall be returned to the subdivider for alteration or correction by the land surveyor responsible for the survey and the plat; providing further that should the responsible land surveyor and the examining land surveyor fail to agree on the matter of alteration or correction, such plat shall be submitted to two (2) other qualified land surveyors for examination and the majority opinion of the three (3) examining land surveyors shall prevail, and the governing body, or its agent, shall grant or withhold approval in accordance with such majority opinion. In all cases the governing body, or its agent, shall approve or disapprove every plat submitted to it for examination within thirty (30) days after it is filed for approval, unless otherwise agreed upon.

#### **Section .11. Monumentation.**

##### **(1) Monuments of Record—Permanent Control Monuments.**

Prior to the offering of the plat of any subdivision for record the land surveyor shall establish, or confirm the prior establishment of permanent control monuments at each and every controlling corner on the boundaries of the parcel or tract of land being subdivided, and shall establish at least two (2) permanent con-

control monuments for each and every block created, or when the area subdivided into lots is less than a block in size at monuments shall be established for that subdivision; such permanent control monuments shall consist of a surface marker placed above an underground monument set not less than twenty-four (24) inches below the surface, and consisting of a concrete monument with iron or steel reinforcement rods, said concrete monument shall be at least four (4) inches in width or diameter and no less than twelve (12) inches in depth; the surface marker shall be placed precisely over the center of the underground monument and shall be set in such a way as to permit its continuing use as a control monument for so long as it shall remain undisturbed; in all cases at least three (3) inches of soil shall separate the top of the underground monument from the lower end of the surface marker so as to lessen the likelihood of any disturbance of the underground monument; the surface marker shall be a galvanized iron or copper pipe of not less than two (2) inches in diameter or twenty (20) inches in length with a brass or bronze cap marked with a point or cross at its precise center and having the registration number of the land surveyor in responsible charge legibly stamped or imprinted thereon; or such pipes as above of a lesser size encased in concrete no less than four (4) inches in width or diameter or twenty (20) inches in length likewise having a brass or bronze cap as required above; such permanent control monuments shall be clearly noted and described on the plat.

**(2) Other Monuments of Record.**

Other monuments set prior to the recording of the plat of such subdivision and shown and described on such plat shall be considered monuments of record

and shall be given the same weight as original permanent control monuments as long as they remain undisturbed in their original position; such additional monuments may be similar to that prescribed for surface markers in the preceding sub-paragraph or may be galvanized iron or copper pipes of no less than one-half ( $\frac{1}{2}$ ) inch inside diameter and no less than twenty-four (24) inches in length, or other materials of equal or superior durability when approved by the local governing body, or its approving agent or agency, providing that in all such cases the monument used shall have a brass or bronze cap showing the registration number of the land surveyor as provided in the preceding sub-paragraph; such additional monuments of record shall not be required to have underground monuments.

**(3) Monuments Set After Recording of Plat.**

No monuments other than the permanent control monuments required in sub-paragraph (1) of this section shall be required to be set before the recording of the plat or the conveyancing of lands by reference to the plat if the land surveyor includes in his certification on such plat that the additional monuments required by this Act and by any local ordinance shall be set on or before a specified later date, and if the subdivider shall furnish the governing body, or its agent or agency, a bond or cash deposit in an amount equal to the estimated cost of setting such additional monuments, guaranteeing payment of the cost thereof, but not in excess of the amount of the bond or cash deposit; within five days after the setting of all required additional monuments the land surveyor shall give written notice to the subdivider and to the governing body or its agent or agency that the monuments have been set; upon payment to the land surveyor for setting

said monuments the subdivider shall present evidence of such payment to the governing body or its agent or agency and of the receipt thereof by the land surveyor together with a request that his bond be released or that his cash deposit be returned; at the earliest possible date thereafter said bond shall be released or said cash deposit shall be returned to the depositor; or in lieu of the above procedure when it involves a cash deposit the governing body or its agent or agency may pay the land surveyor for the setting of the additional monuments as required from said cash deposit, if so requested by the depositor; if the subdivider does not present evidence to the governing body or its agent or agency that he has paid the land surveyor for the setting of such additional monuments, and if the land surveyor notifies the governing body or its agent or agency that he has not been paid by the subdivider for setting said additional monuments, the governing body or its agent or agency shall within ninety (90) days from the date of said notification pay to the land surveyor the amount of the bond or cash deposit, the placement of any monument at any time after the recording of the plat shall be subject to the actual location of all monuments of record and their position shall be established both at law and in equity at prorated positions as determined from direct remeasurements between the established monuments of record rather than as precisely stated or shown on the recorded plat.

**(4) Additional Monuments Required.**

Required additional monuments shall be of such types as prescribed in sub-paragraph (2) of this section, and shall be set at all of the following locations whether set prior to the recording of the plat, or subsequent to such recording as provided in sub-paragraph (3) of this section;

- (a) at every corner and angle point of every lot, block or parcel of land created;
- (b) at every point of intersection of the outer boundary of the subdivision with an existing or created right-of-way line of any street, railroad, or other way;
- (c) at every point of curve, point of tangency, point of reversed curve, point of compounded curve on each and every right-of-way line established;

In such cases where the placement of a required monument at its proper location is impractical it shall be permissible to set a reference monument close by that point, and if such reference monument is set prior to the recording of the plat and its location properly shown it shall have the same status as other monuments of record; where any point requiring monumentation has been previously monumented, the correctness of the existing monument shall be confirmed by the land surveyor if used, and if so confirmed shall likewise be considered a monument of record when properly shown and described on the plat recorded.

**Section .12. Final Plats Made for Record.**

Every final plat of a subdivision offered for record shall conform to all of the following provisions where applicable:

- (a) It shall be an original drawing made with india ink on a good grade linen tracing cloth, or with a suitable black acetate base ink on a stable polyester base film coated upon completion with a suitable plastic material to prevent flaking and to assure permanent legibility, or a print on a stable polyester base film made by photographic processes from a film scribing tested



for residual hypo with an approved hypo testing solution to assure permanency. Marginal lines, standard certificates and approval forms may be printed or legibly stamped on the plat with permanent opaque black ink when permitted by local ordinance.

- (b) The size of each sheet shall be 18 inches by 26 inches overall with a marginal line drawn, or printed when permitted by local ordinance, completely around each sheet having dimensions of 17 inches by 24 inches and placed so as to leave a one-half inch margin on each of three sides and a one and one-half inch margin on the binding side.
- (c) Whenever more than one sheet must be used to accurately portray the lands subdivided, each sheet must show the particular number of that sheet and the total number of sheets included, as well as clearly labeled match lines to show where other sheets adjoin.
- (d) A scale of one inch equals one hundred feet shall be used at all times unless permission to do otherwise is obtained in writing from the local governing body or its approving agent or agency. In all cases the scale used shall be both clearly stated and graphically illustrated by a bar scale drawn on every sheet showing any portion of the lands subdivided.
- (e) The name of the subdivision shall be shown in bold letters inside the margin at the top of each and every sheet included.
- (f) A prominent North Arrow shall be drawn on every sheet included showing any portion of the lands subdivided, and when possible it shall be placed in the upper right-hand corner. The bearing reference shall be clearly stated below each North Arrow shown.
- (g) All monuments to be of record must be adequately described and clearly identified on the plat. Where additional monuments are to be set subsequent to the recording of the plat as provided in Section .12. (3), the location of such additional subordinate monuments shall be shown by a distinct symbol noted on the plat as representing subordinate monuments.
- (h) Sufficient survey data shall be shown to positively describe the bounds of every lot, block, street, easement, and other areas shown on the plat, as well as the outer boundaries of the lands subdivided.
- (i) All distances shall be shown in feet and to the nearest one-hundredth foot, and in accordance with the definition of a foot adopted by the United States Bureau of Standards. All measurements shall refer to the horizontal plane.
- (j) The course of every boundary line shown on the plat shall be indicated by a direct bearing reference or by an angle between it and an intersecting line having a shown bearing, except where such line has an irregular or constantly changing course, as along a body of water, or where its description is better illustrated by measurements shown at points or intervals along a meander line having shown courses. All bearings and/or angles shown shall be given to the nearest minute of arc, or to a smaller fraction to be stated in seconds of arc.



- (k) Curve data shall be stated in terms of radius, central angle, and tangent, or length of curve, and unless otherwise specified by local ordinance curve data for streets of uniform width may be shown only with reference to the center-line, and lots fronting on such curves may show only the chord bearing and distance of such portion of the curve as is included in their boundary; in all other cases the curve data must be shown for the line affected.
- (l) When any lot or portion of the subdivision is bounded by an irregular line, the major portion of that lot or subdivision shall be enclosed by a meander line showing complete data with distances along all lines extending beyond the enclosure to the irregular boundary shown with as much certainty as can be determined or as "more or less," if variable. In all cases the true boundary shall be clearly indicated on the plat.
- (m) All interior excepted parcels shall be clearly indicated and labeled, "not a part of this plat."
- (n) All adjoining properties shall be identified, and where such adjoining properties are a part of a recorded subdivision the name of that subdivision and the book and page number where it is recorded shall be shown. If the subdivision platted is a re-subdivision of a part or the whole of a previously recorded subdivision, sufficient ties shall be shown to controlling lines appearing on the earlier plat to permit an overlay to be made; the fact of its being a re-subdivision shall be stated as a sub-title following the name of the subdivision wherever it appears on the plat.
- (o) The purpose of any easement shown on the plat must be clearly stated, and shall be confined to only those that deal with public utilities, such as gas, power, telephone, water, and such drainage easements as deemed necessary for the orderly development of the land encompassed within the plat. All such easements relative to their usage and maintenance must be approved by the governing or jurisdictional body or their agent prior to recording of final plat.
- (p) No strip of land shall be reserved by the subdivider unless the same is of sufficient size and shape to be of some practical use or service.
- (q) All blocks must be numbered or lettered in consecutive order. All lots within each block must be numbered in consecutive order. All streets must be named, numbered, or lettered in a manner acceptable to the local governing body or its approving agent or agency.
- (r) The purpose of all areas dedicated to the public must be clearly indicated or stated on the plat.

### Section .13. Affidavit Confirming Error on Recorded Plat.

In the event an appreciable error or omission, in the data shown on any plat duly recorded under the provisions of this Act, is detected by subsequent examinations, or revealed by a retracement of the lines run during the original survey of the lands shown on such recorded plat, the land surveyor who was in responsible charge of the original survey and the preparation of the plat

as recorded may file an affidavit confirming that such error was made, describing the nature and extent of such error or omission and the appropriate correction that in his opinion should be substituted for the erroneous data shown on such plat, or added to the data shown on such plat. In the event that the responsible land surveyor is no longer living, or that he is no longer available, or unwilling to confirm such error, a similar affidavit may be filed by others providing that such similar affidavit be signed and acknowledged by three (3) practicing registered, licensed, certified or public land surveyors in good standing with the board of examiners of this state. In either case where such affidavit has been filed for record, it shall be the duty of the (recorder) to place a notation in the margin of such recorded plat stating that such affidavit has been filed, the date when it was filed, and the book and page where it is recorded; said affidavit shall have no effect upon the validity of the plat, or of the information shown thereon, but shall be admissible as evidence by the courts and given the same weight as testimony offered voluntarily by a qualified expert witness.

#### Section .14. Existing Plats Validated.

All plats recorded in pursuance of any law heretofore in force prior to the effective date of this Act and not subsequently vacated are hereby validated, notwithstanding irregularities, and given the same legal status of those recorded under the provisions of this Act.

#### Section .15. Vacation of Recorded Plats.

Any plat recorded under the provisions of this Act, or of prior acts, may be vacated by the proprietor, or his or her heirs or assigns, at any time before the sale of any lot shown thereon, by a written instrument declaring the same to be vacated,

executed, acknowledged and recorded with the approval of the local governing body, or the agent or agency of such governing body having the authority to approve or disapprove plats of subdivisions; such local governing body, or its agent or agency, may reject any such instrument which abridges or destroys any public rights in any of its streets, or interferes with the rights of others granted by any conveyance or dedication of lands within a subdivision created subsequent to the recording of such plat; or such local governing body, or its agent or agency, may approve the vacation of parts of such subdivision as shown on such recorded plat at any time before the sale of any lot shown thereon; after the sale of any lot shown on such plat, the plat, or any part thereof, may be vacated as provided herein by all of the owners of the lots shown thereon joining in the execution of such written instrument, said vacation being likewise subject to the approval or disapproval of the local governing body, or its agent or agency, as herein provided; upon the filing of any such written declaration approved by the local governing body, or its agent or agency, the recorder shall cause the word "vacated" to be plainly and boldly written across the face of such vacated plat, or part of such plat vacated, and place a note on the margin of such plat stating where such declaration has been recorded, and the date of such filing.

Where any street, as defined by this Act, is vacated as herein provided, such vacation shall be construed to convey to each abutting owner that portion of such vacated street lying between the center line and the adjoining property line and between lines extended from the property corners of such abutting owners normal to the center line of such vacated street; where such vacated lands are thus acquired any subsequent

conveyance of such lands must make specific reference to the written declaration approved by said local governing body, or its agent or agency.

If at any time within twenty (20) years of the recording of the plat, any park or other public area dedicated to the public in such plat has been vacated in the same manner as provided herein for the vacation of streets the fee of such vacated lands shall revert to the dedicator, or his or her heirs or assigns; if at any time after twenty (20) years of the recording of the plat, such part or other public area dedicated to the public in such plat should be declared vacated by the local governing body, or its agent or agency, the fee of such vacated lands shall remain in the public and shall be held in trust by the local governing body for whatever purpose or purposes such local governing body may select, or be disposed of at the discretion of said local governing body.

#### **Section .16. Legal Status of Recorded Plats.**

The recording of any plat made in compliance with the provisions of this Act shall serve to establish the identity of all lands shown on and being a part of such plat, and where lands are thenceforth conveyed by reference to such plat, the plat itself, or any copy of such plat properly certified by the (recorder) as being a true copy thereof, shall be regarded as incorporated into the instrument of conveyance and shall be received in evidence in all courts of this state.

#### **Section .17. Provisions Declared to be Severable.**

If any provision of this Act shall be declared invalid, such invalidity shall not affect any other portion of this Act which can be given effect without the invalid provision, and to this end the provisions

of this Act are declared to be severable.

As Mr. Peterson pointed out, some of the better model plat laws which have been passed and are in effect include those in California, Minnesota and Florida. Several years ago, a committee from the Arkansas Association of Registered Land Surveyors initiated action to prepare a model plat law. A large quantity of information has been obtained from other states including a copy of the Florida Plat Law which is considered to be one of the most comprehensive and effective of all. While some of the items deal with situations in Florida which may be somewhat different from Arkansas, there is much in this plat law which would be of great assistance to Arkansas land surveyors, particularly those platting land subdivisions. Excerpts from the Florida law are enclosed herein for guidance and use as appropriate by Arkansas land surveyors.

*"Be It Enacted by the Legislature of the State of Florida:*

#### **177.011 Purpose and scope of act**

This act shall be deemed to establish consistent minimum requirements and to create such additional powers in local governing bodies as herein provided to regulate and control the platting of lands. This act establishes minimum requirements and does not exclude additional provisions or regulations by local ordinance, laws or regulations.

#### **177.021 Legal status of recorded plats**

The recording of any plats made in compliance with the provisions of this act shall serve to establish the identity of all lands shown on and being a part of such plats and lands may thenceforth be conveyed by reference to such plat.

#### **177.031 Definitions**

As used in this act:

(1) "Alley" means a right-of-way providing a secondary means of access and service to abutting property.

(2) "Block" includes tier or group and means a group of lots existing within well-defined and fixed boundaries, usually being an area surrounded by streets or other physical barriers and having an assigned number, letter or other name through which it may be identified.

(3) "Board" means any board appointed by a municipality, county commission or state agency, such as the planning and zoning board, area planning board, or the governing board of a drainage district.

(4) "Governing body" means the board of county commissioners or the legal governing body of a county, municipality, town or village of this state.

(5) "Cul-de-sac" means a street terminated at the end by a vehicular turn around.

(6) "Developer" is the person or legal entity applying for approval of a plat of a subdivision pursuant to this chapter.

(7) "Easement" means any strip of land created by the subdivider for public or private utilities, drainage, sanitation or other specified uses having limitations, the title to which shall remain in the name of the property owner, subject to the right of use designated in the reservation of the servitude. "Public utility" includes any public or private utility, such as, but not limited to, storm drainage, sanitary sewers, electric power, water service, gas service, telephone line, whether underground or overhead.

(8) "Survey data" means all information shown on the face of a plat that would delineate the physical boundaries of the subdivision and any parts thereof.

(9) "Improvements" may include, but are not limited to, street pavements, curbs and gutters, sidewalks, alley pavements, walkway pavements, water mains, sanitary sewers, storm sewers or drains, street names, signs, landscaping, permanent reference monuments ("PRM's"), permanent control points ("PCP's") or any other improvement required by a governing body.

(10) "Land Surveyor" means a land surveyor registered under chapter 472, Florida Statutes, who is in good standing with the Florida State Board of Engineer Examiners.

(11) "Lot" includes tract or parcel and means the least fractional part of subdivided lands having limited fixed boundaries, having an assigned number, letter, or other name through which it may be identified.

(12) "Municipality" means any incorporated city, town or village.

(13) "PCP" means permanent control point which shall be a secondary horizontal control monument and shall be a metal marker with the point of reference marked thereon, or a four (4) inch by four (4) inch concrete monument a minimum of twenty-four (24) inches long with the point of reference marked thereon. "PCP's" shall bear the registration number of the surveyor filing the plat of record.

(14) "Plat" means a map or delineated representation of the subdivision of lands, being a complete exact representation of the subdivision and other information in compliance with the requirement of all applicable sections of this act and of any local ordinances and may include the terms "replat", "amended plat" or "revised plat".

(15) "PRM" means a permanent reference monument which consists of a metal rod a minimum of twenty-four (24) inches long or one-and-one-half (1½) inch minimum diameter metal pipe a minimum of twenty-four (24)



inches long, either of which, shall be encased in a solid block of concrete or set in natural bedrock, a minimum of six (6) inches in diameter, and extending a minimum of eighteen (18) inches below the top of the monument or a concrete monument four (4) inches by four (4) inches, a minimum of twenty-four (24) inches long with the point of reference marked thereon. A metal cap marker, with the point of reference marked thereon, shall bear the registration number of the surveyor certifying the plat of record and the letters "PRM" shall be placed in the top of the monument.

(16) "Right-of-way" means land dedicated, or deeded, used or to be used, for a street, alley, walkway, boulevard, drainage facility or access for ingress and egress or other purposes by the public or certain designated individuals or governing bodies.

(17) "Street" includes any access way such as a street, road, lane, highway, avenue, boulevard, alley, parkway, viaduct, circle, court, terrace, place and cul-de-sac and also includes all of the land lying between the right-of-way lines as delineated on a plat showing such streets whether improved or unimproved, but shall not include those access ways such as easements and rights-of-way intended solely for limited utility purposes, such as for electric power lines, gas lines, telephone lines, water lines or drainage and sanitary sewers and easements of ingress and egress.

(18) "Subdivision" means the platting of real property into three (3) or more lots, parcels, tracts, tiers, blocks, sites, units or any other division of land and includes establishment of new streets and alleys, additions and resubdivisions and, when appropriate to the context, relates to the process of subdividing or to the lands or area subdivided.

(19) "State plane coordinates" means the system of plane coordinate which has been established by the National Ocean Survey

for defining and starting the positions or locations of points on the surface of the earth within the state and shall hereinafter be known and designated as the "Florida coordinate system." For the purpose of the use of this system, the division established by the National Ocean Survey in special publication number 255, that the appropriate projection and zone designation shall be indicated and included in any description using the "Florida coordinate system."

(2) Surveying data:

(a) "Point of curvature", written "P.C.", means the point where a tangent circular curve begins.

(b) "Point of tangency", written "P.T.", means the point where a tangent circular curve ends and becomes tangent.

(c) "Point of compound curvature", written "P.C.C.", means the point where two (2) circular curves have a common point of tangency, the curves lying on the same side of the common tangent.

(d) "Point of reverse curvature" written "P.R.C.", means the point where two (2) circular curves have a common point of tangency, the curves lying on opposite sides of the common tangent.

177.041 Title certification

Every plat of a subdivision submitted to the approving agency of the local governing body, must be accompanied by a title opinion by an attorney-at-law, licensed in Florida, or a title insurance company policy confirming that the lands as described and shown on the plat are in the name of the person, persons or organization executing the dedication as it is shown on the plat and that the developer has apparent title to the lands. The title opinion or policy shall also show all mortgages on the land to be platted.



**177.051 Name of subdivision**

Every subdivision shall be given a name by which it shall be legally known. Such name shall not be the same or in any way so similar to any name appearing on any recorded plat in the same county as to confuse the records or to mislead the public to the identity of the subdivision, except where the subdivision is subdivided as an additional unit or section by the same developer or his successors in title. Every subdivision's name shall have legible lettering of the same size and type, including the words "section", "unit", "replat", "amended", etc. The name of the subdivision shall be shown in the dedication and shall coincide exactly with the subdivision name.

**177.061 Qualification of person making survey and plat certification**

Every subdivision of lands made within the provisions of this act shall be made under the responsible direction and supervision of a Land Surveyor who shall certify on the plat that the plat is a true and correct representation of the lands surveyed, that the survey was made under his responsible direction and supervision, and that the survey data complies with all of the requirements of this chapter. The certification shall bear the signature, registration number and the official seal of the Land Surveyor.

**177.071 Approval of plat by governing bodies**

Before a plat is offered for recording it shall be approved by the appropriate governing bodies in a county and evidence of their approvals shall be placed thereon. If not approved, the governing bodies shall return the plat to the Land Surveyor. However, such examination and approval for conformity to this act by the appropriate governing bodies shall not include the verification of the survey data, except by a Land Surveyor either employed by or under contract to the local governing body for the purpose of

such examination.

**177.081 Dedication and adoption**

(1) Every plat of a subdivision filed for record must contain a dedication by the developer. The dedication shall be executed by all developers and mortgagees having a record interest in the lands subdivided, in the same manner in which deeds are required to be executed.

(2) When a tract or parcel of land has been subdivided and a plat thereof bearing the dedication executed by the developers and mortgagees having a record interest in the lands subdivided, and the approval of the governing body has been secured and recorded in compliance with this act, all streets, alleys, easements, rights-of-way and public areas shown on such plat, unless otherwise stated, shall be deemed to have been dedicated to the public for the uses and purposes thereon stated. However, nothing herein shall be construed as creating an obligation upon any governing body to perform any act of construction or maintenance within such dedicated areas except where the obligation is voluntarily assumed by the governing body.

**177.091 Plats made for recording**

Every plat of a subdivision offered for recording shall conform to the following:

(1) It shall be an original drawing made with black permanent drawing ink or veritype process on a good grade linen tracing cloth or with a suitable permanent black drawing ink on a stable base film, a minimum of .003 inches thick, coated upon completion with a suitable plastic material to prevent flaking and to assure permanent legibility or a non-adhered scaled print on a stable base film made by photographic processes from a film scribing tested for residual hypo testing solution to assure permanency. Marginal lines, standard certificates and approval forms

shall be printed on the plat with a permanent black drawing ink. A print or photographic copy of the original drawing shall be submitted with the original drawing.

(2) The size of each sheet shall be determined by the local governing body and shall be drawn with a marginal line, or printed when permitted by local ordinance, completely around each sheet and placed so as to leave at least a one-half ( $\frac{1}{2}$ ) inch margin on each of three (3) sides and a three (3) inch margin on the left side of the plat for binding purposes.

(3) Whenever more than one (1) sheet must be used to accurately portray the lands subdivided, each sheet must show the particular number of that sheet and the total number of sheets included, as well as clearly labeled match lines to show where other sheets match or adjoin.

(4) In all cases, the scale used shall be of sufficient size to show all detail and shall be both stated and graphically illustrated by a graphic scale drawn on every sheet showing any portion of the lands subdivided.

(5) The name of the plat shall be shown in bold legible letters, as stated in Section 177.051 of this chapter. The name of the subdivision shall be shown on each sheet included.

(6) A prominent "north arrow" shall be drawn on every sheet included showing any portion of the lands subdivided. The bearing or azimuth reference shall be clearly stated on the face of the plat in the notes or legend.

(7) Permanent reference monuments shall be placed at each corner or change in direction on the boundary of the lands being platted, however, "PRM's" need not be set closer than three hundred ten (310) feet, but shall not be more than fourteen hundred (1400) feet apart. In all cases there shall be

a minimum of four (4) "PRM's" placed on the boundary of the lands being platted. Where such corners are in an inaccessible place, "PRM's" shall be set on a nearby offset within the boundary of the plat and such offset shall be so noted on the plat. Where corners are found to coincide with a previous set "PRM", the number on the previous set "PRM" shall be shown on the new plat or, if unnumbered, shall so state. It is further stipulated that permanent reference monuments shall be set before the recording of the plat and will be so stated in the surveyor's certificate on the plat. Such "PRM" shall be shown on the plat by an appropriate designation.

(8) "PCP's" shall be set at the intersection of the center line of the right-of-way at the intersection of all streets, at "PC's", "PT's", "PRC's" and "PCC's" and no more than one thousand (1,000) feet apart, on tangent, between changes of direction, or along the street right-of-way or block lines at each change in direction and no more than one thousand (1,000) feet apart. Such "PCP's" shall be shown in the plat by an appropriate designation. In those counties or municipalities that do not require subdivision improvements and do not accept bonds or escrow accounts to construct improvements, "PCP's" may be set prior to the recording of the plat and shall be set within one (1) year of the date the plat was recorded and shall be referred to in the surveyor's certificate. In the counties or municipalities that require subdivision improvements and have the means of insuring the construction of said improvements, such as bonding requirements, "PCP's" shall be set prior to the expiration of the bonds or other surety. It is the land surveyor's responsibility to furnish the clerk or recording officer of the county or municipality his certificate that the "PCP's" have been set and the dates the "PCP's" were set.

(9) Each plat shall show the section, township, and range as applicable or, if in a land grant, the plat will so state.

(10) The name of the city, town, village, county and state in which the land being platted is situated shall appear under the name of the plat as applicable.

(11) Each plat shall show a description of the lands subdivided and the description shall be the same in the title certification. The description must be so complete that from it, without reference to the plat, the starting point and boundary can be determined.

(12) The dedications and approvals required by sections 177.071 and 177.081, Florida Statutes.

(13) The circuit court clerk's certificate and the Land Surveyor's certificate and seal.

(14) All section lines and quarter section lines occurring in the map or plat shall be indicated by lines drawn upon the map or plat, with appropriate words and figures. If the description is by metes and bounds, the point of beginning shall be indicated together with all bearings and distances of the boundary lines. If the platted lands are in a land grant or are not included in the subdivision of government surveys, then the boundaries are to be defined by metes and bounds and courses. The initial point in the description shall be tied to the nearest government corner, or other recorded and well established corner.

(15) Location, width and names of all streets, waterways or other rights-of-way shall be shown, as applicable.

(16) Location and width of easements shall be shown on the plat or in the notes or legend and their intended use shall be clearly stated.

(17) All contiguous properties shall be identified by subdivision title, plat book and page or, if unplatted, land shall be so designated. If the subdivision platted is a resubdivision of a part or the whole of a previously

recorded subdivision, sufficient ties shall be shown to controlling lines appearing on the earlier plat to permit an overlay to be made; the fact of its being a resubdivision shall be stated as a subtitle following the name of the subdivision wherever it appears on the plat.

(18) All lots shall be numbered either by progressive numbers or, if in blocks, progressively numbered in each block, and the blocks progressively numbered or lettered, except that blocks in numbered additions bearing the same name may be numbered consecutively throughout the several additions.

(19) Block corner radii dimensions shall be shown.

(20) Sufficient survey data shall be shown to positively describe the bounds of every lot, block, street easement, and all other areas shown on the plat. When any lot or portion of the subdivision is bounded by an irregular line, the major portion of that lot or subdivision shall be enclosed by a witness line showing complete data with distances along all lines extended beyond the enclosure to the irregular boundary shown with as much certainty as can be determined or as "more or less" if variable. Lot, block, street and all other dimensions except to irregular boundaries, shall be shown to a minimum of hundredths of feet. All measurements shall refer to horizontal plane and in accordance with the definition of a foot or meter adopted by the United States Bureau of Standards.

(21) Curvilinear lots shall show the radii are distances, and central angles, or radii, chord and chord bearing, or both. Radial lines will be so designated. Direction of non-radial lines shall be indicated.

(22) Sufficient angles, bearings or azimuth to show direction of all lines and all bearings, or angles or azimuth shall be shown

to the nearest second of arc.

(23) The centerlines of all streets shall be shown with distances, angles, or bearings or azimuth, "PC's," "PT's," "PRC's," "PCC's" are distance, central angles, tangents, radii or chord, and chord bearing or azimuth or both.

(24) Park and recreation parcels as applicable shall be so designated.

(25) All interior excepted parcels shall be clearly indicated and labeled "Not a part of this plat."

(26) The purpose of all areas dedicated must be clearly indicated or stated on the plat.

(27) Where it is not possible to show curve detail information on the map, a tabular form may be used.

#### **177.101 Vacation and annulment of plats subdividing land**

(1) Whenever it is discovered after the plat has been recorded in the public records that the developer has previously caused the lands embraced in the second plat to be differently subdivided under and by virtue of another plat of the same identical lands, and the first plat was also filed of public record at an earlier date, and no conveyances of lots by reference to the first plat so filed appears of record in such county, the governing body of the county is authorized and directed to and shall, by resolution, vacate and annul the first plat of such lands appearing of record, upon the application of the developer of such lands under the first plat or upon application of the owners of all the lots shown and designated upon the second and subsequent plat of such lands and the circuit court clerk of the county shall thereupon make proper notation of the annulment of such plat upon the face of such annulled plat.

(2) Whenever it is discovered that after the filing of a plat subdividing a parcel of land located in the county, the developer of the lands therein and thereby subdivided did cause such lands embraced in said plat, or a part thereof, to be again and subsequently differently subdivided under another plat of the same and identical lands or a part thereof, which said second plat was also filed at a later date; and it is further made to appear to the governing body of the county that the filing and recording of the second plat would not materially affect the right of convenient access to lots previously conveyed under the first plat, the governing body of the county is authorized by resolution to vacate and annul so much of the first plat of such lands appearing of record as are included in the second plat, upon application of the owners and developer of such lands under the first plat or their successors, grantees or assignees and the circuit court clerk of the county shall thereupon make proper notation of the action of the governing body upon the face of the first plat.

(3) The governing body of the counties of the state may adopt resolutions vacating plats in whole or in part of subdivisions in said counties, returning the property covered by such plats either in whole or in part into acreage. Before such resolution of vacating any plat either in whole or in part shall be entered by the governing body of a county it must be shown that the persons making application for said vacation owns the fee simple title to the whole or that part of the tract covered by the plat sought to be vacated and it must be further shown that the vacation by the governing body of the county will not affect the ownership or right of convenient access of persons owning other parts of the subdivision.

(4) Persons making application for vacations of plats either in whole or in part shall give notice of their intention to apply to the governing body of the county to vacate



said plat by publishing legal notice in newspaper of general circulation in the county in which the tract or parcel of land is located in not less than two weekly issues of said paper and must attach to the petition for vacation the proof of such publication, together with certificates showing that all state and county taxes have been paid; provided, that if such tract or parcel of land is within the corporate limits of any incorporated city or town the governing body of the county shall be furnished with certified copy of resolution of the town council or city commission, as the case may be, showing that they have already by suitable resolution vacated such plat or subdivision or such part thereof sought to be vacated.

(5) Every such resolution by the governing body shall have the effect of vacating all streets and alleys which have not become highways necessary for use by the traveling public; and provided, that such vacation shall not become effective until certified copy of such resolution has been filed in the offices of the circuit court clerk and duly recorded in the public records of said county.

(6) All resolutions vacating plats by the governing body of a county prior to the effective date of this act are hereby validated, ratified, and confirmed. Such resolutions shall have the same effect as if the plat had been vacated after the effective date of this act.

#### **177.111 Instructions for filing plat**

After the approval by the appropriate governing bodies required by section 177.071 the plat shall be submitted to the circuit court clerk or other recording officer for his acceptance and recording. The circuit court clerk or other recording officer shall maintain in his office in a book of the proper size for such papers so that they shall not be folded, and kept in the vault. A print or photographic copy on cloth shall be filed in a similar book and kept in his office for the use of the public. The clerk shall make

available to the public a full size copy of the record plat at a reasonable fee.

#### **177.121 Misdemeanor to molest monument or deface or destroy map or plat**

It is a misdemeanor for any person or persons to molest any monuments established according to this chapter, or to deface or destroy any map or plat placed on public record.

#### **177.131 Recordation of the department of transportation official right-of-way maps and other governmental right-of-way maps**

(1) The circuit court clerk of a county shall record in the public land records of the county any map prepared and adopted by the department of transportation or any other governmental entity as its official right-of-way map after the same has been approved by the appropriate governmental authority. The clerk shall use special plat books provided by the appropriate governmental authority for such maps, and which shall be kept with other plat books. The clerk shall make available to the public a full size copy of the right-of-way maps at a reasonable fee.

(2) Sections 177.011 through 177.121 of this act are not applicable to this section. Upon request of the clerk, the department of transportation shall furnish without charge a reproducible copy of its right-of-way maps.

#### **177.141 Affidavit confirming error on a recorded plat**

In the event an appreciable error or omission in the data shown on any plat duly recorded under the provisions of this act is detected by subsequent examination or revealed by a retracement of the lines run during the original survey of the lands shown on such recorded plat, the land surveyor who was responsible for the survey and the preparation of the plat as recorded may file an affidavit



confirming that such error or omission was made. However, the affidavit must state that he has made a re-survey of the subject property in the recorded subdivision within the last ten (10) days and that no evidence existed on the ground that would conflict with the corrections as stated in the affidavit. The affidavit shall describe the nature and extent of such error or omission and the appropriate correction that in his opinion should be substituted for the erroneous data shown on such plat or added to the data on such plat. Where such an affidavit is filed, it is the duty of the circuit court clerk to record such affidavit and he may place in the margin of such recorded plat a notation that the affidavit has been filed, the date of filing, and the book and page where it is recorded. The affidavit shall have no effect upon the validity of the plat or on the information shown thereon.

#### 177.151 State plane coordinate

(1) Coordinates may be used to define or designate the position of points on the surface of the earth within the state for land descriptions and subdivision purposes provided the initial point in the description shall be tied to the nearest government corner, or other recorded and well established corner. The plane coordinates of a point on the earth's surface, to be used in expressing the position or location of such point in the appropriate projection and zone system, shall consist of two (2) distances, expressed in feet and decimals of a foot. One (1) distance, to be known as the "coordinate," shall give the position in an east and west direction; the other, to be known as the "y-coordinate," shall give the position in a north and south direction. These coordinates shall be made to depend upon and conform to the origins and projections on the Florida Coordinate System and the triangulation and traverse stations of the National Ocean Survey within the state, as those origins and projections have been determined by the said survey. When any tract of land to be defined by a

single description extends from one into the other of the above projections or zones, the positions of all points on its boundary may be referred to either of the zones or projections, the zone and projection being used specifically named in the description.

(2) The position of points on the Florida Coordinate System shall be as marked on the ground by triangulation or traverse stations established in conformity with standards adopted by the National Ocean Survey for first-order and second-order work, whose geodetic positions have been rigidly adjusted on the North American datum of 1927, and whose coordinates have been computed on the system herein defined. Any such station may be used for establishing a survey connection with the Florida Coordinate System.

(3) No coordinates based on the Florida Coordinate System, purporting to define the position of a point on a land boundary, shall be presented to be recorded in any public land records or deed records unless such point is within one half ( $\frac{1}{2}$ ) mile of a triangulation or traverse station established in conformity with the standards described in section 177.031(19), Florida Statutes, provided that the said one half ( $\frac{1}{2}$ ) mile limitation may be waived when coordinates shown are certified as having been established in accordance with National Ocean Survey requirements and procedures for first or second-order work by a surveyor licensed in the state. This certification of order-of-accuracy must be included in the description of the land involved.

(4) The use of the term "Florida Coordinate System" on any map, report of survey, or other document shall be limited to coordinates based on the Florida Coordinate System as defined in this act.

(5) Wherever coordinates based on the Florida Coordinate System are used to describe a tract of land which in the same document is also described by reference to any

subdivision, line or corner of the United States public land surveys, the description by coordinates shall be construed as supplemental to the basic description of such subdivision, line or corner contained in the official plats and field notes of record and in the event of any conflict the description by reference to the subdivision, line or corner of the United States public land survey shall prevail over the description by coordinates.

(6) Nothing contained in this act shall require any purchaser or mortgagee to rely on a description, any part of which depends exclusively upon the Florida Coordinate System.

Section 1A. Section 177.121, Florida Statutes, is created to read:

**177.121 Misdemeanor to molest monument or deface or destroy map or plat**

It is a misdemeanor of the second degree, punishable as provided in sections 775.082 or 775.083, for any person to molest any monuments established according to this chapter, or to deface or destroy any map or plat placed on public record.

**Section 1B.**

In the event CS for HB 935, introduced in the 1971 regular session of the legislature, is enacted into law, section 177.121, Florida Statutes, as published in section 1 of this act will stand repealed and be omitted from the Florida Statutes. In the event CS for HB 935 is not enacted into law, section 1A of this act will stand repealed and be omitted from the Florida Statutes.

**Section 2.**

If any provisions of this act shall be declared invalid, such invalidity shall not affect any other portion of this act which can be given effect without the invalid provisions and to this end the provisions of this act are declared to be severable.

Section 3. Sections 177.01, 177.02, 177.03, 177.04, 177.05, 177.06, 177.07, 177.08, 177.09, 177.10, 177.11, 177.12, 177.13, 177.14, 177.15, 177.16, and 177.17, Florida Statutes are repealed.

Section 4. This act shall take effect September 1, 1971.

Approved by the Governor June 28, 1971. Filed in Office Secretary of State June 28, 1971."

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**ACT 333 – UNIFORM FILING FEES**

An excerpt from Act 333 of 1977 has been added to this chapter in this second edition. Attention is called to Section 3(b) which establishes a uniform fee for filing plats and other documents.

"SECTION 3. Section 2 of Act 55 of 1945, as amended, the same being Arkansas Statutes Section 12-1720, is hereby amended to read as follows:

Section 2. The *uniform* fees to be charged by the recorders in the various counties in this State shall be as follows:

(a) For recording deeds, deeds of trust, mortgages, release deeds, power of attorney, and other recordable instruments, except as hereinafter prescribed, \$3.00 for one page (one size only) and \$1.00 for each additional page.

(b) For filing or recording all other instruments than those prescribed in subsection (a) hereof which are normally placed of record in the recorder's office:

(1) Plats: When measurements exceed 8-1/2 x 14, \$5.00

(2) Survey plats 8-1/2 x 14 or smaller, \$3.00

- (3) Materialman's lien and certificate of assessment, \$3.00
- (4) Notary bond, \$3.00
- (5) Judgments (Foreign), \$3.00
- (6) Writs of garnishment or execution of garnishment, \$4.00
- (7) For entering satisfaction of record (marginal) \$.50."

SECTION 4. The appropriate fee prescribed herein shall be in lieu of the fee prescribed in Section 12 of Act 146 of 1895 (Ark. Stats. 51-614) for filing mechanics and materialmen's liens, and in lieu of the fee prescribed in Section 14 of Act 130 of 1933 (Ark. Stats 51-814) for filing medical, nursing and hospital liens, and in lieu of the fee prescribed in Section 1 of Act 56 of 1891 (Ark. Stats. 29-130) for filing judgments to establish judgment liens on lands, and in lieu of the fee prescribed in Section 11 of Act 94 of 1941 (Ark. Stats. 72-814) for recording licenses of optometrists."

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As was stated earlier in this chapter, it

would be impossible for a work of this nature to include all of the problems and situations which face the land surveyor in drawing an accurate legal description and preparing a proper plat of a survey. However, the information contained herein has been carefully selected in order to present in condensed form as much practical information as is possible for the use of Arkansas land surveyors; however, a word of caution, statutes and court decisions have a habit of being changed over the years and the history of Arkansas is filled with cases of where what was law at one time in the past is no longer necessarily the law at present. For example, Chapter VII of this handbook points out clearly the current law concerning the functions of county surveyors who are not registered land surveyors. However, in Section 235 of "Arkansas Titles to Real Property", if read out of context appears to be in conflict with later laws and decisions and without updating would lead one to believe that only the county surveyor can prepare surveys. Thus again, we find the extreme importance of obtaining accurate and current legal advice in many cases.

One of the principal objectives of our profession in Arkansas should be to prepare and have passed a model plat law which will be of great value to the public as well as to the surveying profession and it is hoped that this will be accomplished in the near future.

The importance of the coordinate system in land surveys cannot be over emphasized. Grimes, in his excellent book *Clark on Surveying and Boundaries*, says:

"Just as there is but one point on the surface of the earth corresponding to a stated geographical position, so too there is but one point corresponding to a given pair of plane (x, y) coordinates on definite plane projection. In triangulation, *when all surface marks at a station have disappeared*, it is very effective practice to reproduce on the ground by surveys from other stations the coordinate position of the sought-for point, and on digging there, to recover the underground mark. Old stations are recovered in this way, some after apparently being lost for many years. The plane coordinate systems merely afford a simple means of utilizing geodetic data."

It is particularly interesting to note the statement *in italics* that it is a very effective practice to reproduce on the ground by surveys from other stations the coordinate position of the sought-for point. This can certainly be applied to land corners to which have been located, monumented and are at the present time well known in so far as their location is concerned. However, as has been shown in the past the time and activities of man have the effect of destroying or losing these monuments, and even the much more durable monuments being set by the present day surveyor are often lost and need to be re-located. Certainly, with an adequate plane coordinate system, the job of the surveyor in relocating this corner and placing it in it's exact same location becomes greatly simplified.

Unfortunately, the cost of establishing coordinate positions on section corners in the past and even to a great extent at the

present time has been excessive since in many cases a geographic position which could be related to a plane coordinate system might be a considerable distance away and would require a great deal of time and expense to run the necessary lines or triangulation to tie the point to a known position. However, as land becomes more and more valuable and as the requirements for accuracy in surveys become more important, it is anticipated that the plane coordinate system will become more and more used. For example, the monumentation of boundaries of government reservoirs and government preserves within the State of Arkansas are often tied to plane coordinate systems and present an opportunity for land surveyors to obtain coordinates on their section corners which they may locate or reestablish through field methods. Because of the difficulty in establishing geodetic coordinates due to the curvature of the earth a plane coordinate system has been established for each of the states in the United States by the Coast and Geodetic Survey. Included in this chapter is a pamphlet on plane coordinate systems which describes the difficulties in using spherical coordinates and the use of plane coordinates as an alternative. Also enclosed in this chapter is Act 424 of the Acts of Arkansas which describes, defines and officially adopts a system of coordinates per designating the positions of points on the surface of the earth within the State of Arkansas and for other purposes. This Act was approved on March 28, 1957, and although the Act has been in effect for 18 years at the time of the writing of this manual, very little use has been made of the plane coordinate system in connection with land surveys. The reason for this is explained in *Clark on Surveying and Boundaries* as follows:

"Plane Coordinates. There has been little use of geodetic methods and data in local surveys in this country because of the special training and equipment



required, and because of the greater cost over the ordinary methods of land surveying. Such use as has been made of geodetic data has largely been through the medium of plane coordinates — the geographic coordinates being projected onto a plane and used in the form of plane (x & y) coordinates. Sometimes only one triangulation station and the meridian through it were used to fix the origin and axes of the local system. Such procedure was not very satisfactory because accurate results could be had for only a few miles out from the origin of the coordinate system, and it would be necessary to use several projections to cover a fairly large survey."

However, with the passage of Act No. 424, the use of plane coordinates and much of the detailed work involved in the computation, has been accomplished by the Coast and Geodetic Survey. In view of the nature and potential for the use of plane coordinate systems there has been included in this manual a paper presented by Mr. James E. Newman at the Seventh Annual Convention of the Arkansas Association of Registered Land Surveyors in Little Rock, Arkansas on April 18–20, 1974. This paper explains in detail for those who are interested in the derivation of plane coordinates, the methods and computations needed to project geographic positions onto the plane coordinate system. Also, included as a part of the appendix to this handbook is a pamphlet prepared by the United States Department of Commerce Coast and Geodetic Survey entitled 'Plane Coordinate Projection Tables' for Arkansas (Lambert) Special Publication No. 289. This booklet contains all the data necessary for the computation of plane coordinates in the State of Arkansas. However, because of the problems of terrain within the state, the Arkansas Highway Department has prepared a report on data adjustment to establish from the state plane coordinate system, the Arkansas State Highway plane coordinate system which is one of the broadest uses of plane coordinates

at the present time in the state. In order to better understand the methods used by the Highway Department, a copy of this report is also included.

While it is recognized that considerable work must be done before universal use of plane coordinates will be accepted within the State of Arkansas, it is felt that the inclusion of this data in this manual will be of assistance to those surveyors who find themselves in the position where they can tie their surveys to the plane coordinate system, thereby, preserving (with proper recordation) the location of the corner in perpetuity. The geographic position as well as the plane coordinates of monuments and stations in the State of Arkansas are available in the Land Survey Division.

U. S. Department of Commerce  
Coast and Geodetic Survey  
Serial No. 562

## PLANE—COORDINATE SYSTEMS

### Introduction

What means can be employed to simplify the task of the local cadastral surveyor and the engineer making surveys for public works or for projects of a private character? For practically all such surveys the computations are made as if the region involved were a plane, and the results are thus based on a local plane-coordinate system. This is satisfactory when the work is limited to a very restricted area, but when extensions of the surveys are made to surrounding areas trouble is apt to arise. Two adjoining local systems can be coordinated only with a great deal of extra computation. It seemed advisable therefore to give study to the possibility of establishing plane-coordinate systems for more extended areas, so as to provide the advantages of plane coordinates and at the same time to make possible a perfect coordination of the work of different engineers throughout the whole region for which one system is adequate.



### Difficulties in Using Spherical Coordinates

The surface of the earth is not a plane but is very irregular. For purposes of mapping, an ideal surface is assumed that approaches very nearly to what it would be if the entire surface were covered with water. This assumed surface is not even a sphere but is an ellipsoid of revolution, since this shape is the one that approaches most nearly the sea-level surface. This spheroidal shape introduces complications in the calculations of survey work when it is extended over a large area. Geodetic surveying is exactly such extensive work, and all computations arising in it have to take into consideration this assumed spheroidal shape which fits closely the actual shape of the earth. All geodetic stations on the earth have to be located by latitude and longitude; that is, each one is referred to a definite place in the network of meridians and parallels that are assumed to cover the surface of the earth in a definite and standardized way. The longitude and latitude of a place on the curved surface of the earth thus corresponds in a general way to the  $x$  and  $y$  coordinates of a place on the usual system of plane coordinates which presupposes a flat surface. But the  $x$  and  $y$  coordinates of the ordinary plane system have no relation to anything but the assumed origin and the assumed directions of the  $X$  and  $Y$  axes. Much would be gained if these coordinate systems could be made parts of a more extensive system based on a definite relationship with the meridians and parallels of the earth.

### Unit of Area for Plane-Coordinate Systems

In the consideration of plans for the establishment of coordinate systems, the first question to be settled was the unit of area to be used for a single system. Since the earth's surface is curved, no part of it can be represented on a plane without distortions and discrepancies entering into the computations. At first, county units were contemplated but it was seen that this would not give systems of sufficient extent. Some States under such

an arrangement would have 50 or more separate systems which would be continually giving trouble in the matter of coordination. The ideal unit is, of course, a State. If the State is not too large, it is possible to use a single system for it that meets the requirements in all respects.

### Limits for State Systems

What can be done for a State depends upon its size, the shape of its area, and the direction of its greatest dimension. A State of greatest extent in an east-west direction and a width not greater than 158 miles in a north-south direction can have a system of plane coordinates with variations of scale limited to one part in 10,000. Also, a State with greatest extent in a north-south direction and with a width not more than 158 miles in the east-west direction can be fitted with a system with the same limitations of scale discrepancies. These discrepancies are well within the accuracy of general local surveys, so such State systems can be used in the same way as are ordinary plane coordinates in the computation of surveys.

### Possibility for Greater Extension

Fortunately it is not necessary to confine a single system to even the limitations specified above. When the coordinate system is based on a definite system of projection, the scale distortion becomes known for all parts of the region. This is a definite factor that can easily be applied so as to make the computations practically as accurate as are those in geodetic work. Even if distortions of scale become as great as one part in 5,000, or more, they can be taken into consideration and a high accuracy can still be maintained. This gives the possibility of using a single system for almost any of the States. It was found best, however, to divide each of the larger States into two or more zones or sections. The boundary between the sections was taken as a zigzag line following county boundaries. The advantage of having

a plane-coordinate system with very small scale factors is that the factors can be ignored except for special surveys requiring great accuracy.

### Geodetic Control Surveys

A vast system of control framework has been established by the Coast and Geodetic Survey and stations of this network are available in every State for use in controlling regional and local surveys. There are something over 40,000 well-marked control stations distributed throughout the country and a larger number of intersection stations such as water tanks, church spires, forest lookout towers, etc. It is hoped that soon every point in the country will be within 20 or 25 miles of a control station. This distance will be reduced to a maximum of 10 or 12 miles as rapidly as appropriations of funds permit. If local surveys are made and fitted into this control, they can then serve as control for further work in the same region. All of the triangulation stations are well marked and full descriptions of them are available, so that any surveyor, after securing the necessary data, can easily locate them on the ground. The locations of these points are given by longitude and latitude, and they may now also be referred to a system of plane coordinates and their positions given in the  $x$  and  $y$  coordinates of the system. It is thus an easy matter to make use of them for any local survey.

### Method of Using Control

The Coast and Geodetic Survey is computing the plane coordinates of all of its triangulation stations and is making the results available for local use. Most of the triangulation stations have an azimuth mark that is visible from the ground at the station. The azimuth of this mark on the plane-coordinate system is furnished as a part of the data, and a traverse may be started from the station by turning off an angle from this mark to the first station of the traverse. Then, when

the lengths of the traverse have been measured, together with the angles at the various stations, the whole may be computed directly on the plane with  $x$  and  $y$  coordinates for each of the stations. If the traverse ends on another control point, a check may be obtained on the angle measurements by means of the plane-coordinate azimuth on the azimuth mark at this end point and also a check on all measurements by seeing whether the  $x$  and  $y$  coordinates computed through the traverse agree with the fixed  $x$  and  $y$  of the end station. The discrepancy due to the failure to check, if within allowable limits, may then be distributed throughout the traverse and the survey will thus be coordinated with the general control survey.

### Kind of Projection to be Used

When the greatest extent of a State is in an east-and-west direction with comparative narrow width in a north-and-south direction, use has been made of the Lambert conformal conic projection with two parallels held true to scale. Along these two standard parallels the scale is exact; between them the scale is too small and outside of them the scale is too large. This gives a balance of scale over the projection and makes it possible to cover a greater extent of latitude. At each point the scale is the same in all directions but only for infinitesimal distances. Along a given parallel the scale is constant but it varies from parallel to parallel. A table of these scale variations has been computed for every minute of latitude, so that these variations may be taken into consideration in any computations and full allowance made for them. The computations may thus be very accurate in all parts of the projection.

When the greatest extent of a State is in a north-and-south direction with limited width in an east-and-west direction, use has been made of the transverse Mercator projection. This is the well-known Mercator projection, but now related to a meridian

in the same way as it is ordinarily related to the Equator. To bring about a balance of scale in this case, the scale is reduced a certain amount in the center of the projection, thus providing for holding the scale along two small circles of the earth parallel to the meridian. The scale then is constant along any small circle parallel to the central meridian but varies with the distance from this meridian. A table of these scale factors, given for every 5,000 feet, is included with the table for the projection and can be used just as the one for the Lambert system, except that the variation depends upon the distance from the central meridian.

These are the two most useful projections to be employed for plane-coordinate systems, but others could be used in certain cases. The stereographic projection could be employed to advantage for a small circular area, but no actual State is of that shape. With this projection the scale is constant along small circles concentric with the center of the projection. The table of scale factors would thus be more troublesome to apply and hence would not be as useful as in the case of either of the other two types. All three of these projections are conformal and hence the angles are true on the projection. This is important, since survey work makes much use of angles. It would be advisable, therefore, to make use of one of these three projections in all cases where plane-coordinate systems are to be established.

It can be seen that plane-coordinate systems are special cases of general map coordinates. Any projection that is used for extensive maps could be used as the basis of a plane-coordinate system. However, the conformal projections are chosen because of their peculiar fitness for such work and because the definite scale discrepancies make it possible to carry out the computations with practically any degree of exactness.

### List of States With Their Respective Grids

Tables have been computed and lithographed for all of the 48 States with the following arrangement of systems and zones:

#### *Lambert System*

1. Arkansas, 2 zones.
2. California\*, 7 zones.
3. Colorado, 3 zones.
4. Connecticut\*, 1 zone.
5. Iowa, 2 zones.
6. Kansas, 2 zones.
7. Kentucky, 2 zones.
8. Louisiana\*, 2 zones.
9. Maryland\*, 1 zone.
10. Massachusetts\*, 2 zones.
11. Minnesota\*, 3 zones.
12. Montana, 3 zones.
13. Nebraska, 2 zones.
14. North Carolina\*, 1 zone.
15. North Dakota, 2 zones.
16. Ohio\*, 2 zones.
17. Oklahoma, 2 zones.
18. Oregon\*, 2 zones.
19. Pennsylvania\*, 2 zones.
20. South Carolina, 2 zones.
21. South Dakota\*, 2 zones.
22. Tennessee\*, 1 zone.
23. Texas\*, 5 zones.
24. Utah, 3 zones.
25. Virginia\*, 2 zones.
26. Washington\*, 2 zones.
27. West Virginia, 2 zones.
28. Wisconsin, 3 zones.

\* The use of the State plane-coordinate system in recording land surveys has received approval by legislative enactment in this State.

#### *Transverse Mercator System*

1. Alabama\*, 2 zones.
2. Arizona, 3 zones.
3. Delaware\*, 1 zone.
4. Georgia\*, 2 zones.
5. Idaho, 3 zones.
6. Illinois, 2 zones.

7. Indiana\*, 2 zones.
8. Maine\*, 2 zones.
9. Michigan, 3 zones.
10. Mississippi, 2 zones.
11. Missouri, 3 zones.
12. Nevada\*, 3 zones.
13. New Hampshire, 1 zone.
14. New Jersey\*, 1 zone.
15. New Mexico, 3 zones.
16. Rhode Island\*, 1 zone.
17. Vermont\*, 1 zone.
18. Wyoming, 4 zones.

#### *Both Systems*

1. Florida, Lambert 1 zone. Transverse Mercator, 2 zones.
2. New York\*, Lambert 1 zone. Transverse Mercator, 3 zones.

#### **Usefulness of the Systems**

The establishment of plane-coordinate systems not only simplifies the use of control data, but it gives a permanent general grid useful for many purposes. County boundaries, township boundaries, property boundaries, intersections of roads and streets, and any prominent features of a region can be accurately located with definite  $x$  and  $y$  coordinates. In the general system these plane coordinates can readily be transformed into latitude and longitude, and the point can thus be definitely located in the network of and parallels that serve to locate points on the earth's surface. If the marker at such a point should in some way be destroyed, it could be definitely relocated on the ground from its relation to other marked points. This is a very important characteristic and one that should be given due consideration by all engineers and surveyors.

#### **Importance of Plane Coordinates**

Those in position to judge of the matter, consider the establishment of these general systems of plane coordinates to be of the

utmost importance to State, city, county, and private engineers. It immediately makes the general control network of the country readily available for actual use by the field surveyor and this is enough to convince any who are interested in such matters that the method is an important advance in the interest of local surveys.

#### **Reference**

For further information regarding the application of the State plane-coordinate systems to local surveys the reader is referred to United States Coast and Geodetic Survey Special Publication No. 235, "The State Coordinate Systems," which can be purchased from the Superintendent of Documents, Washington 25, D. C.

\* The use of the State plane-coordinate system in recording land surveys has received approval by legislative enactment in this State.

\* \* \* \* \*

#### **ACT 424**

**"AN ACT** to Describe, Define, and Officially Adopt a System of Coordinates for Designating the Position of Points on the Surface of the Earth, Within the State of Arkansas; and for Other Purposes.

*Be It Enacted by the General Assembly of the State of Arkansas:*

**SECTION 1.** The system of plane coordinates which has been established by the United States Coast and Geodetic Survey for defining and stating the positions or locations of points on the surface of the earth within the State of Arkansas is hereafter to be known and designated as the "Arkansas Coordinate System."

For the purpose of the use of this system the state is divided into a "North Zone" and a "South Zone".



The area now included in the following counties shall constitute the North Zone: Baxter, Benton, Boone, Carroll, Clay, Cleburne, Conway, Craighead, Crawford, Crittenden, Cross, Faulkner, Franklin, Fulton, Greene, Independence, Izard, Jackson, Johnson, Lawrence, Logan, Madison, Marion, Mississippi, Newton, Perry, Poinsett, Pope, Randolph, Scott, Searcy, Sebastian, Sharp, St. Francis, Stone, Van Buren, Washington, White, Woodruff and Yell.

The area now included in the following counties shall constitute the South Zone: Arkansas, Ashley, Bradley, Calhoun, Chicot, Clark, Cleveland, Columbia, Dallas, Desha, Drew, Garland, Grant, Hempstead, Hot Spring, Howard, Jefferson, Lafayette, Lee, Lincoln, Little River, Lonoke, Miller, Monroe, Montgomery, Nevada, Ouachita, Phillips, Pike, Polk, Prairie, Pulaski, Saline, Sevier and Union.

SECTION 2. As established for use in the North Zone, the Arkansas Coordinate System shall be named, and in any land description in which it is used it shall be designated, the "Arkansas Coordinate System, North Zone."

As established for use in the South Zone the Arkansas Coordinate System shall be named, and in any land description in which it is used it shall be designated, the "Arkansas Coordinate System, South Zone."

SECTION 3. The plane coordinates of a point on the earth's surface, to be used in expressing the position or location of such point in the appropriate zone of this system, shall consist of two distances, expressed in feet and decimals of a foot. One of these distances, to be known as the "x-coordinate," shall give the position in an east-and-west direction; and the other, to be known as the "y-coordinate," shall give the position in a north-and-south direction. These coordinates shall be made to depend upon and conform to the coordinates, on the Arkansas Coordinate System, of the triangulation and tra-

verse stations of the United States Coast and Geodetic Survey within the State of Arkansas, as those coordinates have been determined by the said Survey.

SECTION 4. When any tract of land to be defined by a single description extends from one into the other of the above coordinate zones, the positions of all points on its boundaries may be referred to either of the two zones, the zone which is used being specifically named in the description.

SECTION 5. (a) For purposes of more precisely defining the Arkansas Coordinate System the following definition by the United States Coast and Geodetic Survey is adopted:

The Arkansas Coordinate System, North Zone, is a Lambert conformal projection of the Clarke spheroid of 1866, having standard parallels at north latitudes of 34 degrees 56 minutes and 36 degrees 14 minutes, along which parallels the scale shall be exact.

The origin of coordinates is at the intersection of the meridian 92 degrees 00 minutes west of Greenwich and the parallel 34 degrees 20 minutes north latitude. This origin as given the coordinates: x equals 2,000,000 feet and y equals 0 feet.

The Arkansas Coordinate System South Zone, is a Lambert conformal projection of the Clarke spheroid of 1866, having standard parallels at north latitudes 33 degrees 18 minutes and 34 degrees 40 minutes, along which parallels the scale shall be exact. The origin of coordinates is at the intersection of the meridian 92 degrees 00 minutes west of Greenwich and the parallel 32 degrees 40 minutes north latitude. This origin is given the coordinates: x equals 2,000,000 feet and y equals 0 feet.

(b) The position of Arkansas Coordinate System shall be as marked on the ground by triangulation or traverse stations established in conformity with standards adopted by the



United States Coast and Geodetic Survey for first-order and second-order work, whose geodetic positions have been rigidly adjusted on the North American datum of 1927, and whose coordinates have been computed on the system herein defined. Any such station may be used for establishing a survey connection with the Arkansas Coordinate System.

SECTION 6. No coordinates based on the Arkansas Coordinate System, purporting to define the position of a point on a land boundary shall be presented to be recorded in any public land records or deed records unless such point is within one-half mile of a triangulation or traverse station established in conformity with the standards prescribed in Section 5 of this Act, provided that said one-half mile limitation may be modified by a duly authorized state agency to meet local conditions.

SECTION 7. The use of the term "Arkansas Coordinate System" on any map, report of survey, or other document, shall be limited to coordinates based on the Arkansas Coordinate System as defined in this Act.

SECTION 8. Wherever coordinates based on the Arkansas Coordinate System are used to describe any tract of land which in the same document is also described by reference to any subdivision, line, or corner of the United States public land surveys, the description by coordinates shall be construed as supplemental to the basic description of such subdivision, line, or corner contained in the official plats and field notes filed of record, and in the event of any conflict the description by reference to the subdivision, line, or corner of the United States public land surveys shall prevail over the description by coordinates.

SECTION 9. Nothing contained in this Act shall require any purchaser or mortgagee to rely on a description, any part of which depends exclusively upon the Arkansas Coordinate System.

SECTION 10. If any provision of this Act or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of the Act which can be given effect without the invalid provision or application, and to this end the provisions of this Act are declared to be severable.

APPROVED: March 28, 1957."

\* \* \* \* \*

## THE USE OF STATE PLANE COORDINATE SYSTEMS

BY JAMES E. NEWMAN

Presented at the Seventh Annual Convention of the AARLS/AS, ACSM, Little Rock, Arkansas, April 18-20, 1974.

### Biographical Sketch

Mr. Newman is a native of Arkansas. He received his formal education in surveying, mapping and photogrammetry at the University of Arkansas, University of Illinois and George Washington University. He retired in 1972 with more than forty years experience in the field of surveying, mapping and applied photogrammetry.

### Abstract

The design and preparation of State Plane Coordinate Systems has made it possible for engineers and surveyors to define by dimensions, the inherent relationship between points on a plane of reference, on a State-wide basis.

For surveying purposes, a system of Plane Coordinates, by zones, has been established for the 50 states and Puerto Rico.

State Plane Coordinates are the results of a mathematical translation of the curved surface of the earth to a plane of reference.

Some of the technical aspects of the State systems and their effects on surveying are discussed.

In 1933, some of our Engineers and Surveyors began to recognize the need for State Plane Coordinate Systems. This need was made known to the National Geodetic Survey, and soon thereafter, a system of plane coordinates was devised for all States. The mathematical solution to the various State Systems was the work of Dr. O. S. Adams, Chief Mathematician, in the Geodesy Division.

By this time, their network of triangulation and traverse stations was of sufficient density to make such systems feasible and economical. Some engineers and surveyors realized that a means of restoring lost or obliterated corners by using existing National Geodetic Survey monuments for starting and closing points was not only desirable, but essential. They further realized that such a system would permit the application of plane surveying methods. It is now standard procedure for the National Geodetic Survey to publish coordinates using the appropriate State System, for all monuments on which geographic positions are determined, and referred to 1927 North American Datum. Many States have adopted the coordinate system by formal recognition by their Legislatures. The National Geodetic Survey is continually working to close gaps in our National System of triangulation and traverses. As these gaps continue to close or become smaller, the State Plane Coordinate Systems will become more economical to use.

The use of the State Plane Coordinate Systems does not require a broad knowledge of geodetic surveying, which is highly specialized, and requires many mathematical calculations and reductions. The average Surveyor may not have training in this specialized field.

I would like to deal briefly with some of

the technical aspects of the State Coordinate Systems.

A representation of just that small part of the Earth's surface covered by any State cannot be projected upon a plane, and at the same time, retain all lines, distances, angles, and areas in true relation to one another. This representation is accomplished by projecting small sections of the Earth that can be developed or flattened into a plane as shown in Figure 1. The commonly used surfaces are the cylinder, cone, and plane, as shown in Figure 2. These surfaces may be tangent to the spheroid or made secant as the cylinder or cone. The selection of either secant or tangent position depends upon the ultimate purpose of the projection. The tangent plane lends itself well to projecting very small areas. The tangent plane is used when small areas to be mapped are too remote from existing monuments to make the use of State Plane Coordinates feasible.

States that are lengthy in a North-South direction but narrow in an East-West direction (which Illinois is a case in point) use a projection that is oriented along selected meridians of longitude. The Transverse Mercator Projection is a typical example. States that are elongated in the East-West direction -- Texas, Tennessee, etc., use a projection that is oriented along selected parallels of latitude, for example, the Lambert Conformal Projection, a type of conic projection.

Mercator's Projection can be visualized as a spheroid projected upon a cylinder with tangency established at the Equator, and with the polar axis of the spheroid in coincidence with the cylinder axis, as was shown in Figure 2. When the cylinder is opened and flattened, a distortion appears in both North-South and East-West directions. In this visualization, the Equator represents a true distance line, and distortions become more pronounced as the distance North and South of the Equator increases. The Transverse Mercator Projection can be transversed by rotating the

axis of the cylinder any desired angle from its coincidence with the Earth's polar axis.

For mapping purposes, the cylinder axis is usually rotated so that it lies in the equatorial plane. If the cylinder is made tangent to some selected meridian of longitude, this meridian reflects true distances, and noticeable distortions occur Eastward and Westward of the meridian of tangency. In projecting maps, the axis of the cylinder is rotated  $90^\circ$ . The cylinder is made elliptical in cross section, and its semidiameters are made smaller than the semidiameters of the Earth spheroid as shown in Figure 3. This cylinder is thus made secant to the spheroid along two lines parallel to the Central Meridian of the projection. The projection is mathematically manipulated to equal the stretch in longitude with the stretch in latitude. Certain mathematical adjustments are made to compensate for scale.

With the application of the Transverse Mercator Projection, the Hemisphere appears distorted at the outer edges when projected upon a cylinder as shown in Figure 4. The two shaded areas show the varying distortion of two equivalent geographic areas on the same projection. Note that both areas extend  $20^\circ$  in latitude and  $20^\circ$  in longitude, within the  $20^\circ$  to  $40^\circ$  North latitude band. The area bounded by the  $60^\circ$  to  $80^\circ$  longitudes is greatly magnified in comparison to the area bounded by the  $0^\circ$  -  $20^\circ$  longitudes. The problem of eliminating or reducing this necessitates modification of the simple Mercator Projection. When the National Geodetic Survey devised the Illinois Plane Coordinate System, they divided the State into two zones, namely: East and West, to reduce the distortion. The Central Meridian for the East zone is  $88^\circ$  -  $20'$ , and  $90^\circ$  -  $10'$  for the West zone. They made these two meridians tangent to an enveloping cylinder. The enveloping cylinder was moved into a secant position, as shown in Figure 3. This causes the radius of the cylinder to become smaller than the radius of the spheroid, and the cylinder to cut the

spheroid along lines A B and D E (East zone) as shown in Figures 5 and 6. The secant condition thereby gains an advantage over the tangent condition, in that two North-South lines become exact distance lines instead of only one true North-South line. These two North-South lines are located 28 miles East and 28 miles West of the Central Meridian for the East zone only. Since the Central Meridian of the two zones is assigned a false Easting value of 500,000 feet, the secant lines have coordinates of 352,160 feet East and 647,840 feet East respectively for the East zone. Figure 7 gives a schematic representation of the scale distortion at any latitude in the East zone. Note that the scale of the intersecting spheroid, and the scale of the intersecting cylinder are represented as being exactly the same along 352,160 feet East and 647,840 feet East, or 28 miles each side the Central Meridian. The Central Meridian is given a scale factor of 0.99997. Then, the scale factor increases from the Central Meridian, Eastwardly and Westwardly to unity in the vicinity of the 28 mile lines, and continues to increase Eastwardly and Westwardly to about 1.0001 at 350,000 feet each side the Central Meridian.

The Lambert Conformal Projection is of the simple conical type in which all meridians are straight lines, that meet in a common point beyond the limits of the map, and the parallels or lines of latitude are concentric circles, whose center is at the point of intersection of the meridians as shown in Figure 8. Meridians and parallels intersect at right angles and the angles formed by any two lines on the earth's surface are correctly represented on this projection. It employs a cone intersecting the spheroid at two parallels known as the standard parallels for the area to be represented. In general, for equal distribution of scale error, the standard parallels are chosen at one-sixth ( $1/6$ ) and five-sixths ( $5/6$ ) of the total length of that portion of the central meridian to be represented. It may be advisable in some localities, or for special reasons, to bring them closer

together in order to have greater accuracy in the center of the map, at the expense of the upper and lower border areas on the two selected parallels, or lines of latitude. Arcs of longitude are represented in their true length, or to exact scale. Between these parallels the scale will be too small, and beyond them too large.

When the Arkansas Plane Coordinate System was devised, the State was divided into two zones, namely: North and South. The Central Meridian for the two zones is  $92^{\circ} 00'$ .

They made this Central Meridian tangent to an enveloping cone. The enveloping cone was moved into a secant position as shown in Figure 8. This creates a similar mathematical condition to that of the cylinder.

Referring back to the Illinois System, you will note in Figure 9 that the scale is reduced at the Central Meridian of both zones. The amount of scale reduction is based on the distance between the points where the cylinder intersects the spheroid. National Geodetic Survey Special Publication No. 303 lists scale correction factors at 5,000-foot intervals each side of the Central Meridians for both zones. This publication also gives a spoon-fed method of converting a geographic position to State Plane Coordinates, and vice-versa. Special Publication No. 289 for Arkansas lists scale correction factors for each minute of latitude for each zone.

Scale factors are applied to ground distances that are measured to an accuracy of second order or higher. For instance, if you were measuring traverse lengths with an electronic measuring device and expecting your traverse to close within second-order limits, these factors along with sea level reduction factors would apply. These combined factors actually convert ground distances to grid or plane distances.

The National Geodetic Survey computes

and publishes Plane Coordinate positions on the appropriate State System for all monuments on which geographic positions are determined. They also publish the angle between geodetic North and grid North. This angle is referred to as delta alpha and theta, for the Transverse Mercator and Lambert Conformal Projection, respectively.

Figure 10 presents some of the elements of the Transverse Mercator Projection. In this representation, the Illinois East zone is considered. The Central Meridian of  $88^{\circ} - 20'$  is both geodetic and grid North. The farther a point falls from the Central Meridian, either East or West, the greater the delta alpha ( $\Delta \alpha$ ) angle becomes.  $X'$  is the distance in feet from the Central Meridian to the point of argument, and delta lambda ( $\Delta \lambda$ ) is the difference in seconds of longitude. Phi ( $\phi$ ) is the latitude of the point, and the origin of the State Coordinate System is  $36^{\circ} - 40'$  or Y zero. The delta alpha angle is determined by the following formula:  $\Delta \alpha = \Delta \lambda \sin \phi$ . Figure 11 presents some of the elements of the Lambert Conformal Projection.

In Figure 12, the plane azimuth of Line A to B is the clockwise angle from grid North to the straight line A B as it appears on the projection. The formula, as shown in Figure 12, computes the plane azimuth from A to B, in which subscript 1 denotes the coordinates of initial point A, and subscript 2 denotes point B. The results of the equated subtraction and division give an angular value of ( $\beta$ ) by interpolating from trigonometric table of natural tangents.

The surveyor who wishes to make use of National Geodetic Survey monuments may do so by using their plane coordinates on the State System. He would not necessarily have to be familiar with geodetic computations by which geographic values are obtained or the mathematics involved in transforming geographic positions to plane coordinates and the inverse. He may start his



survey with State Plane Coordinates and use plane surveying methods for all of his work. The extent to which State Plane Coordinate Systems can be used now or in the future is contingent upon the availability of monuments in the national system.

In actual practice, the Land Surveyor can use one of the National Geodetic Survey monuments which is a point on the State Plane Coordinate System. This point, along with the accompanying azimuth marker will provide a known starting position and grid bearing. If the azimuth marker is destroyed, an astronomical observation must be made. From this point, he can proceed by accurate traversing to the nearest located corner of land which he is to survey, and continues around the land to the initial corner. He can make his computation in about the same way as he would had there been no monument with State Coordinate Values available. The difference is this: He starts with a known position and bearing and takes into account all angles and distances required to tie the land survey to the State System. When the survey and computations are completed, he has obtained a State Plane Coordinate position for each corner of land and has tied his survey to the National System of monuments. His survey can be checked by running a loop or closing on another National Geodetic Survey monument. He could have used any conveniently located monument in the National System and obtained the same coordinates within certain limits. By this method, all land corners are tied to the National System, whose coordinates on a State System are known. The land corner markers such as trees, stones, fence posts, etc., may be destroyed, yet their position can be accurately reestablished from any monument in the National System, which is within reasonable surveying distance, provided the corner to be reestablished has a coordinate value based on the State Coordinate System. As a result, a survey marker or land corner which is described in terms of the State Plane Coordinate System is practically indestructible.

One of the most serious problems that the land surveyor faces today is the obliteration of land corners. All corners are subject to obliteration either willfully or accidentally. The only means yet devised by man to assure the permanence of the position of a land corner, as contrasted with the permanence of the physical object which may mark that position, is an accurate or true relationship of one monument to that of another, by mathematical means.

The State Plane Coordinate System offers a direct and simple solution to this problem. The drawbacks to such a solution are twofold: 1. Lack of any means of giving legal significance to its use in a recorded land description, and 2. As a result of no formal recognition by the State Legislature, the average land surveyor in that State has not accepted its use in actual surveying practices.

There is really nothing new about using State Plane Coordinates, for survey computations and mapping. I have used coordinate systems in surveying and mapping for more than 30 years. Reestablishing obliterated or lost monuments can be accomplished by plane surveying unless there is an absence of National Geodetic Survey monuments comprising a large area.

It should be clearly understood by all concerned that the use of the State Plane Coordinate System in land descriptions does not mean the present method of describing land should be abandoned. State Plane Coordinates may be used as an adjunct or supplement to the present method. State Plane Coordinates may be used to facilitate or expedite the finding of corners described in present forms of descriptions. The State Plane Coordinate System is a means of increasing the certainty, and facilitating the field use of old descriptions, and not to superced them.

I would like to mention briefly a mathematical adjustment that is being applied to



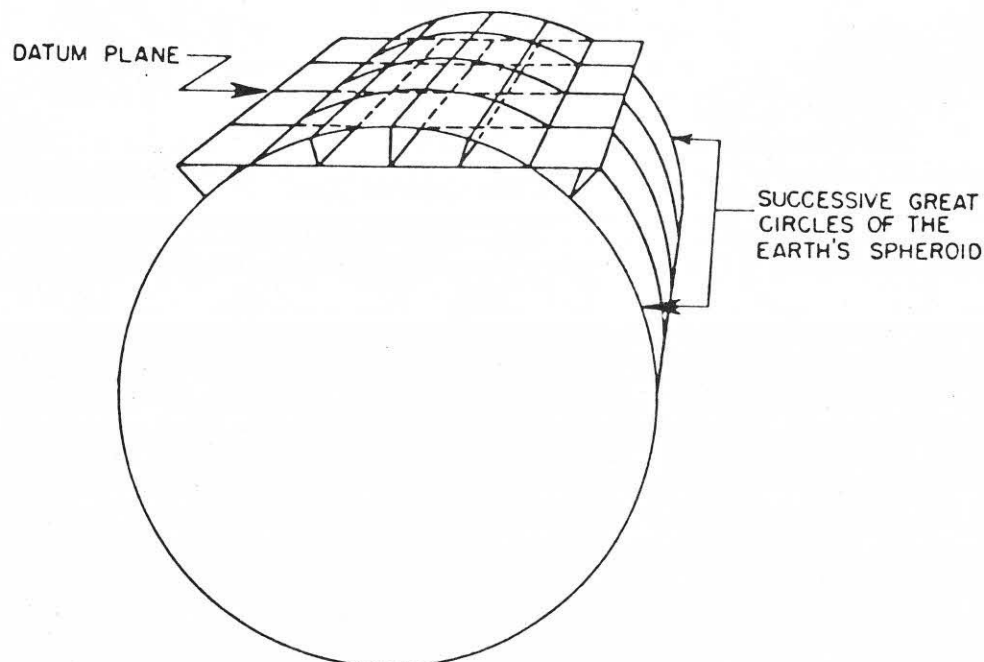
State Systems, referred to as datum adjustments. This simply means raising the initial datum for any one zone a specified amount. For example, if you were to raise the initial datum for the North zone in Arkansas, 2,299 feet the datum adjustment factor becomes 1.001100. Any difference between distances on the ground and on the adjusted datum would not exceed 1:14,300 and would be as small as 1:44,500, considering the zone as a whole. This eliminates the problem of adjusting distances from ground to plane and the inverse.

#### References

1. U. S. Coast and Geodetic Survey "The State Coordinate Systems."
2. Department of the Army Technical Manual TM 5-241.
3. U. S. Coast and Geodetic Survey "The State Plane Coordinate Systems Interpretative Statement." 1964 Revision
4. "Surveying for Civil Engineers" by Phillip Kissam,; McGraw-Hill Book Company, New York
5. "Plane Coordinate Projection Tables," Special Publication No. 289, Arkansas (Lambert) 1953
6. "Plane Coordinate Projection Tables," Special Publication No. 303, Illinois (Transverse Mercator) 1953.

**FIGURE 1 DATUM PLANE**

FORMED BY FLATTENED CYLINDER OR CONE



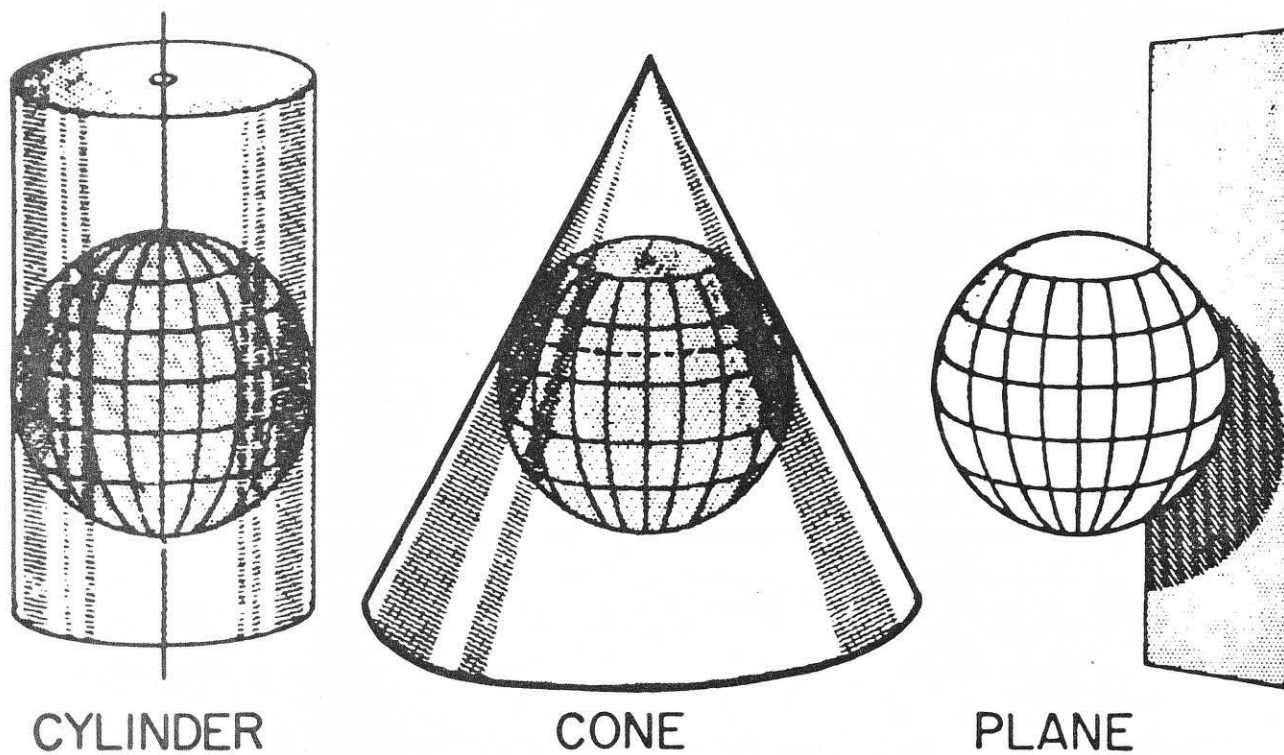


FIGURE 2

CYLINDER, CONE, AND PLANE TANGENT TO A SPHEROID

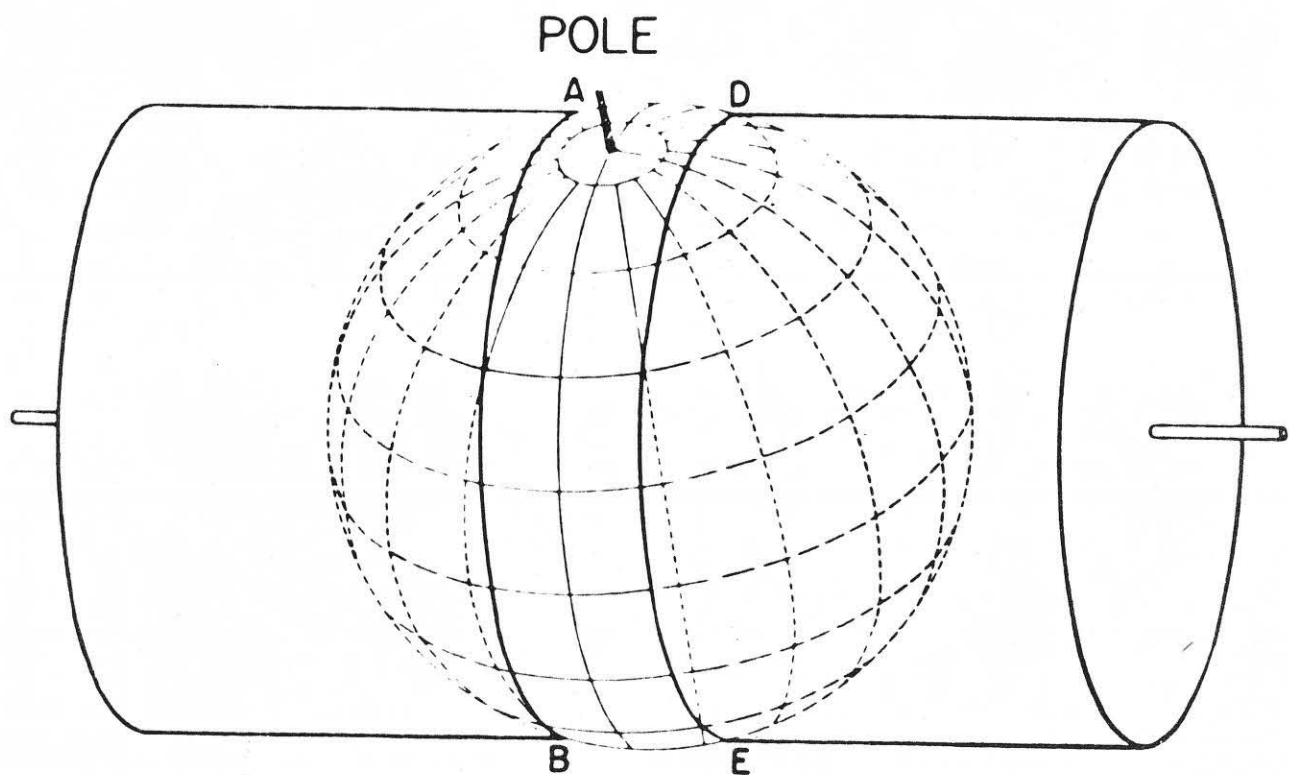


FIGURE 3

CYLINDER MADE SECANT TO A SPHEROID

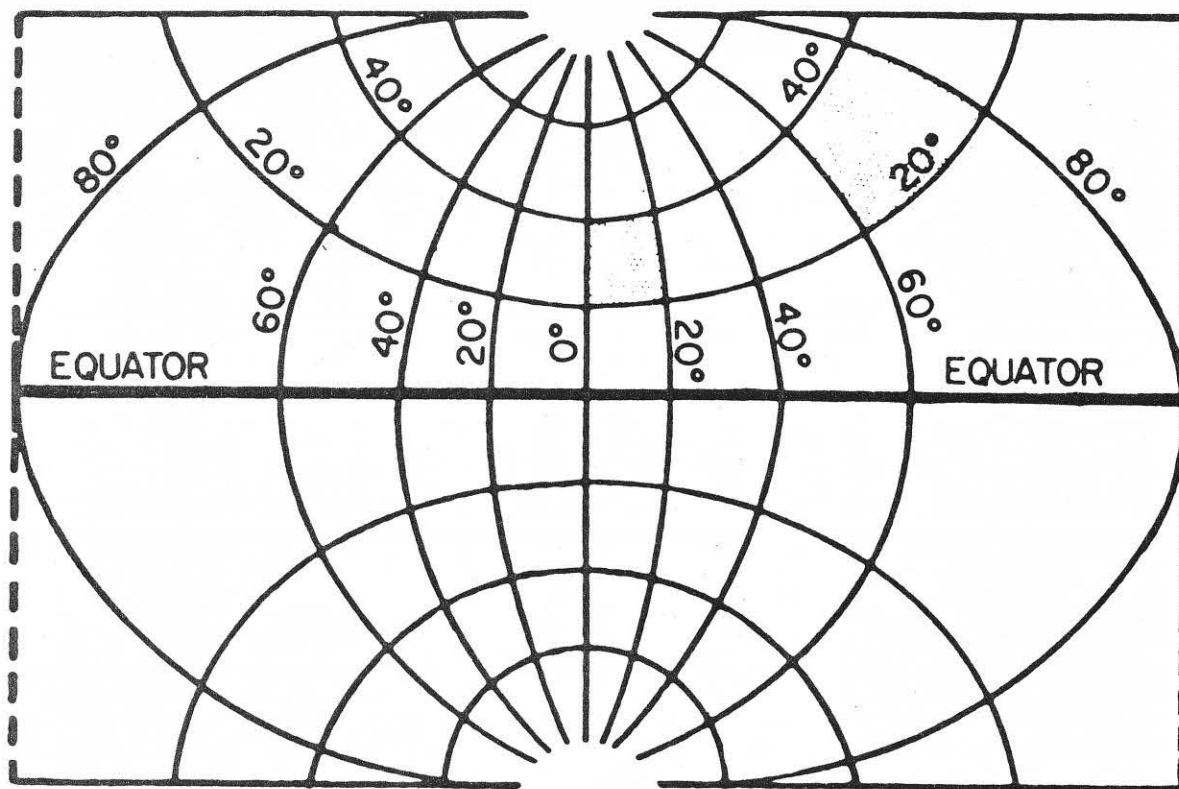


FIGURE 4

HEMISPHERE APPEARS DISTORTED AT THE  
OUTER EDGES.

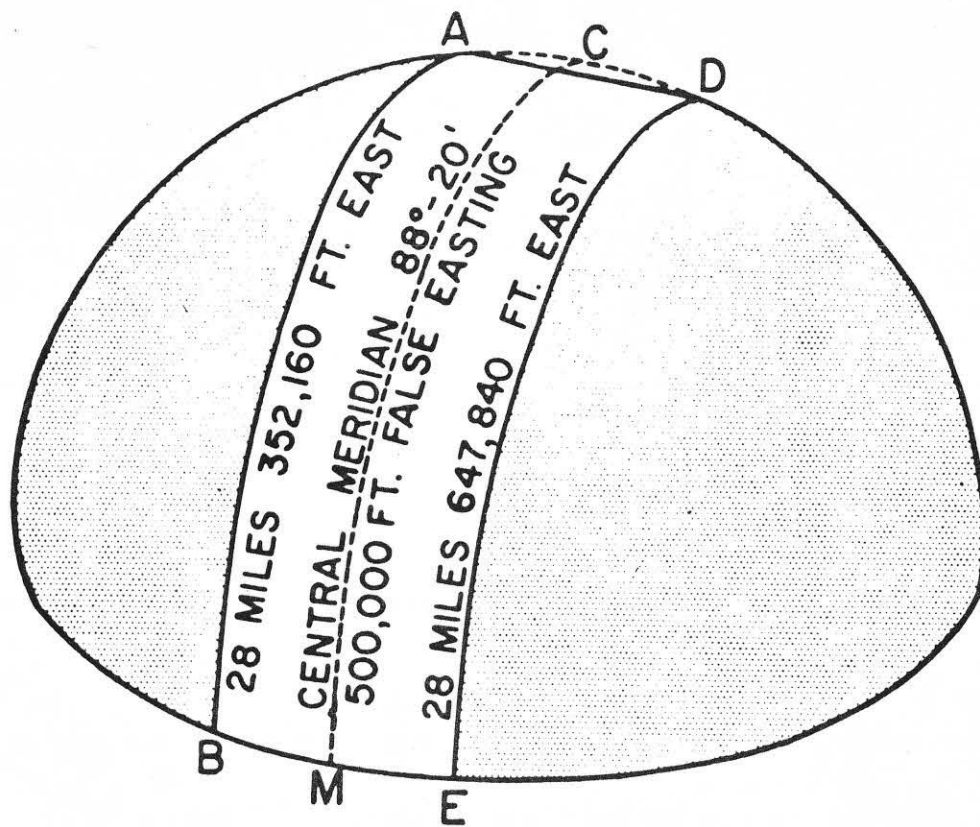


FIGURE 5  
CYLINDER CUTTING A SPHERE



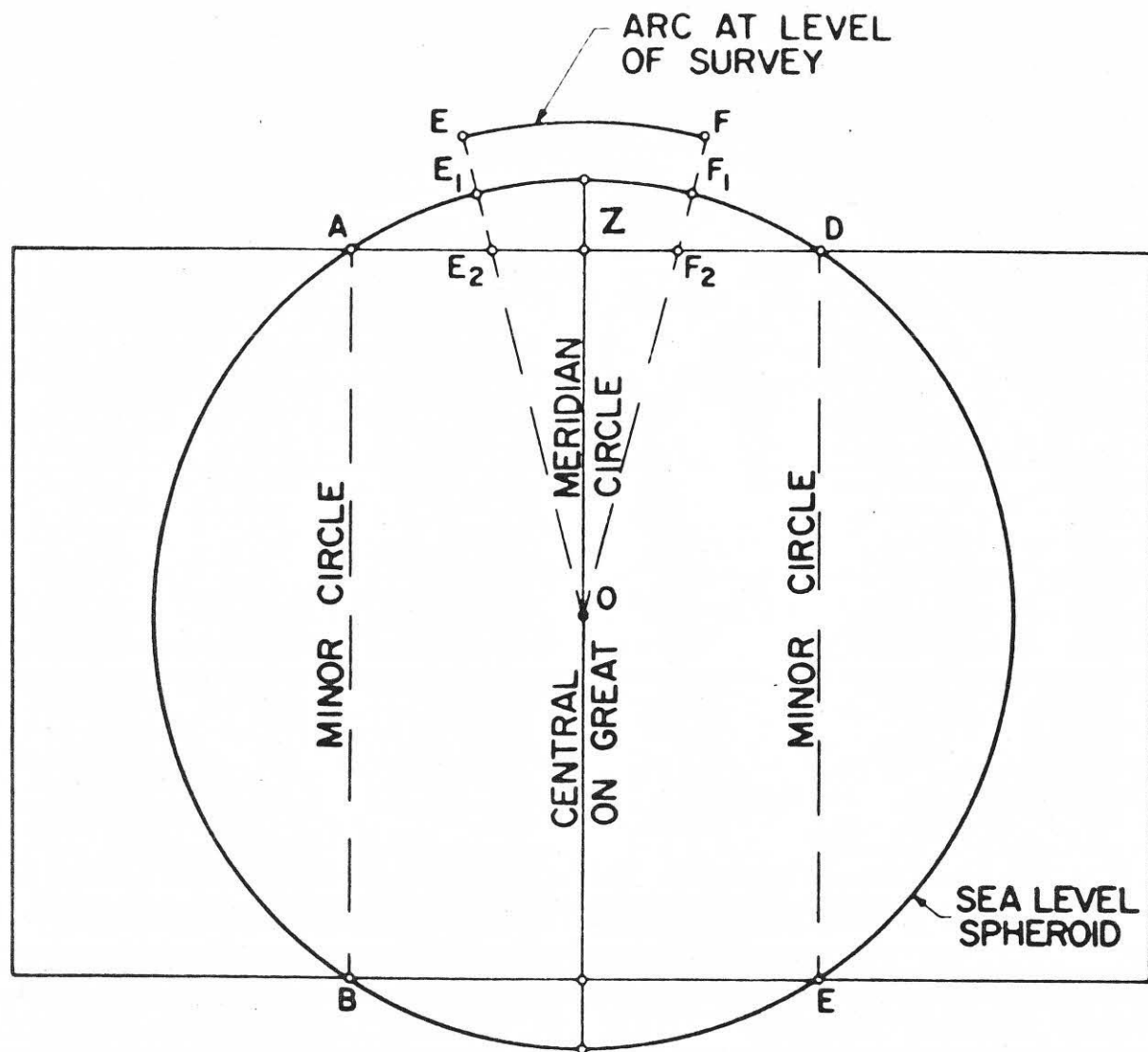


FIGURE 6

TRANSVERSE MERCATOR PROJECTION  
CROSS-SECTION OF INTERSECTION OF CYLINDER AND SPHERE

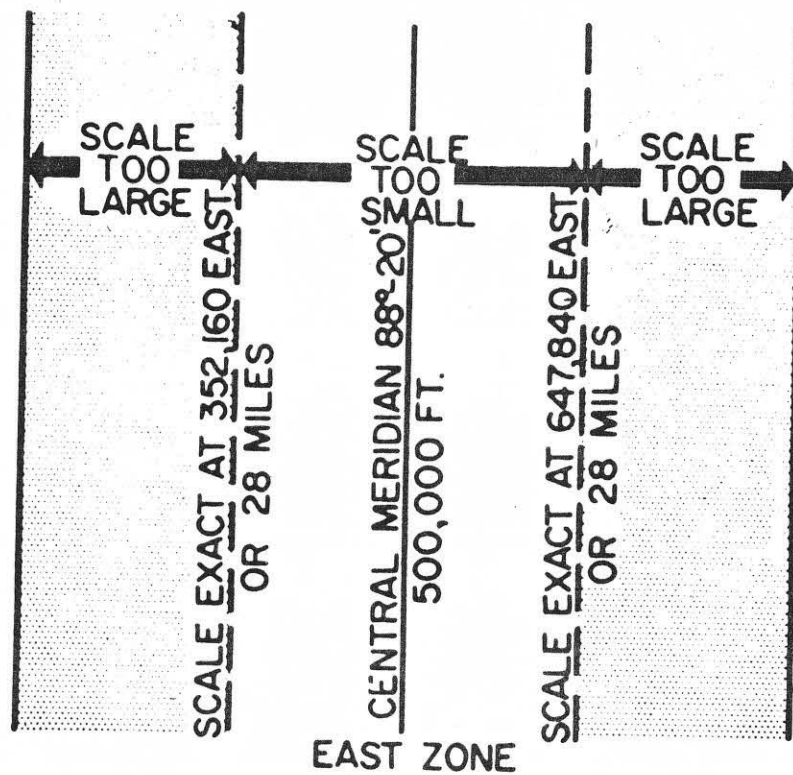
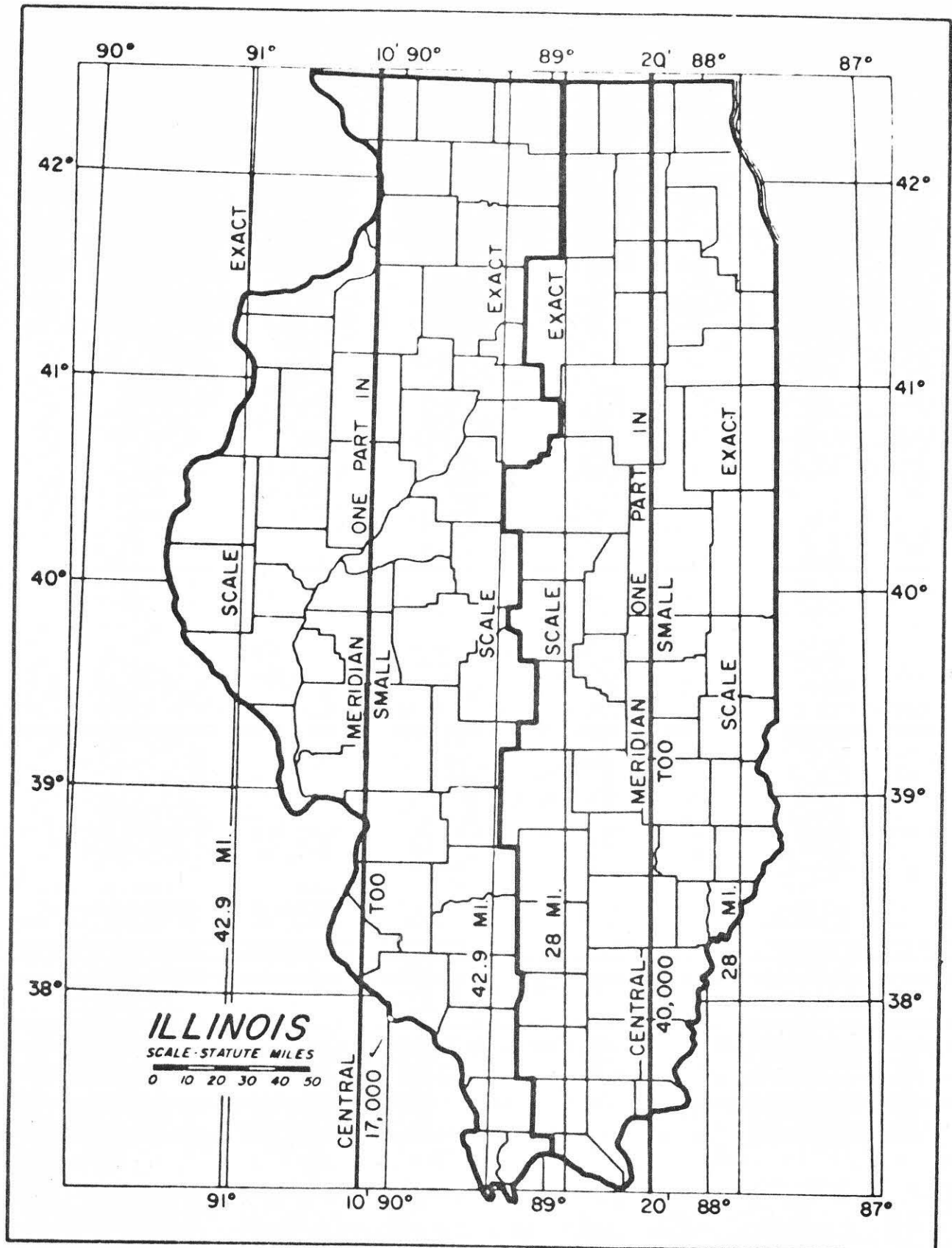


FIGURE 7

SCALE DISTORTION AT ANY LATITUDE





**FIGURE 9**  
**STATE PLANE-COORDINATE ZONES**





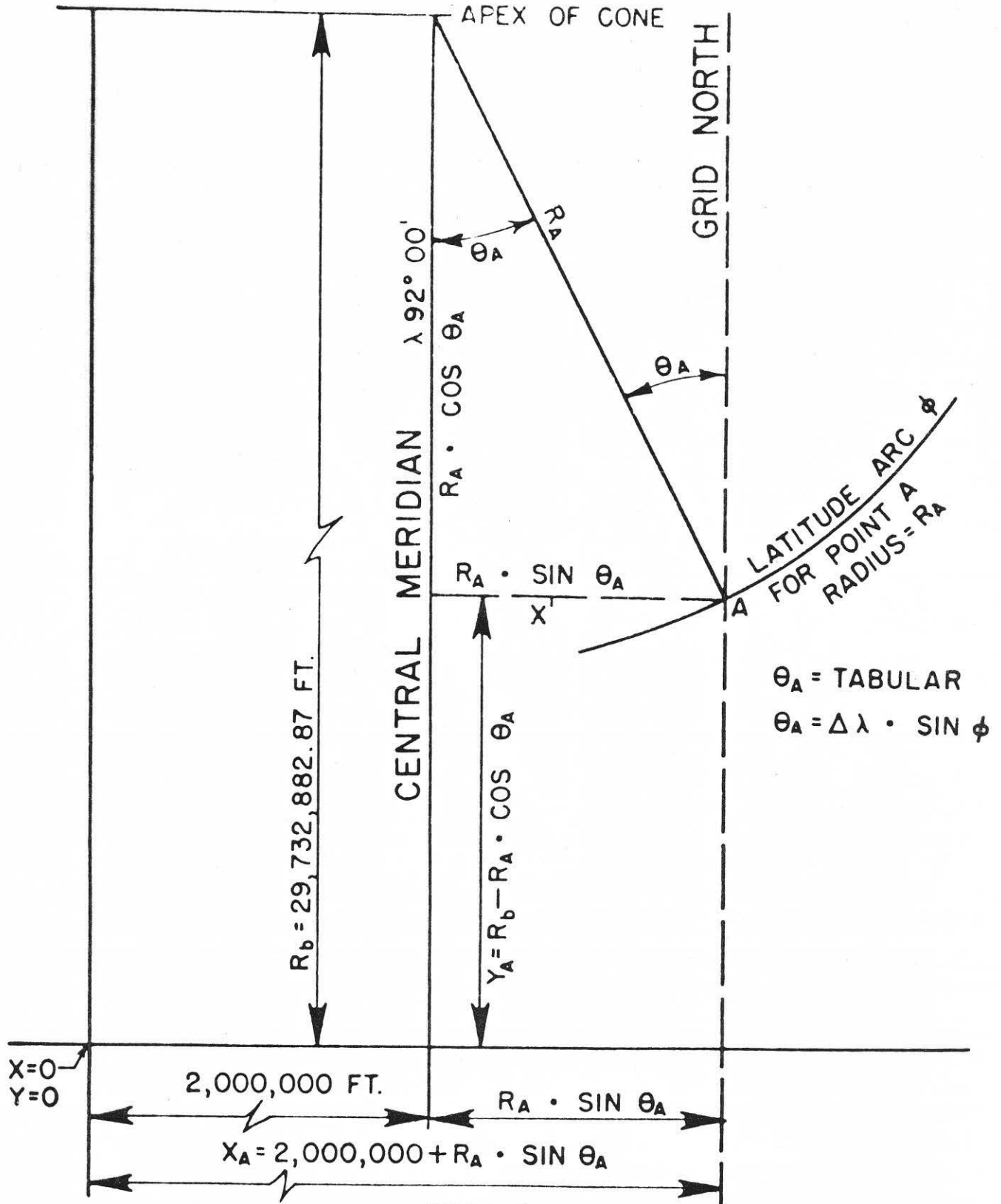


FIGURE II

ELEMENTS OF THE LAMBERT CONFORMAL CONIC PROJECTION  
 ARKANSAS - NORTH ZONE

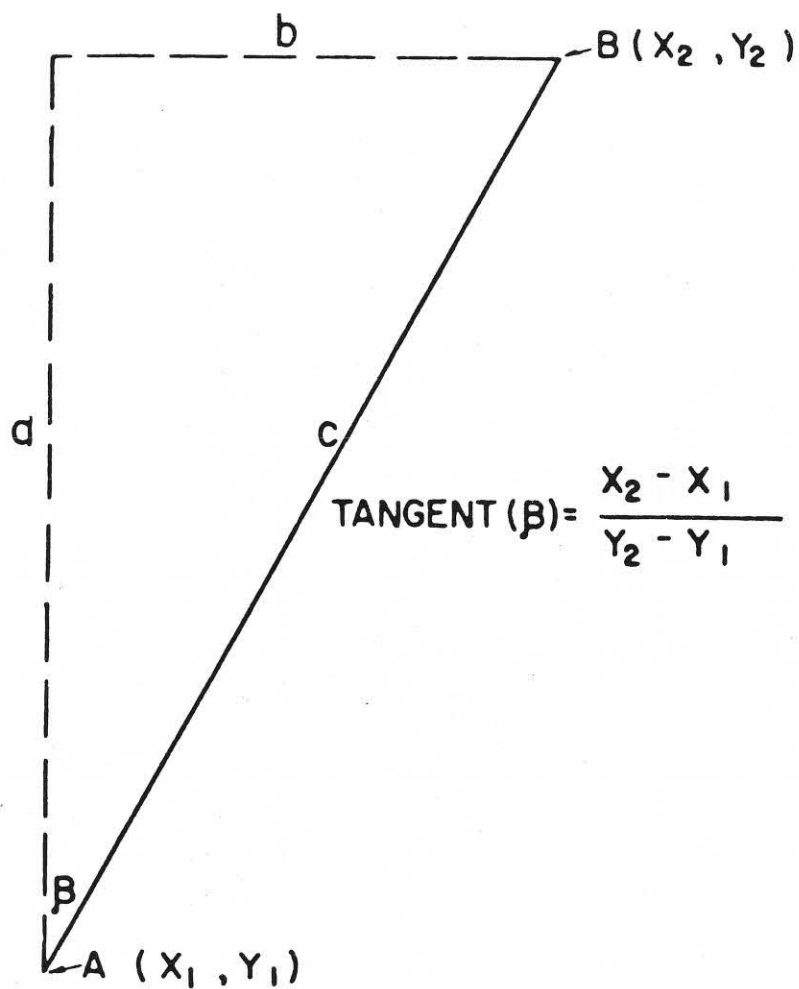


FIGURE 12  
COMPUTING PLANE AZIMUTH

REPORT ON DATUM ADJUSTMENT TO  
ESTABLISH FROM THE STATE PLANE  
COORDINATE SYSTEM THE ARKANSAS  
STATE HIGHWAY DEPARTMENT PLANE  
COORDINATE SYSTEM

The information herein pertains to principles and procedures employed in computing applicable combined adjustment factors for establishing the Arkansas State Highway Department Plane Coordinate System. Use of a combined adjustment factor (CAF) is necessary to adjust the initial datum of the North Zone and the South Zone of the State plane coordinate system, as established by the U. S. Coast and Geodetic Survey for Arkansas, because of the extremes in ground relief within the State and the geographic size and shape of the State, and width of both the north and south zones.

Actually, the adjustment is merely the establishment of another datum which is parallel to, and either above or below, the initial datum. When the adjustment has been accomplished, the distance differences are negligible, such as 1:10,000 (the equivalent of Second Order accuracy in surveying) between one survey control point and another, as surveyed on the ground and as determined from plane coordinates of the points on the maps which are compiled on the adjusted datum. Thus each distance measured on the ground and computed from coordinates of points on the maps are in agreement, which is essential for both engineering and cadastral surveying. Then, when closure differences occur, the differences are surveying in character rather than inherent in the system of utilizing basic control.

Unless a datum adjustment is made, distance differences will generally be so large between map and ground as to require modification of each distance determined from maps compiled on the initial datum to make survey measurements on the ground for staking designed and computed highway alignment

and rights-of-way boundaries, so points thereof will be in their proper position on the ground. Otherwise, the ground-measured points, using plane-coordinate-computed distances, will not be where they should be on the ground. This adjustment-of-each distance procedure is costly and frustrating. The most satisfactory aspect of modifying each distance is the fact each measured distance is not the same as the distance computed by using the plane coordinates of points on the maps. Therefore, adjustment of the datum of the plane coordinate system is desirable, and can be done easily on an area basis within each zone of the State plane coordinate system.

In computing combined adjustment factors for Arkansas, the extreme variance in elevation between mountain-top areas and low portions of each valley precluded the use of one CAF for both zones in the State. Instead, six CAF's were required for the North Zone and four CAF's for the South Zone.

Subsequent information identifies the separate areas by counties, throughout which each combined adjustment factor (CAF) should be used to adjust the datum and make the difference between ground-measured distances and map-computed distances less than 1:10,000, as illustrated on the accompanying map.

In the North Zone, the CAF of 0.999990 is applicable for the following counties:

Clay  
Randolph

The CAF of 1.000020 is applicable for the following counties:

Baxter  
Fulton  
Izard  
Sharp

The CAF of 1.000040 is applicable for the following counties:

Craighead	Mississippi
Crittenden	Poinsett
Cross	St. Francis
Greene	Woodruff
Lawrence	

The CAF of 1.000050 is applicable for the following counties:

Benton	Faulkner
Boone	Marion
Carroll	Perry
Conway	Yell

The CAF of 1.000080 is applicable for the following counties:

Cleburne	Scott
Independence	Sebastian
Jackson	Stone
Logan	White

The CAF of 1.000110 is applicable for the following counties:

Crawford	Pope
Franklin	Searcy
Johnson	Van Buren
Madison	Washington
Newton	

In the South Zone, the CAF of 0.999980 is applicable for the following counties:

Ashley  
Chicot

Columbia  
Union

The CAF of 1.000000 is applicable for the following counties:

Lafayette	Monroe
Lee	Prairie
Lonoke	Pulaski
Miller	

The CAF of 1.000040 is applicable for the following counties:

Bradley  
Calhoun  
Ouachita

The CAF of 1.000080 is applicable in the following counties:

Arkansas	Clark
Cleveland	Dallas
Desha	Drew
Garland	Grant
Hempstead	Hot Spring
Howard	Jefferson
Lincoln	Little River
Montgomery	Nevada
Phillips	Pike
Polk	Saline
Sevier	

The following table contains data showing results obtained by using the applicable CAF to reduce the difference between map-computed distances and ground-measured distances for principal cities in the State of Arkansas.

TABLE 1  
ADJUSTED DATUM APPLICATION FOR PRINCIPAL CITIES  
FOR PLANE COORDINATE ZONES OF ARKANSAS

City	County	General Elevation (feet)	General Difference in Distances (as a Ratio)	Applicable CAF
(1)	(2)	(3)	(4)	(5)
Little Rock	Pulaski	270	1:51,000	1.000000
Hot Springs	Garland	600	1:200,000	1.000080
Pine Bluff	Jefferson	225	1:137,000	1.000080
El Dorado	Union	250	1:128,000	0.999980
Camden	Ouachita	140	1:57,000	1.000040
Paragould	Greene	275	1:600,000	1.000040
Jonesboro	Craighead	295	1:36,000	1.000040
Batesville	Independence	265	1:120,000	1.000080
Helena	Phillips	190	1:37,000	1.000080
Russellville	Pope	350	1:23,000	1.000110
Conway	Faulkner	310	1:120,000	1.000050
Harrison	Boone	1060	1:2000,000	1.000050
Blytheville	Mississippi	240	1:56,000	1.000040
Texarkana	Miller	300	1:24,000	1.000000
Fort Smith	Sebastian	420	1:420,000	1.000080
West Memphis	Crittenden	215	1:300,000	1.000040
Arkadelphia	Clark	190	1:100,000	1.000080

From the foregoing, it is evident all differences are smaller than 1:10,000; and for most of the cities, the differences are much smaller than 1:25,000, the equivalent of first-order accuracy in surveying. It can therefore be concluded the adjustment factors are well selected for achievement of precision where it is needed most.

The subsequent explanation was prepared to present in more detail the procedure employed in applying the principles of datum adjustment.



## EXPLANATION OF PROCEDURE IN DETERMINING A COMBINED ADJUSTMENT FACTOR

The attached computation sheet 1 is used in making evaluation determinations to compute the combined adjustment factor (CAF) for a State plane coordinate zone which is based on the Lambert Conformal Projection. The external distances thereon (column 4) are the actual elevations a computation reference plane has at each  $0^{\circ} -01'$  increment (column 2 and column 3) north and south from the central latitude of the plane coordinate zone, if the plane is tangent to the sea level arc of the earth at the central latitude of the zone. Column 5, headed "External Plus Datum Elevation," is provided for computing the elevation, (-) for below and (+) for above sea level arc, of the datum initially established for the particular zone of the State plane coordinate system which is being analyzed. The principles are illustrated in Figure 1.

Critical elevations of the ground must be ascertained and used in computing the combined adjustment factor and in determining the geographic limits of its applicability. Consequently, columns 6 and 7, headed "Actual Ground Elevation," are for recording the actual elevations of the ground, minimum for lowest and maximum for highest, along each line of latitude which is parallel to and north and south, respectively, from the central latitude. Reason for using the increment of  $0^{\circ} -01'$  latitude is the State plane coordinate projection tables for the Lambert System established by the U. S. Coast and Geodetic Survey provide "scale factors" for lines at such increments of latitude from the central latitude of the plane coordinate zone. The "scale factors," of course, merely represent the ration of distance on the initially established datum of the applicable State plane coordinate zone to distance along

the sea level arc of the earth.

Once all applicable data are recorded in the sixth and seventh columns for the plane coordinate zone or portion thereof being analyzed, the combined adjustment factor is determined by choosing an appropriate height above or below the initial datum for the adjusted datum.

Whenever the difference between distances measured on the ground and distances determined from plane coordinates on the maps are not to differ by more than 1:10,000, the new datum should be not more than 2,090 feet above or 2,090 feet below the ground at any point within the zone or area of adjustment. Data from columns 1, 2, 3, 4, 6, and 7 are transferred to other computation sheets, number 2 and so on. Visual inspection (or an arithmetical ascertainment) of the elevation differences reveals where a trial datum should be positioned to keep distance differences to less than desired, as say 1:10,000. Then applicable data are recorded in columns 5, 8, and 9 for a trial datum. If the trial datum has been properly selected, elevations in column 6 will be not lower than elevations in column 8, and elevations in column 7 will be not higher than elevations in column 9. Then this trial datum is accepted as the adjusted datum. Otherwise, another trial is made. Elevation increments in the trials are 209 feet so the resultant CAF will be an even number. Sometimes during trial computations, changing the area of application of the trial adjustment is also necessary in order to keep the differences in distances from being larger than desired. If such differences are not to exceed 1:20,000, the adjusted datum must be not more than 1,045 feet above or 1,045 feet below the ground elevations throughout the area of application. The principles are illustrated in Figure 2.

Computation Sheet No. 1  
for making  
DATUM ADJUSTMENT  
LAMBERT CONFORMAL STATE PLANE COORDINATE SYSTEM

Computed CAF \_\_\_\_\_ Area of Application *North Zone — Arkansas*

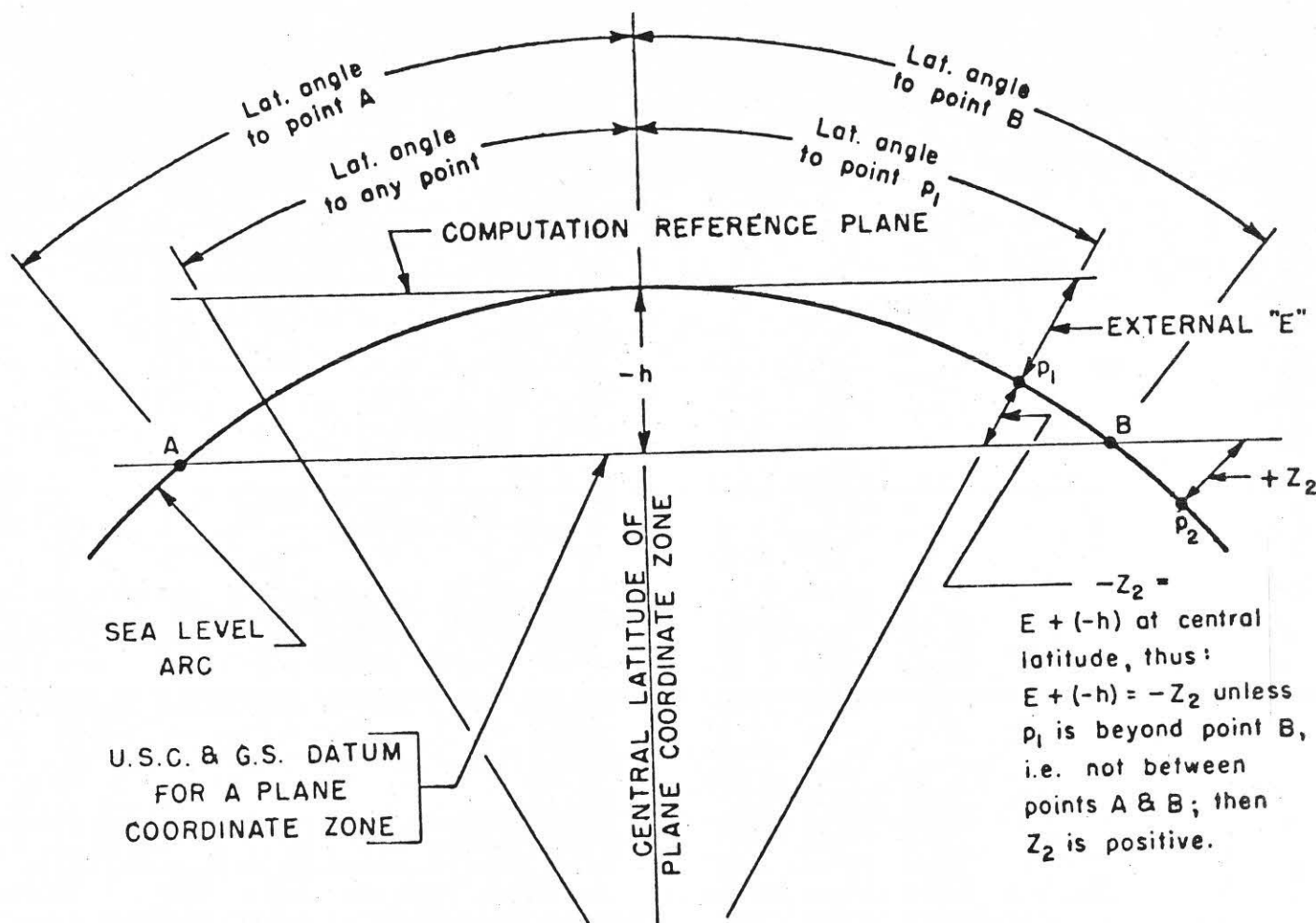
Angle in Min. from Cen. Lat.	Latitude Deg. Min. and North South from Cen. Lat.		External (feet)	External plus Datum Elev. (feet) At Cen. Lat.	Actual Ground Elev. (feet)		Elevation where 1:10,000 Difference Occurs		Difference between Distances on the Ground and on the Datum	
	North	South			Min.	Max.	Low	High	At Min. Elev.	At Max. Elev.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
00	35 35	35 35	0	-1,340	450	2,000	-3,340	+ 750	1:11,600	1:6,200
01	36	34	1	-1,339						
02	37	33	4	-1,336						
03	38	32	8	-1,332						
04	39	31	14	-1,326						
05	35 40	35 30	22	-1,318	390	2,000	-3,408	+ 772	1:12,200	1:6,300
06	41	29	32	-1,308						
07	42	28	43	-1,297	380	2,250	-3,387	+ 793	1:12,400	1:5,800
08	43	27	57	-1,283						
09	44	26	72	-1,268	370	2,300	-3,358	+ 882	1:12,700	1:5,800
10	45	25	88	-1,252						
11	46	24	107	-1,233						
12	47	23	127	-1,213						
13	48	22	149	-1,191	300	2,300	-3,281	+ 899	1:14,000	1:5,900
14	49	21	173	-1,167						
15	35 50	35 20	199	-1,141						
16	51	19	226	-1,141						
17	52	18	256	-1,084	300	2,500	-3,174	+ 1,006	1:15,100	1:5,800
18	53	17	287	-1,053						
19	54	16	319	-1,021						
20	55	15	354	- 986						
21	56	14	390	- 950						
22	57	13	428	- 912	290	2,270	-3,002	+ 1,178	1:17,300	1:6,500
23	58	12	468	- 872						
24	59	11	509	- 831						
25	36 00	35 10	553	- 787						
26	01	09	598	- 742						
27	02	08	645	- 695	280	2,230	-2,785	+ 1,395	1:21,400	1:7,100
28	03	07	693	- 647						
29	04	06	744	- 596						
30	05	05	796	- 544						
31	06	04	850	- 490	1,000	2,166	-2,580	+ 1,600	1:14,000	1:7,800
32	07	03	906	- 434						
33	08	02	963	- 377						
34	09	01	1,023	- 317	1,240	1,368	-2,407	+ 1,773	1:13,400	1:12,400
35	36 10	35 00	1,084	- 256						
36	11	59	1,146	- 194						
37	12	58	1,211	- 129						
38	13	57	1,277	- 63						
39	36 14	34 56	1,345	+ 5	1,150	1,600	-2,085	+ 2,095	1:18,200	1:13,100
40	36 15	34 55	1,415	+ 75						
41	16	54	1,487	+ 147						
42	17	53	1,560	+ 220						
43	36 18	34 52	1,636	+ 296	1,250	1,510	-1,794	+ 2,386	1:21,900	1:17,200

END OF AREA

1 This table exemplifies the relationship between USC&GS datum distances and corresponding distances on the ground, before any datum adjustment is made. Computation Sheet No. 2 illustrates effective datum adjustment, based on a Computed CAF of 1.000110.

ILLUSTRATING USE OF DATUM ADJUSTMENT FORMS  
(for Lambert Conformal System of Plane Coordinates)

FIGURE 1



Exaggerated X-section, not to scale

The sea level arc of the earth is intersected by plane of the initial datum at points A and B. The distance the datum is below the sea level arc at the central latitude of the plane coordinate zone is  $-h$ . When the scale factor at that latitude is 0.9999568, the  $-h$  is 903 feet; and when the scale factor is 0.9999000, the  $-h$  is 2,090 feet. Such specific data are the consequence of the fact  $-h$  is actually radius of the earth multiplied by the scale factor at the point of concern minus the radius, which is an average of 20,906,000 feet for the United States.

The external, E, is the elevation above any point, as  $P_1$ , measured along a radial line, of the computation plane which is tangent to the sea level arc of the earth at the central latitude of the zone.

Computation Sheet No. 2  
for making  
DATUM ADJUSTMENT  
LAMBERT CONFORMAL STATE PLANE COORDINATE SYSTEM

Computed CAF 1.000110 2

Area of Application North Zone - Arkansas

Angle in Min. from Cen. Lat.	Latitude Deg. North South from Cen. Lat.		External (feet)	External plus Datum Elev. (feet) At. Cen Lat.	Actual Ground Elev. (feet)		Elevation where 1:10,000 Difference Occurs		Difference between Distances on the Ground and on the Datum	
	North	South			Min.	Max.	Low	High	At. Min. Elev.	At Max. Elev.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
00	35 35	35 35	0	+ 959	450	2.000	-1.131	+3.049	1:41,000	1:20,000
01	36	34	1	+ 960						
02	37	33	4	+ 963						
03	38	32	8	+ 967						
04	39	31	14	+ 973						
05	35 40	35 30	22	+ 981	390	2.000	-1.109	+3.071	1:35,300	1:20,500
06	41	29	32	+ 991						
07	42	28	43	+ 1,002	380	2.250	-1.088	+3.092	1:33,600	1:16,700
08	43	27	57	+ 1,016						
09	44	26	72	+ 1,031	370	2.300	-1.059	+3.121	1:31,600	1:16,400
10	45	25	88	+ 1,047						
11	46	24	107	+ 1,066						
12	47	23	127	+ 1,086						
13	48	22	149	+ 1,108	300	2.300	- 982	+3,198	1:25,800	1:17,500
14	49	21	173	+ 1,132						
15	35 50	35 20	199	+ 1,158						
16	51	19	226	+ 1,185						
17	52	18	256	+ 1,215	300	2.500	- 875	+3,305	1:22,800	1:16,200
18	53	17	287	+ 1,246						
19	54	16	319	+ 1,278						
20	55	15	354	+ 1,313						
21	56	14	390	+ 1,349						
22	57	13	428	+ 1,387	290	2.270	- 703	+3,477	1:19,000	1:23,600
23	58	12	468	+ 1,427						
24	59	11	509	+ 1,468						
25	36 00	35 10	553	+ 1,512						
26	01	09	598	+ 1,557						
27	02	08	645	+ 1,604	280	2.230	- 486	+3,694	1:15,700	1:33,300
28	03	07	693	+ 1,652						
29	04	06	744	+ 1,703						
30	05	05	796	+ 1,755						
31	06	04	850	+ 1,809	1,000	2.166	- 281	+3,899	1:25,800	1:58,500
32	07	03	906	+ 1,865						
33	08	02	963	+ 1,922						
34	09	01	1,023	+ 1,982	1,240	1,368	- 108	+4,072	1:28,100	1:34,000
35	36 10	35 00	1,084	+ 2,043						
36	11	59	1,146	+ 2,105						
37	12	58	1,211	+ 2,170						
38	13	57	1,277	+ 2,236						
39	36 14	34 56	1,345	+ 2,304	1,150	1,600	+ 214	+4,394	1:18,100	1:29,600
40	36 15	34 55	1,415	+ 2,374						
41	16	54	1,487	+ 2,446						
42	17	53	1,560	+ 2,519						
43	36 18	34 52	1,636	+ 2,595	1,250	1,510	+ 505	+4,685	1:15,500	1:19,200

END OF AREA

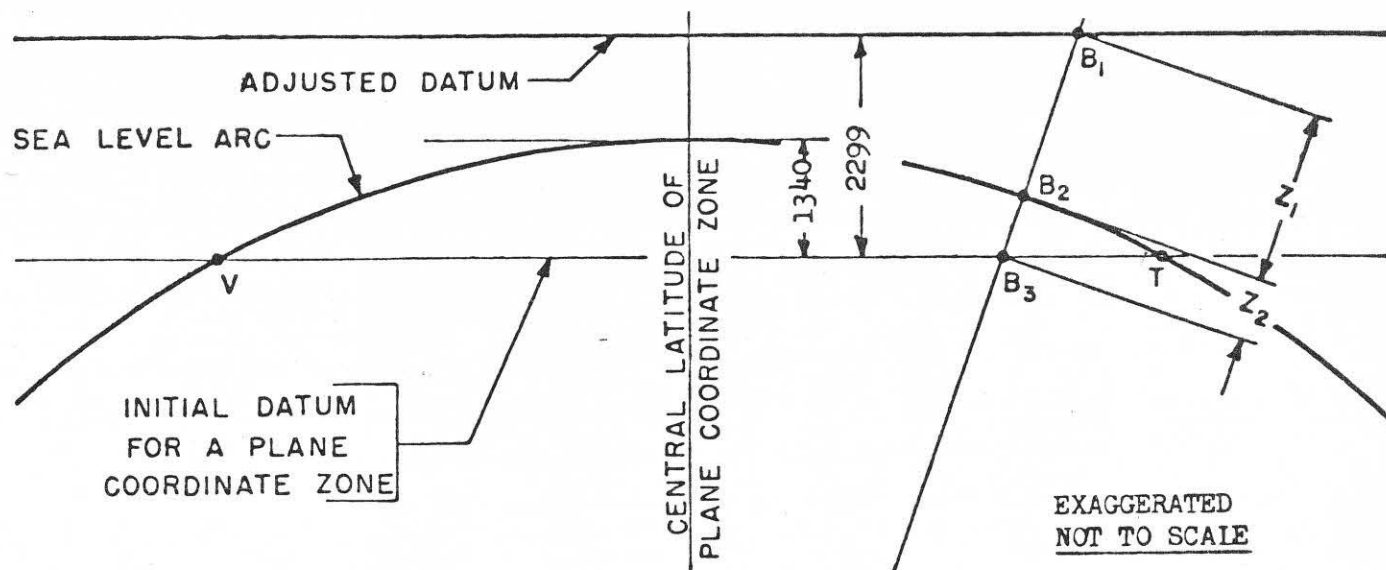
2 This computed CAF is applicable to the following counties: Crawford, Franklin, Johnson, Madison, Newton, Pope, Searcy, Van Buren, Washington.

The significance of datum adjustment can be visualized easily by comparing columns 10 and 11 of computation sheet 1 with columns 10 and 11, respectively, of computation sheet 2. Except near the extreme north and south edges of the area of adjustment, the differences obtained by the adjustment are from values as large as 1:5,800 (column 11, sheet 1) to smaller than 1:16,000 (column 11, sheet 2), and most differences in columns 10 and 11 of computation sheet 2 are smaller than 1:20,000. Consequently, all surveying and mapping done using the adjusted datum will not contain inherent differences between map and ground distances larger than acceptable in both engineering and cadastral measurements.



ILLUSTRATING USE OF DATUM ADJUSTMENT FORMS  
(for Lambert Conformal System of Plane Coordinates)

Figure 2



The widest straight line represents a cross section of the plane of an adjusted datum parallel to the datum initially established by the U. S. Coast and Geodetic Survey for a State plane coordinate zone.

For any point of concern,  $Z_2$  represents height of the initial datum at Point  $B_3$ , below (or above) the sea level arc at point  $B_2$ , and  $Z_1$  represents the height of the adjusted datum at point  $B_1$  (above or or below ) point  $B_2$ .

The scale factor (SF) applicable for point  $B_2$  will approach unity as  $Z_2$  approaches zero. Between the sea level arc intersections, points V and T, the SF will attain its largest deviation from unity when  $Z_2$  is at the center of the plane coordinate zone. For each particular point, the SF is selected from the Plane Coordinate Projection Tables compiled by the U. S. Coast and Geodetic Survey. The SF expresses the ratio of distance on the datum of the initially established State plane coordinate system to distance on sea level arc of the earth.

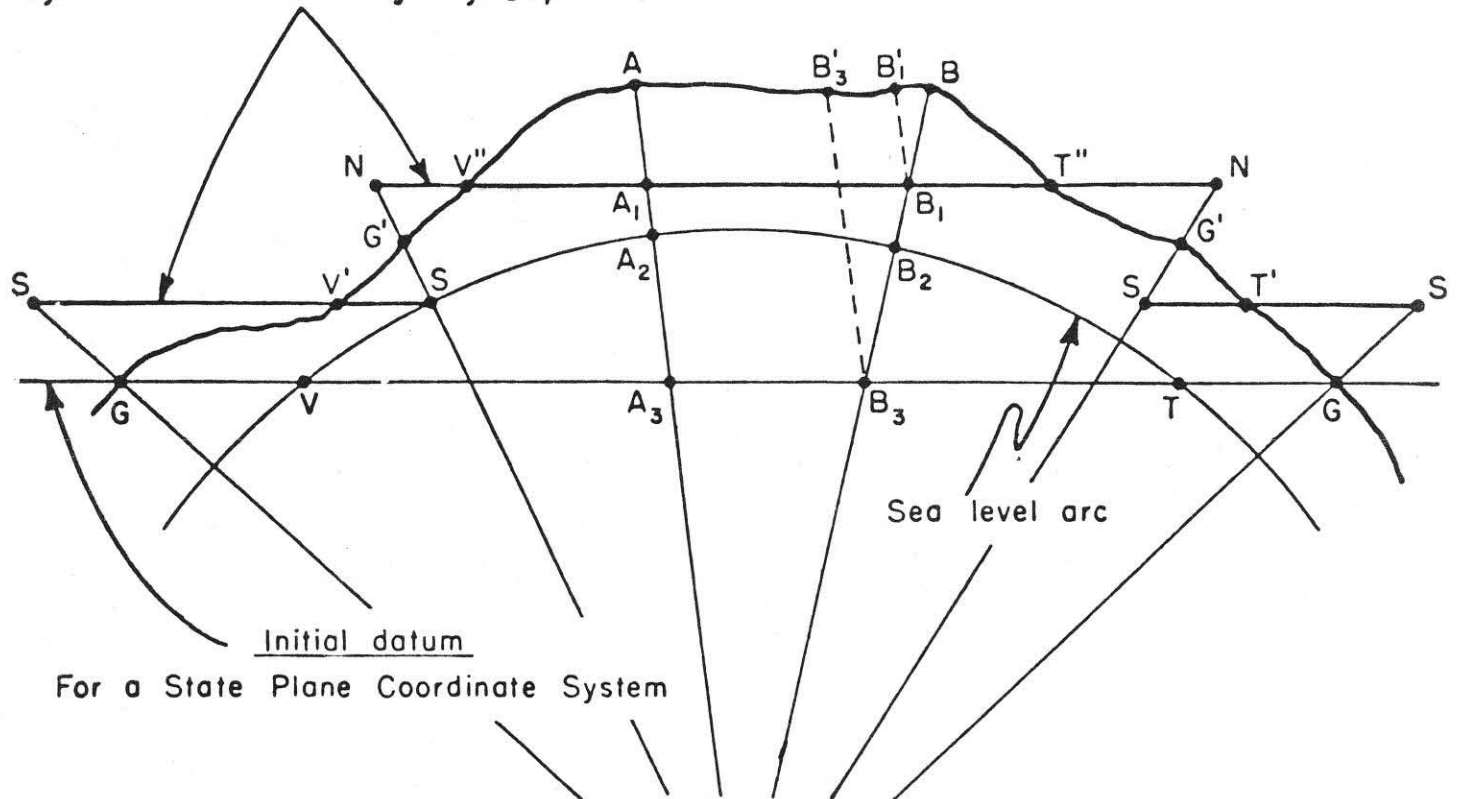
The elevation multiplication factor (EMF) is equal to radius of earth (R) plus  $Z_1$  divided by R. The EMF expresses the ratio of distance on the adjusted datum to distance on sea level arc of the earth. Adjustment of the datum in this manner establishes the State Highway Department plane coordinate system for each area requiring datum adjustment.

Finally, the Combined Adjustment Factor (CAF) expresses the ratio of distance on the adjusted datum to distance on the initial datum. For example, at latitude  $36^{\circ} 06' N$ . in the North Zone for Arkansas,  $Z_2$  is 493 feet and  $Z_1$  is 1,806 feet for a datum adjusted to 2,299 feet above the initial datum, because the initial datum is 1,340 feet below the sea level arc at the central latitude of  $35^{\circ} 35'$  for the North Zone. From the plane coordinate projection tables for Arkansas, the scale factor is 0.9999764 at latitude  $36^{\circ} 06' N$  and  $Z_1$  plus the radius of the earth is 20,907,806 feet. Consequently, for any points on such latitude line the EMF is 20,907,806 divided by 20,906,000 (average radius of earth) giving a result of 1.0000864. Thus, to compute the CAF, 1.0000864 is divided by 0.9999764 and the answer is 1.000110. The CAF for all points of any other latitude of concern within the area where the adjusted datum is 2,299 feet above the initial datum may be similarly computed. For adjusting the datum in any other area or State, a CAF which will be applicable can be computed by using the same procedure, placing the height of the new datum above or below the initial datum where the new datum will be not more than the predetermined permissible amount above or below any point on the ground, as subsequently illustrated in Figure 3.



FIGURE 3 — RELATIONSHIP OF INITIAL DATUM AND ADJUSTED DATUM

Adjusted datums for Plane Coordinate  
System of a State Highway Department



Cross section is exaggerated and diagrammatic, and is applicable to either a Lambert Conformal or a Transverse Mercator Plane Coordinate System

Points V and T are intersections of sea level arc and initial datum, and V' and T' of ground and one of the adjusted datums, and V'' and T'' of the other adjusted datum.

Points S and N on the adjusted datums and points G and G' on the ground, respectively, represent the limits of applicability of the adjusted datums.

$A-B$  = distance on ground

$A_1-B_1$  = distance on adjusted datum =  $A-B'_1$

$A_2-B_2$  = distance on sea level arc

$A_3-B_3$  = distance on initial datum =  $A-B'_3$

Differences are:  $B'_1-B$  (between ground and adjusted datum)

$B'_3-B$  (between ground and initial datum)

Usually it is not necessary to determine the maximum and minimum ground elevation at each separate minute of latitude in the space provided in columns 6 and 7. Extreme minimum and maximum ground elevations within the area of concern will be sufficient for establishing height of the adjusted datum either above or below, as necessary, the initial datum.

The CAF is the elevation multiplication factor (EMF) divided by the scale factor (SF). Thus, for any specific point of concern within the boundaries of an adjustment area within a plane coordinate zone, the elevation multiplication factor for the specific height the new datum is above or below the sea level arc of the earth for any point of concern divided by the SF for that point will result in the applicable CAF. The SF to use for a particular point is selected from the Plane Coordinate Projection tables, as compiled by the U. S. Coast and Geodetic Survey. The elevation multiplication factor is the height at the point of concern of the adjusted datum above or below the sea level arc of the earth algebraically added to the radius of the sea level arc of the earth and divided by that radius. An example is presented on Figure 2. The CAF for each point of concern may be similarly computed, remembering the EMF and SF will change from point to point but not the CAF.

Once determined, the plane coordinates of each basic control point in the initial datum are multiplied by the CAF. These revised coordinates place the control points on the adjusted datum, which is parallel to the initial datum. All surveying done on the adjusted datum will not require further adjustment of

distances, unless errors are made in the measurements. Within the difference limits set by the adjustment, distances measured accurately on the ground and distances computed by use of the plane coordinates of control points and of map features will agree. All intermediate points established therefrom will also be on the adjusted datum. Always remember the bearing of a line between two points on the initial datum is not changed by use of the CAF which places the same points on the adjusted datum.

The combined adjustment factor used to adjust the plane coordinate datum in each specific area should be appropriately recorded on each map compiled using datum-adjusted control. Thereby the map users will be made fully aware of the fact all coordinates on the map apply to the adjusted datum.

Whenever plane coordinates of points in the adjusted datum are to be reverted to plane coordinates for each point of concern onto the initial datum, divide the coordinates of the points on the adjusted datum by the combined adjustment factor. Ordinarily, all basic control surveying would be done by attaining closures on the initial datum. Then, before the maps are compiled, the plane coordinates of each control point being used on the initial datum are separately multiplied by the CAF applicable in the mapping area to compute plane coordinates for each point to be used to control map compilations and subsequent surveying on the adjusted datum. Equations in the plane coordinates are required for each control point used at the border of change from one plane coordinate zone, or area of datum adjustment to another.

## DATUM ADJUSTMENT FACTOR USE

Suggested procedure in use of the datum adjustment factor determined for each respective area of adjustment is as follows:

1. Accomplish all basic control surveying, compute closure accuracy, and make essential survey closure adjustment on the initial datum.
2. Multiply the plane coordinates of each basic control point which will be used in the area of survey for engineering and cadastral measuring and mapping by the datum adjustment factor which is applicable. The result will be plane coordinates for each of such points on the adjusted datum. The datum adjustment does not, in any way, alter the plane coordinate grid lines. Instead, it lengthens the distance between points in the traverse in direct proportion to the magnitude of the DAF applicable in the area of datum adjustment, and changes the position of each point on the coordinate grid.
3. Make essential supplemental control surveys. As desirable, this can be done by ground surveying and/or by aerial photogrammetric analog or aerial analytical triangulation, using coordinates of the basic control points on the adjusted datum.
4. Compile essential topographic and other maps and complete the preliminary survey for the highway (by ground surveys or by photogrammetric methods according to feasibility) using all control, basic and supplemental, on the adjusted datum. Similarly, make essential measurements for cadastral purposes, and measure profile and cross sections for computation of excavation and embankment quantities according to procedures employed in the usual sequence in accomplishing the required design work. Be sure to note on each map the datum adjustment factor used for making the datum adjustment.

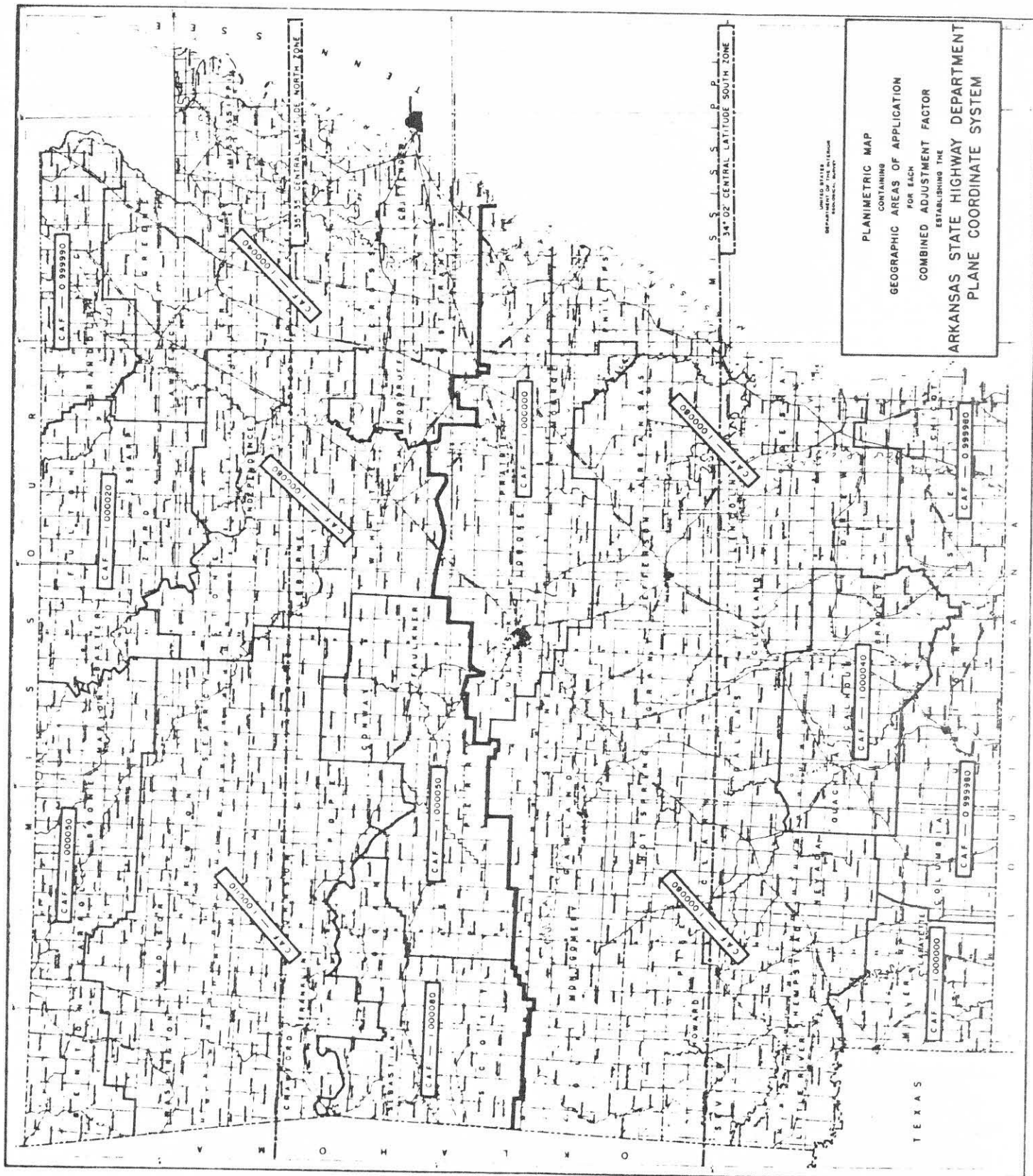
*(Special note:*

Should complete dissimilarity between coordinates of points on the adjusted datum and points on the initial datum be desired, this can be achieved easily by adding a constant of sufficient magnitude to prevent similarity. When and wherever such is done, the same constant must be recorded on the maps, along with the datum adjustment factor, so the constant will be known and readily available for subtraction from the coordinates before dividing by the DAF to revert the datum-adjusted plane coordinates to plane coordinates on the initial datum when and wherever desired.)

When the essential surveying work is done using distances and bearings on the adjusted datum, distances measured on the ground and distances determined by use of plane coordinates of points on the maps (control points and map features) will be in agreement within practical limits. If large differences should occur, the cause would be surveying and would not be attributable to the inherent differences ordinarily existing between map-determined and ground-surveyed distances when maps have been compiled on the initial datum.

5. Accomplish whatever engineering, cadastral, and design work is desirable, using the measurements made and maps compiled on the adjusted datum.

6. Compute the datum adjusted plane coordinates of centerline points of the designed highway location, of the structures, and of the rights-of-way boundaries. Using coordinates of such points and coordinates of nearby basic control points, compute the bearing and distance from the basic control points to the centerline, structures, and right-of-way points. Use distances and bearings computed using the applicable datum adjusted coordinates for staking the highway location survey on the ground, also the boundaries of the rights-of-way.
7. Stake the highway centerline, structures, and right-of-way on the ground for construction. Errors of closure, should they occur, will be attributable to surveying and not to the inherent differences initially existing between map and ground distances.







In the introduction to this manual, it was stated that the purpose was to compile information which will be useful to the Arkansas surveyor, and while a considerable amount of information has been included herein, it is realized that there is much more that could be added and more that remains to be done, which would improve the lot of the Arkansas surveyor. For example, while samples of plat laws have been included, it is most important that a uniform plat law for Arkansas surveys be prepared and enacted into law at the earliest possible date. Likewise while sample minimum standards have been introduced, a set of standards applicable to Arkansas should also be prepared to fit conditions in this state. The perpetuation of original and restored corners is also of great importance and this has been given a high priority by the office of the State Surveyor. However this is a monumental task which will require many years and a great amount of cooperation by all surveyors in the state. Further refinement of the state plane coordinate system to make the system more usable should be undertaken as soon as time and finances permit.

In this second edition several items have been added which will help reduce the work remaining to be done as stated in the paragraph above. A *"Guide for Arkansas Boundary Surveys and Plats"*, which is a great step toward the completion of a set of minimum standards, has been prepared by the Arkansas Association of Registered Land Surveyors and is included in the appendices herein.

In the appendix hereto there is included a copy of the original field notes, dated November 10, 1815 and November 25, 1815, when the Fifth Principal Meridian intersected the base line, thus establishing the original for all rectangular surveys in the State of Arkansas. It is difficult to imagine the problems and hardships encountered by these surveyors, who

160 years ago set out to establish over a period of years, the system of land surveys on which all land ownership is based today.

The improvements in surveying techniques and instruments have been tremendous and the modern surveyor has the benefit of instruments which would have staggered the imagination of the ancient surveyor who hacked his way through the swamps and mountains of our state.

But what of the future? What should the surveyor expect tomorrow and many tomorrows from now? In 1940, the Department of Agriculture, under the planned index of land value, indicated the average price of farm land in Arkansas to be \$24.00 per acre, and by 1970 this had increased to \$264.00 per acre. What will be the average value of land by the year 2000, and what will the responsibility of the surveyor be in surveying the land? What new techniques will be needed for the surveyor to keep pace with the trend toward more accurate and complete surveys? He must always remember that no matter how sophisticated our machines are and how refined our techniques may be, the old corners and old surveys set in the early 1800's cannot be changed, and no matter all else, they must be accepted as the original corners and the original lines, and all we can do is measure them more accurately and preserve them more effectively for future generations.

In a talk given to the 8th annual convention of the Arkansas Association of Registered Land Surveyors and the Arkansas Chapter of the American Congress on Surveying and Mapping, Captain Leonard S. Baker, United States Navy Officer in charge of the National Geodetic Survey and A.C.S.M. President Elect, spoke of the future and the role of surveyors as follows:

"My talk today is aimed at enlisting you in a concerted movement or

enhancement of the surveyors' and map makers' roles in the progress of America. I hope that you will share with me certain thoughts towards this objective.

We need to change attitudes on many issues in this country to achieve the quality of life which we know is possible. I am pleased to be here today in the heart of America; this is where the real strength of our country lies — where we still see evidence of the institutions and principles on which we were founded. We must insure that state and local governments and the people who work in the private sector function more effectively than in the past, so that they become equal partners with the federal government, and in fact give direction to the national programs and policies. The survival and progress of our way of life demand that this partnership become a reality.

.....

This country is still on the road to adopting the metric system. Of course surveyors have always been conscious aware and in many cases have been practicing in metric units. Therefore they are very often in the vanguard and there would be very little change other than in the presentation of completed information to the clients, or to users who have been accustomed to English units. So here we have an illustration of where a surveyor, a map maker, the state and local government, and the private sector can help to mold and impact national progress.

It is conceivable to me, that you here in Arkansas can be one of the leading forces in adopting a change to the metric system. In showing the way rather than waiting and following, it would be in keeping with the pioneering

spirit and nature of the people who settled this territory in the years past, a spirit in my opinion, which prevails in mid-America, and in these parts of our country which are still not cluttered and can still hopefully maintain the quality of life which most of us seek. I urge that you now begin to think individually and collectively of how you are going to face the implementation of the metric system and simultaneously to start thinking about how this massive change of the national adjustment is going to be implemented within the work of which you are a part.

.....

I spoke earlier about a concerted movement for enhancing the role of the surveyor and the map maker. There is a change taking place in the American scene, which is the one area where we of our profession, are probably closer to the actuality than most other people. I am talking about land resources therein and the use we make of it. This is our treasure. This is the bounty we have been blessed with in our country. Fundamentals of what land we have, the inventory if you will, the positions, the relationships of one place to another, that is our promise. That is what our training and experience have taught us to deal with more effectively than the other parts of our population. Hopefully we can now be a part of the movement that is now trying to modernize our system of land data records and the resource information which relates to the land into an orderly fashion, which can be of benefit to all. I sense the need for the surveyor and map maker to become leaders in the groupings which are dealing with the problems of land resources, environment and uses of our technology to insure the most appropriate exploitation of all.

.....

A surveyor is generally knowledgeable in where the records originated. He may have been a part of that origin. He certainly knows where he can go in the courts, where to go for ownership information, where to go for any type of survey and mapping activity that may have impacted the land and the use thereof, which are under study or question. He is a "natural leader", an asset in any group which is now attempting to organize and utilize the masses of information about the land in a more effective manner and with the aid of computer assistance. Here too we must become "partners in progress", federal, state, local, and must touch the private sector, such as the title companies, the utility companies, the mining companies and the engineering profession. Together we all have a role and are engaged in working in activities which must utilize land information.

.....

In the old concept, "Cadastre" involves the geography or the physical aspects with included surveying. We are coming around to the legal and taxing aspects in this country today. With the increased intense need for increased revenue at state and local government level to provide the services people demand and need, and to retain and maintain and perhaps improve, the quality of life for all of us at these levels, it is essential that our land record system be improved. But not simply that the surveyor function in the classical terms of the past. Certainly integrity and the work done by the surveyor is the foundation — it is the key —, without it all is subject to difficulties. We are at a place where a particular part of our resources or any other land related information truly is. We must have and will have quality survey information as a basis

for any responsive land record system. What I am addressing here is the surveyor expanding his horizons, becoming knowledgeable through education, through involvement, through practice in the profession, the related aspect of land records and their utilization. We are talking about the uses of electronic computers for storing and retrieving data, in addition to the use of them for computation, which most of us are doing and have become familiar and perhaps experts in. We are talking about becoming more familiar with titled information and relating the automation of title records to our survey information.

.....

What I have been attempting to point out in this part of the discussion about modern land data systems, is that it is a very large complex movement aimed at changing certain fundamentals in the way we identify land, its ownership, its uses, among a host of different agencies both public and private, and the simplification and eventually indisputable recognition of a particular parcel of land and all the connotations that go with that. It is my hope that you representative surveyors of the profession can begin to acquaint yourselves, if you have not already done so, with the efforts being made at all levels and in many places from the academic institutions, the legal associations, the assessor's office, the engineering, planning, public utilities and related activities that deal with land, all concerned, all grasping toward an integration of their independent needs into a useful uniform system from which everyone can benefit. Here is an opportunity for you, the surveyor, to broaden your horizons, perhaps to be a team leader or certainly a major partner in the groups that are attempting to further this progress.

.....

We surveyors must assume the role of leadership in modernization of land data systems, or we will be replaced by others who have less knowledge and less to gain in the formation of these systems. I urge each of you and the state surveying organizations as a body, to meet with your counterparts in the legal profession to educate them as to the capabilities, expertise and knowledge within the surveying profession, and be their "guiding light" in all matters pertaining to surveying."

\* \* \* \* \*

Thus Captain Baker gives us an insight into some of the things which we may look forward to in the future and which we must attempt to accomplish, if we are to maintain and increase the standards of our surveying

profession.

In this second edition, considerable additional information has been included. The progress being made in land surveying is increasing rapidly and methods little known over ten years ago are now becoming commonplace. The present sky rocketing of land values imposes additional burdens on land surveyors since this situation often results in more controversy between land owners over their boundaries.

As stated in the first edition, it is realized that information available to land surveyors must be constantly reviewed and updated if the usefulness of this volume is to be maintained. It is hoped that future additions will further enhance the usefulness of this book and will improve the land surveying profession in the State of Arkansas.



## APPENDICES



58

North on 5<sup>th</sup> principal meridian

G. L.

30.25 W. C. 12 in. di.

40.00 2<sup>nd</sup> tpy 1/2 mile post in Southern  
edge of a Cypress swamp

60.50 Intersected Base line 26  
miles & 30 chains West of  
Mississippi where set on  
post corner to sec 1, 6, 31 &  
36 & Township 16 N & 16 W  
Range 1 E. & 1 West  
from which a gum 18 in.  
di. bears N. 61 E dist 44  
links & a do 18 in di bears  
S 70 W. dist 10 L

2 1/2 on Line 2<sup>o</sup> later  
Land line W & B Oak  
u.g. Sam. Loham.  
don and mt I. Cypress

Nov. 10. 1875

~~North~~ <sup>59.</sup>  
 Along S boundary of sec 36.  
 6.2 81 N. 121.77  
 14.06 by prop 4 feet or  
 16.50 Neader by prop swamp  
 40.00 Set  $\frac{1}{2}$  mile post from which  
 a post oak 12 in. di. bears  
 N 74 W. dist 21.2 and a gum  
 18 in di. bears S 37 E dist 15.2  
 73.15 W.O. 36 in. di.  
 80.00 Set a m post cor. to sec  
 25. & 36 from which a W.O. 18 in.  
 di bears S 71  $\frac{1}{2}$  W. dist 10 p.c.  
 or 8 in bears N 63 East 18.2  
 Greater part of this mile  
 over Level 2? rate Land Tim  
 Oak and Pine in g. Land

40  
West On the Base line  
C L  
157 A Sweet gum 20 ins diam.  
3060 a deep clear lake bearing  
N 25 W

4<sup>th</sup> November 1815

25<sup>th</sup> November 1815  
Returned back on the  
Base line to the 3<sup>rd</sup> pr  
cipal Meridian.

Thence

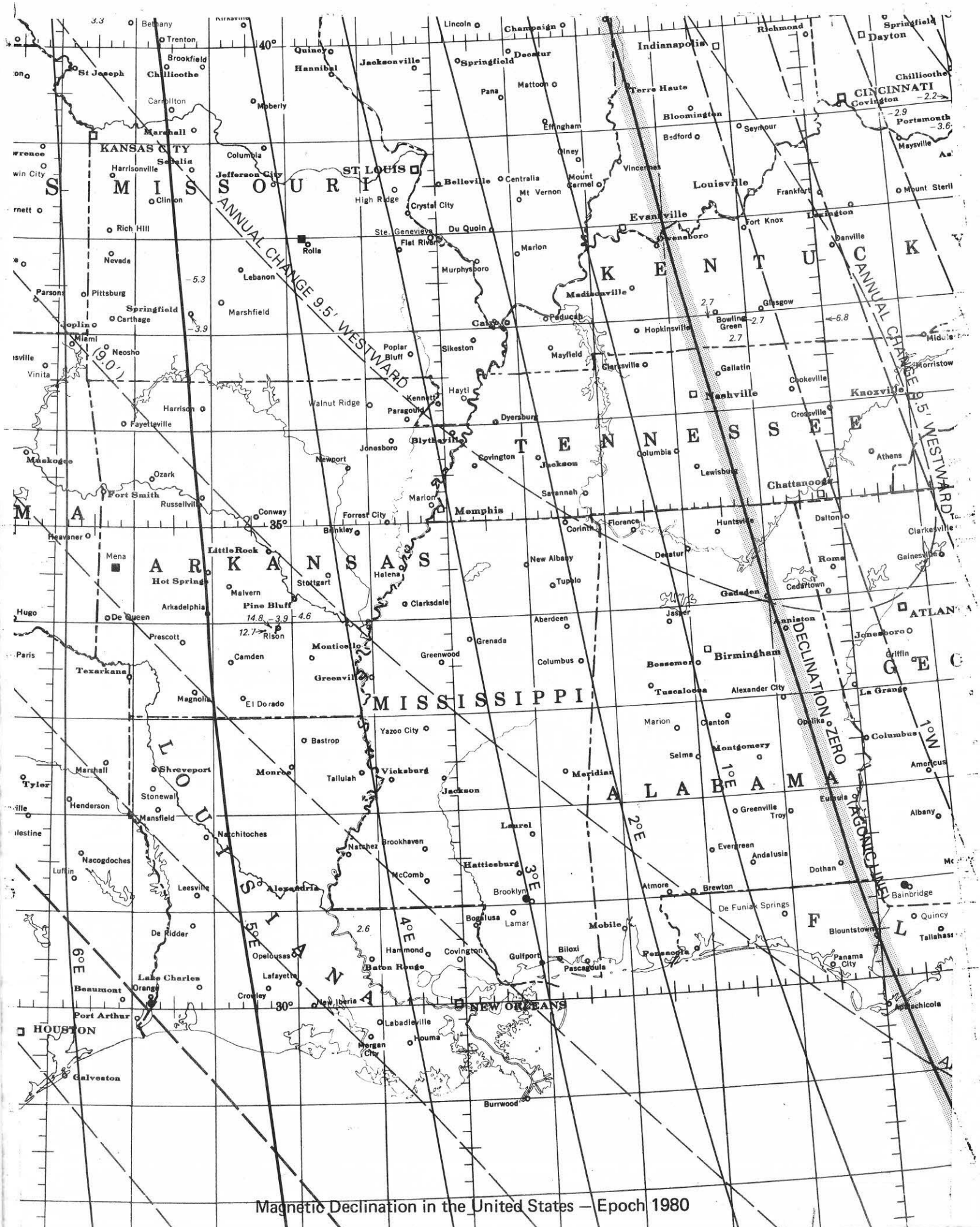
See a note on page  
27<sup>th</sup> before the follow  
ing same N<sup>o</sup> -

41  
West Along the south boundary  
off S. 36 S 1 N. 121 W.  
1018 Temporary 1/2 mile post  
WC 30 ins diam  
Set 1/2 mile post from  
which a Cypress 5 ins diam  
bearing N 5 1/2 E 25 d. and  
a Cypress 8 ins diam S 36 E  
14 d.

270 A Sweet Gum 20 ins diam.  
1050 Temp. 27<sup>th</sup> mile post  
Set post corner to S 36 + 35  
of S 1 N. 121 W. from which  
a Hick. 10 ins diam bearing  
N 26 W 38 d. & a Hick 10 ins  
diam bearing S 16 W 48 d.

Over very swampy land  
for the most part, Gum  
Oak & Hick. Timber bearing  
brushes &c.





U. S. Department of Commerce

*Charles Sawyer, Secretary*

Coast and Geodetic Survey

*Robert F. A. Studds, Director*

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Special Publication No. 289

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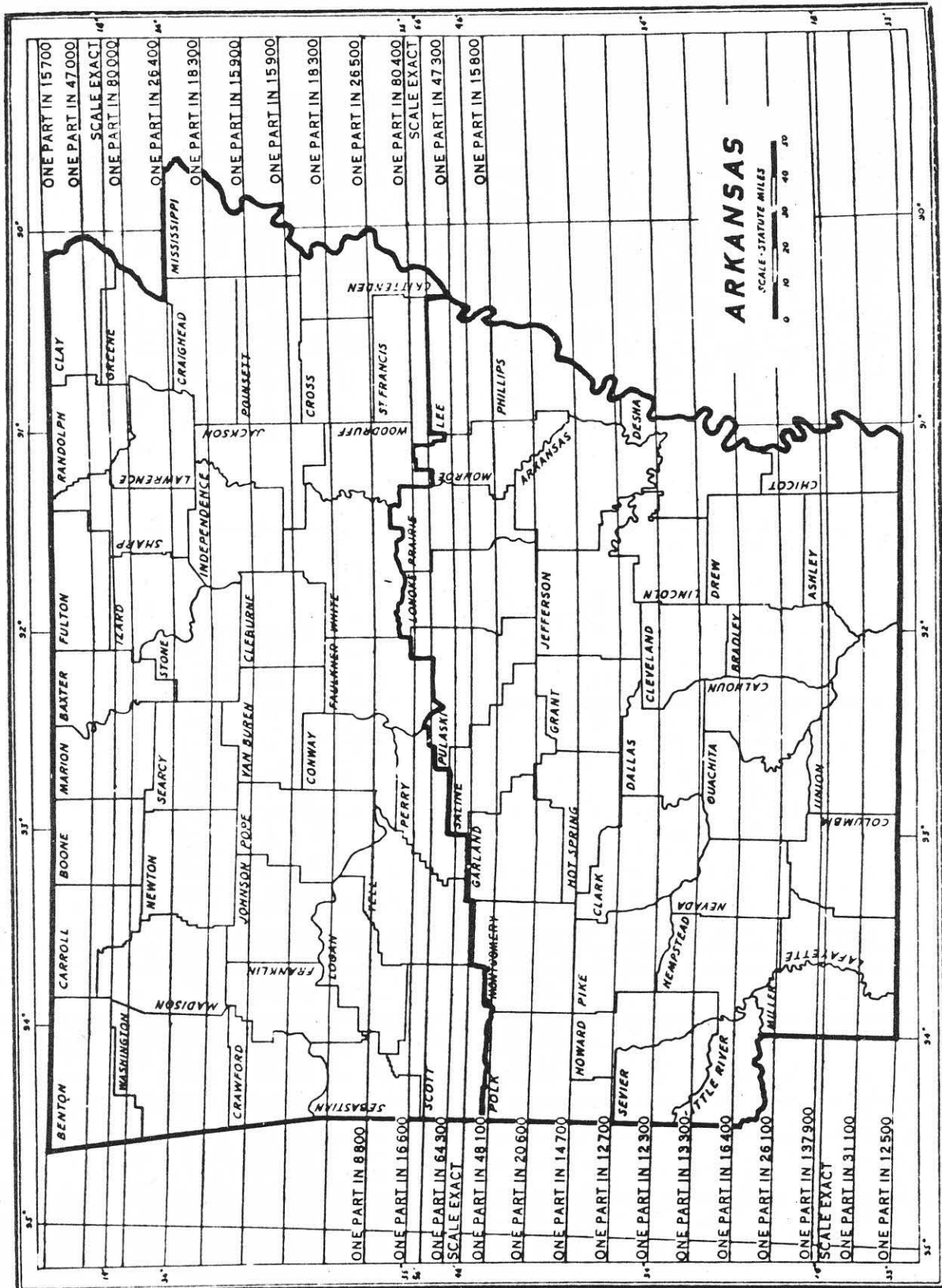
# PLANE COORDINATE PROJECTION TABLES

## ARKANSAS



UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1953

U. S. DEPARTMENT OF COMMERCE  
COAST AND GEODETIC SURVEY



STATE PLANE-COORDINATE ZONES AND SCALE FACTORS

## Foreword

The plane coordinate system used in this State is based on the Lambert conformal conic projection with two standard parallels for each zone. The tables in this publication are to be used for the conversion of geographic positions to plane coordinates or plane coordinates to geographic positions. The constants of the projection are listed with the tables.

The methods of computation have been designed for machine calculation, using tables of natural trigonometric functions. A table of these functions has been published by the Coast and Geodetic Survey to ten decimal places with ten-second intervals for  $0^{\circ}$  to  $6^{\circ}$  in Special Publication No. 246 and is sold for a nominal sum by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

The formulas and sample computations which follow show the general methods for computing either type of coordinates.

Plane Coordinates from Geographic Positions

$$x = R \sin \theta + C$$

$$y = R_0 - R \cos \theta$$

Grid azimuth = geodetic azimuth -  $\theta$  + second term

where

$R$  is the radius for the latitude of the station,

$R_0$  is a constant for a zone,

$\theta$  is the mapping angle for the longitude of the station,

and

$C$  is the value of  $x$  assigned to the Central Meridian for a zone.

The second term for the reduction of geodetic to grid azimuths may be neglected for most work. However, for lines five miles or more in length, if the same degree of accuracy is desired as is obtained by geographic computations, this term should be evaluated and used.

$$\text{Second term} = \frac{x_2 - x_1}{2 \rho_0^2 \sin 1''} \left( y_1 - y_0 + \frac{y_2 - y_1}{3} \right)$$

### Geographic Positions from Plane Coordinates

The formulas show the method of computing  $R$  and  $\theta$  from which the latitude and longitude may be obtained.

$$\begin{aligned} x' &= x - C \\ \tan \theta &= x' \div (R_b - y) \\ R &= (R_b - y) \div \cos \theta \\ \Delta \lambda &= \theta \div \ell \\ \lambda &= \text{Central Meridian} - \Delta \lambda \end{aligned}$$

where

$R$ ,  $R_b$ ,  $\theta$  and  $C$  are the same as previously defined

and

$\ell$  is a constant for a zone.



# PLANE COORDINATES ON LAMBERT PROJECTION

(Condensed form for calculating machine computation)

$$X = R \sin \theta + C$$

$$C = 2,000,000.00$$

$$Y = R_b - R \cos \theta$$

$$R_b = 29,732,882.87$$

State - Zone Arkansas - North  
Grid Az. = Geod. Az. -  $\theta$

Station	Latitude Longitude	R $\theta$	$\sin \theta$ $\cos \theta$	X Y
1 Height, 1934, r. 1940	35 18 37.443	29,377,259.75	+0.00427 02672	2,125,448.75
	91 34 46.321	+0 14 40.8085	0.99999 08824	355,890.97
	Grid azimuth to azimuth mark			97° 10' 20"
2 Rosebud, 1940	35 19 34.269	29,371,514.52	-0.00070 98661	1,979,150.16
	92 04 11.625	-0 02 26.4204	0.99999 97481	361,375.75
	Grid azimuth to azimuth mark			274° 13' 49"
3				
	Grid azimuth to azimuth mark			° ' "
4				
	Grid azimuth to azimuth mark			° ' "

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY  
Form 742 b

## GEODETIC POSITIONS FROM LAMBERT COORDINATES

(CALCULATING MACHINE COMPUTATION)

STATE - ZONE Arkansas - North  $l = 0.5818991407$

Station Height, 1934, r. 1940

C	- 2,000,000.00	$R_b$	29,732,882.87
X	2,125,448.75	Y	- 355,890.97
$X' = X - C$	+ 125,448.75	$R_b - Y$	29,376,991.90
$\tan \theta = X' \div (R_b - Y)$	+0.00427 03062	$\theta$	+880.8085
$\theta$	+0 14 40.8085	$\Delta \lambda = \theta \div l$	+1513.679
$\cos \theta$	0.99999 08824	$\Delta \lambda$	+0° 25' 13.679
$R = (R_b - Y) \div \cos \theta$	29,377,259.75	Central Meridian	92° 00' 00.000
$\phi$	35° 18' 37.443	$\lambda = C.M. - \Delta \lambda$	91° 34' 46.321

Station Rosebud, 1940

C	- 2,000,000.00	$R_b$	29,732,882.87
X	1,979,150.16	Y	- 361,375.75
$X' = X - C$	- 20,849.84	$R_b - Y$	29,371,507.12
$\tan \theta = X' \div (R_b - Y)$	-0.00070 98662	$\theta$	-146.4204
$\theta$	-0 02 26.4204	$\Delta \lambda = \theta \div l$	-251.625
$\cos \theta$	0.99999 97481	$\Delta \lambda$	-0° 04' 11.625
$R = (R_b - Y) \div \cos \theta$	29,371,514.52	Central Meridian	92° 00' 00.000
$\phi$	35° 19' 34.269	$\lambda = C.M. - \Delta \lambda$	92° 04' 11.625

## Constants for Arkansas

Constant	North zone	South zone
C	2,000,000.00 ft.	2,000,000.00 ft.
Central Meridian	92° 00' 00".000	92° 00' 00".000
$R_b$	29,732,882.87 ft.	31,511,724.20 ft.
$y_0$	455,289.26 ft.	497,634.97 ft.
$l$	0.58189 91407	0.55969 06871
$\frac{1}{2\rho^2 \sin 1''}$	$2.360 \times 10^{-10}$	$2.361 \times 10^{-10}$
$\log \frac{1}{2\rho^2 \sin 1''}$	0.372 9862 - 10	0.373 1357 - 10
$\log l$	9.76484 77159 - 10	9.74794 80806 - 10
$\log K$	7.63367 83483	7.64435 04632

Lambert Projection for Arkansas (North)

Table I

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
34° 20'	29,732,882.87	0	101.10800	+746.6	1.0001719
21	29,726,816.39	6,066.48	101.10783	+719.6	1.0001657
22	29,720,749.92	12,132.95	101.10750	+692.9	1.0001595
23	29,714,683.47	18,199.40	101.10700	+666.5	1.0001535
24	29,708,617.05	24,265.82	101.10683	+640.6	1.0001475
25	29,702,550.64	30,332.23	101.10650	+615.0	1.0001416
34° 26'	29,696,484.25	36,398.62	101.10617	+589.7	1.0001358
27	29,690,417.88	42,464.99	101.10583	+564.8	1.0001300
28	29,684,351.53	48,531.34	101.10550	+540.3	1.0001244
29	29,678,285.20	54,597.67	101.10533	+516.1	1.0001188
30	29,672,218.88	60,663.99	101.10517	+492.3	1.0001134
34° 31'	29,666,152.57	66,730.30	101.10483	+468.8	1.0001079
32	29,660,086.28	72,796.59	101.10450	+445.7	1.0001026
33	29,654,020.01	78,862.86	101.10417	+423.0	1.0000974
34	29,647,953.76	84,929.11	101.10400	+400.6	1.0000922
35	29,641,887.52	90,995.35	101.10383	+378.6	1.0000872
34° 36'	29,635,821.29	97,061.58	101.10367	+357.0	1.0000822
37	29,629,755.07	103,127.80	101.10333	+335.7	1.0000773
38	29,623,688.87	109,194.00	101.10317	+314.8	1.0000725
39	29,617,622.68	115,260.19	101.10300	+294.2	1.0000677
40	29,611,556.50	121,326.37	101.10283	+274.0	1.0000631
34° 41'	29,605,490.33	127,392.54	101.10250	+254.2	1.0000585
42	29,599,424.18	133,458.69	101.10250	+234.7	1.0000540
43	29,593,358.03	139,524.84	101.10233	+215.6	1.0000496
44	29,587,291.89	145,590.98	101.10217	+196.8	1.0000453
45	29,581,225.76	151,657.11	101.10200	+178.4	1.0000411
34° 46'	29,575,159.64	157,723.23	101.10183	+160.4	1.0000369
47	29,569,093.53	163,789.34	101.10167	+142.7	1.0000329
48	29,563,027.43	169,855.44	101.10167	+125.4	1.0000289
49	29,556,961.33	175,921.54	101.10150	+108.5	1.0000250
50	29,550,895.24	181,987.63	101.10133	+91.9	1.0000212
34° 51'	29,544,829.16	188,053.71	101.10133	+75.7	1.0000174
52	29,538,763.08	194,119.79	101.10133	+59.8	1.0000138
53	29,532,697.00	200,185.87	101.10117	+44.3	1.0000102
54	29,526,630.93	206,251.94	101.10100	+29.2	1.0000067
55	29,520,564.87	212,318.00	101.10100	+14.4	1.0000033

## Lambert Projection for Arkansas (North)

Table I (Cont'd)

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
34° 56'	29,514,498.81	218,384.06	101.10100	0.0	1.0000000
57	29,508,432.75	224,450.12	101.10100	-14.0	0.9999968
58	29,502,366.69	230,516.18	101.10083	-27.7	0.9999936
59	29,496,300.64	236,582.23	101.10083	-41.0	0.9999906
35° 00'	29,490,234.59	242,648.28	101.10100	-54.0	0.9999876
35° 01'	29,484,168.53	248,714.34	101.10083	-66.6	0.9999847
02	29,478,102.48	254,780.39	101.10083	-78.8	0.9999819
03	29,472,036.43	260,846.44	101.10083	-90.7	0.9999791
04	29,465,970.38	266,912.49	101.10083	-102.2	0.9999765
05	29,459,904.33	272,978.54	101.10100	-113.4	0.9999739
35° 06'	29,453,838.27	279,044.60	101.10083	-124.1	0.9999714
07	29,447,772.22	285,110.65	101.10100	-134.5	0.9999690
08	29,441,706.16	291,176.71	101.10117	-144.6	0.9999667
09	29,435,640.09	297,242.78	101.10100	-154.3	0.9999645
10	29,429,574.03	303,308.84	101.10117	-163.6	0.9999623
35° 11'	29,423,507.96	309,374.91	101.10133	-172.6	0.9999603
12	29,417,441.88	315,440.99	101.10133	-181.2	0.9999583
13	29,411,375.80	321,507.07	101.10133	-189.4	0.9999564
14	29,405,309.72	327,573.15	101.10150	-197.3	0.9999546
15	29,399,243.63	333,639.24	101.10167	-204.8	0.9999528
35° 16'	29,393,177.53	339,705.34	101.10183	-211.9	0.9999512
17	29,387,111.42	345,771.45	101.10183	-218.7	0.9999496
18	29,381,045.31	351,837.56	101.10200	-225.1	0.9999482
19	29,374,979.19	357,903.68	101.10217	-231.1	0.9999468
20	29,368,913.06	363,969.81	101.10233	-236.8	0.9999455
35° 21'	29,362,846.92	370,035.95	101.10250	-242.1	0.9999443
22	29,356,780.77	376,102.10	101.10267	-247.1	0.9999431
23	29,350,714.61	382,168.26	101.10283	-251.6	0.9999421
24	29,344,648.44	388,234.43	101.10300	-255.9	0.9999411
25	29,338,582.26	394,300.61	101.10317	-259.7	0.9999402
35° 26'	29,332,516.07	400,366.80	101.10350	-263.2	0.9999394
27	29,326,449.86	406,433.01	101.10367	-266.3	0.9999387
28	29,320,383.64	412,499.23	101.10383	-269.1	0.9999380
29	29,314,317.41	418,565.46	101.10417	-271.5	0.9999375
30	29,308,251.16	424,631.71	101.10433	-273.5	0.9999370

Lambert Projection for Arkansas (North)

Table I (Cont'd)

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
35° 31'	29,302,184.90	430,697.97	101.10450	-275.2	0.9999366
32	29,296,118.63	436,764.24	101.10483	-276.5	0.9999363
33	29,290,052.34	442,830.53	101.10517	-277.4	0.9999361
34	29,283,986.03	448,896.84	101.10533	-278.0	0.9999360
35	29,277,919.71	454,963.16	101.10567	-278.2	0.9999359
35° 36'	29,271,853.37	461,029.50	101.10600	-278.0	0.9999360
37	29,265,787.01	467,095.86	101.10633	-277.5	0.9999361
38	29,259,720.63	473,162.24	101.10650	-276.6	0.9999363
39	29,253,654.24	479,228.63	101.10683	-275.3	0.9999366
40	29,247,587.83	485,295.04	101.10733	-273.7	0.9999370
35° 41'	29,241,521.39	491,361.48	101.10750	-271.7	0.9999374
42	29,235,454.94	497,427.93	101.10783	-269.4	0.9999380
43	29,229,388.47	503,494.40	101.10833	-266.6	0.9999386
44	29,223,321.97	509,560.90	101.10850	-263.5	0.9999393
45	29,217,255.46	515,627.41	101.10900	-260.1	0.9999401
35° 46'	29,211,188.92	521,693.95	101.10933	-256.3	0.9999410
47	29,205,122.36	527,760.51	101.10983	-252.1	0.9999420
48	29,199,055.77	533,827.10	101.11017	-247.5	0.9999430
49	29,192,989.16	539,893.71	101.11050	-242.6	0.9999441
50	29,186,922.53	545,960.34	101.11083	-237.3	0.9999454
35° 51'	29,180,855.88	552,026.99	101.11133	-231.7	0.9999466
52	29,174,789.20	558,093.67	101.11183	-225.6	0.9999480
53	29,168,722.49	564,160.38	101.11217	-219.2	0.9999495
54	29,162,655.76	570,227.11	101.11267	-212.5	0.9999511
55	29,156,589.00	576,293.87	101.11317	-205.4	0.9999527
35° 56'	29,150,522.21	582,360.66	101.11367	-197.9	0.9999544
57	29,144,455.39	588,427.48	101.11400	-190.0	0.9999563
58	29,138,388.55	594,494.32	101.11450	-181.8	0.9999581
59	29,132,321.68	600,561.19	101.11517	-173.2	0.9999601
36° 00'	29,126,254.77	606,628.10	101.11550	-164.2	0.9999622
36° 01'	29,120,187.84	612,695.03	101.11600	-154.9	0.9999643
02	29,114,120.88	618,761.99	101.11650	-145.2	0.9999666
03	29,108,053.89	624,828.98	101.11717	-135.1	0.9999689
04	29,101,986.86	630,896.01	101.11750	-124.7	0.9999713
05	29,095,919.81	636,963.06	101.11817	-113.9	0.9999738



## Lambert Projection for Arkansas (North)

Table I (Cont'd)

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
36° 06'	29,089,852.72	643,030.15	101.11883	-102.7	0.9999764
07	29,083,785.59	649,097.28	101.11933	-91.1	0.9999790
08	29,077,718.43	655,164.44	101.11983	-79.2	0.9999818
09	29,071,651.24	661,231.63	101.12033	-67.0	0.9999846
10	29,065,584.02	667,298.85	101.12100	-54.3	0.9999875
36° 11'	29,059,516.76	673,366.11	101.12150	-41.3	0.9999905
12	29,053,449.47	679,433.40	101.12217	-27.9	0.9999936
13	29,047,382.14	685,500.73	101.12283	-14.1	0.9999968
14	29,041,314.77	691,568.10	101.12333	0.0	1.0000000
15	29,035,247.37	697,635.50	101.12400	+14.5	1.0000033
36° 16'	29,029,179.93	703,702.94	101.12467	+29.4	1.0000068
17	29,023,112.45	709,770.42	101.12533	+44.6	1.0000103
18	29,017,044.93	715,837.94	101.12600	+60.2	1.0000139
19	29,010,977.37	721,905.50	101.12667	+76.2	1.0000175
20	29,004,909.77	727,973.10	101.12733	+92.5	1.0000213
36° 21'	28,998,842.13	734,040.74	101.12783	+109.2	1.0000251
22	28,992,774.46	740,108.41	101.12867	+126.3	1.0000291
23	28,986,706.74	746,176.13	101.12933	+143.7	1.0000331
24	28,980,638.98	752,243.89	101.13017	+161.5	1.0000372
25	28,974,571.17	758,311.70	101.13083	+179.7	1.0000414
36° 26'	28,968,503.32	764,379.55	101.13150	+198.3	1.0000457
27	28,962,435.43	770,447.44	101.13217	+217.2	1.0000500
28	28,956,367.50	776,515.37	101.13300	+236.5	1.0000545
29	28,950,299.52	782,583.35	101.13383	+256.2	1.0000590
30	28,944,231.49	788,651.38	101.13433	+276.2	1.0000636
36° 31'	28,938,163.43	794,719.44	101.13517	+296.6	1.0000683
32	28,932,095.32	800,787.55	101.13600	+317.4	1.0000731
33	28,926,027.16	806,855.71	101.13683	+338.6	1.0000780
34	28,919,958.95	812,923.92	101.13767	+360.1	1.0000829
35	28,913,890.69	818,992.18	101.13833	+382.0	1.0000880
36° 36'	28,907,822.39	825,060.48	101.13917	+404.2	1.0000931
37	28,901,754.04	831,128.83	101.14017	+426.9	1.0000983
38	28,895,685.63	837,197.24	101.14083	+449.9	1.0001036
39	28,889,617.18	843,265.69	101.14167	+473.3	1.0001090
40	28,883,548.68	849,334.19	101.14250	+497.0	1.0001144

Lambert Projection for Arkansas (North)

Table I (Cont'd)

Lat.	R feet	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
36° 41'	28,877,480.13	855,402.74	101.14333	+521.1	1.0001200
42	28,871,411.53	861,471.34	101.14433	+545.6	1.0001256
43	28,865,342.87	867,540.00	101.14517	+570.5	1.0001314
44	28,859,274.16	873,608.71	101.14600	+595.7	1.0001372
45	28,853,205.40	879,677.47	101.14633	+621.3	1.0001431
36° 46'	28,847,136.59	885,746.28	101.14783	+647.2	1.0001490
47	28,841,067.72	891,815.15	101.14867	+673.6	1.0001551
48	28,834,998.80	897,884.07	101.14950	+700.3	1.0001612
49	28,828,929.83	903,953.04	101.15050	+727.4	1.0001675
50	28,822,860.80	910,022.07		+754.8	1.0001738

## Lambert Projection for Arkansas (North)

1" of Long. = 0.58189914 of  $\theta$ 

Table II

Long.	$\theta$			Long.	$\theta$			Long.	$\theta$		
89° 20'	+1°	33'	06.2317	89° 56'	+1°	12'	09.3296	90° 31'	+0°	51'	47.3414
21	+1	32	31.3178	57	+1	11	34.4157	32	+0	51	12.4275
22	+1	31	56.4038	58	+1	10	59.5017	33	+0	50	37.5135
23	+1	31	21.4899	59	+1	10	24.5878	34	+0	50	02.5996
24	+1	30	46.5760	90° 00'	+1	09	49.6738	35	+0	49	27.6856
25	+1	30	11.6620	90° 01'	+1	09	14.7599	90° 36'	+0	48	52.7717
89° 26'	+1	29	36.7481	02	+1	08	39.8459	37	+0	48	17.8577
27	+1	29	01.8341	03	+1	08	04.9320	38	+0	47	42.9438
28	+1	28	26.9202	04	+1	07	30.0180	39	+0	47	08.0298
29	+1	27	52.0062	05	+1	06	55.1041	40	+0	46	33.1159
30	+1	27	17.0923	90° 06'	+1	06	20.1901	90° 41'	+0	45	58.2019
89° 31'	+1	26	42.1783	07	+1	05	45.2762	42	+0	45	23.2880
32	+1	26	07.2644	08	+1	05	10.3622	43	+0	44	48.3740
33	+1	25	32.3504	09	+1	04	35.4483	44	+0	44	13.4601
34	+1	24	57.4365	10	+1	04	00.5343	45	+0	43	38.5461
35	+1	24	22.5225	90° 11'	+1	03	25.6204	90° 46'	+0	43	03.6322
89° 36'	+1	23	47.6086	12	+1	02	50.7064	47	+0	42	28.7182
37	+1	23	12.6946	13	+1	02	15.7925	48	+0	41	53.8043
38	+1	22	37.7807	14	+1	01	40.8785	49	+0	41	18.8903
39	+1	22	02.8667	15	+1	01	05.9646	50	+0	40	43.9764
40	+1	21	27.9528	90° 16'	+1	00	31.0506	90° 51'	+0	40	09.0624
89° 41'	+1	20	53.0388	17	+0	59	56.1367	52	+0	39	34.1485
42	+1	20	18.1249	18	+0	59	21.2227	53	+0	38	59.2345
43	+1	19	43.2109	19	+0	58	46.3088	54	+0	38	24.3206
44	+1	19	08.2970	20	+0	58	11.3948	55	+0	37	49.4066
45	+1	18	33.3830	90° 21'	+0	57	36.4809	90° 56'	+0	37	14.4927
89° 46'	+1	17	58.4691	22	+0	57	01.5669	57	+0	36	39.5787
47	+1	17	23.5551	23	+0	56	26.6530	58	+0	36	04.6648
48	+1	16	48.6412	24	+0	55	51.7390	59	+0	35	29.7509
49	+1	16	13.7272	25	+0	55	16.8251	91° 00'	+0	34	54.8369
50	+1	15	38.8133	90° 26'	+0	54	41.9111	91° 01'	+0	34	19.9230
89° 51'	+1	15	03.8993	27	+0	54	06.9972	02	+0	33	45.0090
52	+1	14	28.9854	28	+0	53	32.0833	03	+0	33	10.0951
53	+1	13	54.0714	29	+0	52	57.1693	04	+0	32	35.1811
54	+1	13	19.1575	30	+0	52	22.2554	05	+0	32	00.2672
55	+1	12	44.2436								

Lambert Projection for Arkansas (North)

1" of Long. = 0.58189914 of  $\theta$

Table II (Cont'd)

Long.	$\theta$	Long.	$\theta$	Long.	$\theta$
91° 06'	+0° 31' 25.3532	91° 41'	+0° 11' 03.3650	92° 16'	-0° 09' 18.6232
07	+0 30 50.4393	42	+0 10 28.4511	17	-0 09 53.5371
08	+0 30 15.5253	43	+0 09 53.5371	18	-0 10 28.4511
09	+0 29 40.6114	44	+0 09 18.6232	19	-0 11 03.3650
10	+0 29 05.6974	45	+0 08 43.7092	20	-0 11 38.2790
91° 11'	+0 28 30.7835	91° 46'	+0 08 08.7953	92° 21'	-0 12 13.1929
12	+0 27 55.8695	47	+0 07 33.8813	22	-0 12 48.1069
13	+0 27 20.9556	48	+0 06 58.9674	23	-0 13 23.0208
14	+0 26 46.0416	49	+0 06 24.0534	24	-0 13 57.9348
15	+0 26 11.1277	50	+0 05 49.1395	25	-0 14 32.8487
91° 16'	+0 25 36.2137	91° 51'	+0 05 14.2255	92° 26'	-0 15 07.7627
17	+0 25 01.2998	52	+0 04 39.3116	27	-0 15 42.6766
18	+0 24 26.3858	53	+0 04 04.3976	28	-0 16 17.5906
19	+0 23 51.4719	54	+0 03 29.4837	29	-0 16 52.5045
20	+0 23 16.5579	55	+0 02 54.5697	30	-0 17 27.4185
91° 21'	+0 22 41.6440	91° 56'	+0 02 19.6558	92° 31'	-0 18 02.3324
22	+0 22 06.7300	57	+0 01 44.7418	32	-0 18 37.2463
23	+0 21 31.8161	58	+0 01 09.8279	33	-0 19 12.1603
24	+0 20 56.9021	59	+0 00 34.9139	34	-0 19 47.0742
25	+0 20 21.9882	92° 00'	0 00 00.0000	35	-0 20 21.9882
91° 26'	+0 19 47.0742	92° 01'	-0 00 34.9139	92° 36'	-0 20 56.9021
27	+0 19 12.1603	02	-0 01 09.8279	37	-0 21 31.8161
28	+0 18 37.2463	03	-0 01 44.7418	38	-0 22 06.7300
29	+0 18 02.3324	04	-0 02 19.6558	39	-0 22 41.6440
30	+0 17 27.4185	05	-0 02 54.5697	40	-0 23 16.5579
91° 31'	+0 16 52.5045	92° 06'	-0 03 29.4837	92° 41'	-0 23 51.4719
32	+0 16 17.5906	07	-0 04 04.3976	42	-0 24 26.3858
33	+0 15 42.6766	08	-0 04 39.3116	43	-0 25 01.2998
34	+0 15 07.7627	09	-0 05 14.2255	44	-0 25 36.2137
35	+0 14 32.8487	10	-0 05 49.1395	45	-0 26 11.1277
91° 36'	+0 13 57.9348	92° 11'	-0 06 24.0534	92° 46'	-0 26 46.0416
37	+0 13 23.0208	12	-0 06 58.9674	47	-0 27 20.9556
38	+0 12 48.1069	13	-0 07 33.8813	48	-0 27 55.8695
39	+0 12 13.1929	14	-0 08 08.7953	49	-0 28 30.7835
40	+0 11 38.2790	15	-0 08 43.7092	50	-0 29 05.6974

## Lambert Projection for Arkansas (North)

1" of Long. = 0.58189914 of  $\theta$ 

Table II (Cont'd)

Long.	$\theta$			Long.	$\theta$			Long.	$\theta$		
92° 51'	-0°	29'	40.6114	93° 26'	-0°	50'	02.5996	94° 01'	-1°	10'	24.5878
52	-0	30	15.5253	27	-0	50	37.5135	02	-1	10	59.5017
53	-0	30	50.4393	28	-0	51	12.4275	03	-1	11	34.4157
54	-0	31	25.3532	29	-0	51	47.3414	04	-1	12	09.3296
55	-0	32	00.2672	30	-0	52	22.2554	05	-1	12	44.2436
92° 56'	-0	32	35.1811	93° 31'	-0	52	57.1693	94° 06'	-1	13	19.1575
57	-0	33	10.0951	32	-0	53	32.0833	07	-1	13	54.0714
58	-0	33	45.0090	33	-0	54	06.9972	08	-1	14	28.9854
59	-0	34	19.9230	34	-0	54	41.9111	09	-1	15	03.8993
93° 00'	-0	34	54.8369	35	-0	55	16.8251	10	-1	15	38.8133
93° 01'	-0	35	29.7509	93° 36'	-0	55	51.7390	94° 11'	-1	16	13.7272
02	-0	36	04.6648	37	-0	56	26.6530	12	-1	16	48.6412
03	-0	36	39.5787	38	-0	57	01.5669	13	-1	17	23.5551
04	-0	37	14.4927	39	-0	57	36.4809	14	-1	17	58.4691
05	-0	37	49.4066	40	-0	58	11.3948	15	-1	18	33.3830
93° 06'	-0	38	24.3206	93° 41'	-0	58	46.3088	94° 16'	-1	19	08.2970
07	-0	38	59.2345	42	-0	59	21.2227	17	-1	19	43.2109
08	-0	39	34.1485	43	-0	59	56.1367	18	-1	20	18.1249
09	-0	40	09.0624	44	-1	00	31.0506	19	-1	20	53.0388
10	-0	40	43.9764	45	-1	01	05.9646	20	-1	21	27.9528
93° 11'	-0	41	18.8903	93° 46'	-1	01	40.8785	94° 21'	-1	22	02.8667
12	-0	41	53.8043	47	-1	02	15.7925	22	-1	22	37.7807
13	-0	42	28.7182	48	-1	02	50.7064	23	-1	23	12.6946
14	-0	43	03.6322	49	-1	03	25.6204	24	-1	23	47.6086
15	-0	43	38.5461	50	-1	04	00.5343	25	-1	24	22.5225
93° 16'	-0	44	13.4601	93° 51'	-1	04	35.4433	94° 26'	-1	24	57.4365
17	-0	44	48.3740	52	-1	05	10.3622	27	-1	25	32.3504
18	-0	45	23.2880	53	-1	05	45.2762	28	-1	26	07.2644
19	-0	45	58.2019	54	-1	06	20.1901	29	-1	26	42.1783
20	-0	46	33.1159	55	-1	06	55.1041	30	-1	27	17.0923
93° 21'	-0	47	08.0298	93° 56'	-1	07	30.0180	94° 31'	-1	27	52.0062
22	-0	47	42.9438	57	-1	08	04.9320	32	-1	28	26.9202
23	-0	48	17.8577	58	-1	08	39.8459	33	-1	29	01.8341
24	-0	48	52.7717	59	-1	09	14.7599	34	-1	29	36.7481
25	-0	49	27.6856	94° 00'	-1	09	49.6738	35	-1	30	11.6620



Lambert Projection for Arkansas (North)

1" of Long. = 0°58'18.9914" of  $\theta$

Table II (Cont'd)

Long.		$\theta$	
94°	36'	-1° 30'	46.5760
	37	-1 31	21.4899
	38	-1 31	56.4038
	39	-1 32	31.3178
	40	-1 33	06.2317
94°	41'	-1 33	41.1457
	42	-1 34	16.0596
	43	-1 34	50.9736
	44	-1 35	25.8875
	45	-1 36	00.8015
94°	46'	-1 36	35.7154
	47	-1 37	10.6294
	48	-1 37	45.5433
	49	-1 38	20.4573
	50	-1 38	55.3712
94°	51'	-1 39	30.2852
	52	-1 40	05.1991
	53	-1 40	40.1131
	54	-1 41	15.0270
	55	-1 41	49.9410
94°	56'	-1 42	24.8549
	57	-1 42	59.7689
	58	-1 43	34.6828
	59	-1 44	09.5968
95°	00'	-1 44	44.5107

## Lambert Projection for Arkansas (South)

Table I

Lat.	R feet	y y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
32° 40'	31,511,724.20	0	101.08333	+870.6	1.0002005
41	31,505,659.20	6,065.00	101.08300	+841.0	1.0001936
42	31,499,594.22	12,129.98	101.08267	+811.8	1.0001869
43	31,493,529.26	18,194.94	101.08233	+782.9	1.0001803
44	31,487,464.32	24,259.88	101.08183	+754.4	1.0001737
45	31,481,399.41	30,324.79	101.08133	+726.2	1.0001672
32° 46'	31,475,334.53	36,389.67	101.08117	+698.4	1.0001608
47	31,469,269.66	42,454.54	101.08067	+671.0	1.0001545
48	31,463,204.82	48,519.38	101.08050	+644.0	1.0001483
49	31,457,139.99	54,584.21	101.08000	+617.3	1.0001421
50	31,451,075.19	60,649.01	101.07967	+590.9	1.0001361
32° 51'	31,445,010.41	66,713.79	101.07933	+564.9	1.0001301
52	31,438,945.65	72,778.55	101.07917	+539.3	1.0001242
53	31,432,880.90	78,843.30	101.07867	+514.0	1.0001184
54	31,426,816.18	84,908.02	101.07850	+489.1	1.0001126
55	31,420,751.47	90,972.73	101.07817	+464.6	1.0001070
32° 56'	31,414,686.78	97,037.42	101.07783	+440.4	1.0001014
57	31,408,622.11	103,102.09	101.07750	+416.6	1.0000959
58	31,402,557.46	109,166.74	101.07733	+393.1	1.0000905
59	31,396,492.82	115,231.38	101.07700	+370.0	1.0000852
33° 00'	31,390,428.20	121,296.00	101.07700	+347.3	1.0000800
33° 01'	31,384,363.58	127,360.62	101.07650	+324.9	1.0000748
02	31,378,298.99	133,425.21	101.07633	+302.9	1.0000697
03	31,372,234.41	139,489.79	101.07600	+281.3	1.0000648
04	31,366,169.85	145,554.35	101.07583	+260.0	1.0000599
05	31,360,105.30	151,618.90	101.07567	+239.0	1.0000550
33° 06'	31,354,040.76	157,683.44	101.07550	+218.5	1.0000503
07	31,347,976.23	163,747.97	101.07533	+198.3	1.0000457
08	31,341,911.71	169,812.49	101.07517	+178.4	1.0000411
09	31,335,847.20	175,877.00	101.07483	+158.9	1.0000366
10	31,329,782.71	181,941.49	101.07483	+139.8	1.0000322
33° 11'	31,323,718.22	188,005.98	101.07450	+121.0	1.0000279
12	31,317,653.75	194,070.45	101.07450	+102.6	1.0000236
13	31,311,589.28	200,134.92	101.07433	+84.6	1.0000195
14	31,305,524.82	206,199.38	101.07417	+66.9	1.0000154
15	31,299,460.37	212,263.83	101.07400	+49.6	1.0000114

Lambert Projection for Arkansas (South)

Table I (Cont'd)

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
33° 16'	31,293,395.93	218,328.27	101.07383	+32.6	1.0000075
17	31,287,331.50	224,392.70	101.07383	+16.0	1.0000037
18	31,281,267.07	230,457.13	101.07383	0.0	1.0000000
19	31,275,202.64	236,521.56	101.07367	-16.0	0.9999963
20	31,269,138.22	242,585.98	101.07350	-31.5	0.9999927
33° 21'	31,263,073.81	248,650.39	101.07350	-46.6	0.9999892
22	31,257,009.40	254,714.80	101.07333	-61.4	0.9999858
23	31,250,945.00	260,779.20	101.07333	-75.8	0.9999825
24	31,244,880.60	266,843.60	101.07333	-89.9	0.9999792
25	31,238,816.20	272,908.00	101.07333	-103.5	0.9999761
33° 26'	31,232,751.80	278,972.40	101.07333	-116.8	0.9999731
27	31,226,687.40	285,036.80	101.07317	-129.8	0.9999701
28	31,220,623.01	291,101.19	101.07317	-142.4	0.9999672
29	31,214,558.62	297,165.58	101.07317	-154.6	0.9999644
30	31,208,494.23	303,229.97	101.07317	-166.5	0.9999616
33° 31'	31,202,429.84	309,294.36	101.07317	-178.0	0.9999590
32	31,196,365.45	315,358.75	101.07333	-189.2	0.9999564
33	31,190,301.05	321,423.15	101.07317	-199.9	0.9999539
34	31,184,236.66	327,487.54	101.07333	-210.3	0.9999515
35	31,178,172.26	333,551.94	101.07333	-220.4	0.9999492
33° 36'	31,172,107.86	339,616.34	101.07350	-230.0	0.9999470
37	31,166,043.45	345,680.75	101.07350	-239.4	0.9999448
38	31,159,979.04	351,745.16	101.07350	-248.4	0.9999428
39	31,153,914.63	357,809.57	101.07350	-256.9	0.9999408
40	31,147,850.22	363,873.98	101.07367	-265.2	0.9999389
33° 41'	31,141,785.80	369,938.40	101.07383	-273.1	0.9999371
42	31,135,721.37	376,002.83	101.07400	-280.6	0.9999354
43	31,129,656.93	382,067.27	101.07400	-287.7	0.9999337
44	31,123,592.49	388,131.71	101.07417	-294.5	0.9999321
45	31,117,528.04	394,196.16	101.07433	-300.9	0.9999307
33° 46'	31,111,463.58	400,260.62	101.07433	-307.0	0.9999293
47	31,105,399.12	406,325.08	101.07450	-312.6	0.9999280
48	31,099,334.65	412,389.55	101.07483	-317.9	0.9999268
49	31,093,270.16	418,454.04	101.07483	-322.9	0.9999256
50	31,087,205.67	424,518.53	101.07500	-327.5	0.9999246

## Lambert Projection for Arkansas (South)

Table I (Cont'd)

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
33° 51'	31,081,141.17	430,583.03	101.07533	-331.7	0.9999236
52	31,075,076.65	436,647.55	101.07533	-335.6	0.9999227
53	31,069,012.13	442,712.07	101.07567	-339.1	0.9999219
54	31,062,947.59	448,776.61	101.07583	-342.2	0.9999212
55	31,056,883.04	454,841.16	101.07617	-344.9	0.9999205
33° 56'	31,050,818.47	460,905.73	101.07633	-347.3	0.9999200
57	31,044,753.89	466,970.31	101.07650	-349.4	0.9999195
58	31,038,689.30	473,034.90	101.07667	-351.0	0.9999191
59	31,032,624.70	479,099.50	101.07700	-352.3	0.9999188
34° 00'	31,026,560.08	485,164.12	101.07733	-353.3	0.9999186
34° 01'	31,020,495.44	491,228.76	101.07750	-353.9	0.9999185
02	31,014,430.79	497,293.41	101.07783	-354.1	0.9999184
03	31,008,366.12	503,358.08	101.07817	-354.0	0.9999184
04	31,002,301.43	509,422.77	101.07833	-353.4	0.9999186
05	30,996,236.73	515,487.47	101.07867	-352.5	0.9999188
34° 06'	30,990,172.01	521,552.19	101.07900	-351.3	0.9999191
07	30,984,107.27	527,616.93	101.07933	-349.7	0.9999195
08	30,978,042.51	533,681.69	101.07967	-347.7	0.9999199
09	30,971,977.73	539,746.47	101.08000	-345.3	0.9999205
10	30,965,912.93	545,811.27	101.08033	-342.6	0.9999211
34° 11'	30,959,848.11	551,876.09	101.08067	-339.5	0.9999218
12	30,953,783.27	557,940.93	101.08117	-336.0	0.9999226
13	30,947,718.40	564,005.80	101.08133	-332.2	0.9999235
14	30,941,653.52	570,070.68	101.08183	-328.0	0.9999245
15	30,935,588.61	576,135.59	101.08217	-323.4	0.9999255
34° 16'	30,929,523.68	582,200.52	101.08267	-318.5	0.9999267
17	30,923,458.72	588,265.48	101.08300	-313.2	0.9999279
18	30,917,393.74	594,330.46	101.08333	-307.6	0.9999292
19	30,911,328.74	600,395.46	101.08400	-301.5	0.9999306
20	30,905,263.70	606,460.50	101.08417	-295.2	0.9999320
34° 21'	30,899,198.65	612,525.55	101.08467	-288.4	0.9999336
22	30,893,133.57	618,590.63	101.08517	-281.3	0.9999352
23	30,887,068.46	624,655.74	101.08567	-273.8	0.9999370
24	30,881,003.32	630,720.88	101.08600	-265.9	0.9999388
25	30,874,938.16	636,786.04	101.08667	-257.7	0.9999407

Lambert Projection for Arkansas (South)

Table I (Cont'd)

Lat.	R (feet)	Y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
34° 26'	30,863,872.96	642,851.24	101.08700	-249.1	0.9999426
27	30,862,807.74	648,916.46	101.08750	-240.2	0.9999447
28	30,856,742.49	654,981.71	101.08817	-230.8	0.9999469
29	30,850,677.20	661,047.00	101.08850	-221.1	0.9999491
30	30,844,611.89	667,112.31	101.08900	-211.1	0.9999514
34° 31'	30,838,546.55	673,177.65	101.08967	-200.7	0.9999538
32	30,832,481.17	679,243.03	101.09000	-189.9	0.9999563
33	30,826,415.77	685,308.43	101.09083	-178.7	0.9999588
34	30,820,350.32	691,373.88	101.09117	-167.2	0.9999615
35	30,814,284.85	697,439.35	101.09167	-155.3	0.9999642
34° 36'	30,808,219.35	703,504.85	101.09250	-143.0	0.9999671
37	30,802,153.80	709,570.40	101.09283	-130.4	0.9999700
38	30,796,088.23	715,635.97	101.09350	-117.4	0.9999730
39	30,790,022.62	721,701.58	101.09417	-104.0	0.9999760
40	30,783,956.97	727,767.23	101.09467	-90.3	0.9999792
34° 41'	30,777,891.29	733,832.91	101.09533	-76.2	0.9999824
42	30,771,825.57	739,898.63	101.09600	-61.7	0.9999858
43	30,765,759.81	745,964.39	101.09650	-46.8	0.9999892
44	30,759,694.02	752,030.18	101.09717	-31.5	0.9999927
45	30,753,628.19	758,096.01	101.09800	-16.0	0.9999963
34° 46'	30,747,562.31	764,161.89	101.09850	0.0	1.0000000
47	30,741,496.40	770,227.80	101.09917	+16.3	1.0000037
48	30,735,430.45	776,293.75	101.09983	+33.0	1.0000076
49	30,729,364.46	782,359.74	101.10050	+50.1	1.0000115
50	30,723,298.43	788,425.77	101.10133	+67.5	1.0000155
34° 51'	30,717,232.35	794,491.85	101.10183	+85.3	1.0000196
52	30,711,166.24	800,557.96	101.10267	+103.5	1.0000238
53	30,705,100.08	806,624.12	101.10333	+121.9	1.0000280
54	30,699,033.88	812,690.32	101.10417	+140.9	1.0000324
55	30,692,967.63	818,756.57	101.10483	+160.2	1.0000369
34° 56'	30,686,901.34	824,822.86	101.10550	+179.8	1.0000414
57	30,680,835.01	830,889.19	101.10633	+199.8	1.0000460
58	30,674,768.63	836,955.57	101.10700	+220.2	1.0000507
59	30,668,702.21	843,021.99	101.10783	+240.9	1.0000555
35° 00'	30,662,635.74	849,088.46	101.10867	+262.1	1.0000603



## Lambert Projection for Arkansas (South)

Table I (Cont'd)

Lat.	R (feet)	y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
35° 01'	30,656,569.22	855,154.98	101.10950	+283.6	1.0000653
02	30,650,502.65	861,221.55	101.11017	+305.4	1.0000703
03	30,644,436.04	867,288.16	101.11100	+327.7	1.0000754
04	30,638,369.38	873,354.82	101.11167	+350.3	1.0000806
05	30,632,302.68	879,421.52	101.11267	+373.3	1.0000859
35° 06'	30,626,235.92	885,488.28	101.11350	+396.7	1.0000913
07	30,620,169.11	891,555.09	101.11433	+420.4	1.0000968
08	30,614,102.25	897,621.95	101.11517	+444.5	1.0001023
09	30,608,035.34	903,688.86	101.11600	+468.9	1.0001080
10	30,601,968.38	909,755.82	101.11683	+493.8	1.0001137
35° 11'	30,595,901.37	915,822.83	101.11767	+519.0	1.0001195
12	30,589,834.31	921,889.89	101.11867	+544.6	1.0001253
13	30,583,767.19	927,957.01	101.11950	+570.5	1.0001314
14	30,577,700.02	934,024.18	101.12050	+596.8	1.0001374
15	30,571,632.79	940,091.41	101.12133	+623.5	1.0001436
35° 16'	30,565,565.51	946,158.69	101.12217	+650.5	1.0001498
17	30,559,498.18	952,226.02	101.12317	+678.0	1.0001561
18	30,553,430.79	958,293.41	101.12417	+705.8	1.0001625
19	30,547,363.34	964,360.86	101.12500	+734.0	1.0001690
20	30,541,295.84	970,428.36		+762.5	1.0001755

Lambert Projection for Arkansas (South)

1" of Long. = 0.55969069 of  $\theta$

Table II

Long.	$\theta$	Long.	$\theta$	Long.	$\theta$
89° 50'	+1° 12' 45.5874	90° 26'	+0° 52' 36.6555	91° 01'	+0° 33' 01.3050
51	+1 12 12.0059	27	+0 52 03.0740	02	+0 32 27.7236
52	+1 11 38.4245	28	+0 51 29.4926	03	+0 31 54.1422
53	+1 11 04.8430	29	+0 50 55.9112	04	+0 31 20.5607
54	+1 10 31.2616	30	+0 50 22.3297	05	+0 30 46.9793
55	+1 09 57.6802				
89° 56'	+1 09 24.0987	90° 31'	+0 49 48.7483	91° 06'	+0 30 13.3978
57	+1 08 50.5173	32	+0 49 15.1668	07	+0 29 39.8164
58	+1 08 16.9358	33	+0 48 41.5854	08	+0 29 06.2349
59	+1 07 43.3544	34	+0 48 08.0039	09	+0 28 32.6535
90° 00'	+1 07 09.7729	35	+0 47 34.4225	10	+0 27 59.0721
90° 01'	+1 06 36.1915	90° 36'	+0 47 00.8411	91° 11'	+0 27 25.4906
02	+1 06 02.6101	37	+0 46 27.2596	12	+0 26 51.9092
03	+1 05 29.0286	38	+0 45 53.6782	13	+0 26 18.3277
04	+1 04 55.4472	39	+0 45 20.0967	14	+0 25 44.7463
05	+1 04 21.8657	40	+0 44 46.5153	15	+0 25 11.1649
90° 06'	+1 03 48.2843	90° 41'	+0 44 12.9339	91° 16'	+0 24 37.5834
07	+1 03 14.7029	42	+0 43 39.3524	17	+0 24 04.0020
08	+1 02 41.1214	43	+0 43 05.7710	18	+0 23 30.4205
09	+1 02 07.5400	44	+0 42 32.1895	19	+0 22 56.8391
10	+1 01 33.9585	45	+0 41 58.6081	20	+0 22 23.2576
90° 11'	+1 01 00.3771	90° 46'	+0 41 25.0267	91° 21'	+0 21 40.6762
12	+1 00 26.7957	47	+0 40 51.4452	22	+0 21 16.0948
13	+0 59 53.2142	48	+0 40 17.8638	23	+0 20 42.5133
14	+0 59 19.6328	49	+0 39 44.2823	24	+0 20 08.9319
15	+0 58 46.0513	50	+0 39 10.7009	25	+0 19 35.3504
90° 16'	+0 58 12.4699	90° 51'	+0 38 37.1194	91° 26'	+0 19 01.7690
17	+0 57 38.8884	52	+0 38 03.5380	27	+0 18 28.1876
18	+0 57 05.3070	53	+0 37 29.9566	28	+0 17 54.6061
19	+0 56 31.7256	54	+0 36 56.3751	29	+0 17 21.0247
20	+0 55 58.1441	55	+0 36 22.7937	30	+0 16 47.4432
90° 21'	+0 55 24.5627	90° 56'	+0 35 49.2122	91° 31'	+0 16 13.8618
22	+0 54 50.9812	57	+0 35 15.6308	32	+0 15 40.2804
23	+0 54 17.3998	58	+0 34 42.0494	33	+0 15 06.6989
24	+0 53 43.8184	59	+0 34 08.4679	34	+0 14 33.1175
25	+0 53 10.2369	91° 00'	+0 33 34.8865	35	+0 13 59.5360

## Lambert Projection for Arkansas (South)

1" of Long. = 0.55969069 of  $\theta$ 

Table II (Cont'd)

Long.	$\theta$			Long.	$\theta$			Long.	$\theta$		
91° 36'	+0°	13'	25.9546	92° 11'	-0°	06'	09.3959	92° 46'	-0°	25'	44.7463
37	+0	12	52.3731	12	-0	06	42.9773	47	-0	26	18.3277
38	+0	12	18.7917	13	-0	07	16.5587	48	-0	26	51.9092
39	+0	11	45.2103	14	-0	07	50.1402	49	-0	27	25.4906
40	+0	11	11.6288	15	-0	08	23.7216	50	-0	27	59.0721
91° 41'	+0	10	38.0474	92° 16'	-0	08	57.3031	92° 51'	-0	28	32.6535
42	+0	10	04.4659	17	-0	09	30.8845	52	-0	29	06.2349
43	+0	09	30.8845	18	-0	10	04.4659	53	-0	29	39.8164
44	+0	08	57.3031	19	-0	10	38.0474	54	-0	30	13.3978
45	+0	08	23.7216	20	-0	11	11.6288	55	-0	30	46.9793
91° 46'	+0	07	50.1402	92° 21'	-0	11	45.2103	92° 56'	-0	31	20.5607
47	+0	07	16.5587	22	-0	12	18.7917	57	-0	31	54.1422
48	+0	06	42.9773	23	-0	12	52.3731	58	-0	32	27.7236
49	+0	06	09.3959	24	-0	13	25.9546	59	-0	33	01.3050
50	+0	05	35.8144	25	-0	13	59.5360	93° 00'	-0	33	34.8865
91° 51'	+0	05	02.2330	92° 26'	-0	14	33.1175	93° 01'	-0	34	08.4679
52	+0	04	28.6515	27	-0	15	06.6989	02	-0	34	42.0494
53	+0	03	55.0701	28	-0	15	40.2804	03	-0	35	15.6308
54	+0	03	21.4886	29	-0	16	13.8618	04	-0	35	49.2122
55	+0	02	47.9072	30	-0	16	47.4432	05	-0	36	22.7937
91° 56'	+0	02	14.3258	92° 31'	-0	17	21.0247	93° 06'	-0	36	56.3751
57	+0	01	40.7443	32	-0	17	54.6061	07	-0	37	29.9566
58	+0	01	07.1629	33	-0	18	28.1876	08	-0	38	03.5380
59	+0	00	33.5814	34	-0	19	01.7690	09	-0	38	37.1194
92° 00'	0	00	00.0000	35	-0	19	35.3504	10	-0	39	10.7009
92° 01'	-0	00	33.5814	92° 36'	-0	20	08.9319	93° 11'	-0	39	44.2823
02	-0	01	07.1629	37	-0	20	42.5133	12	-0	40	17.8638
03	-0	01	40.7443	38	-0	21	16.0948	13	-0	40	51.4452
04	-0	02	14.3258	39	-0	21	49.6762	14	-0	41	25.0267
05	-0	02	47.9072	40	-0	22	23.2576	15	-0	41	58.6081
92° 06'	-0	03	21.4886	92° 41'	-0	22	56.8391	93° 16'	-0	42	32.1895
07	-0	03	55.0701	42	-0	23	30.4205	17	-0	43	05.7710
08	-0	04	28.6515	43	-0	24	04.0020	18	-0	43	39.3524
09	-0	05	02.2330	44	-0	24	37.5834	19	-0	44	12.9339
10	-0	05	35.8144	45	-0	25	11.1649	20	-0	44	46.5153

Lambert Projection for Arkansas (South)

1" of Long. = 0.55969069 of  $\theta$

Table II (Cont'd)

Long.	$\theta$			Long.	$\theta$			Long.	$\theta$		
93° 21'	-0° 45'	20.0967		93° 56'	-1° 04'	55.4472		94° 31'	-1° 24'	30.7976	
22	-0 45	53.6782		57	-1 05	29.0286		32	-1 25	04.3791	
23	-0 46	27.2596		58	-1 06	02.6101		33	-1 25	37.9605	
24	-0 47	00.8411		59	-1 06	36.1915		34	-1 26	11.5419	
25	-0 47	34.4225		94° 00'	-1 07	09.7729		35	-1 26	45.1234	
93° 26'	-0 48	08.0039		94° 01'	-1 07	43.3544		94° 36'	-1 27	18.7048	
27	-0 48	41.5854		02	-1 08	16.9358		37	-1 27	52.2863	
28	-0 49	15.1668		03	-1 08	50.5173		38	-1 28	25.8677	
29	-0 49	48.7483		04	-1 09	24.0987		39	-1 28	59.4492	
30	-0 50	2.3297		05	-1 09	57.6802		40	-1 29	33.0306	
93° 31'	-0 50	55.9112		94° 06'	-1 10	31.2616		94° 41'	-1 30	06.6120	
32	-0 51	29.4926		07	-1 11	04.8430		42	-1 30	40.1935	
33	-0 52	03.0740		08	-1 11	38.4245		43	-1 31	13.7749	
34	-0 52	36.6555		09	-1 12	12.0059		44	-1 31	47.3564	
35	-0 53	10.2369		10	-1 12	45.5874		45	-1 32	20.9378	
93° 36'	-0 53	43.8184		94° 11'	-1 13	19.1688		94° 46'	-1 32	54.5192	
37	-0 54	17.3998		12	-1 13	52.7502		47	-1 33	28.1007	
38	-0 54	50.9812		13	-1 14	26.3317		48	-1 34	01.6821	
39	-0 55	24.5627		14	-1 14	59.9131		49	-1 34	35.2636	
40	-0 55	58.1441		15	-1 15	33.4946		50	-1 35	08.8450	
93° 41'	-0 56	31.7256		94° 16'	-1 16	07.0760		94° 51'	-1 35	42.4265	
42	-0 57	05.3070		17	-1 16	40.6574		52	-1 36	16.0079	
43	-0 57	38.8884		18	-1 17	14.2389		53	-1 36	49.5893	
44	-0 58	12.4699		19	-1 17	47.8203		54	-1 37	23.1708	
45	-0 58	46.0513		20	-1 18	21.4018		55	-1 37	56.7522	
93° 46'	-0 59	19.6328		94° 21'	-1 18	54.9832		94° 56'	-1 38	30.3337	
47	-0 59	53.2142		22	-1 19	28.5647		57	-1 39	03.9151	
48	-1 00	26.7957		23	-1 20	02.1461		58	-1 39	37.4965	
49	-1 01	00.3771		24	-1 20	35.7275		59	-1 40	11.0780	
50	-1 01	33.9585		25	-1 21	09.3090		95° 00'	-1 40	44.6594	
93° 51'	-1 02	07.5400		94° 26'	-1 21	42.8904					
52	-1 02	41.1214		27	-1 22	16.4719					
53	-1 03	14.7029		28	-1 22	50.0533					
54	-1 03	48.2843		29	-1 23	23.6347					
55	-1 04	21.8657		30	-1 23	57.2162					

CORRECTIONS TO NATURAL SCALE RATIOS\*  
(in units of the 7th decimal place)

For Lambert Projection				For Lambert or transverse Mercator Projection			
$\Delta\phi'$ as argument							
$\Delta\phi'$	Corr'n (Plus)	$\Delta\phi'$	Corr'n (Plus)	$\Delta y$	or	$\Delta x$	Corr'n (Plus)
1	0	31	34			10,000	0
2	0	32	36			20,000	0
3	0	33	38			30,000	1
4	1	34	40			40,000	2
5	1	35	43			50,000	2
6	1	36	45			60,000	3
7	2	37	48			70,000	5
8	2	38	51			80,000	6
9	3	39	53			90,000	8
10	4	40	56			100,000	10
11	4	41	59			110,000	11
12	5	42	62			120,000	14
13	6	43	65			130,000	16
14	7	44	68			140,000	19
15	8	45	71			150,000	21
16	9	46	74			160,000	24
17	10	47	77			170,000	27
18	11	48	81			180,000	31
19	13	49	84			190,000	34
20	14	50	88			200,000	38
21	15	51	91			210,000	42
22	17	52	95			220,000	46
23	19	53	98			230,000	50
24	20	54	102			240,000	55
25	22	55	106			250,000	59
26	24	56	110			260,000	64
27	26	57	114			270,000	69
28	27	58	118			280,000	74
29	29	59	122			290,000	80
30	32	60	126			300,000	86
$\Delta\phi'$ is the difference in latitude in minutes of the ends of the line.						310,000	91
						320,000	97
						330,000	103
						340,000	110
						350,000	116

\*Scale ratio interpolated for mean latitude or mean  $x'$  of the ends of a line and corrected by the above table is a true mean value accurate to within one in the seventh decimal place.



# MINIMUM STANDARDS FOR PROPERTY BOUNDARY SURVEYS STATE LAND SURVEY AUTHORITY AUGUST 1973

## PREFACE

*The State Land Survey Authority in accordance with its duties and responsibilities defined in Chapter 60.510(7) RSMo 1969, does herewith prescribe the following advisory regulations for Property Boundary Surveys. It is the intent of these specifications to provide the surveyor and the recipient of surveys a realistic yardstick of adequate surveying performance.*

a survey, shall in so far as possible acquire all necessary data, including but not limited to deeds, maps, certificates of title, abstracts of title, section line, and other boundary line locations in the vicinity. He shall compare and analyze all of the data obtained, and make the most nearly correct determination possible of the legal boundaries of such parcel.

### 10.010. Type of Survey Included.

These standards for Property Boundary Surveys shall apply to surveys made for the purpose of establishing or reestablishing the boundary of any lot, tract or parcel of real property in the State of Missouri.

### 10.020. Research and Investigation.

Every parcel of land whose boundaries are surveyed should be made conformable with the record title boundaries of such land. The surveyor, prior to making such

### 10.030. Survey.

(1) The Registered Land Surveyor shall, under his personal direction, cause a survey to be executed, traversing and connecting all available monuments appropriate or necessary for the location, and coordinate the facts of such survey with the predetermined analysis. He shall cause monuments marking the corners of such parcel to be set, and such monuments shall be set in accordance with the full and most satisfactory analysis obtainable.

(2) Measurements will be taken to a precision compatible with the size and geometric shape of the parcel involved, and consistent with the accuracy desired for the area in which the survey is located, and in accordance with the accuracy standards as set out in Section 10.080. Measurements will be recorded and shown on the plat to a number of significant figures representative of the actual significant figures of the measurements.

**10.040. Monumentation.**

(1) Unless specifically excluded by agreement with the client, the land surveyor shall establish, or confirm the prior establishment of permanent monuments, at each and every controlling corner on the boundaries of the parcel or tract of land being surveyed, and in addition shall establish at least two (2) permanent monuments for each and every block created in a new subdivision. In such cases where the placement of a required monument at its proper location is impractical, it shall be permissible to set a reference monument or mark close by that point, and if such reference monument or mark is set, its location shall be properly shown on the survey plat; where any point requiring monumentation has been previously monumented, the correctness of the existing monument shall be confirmed by the land surveyor, and in any event, it shall be shown and referenced by measurements on the survey plat.

When conditions warrant setting a monument or mark on an offset, the location shall be selected so the monument or mark lies on a line of the survey or on a prolongation of such line. Offsets shall not be in fractional feet from the corner unless a physical obstruction affects their location.

(2) The type of permanent monument to be placed shall be selected from the following types. The surveyor shall select a type providing a degree of permanency consistent with that of the adjacent terrain and physical features.

- a) Concrete monuments consisting of reinforced concrete at least four (4) inches in width or diameter and no less than twenty-four (24) inches in depth with its precise position marked by either a brass cap, formed cross, or metal rod.
- b) Cast iron or aluminum survey markers (similar to Harrison's survey marker) shall be no less than twenty-four (24) inches in depth unless encased in concrete with its precise position marked by a point or cross and having the registration number of the land surveyor in responsible charge, or the corporate registration number or name, legibly stamped or imprinted thereon. These monuments shall be placed so as to be solid and free from movement and below normal frost line.
- c) Iron pipe not less than ½ inch in diameter and/or solid or coated steel rods not less than ¾ inch in diameter. These monuments shall have affixed thereto a cap or other device bearing the registration number of the land surveyor in responsible charge, or the

corporate registration number or name legibly stamped or imprinted thereon. These monuments shall be solid and free from movement, and below normal frost line. All monuments one inch in diameter and larger shall have the precise position of the corner marked by a point or cross.

- d) Brass disk not less than 2 inches in diameter, countersunk and well cemented in a drill hole in either solid rock or concrete with its precise position marked by a point or cross, and having the registration number of the land surveyor in responsible charge or the corporate registration number or name legibly stamped or imprinted thereon.

**10.050. Publication of Results.**

A plat shall be made showing the results of such survey and a copy of said plat shall be furnished to the client requesting such survey. This survey plat shall conform to all of the following provisions where applicable:

(1) The plat shall be an original drawing made to a convenient scale on the type of material consistent with purpose and permanency required.

(2) The plat shall show the name of the person for whom the survey was made, the legal description of the property surveyed, or if the description is too long, the deed or other public record reference shall be given. The plat shall bear a certification of the survey with the signature and seal of the surveyor in responsible charge. Whenever more than one sheet must be used to accurately portray the lands platted, each sheet shall bear the signature and seal of the surveyor.

(3) Lettering used on the plat presented to the client or recorder shall be 0.080 inches in height or larger. All characters shall be open, well-rounded and of uniform width. Line width shall be 0.010 inches (mechanical pen size 000) or larger. Typing of notes and other appropriate material shall be used as much as practical. Machines used for typing should be kept clean so that letters are sharp and uniform in density. Typed letters shall be 0.10 inches in height or larger on the final presented plat. Preference shall be given to Pica, Gothic or Executive type styles.

(4) The direction of all boundary lines shall be shown in relationship to grid north, Missouri State Coordinate

System, or in lieu thereof to true north, or to such other established line or lines to which the survey is referenced. The direction of the boundary lines shall be by direct angles, azimuths or bearings.

(5) A prominent North Arrow shall be drawn on every sheet. When possible it shall be placed in the upper right hand corner. The bearing reference or derivation and method shall be clearly stated below each North Arrow shown (grid north, true north, assumed north) (by solar observation, Polaris observation, compass reading).

(6) Sufficient survey data shall be shown to positively describe the bounds of every lot, block, street, easement, and other areas shown on the plat, as well as the outer boundaries of the lands surveyed.

(7) All distances shall be shown in feet, and in accordance with the definition of the American survey foot (1 meter = 39.37 inches exactly). All distances shall be horizontal distances.

(8) Curved lines shall show at least two elements of the curve and preferably these three: Radius, Central Angle and Length of Arc. When not tangent to the preceding and/or succeeding course, the bearing or angle of either the initial tangent radial line or long chord shall be shown. Pertinent information on compound curves shall be shown.

(9) The survey shall be referenced to the corners or subdivisional corners of the General Land Office Surveys or to other lines and points sufficiently established by record by at least one measurement. This reference shall be shown on the plat.

(10) The plat shall show all permanent survey monuments found or set with a notation indicating which were found and which were set.

(11) Where sufficient horizontal control stations exist according to the statutory requirements of the Missouri State Coordinate System (60.400-60.480 RSMo 1969), the surveyor shall make a connection traverse tie between the control station or stations and the outboundary of the survey. Such a connection traverse shall meet accuracy standards of the outboundary survey. The plat shall show the Missouri State Coordinate value on each exterior corner of the tract or parcel. The plat shall also contain a traverse table showing the connection traverse, giving the state coordinates of each station, the final azimuth, grid length, and Missouri State Coordinate System grid factor (combined scale factor and elevation factor).

#### 10.060. Certification.

The surveyors certification should include a statement that the survey was executed in accordance with the current Minimum Standards for Property Boundary Surveys of the State Land Survey Authority.

#### 10.070. Definitions.

(1) URBAN AREA includes the urban area counties as designated by the State Land Survey Authority, plus all incorporated cities within the State having a population of 500 or more.

(2) RESOURCES DEVELOPMENT AREA includes the resources development area counties as designated by the State Land Survey Authority.

(3) RURAL AREA includes the rural counties as designated by the State Land Survey Authority.

(4) ERROR OF CLOSURE — the ratio "error of closure" indicating the accuracy of the survey is expressed in the form of a fraction with the figure "1" as the numerator. It is computed as follows:

$$\frac{\text{linear error closure}}{\text{perimeter of closed traverse}} \text{ as } \frac{1}{x}$$

and the linear error of closure is the square root of the sum of the squares of the error in latitudes (or cosines) and the error in departures (or sines).

(5) POSITIONAL ACCURACY is the degree of perfection obtained from actual field work. It is a value estimated by the surveyor according to his surveying methods, procedures and equipment. The positional accuracy of a survey point is a value computed as the square root of the sum of the squares of each contributing measurement error. Positional accuracy is not related to uncertainties due to differences between measured values and record values or uncertainties in the position of the point of beginning of the survey.

The surveyor should be guided by computed positional accuracy and the recommended maximum positional accuracy values in selecting the equipment and methods necessary for the execution of a survey.

Field work which has a linear error of closure greater than the recommended maximum or computed positional accuracy shall be considered unacceptable and shall be remeasured. Adjustment of closed traverses must not shift the position of any point more than the recommended maximum positional accuracy value.

## 10.080. Accuracy Standards.

Type "A" Property — Small lots where buildings may be erected along property lines or where high land values warrant high accuracy.

Type "B" Property — Parcels or tracts normally encountered in survey work other than Type "A" or Type "C," the surveyor should select the positional accuracy within the range given according to the value and expected use of the land.

Type "C" Property — Parcels or tracts with all sides 1000' or longer, and those having a periphery of 5000' or more.

	Property Type	Positional Accuracy	Error of Closure
Urban Area	A	± 0.10'	N/A
	B	± 0.25' to ± 0.50'	N/A
	C	± 0.75'*	1:10,000*
Resources Development Areas	A	± 0.15'	N/A
	B	± 0.25' to ± 0.67'	N/A
	C	± 1.5'*	1:5,000*
Rural Areas	A	± 0.20'	N/A
	B	± 0.25' to ± 1.0'	N/A
	C	± 3.0'*	1:5,000*

\*Use either positional accuracy or error of closure, depending upon which gives the smaller value.

## References

1. Brown, Curtis M., and Winfield H. Eldridge, *Evidence and Procedures for Boundary Location*, John Wiley & Sons, Inc., New York, 1967.
2. Kissam, Phillip, *Surveying for Civil Engineers*, McGraw-Hill Book Co., New York, 1956.
3. Jacobi, Joseph W., "Minimum Standard Detail Requirements for Land Title Surveys," *Proceedings of Conferences on Land Surveying 1964*, Purdue University Engineering Extension Series No. 120, Lafayette, Indiana.
4. Bauer, S. A., "Factors in Surveying Accuracies," *Surveying and Mapping*, Vol. XI, No. 2, pp. 145-148, American Congress on Surveying and Mapping, Washington, 1951.

## RULES OF PROFESSIONAL CONDUCT

In order to safeguard the life, health, and the welfare of the public and to establish and maintain a high standard of integrity, skill and practice in the professions of engineering and land surveying, the following Rules of Professional Conduct are promulgated in accordance with Acts, (Ark. Stat. 71-1001 through 71-1024 and 71-2301 through 71-2313) of the General Assembly of the State of Arkansas, and shall be binding upon every person holding a certificate of registration as a Professional Engineer or Professional Land Surveyor.

The Rules of Professional Conduct as stated herein are an exercise of the police power vested in the Arkansas State Board of Registration for Professional Engineers and Land Surveyors by virtue of the Acts, (Ark. Stat. 71-1001 through 71-1024 and 71-2301 through 71-2313) of the General Assembly, and as such, the Board is authorized to establish conduct, policy, and practices in accordance with the powers herein stated.

All persons registered under the Acts, (Ark. Stat. 71-1001 through 71-1024 and 71-2301 and 71-2313) are charged with having knowledge of the existence of these Rules of Professional Conduct, and shall be deemed to be familiar with their several provisions and to understand said rules.

- No. 1. The Engineer or Land Surveyor shall conduct his practice to protect life, health, safety and welfare of the public.
- No. 2. The Engineer or Land Surveyor shall perform his services in areas of his competence.
- No. 3. The Engineer or Land Surveyor shall issue public statements objectively and truthfully.
- No. 4. The Engineer or Land Surveyor shall avoid conflict of interests.
- No. 5. The Engineer or Land Surveyor shall solicit or accept work on the basis of his professional qualifications.
- No. 6. The Engineer or Land Surveyor shall restrict his professional services to honest endeavors.

\* \* \* \* \*

## CODE OF ETHICS AND RULES OF PROFESSIONAL CONDUCT FOR REGISTERED LAND SURVEYORS

### Foreword

Honesty, justice and courtesy form a moral philosophy which, associated with mutual interest among men, constitutes the foundations of ethics. The surveyor should recognize such a standard, not in passive observance, but as a set of dynamic principles, guiding his conduct and way of life. It is his duty to practice his profession according to this Code of Ethics.

As the keystone of professional conduct is integrity, the surveyor will discharge his duties with fidelity to the public, his employers and clients; and with fairness and impartiality to all. It is his duty to interest himself in public welfare and to be ready to apply his special knowledge for



the benefit of mankind. He should uphold the honor and dignity of his profession and avoid association with any enterprise of questionable character. In his dealings with fellow surveyors he should be fair and tolerant.

### CODE OF ETHICS

With full realization that as a Professional Land Surveyor, I am also in a dignified profession, I hereby profess that I will not:

1. Act for my client or for my employer otherwise than as a faithful agent or trustee.
2. Accept remuneration for services rendered other than from my client or my employer.
3. Invite or submit priced proposals under conditions that constitute price competition for professional services.
4. Attempt to supplant another Land Surveyor in a particular engagement after definite steps have been taken toward his employment.
5. Attempt to injure, falsely or maliciously, the professional reputation, business, or employment position of another Land Surveyor.
6. Review the work of another Land Surveyor for the same client, except with the knowledge of such Land Surveyor, unless such Land Surveyor's engagement on the work which is subject to review has been terminated.
7. Advertise Land Surveying services in self-laudatory language, or in any other manner derogatory to the dignity of the profession.
8. Use the advantages of a salaried position to compete unfairly with other Land Surveyors.
9. Exert undue influence or to offer, solicit or accept compensation for the purpose of affecting negotiation for any Land Surveying engagement.
10. Act in any manner derogatory to the honor, integrity or dignity of the Land Surveying Profession.

Minnesota Land Surveyors Association  
Affiliated with American Congress on Surveying and Mapping

PROFESSIONAL CONDUCT FOR LAND SURVEYORS

Preamble  
Standards of Integrity  
Responsibility to the Public  
Public Statements  
Truth in Reports and Testimony  
Conflict of Interest  
Improper Solicitation of Employment  
Personal Conduct  
False or Malicious Statements  
Knowledge of Improper Conduct by Others  
Association and Use of Name  
Action by Other Jurisdiction  
Advertising and Publicity  
Standards for Conducting Property Surveys

**Preamble**

In order to establish and maintain a high standard of integrity, skill and practice in the profession of Land Surveying, the following rules of professional conduct shall be binding upon every person holding a certificate of registration as a Land Surveyor, and all agents, employees, or partners of a person holding a certificate of registration.

The rules as set forth therein are specifically intended to implement the laws and regulations governing the practice of land surveying and to further safeguard the property and public welfare of the citizens of the State of Minnesota. These rules shall be deemed to be a reasonable exercise of the enforcement powers vested in the Board of Directors of the Minnesota Land Surveyors Association by virtue of its By-Laws and are adopted in accordance with the powers granted therein.

A Land Surveyor who holds a certificate of registration from the State Board of Registration for Architects, Engineers and Land Surveyors is charged with knowledge of the Rules of Professional Conduct for Land Surveyors as hereinafter set forth as such Rules may be amended from time to time. In the exercise of the privileges granted by a certificate of registration, the Land Surveyor shall conform his professional conduct to the public and to the Board of Directors or its representatives in accordance with the provisions of the Rules for Professional Conduct hereinafter set forth.

**Standards of Integrity**

The Land Surveyor shall be governed in all of his professional relations by the highest standards of ethics and integrity and shall act in all professional matters for each client or employer as a faithful agent or trustee, with due consideration for the rights of others adjoining said client or employer.

**Responsibility to the Public**

The Land Surveyor shall steadfastly protect the safety, health, and welfare of the public in the performance of his professional duties.

### **Public Statements**

Except as he may be required to testify before a competent court of law, a hearing conducted by the State Board of Registration for Architects, Engineers and Land Surveyors or by the Ethics Committee of this Association.

(1) A Land Surveyor shall not engage in any public disputes or controversy relating to fees or the professional practices of another Land Surveyor.

(2) A Land Surveyor shall not publicly express an opinion concerning a land surveying subject unless he is informed of the facts relating thereto necessary to form a sound opinion thereof.

(3) A Land Surveyor shall at all times strive to maintain the honor and dignity of his profession and shall make no public statement concerning land surveying, land surveyors or surveying practices which would tend to bring discredit to any land surveyor or the profession of land surveying.

### **Truth in Reports and Testimony**

(1) The Land Surveyor shall not be untruthful, deceptive or misleading in any professional report, statement or testimony, whether or not under oath, nor shall he knowingly omit relevant and pertinent information from such report, statement or testimony when the result of such omission would or reasonably could lead to a fallacious conclusion.

(2) As an expert witness before any court, commission or other tribunal, the Land Surveyor shall express an opinion only when it is founded upon adequate knowledge of the facts in issue, and upon his honest conviction of the accuracy and propriety of his testimony. Under such circumstances, should his knowledge be inadequate, the Land Surveyor must so state his lack of adequate knowledge of the facts in issue.

### **Conflict of Interest**

(1) A Land Surveyor should avoid employment where duty to the employer would conflict with the interest of the land surveyor or another employer. Prior to accepting employment, a Land Surveyor shall disclose to a prospective employer such facts as may, in the opinion of the Land Surveyor, give rise to a possible conflict of interest.

(2) A Land Surveyor shall not accept compensation for services relating or pertaining to the same project from more than one party unless there is a unity of interest between or among the parties to the project and unless the Land Surveyor makes full disclosure and obtains the express consent of all parties from whom compensation will be received.

(3) A Land Surveyor shall not, directly or indirectly, solicit or accept any compensation, gratuity, or item of value from contractors, their agents or other person dealing with the client or employer in connection with the work for which the Land Surveyor has been retained.

### **Improper Solicitation of Employment**

(1) The Land Surveyor shall seek professional work or employment only on the basis of his qualification, experience, skill and competence.

(2) The Land Surveyor should not solicit, invite or submit proposals for surveying work on the basis of a bidding procedure where there is reasonable grounds for belief that the fee alone will be the sole consideration in the selection of a surveyor. This rule shall not preclude a Land Surveyor from accepting work on a negotiated fixed fee basis.

(3) The Land Surveyor shall not solicit, or attempt to replace or supplant another Land Surveyor on any project.

(4) A Land Surveyor shall not accept employment to review the work or to replace another Land Surveyor, except with his express knowledge and consent, or unless the employment of such other Land Surveyor by the client has been terminated.

(5) A Land Surveyor shall not falsify or misrepresent the extent of his education, training, or experience to any person or to the public; nor shall he misrepresent the extent of his responsibility in connection with any prior employment.

(6) A Land Surveyor may prepare a brochure or other written materials for the purpose of informing the public or any prospective employer of his qualifications, training, or experience; provided that such brochure or written materials shall not contain any false or misleading information concerning the Land Surveyor or his employer, employees, associates, or joint venturers.

(7) A Land Surveyor shall not tender any gift, pay, or offer to pay, directly or indirectly, any thing of value, whether in a form of commission or otherwise, as an inducement to secure employment as a Land Surveyor; provided that this Rule shall not prohibit a Land Surveyor from paying a commission to a licensed employment agency for securing a salaried position.

(8) The Land Surveyor who is regularly employed by a governmental office or agency and who accepts private part-time employment shall not use the equipment or facilities of such governmental office or agency in connection with such part-time employment. A Land Surveyor who is regularly employed by another Land Surveyor in full-time practice and who accepts other part-time employment shall not, without the express consent of his regular employer, use his (a) equipment; (b) time to do research or mapping, or (c) office to seek or accept part-time work.

#### **Personal Conduct**

(1) A Land Surveyor shall avoid any act which may diminish public confidence in the profession and shall, at all times, conduct himself so as to maintain its reputation for professional integrity.

(2) The Land Surveyor shall not act in any manner or engage in any practice which will tend to bring discredit on the honor or dignity of the land surveying profession.

#### **False or Malicious Statements**

The Land Surveyor shall make no false or malicious statements, or do any other act, which may have the effect, directly or indirectly, or by implication, of injuring the personal or professional reputation or business of another Land Surveyor.

### Knowledge of Improper Conduct by Others

(1) A Land Surveyor who has knowledge or reasonable grounds for believing that another Land Surveyor has violated any of the provisions of these Rules of Professional Conduct, shall have the duty of presenting such information to the Board. A Land Surveyor who has knowledge or reasonable grounds for believing that another Land Surveyor has violated any statute or Rule regulating the practice of Land Surveying shall have the duty of presenting such information to the State Board of Registration for Architects, Engineers and Land Surveyors.

(2) The Land Surveyor, when questioned concerning any alleged violation on the part of another person by any member or authorized representative of the Board commissioned or delegated to conduct an official inquiry, shall neither fail nor refuse to divulge such information as he may have relative thereto.

### Associations and Use of Name

The Land Surveyor shall not knowingly associate with or permit the use of his name or firm name in a business venture by any person or firm which he knows or has reason to believe is engaging in business or professional practices of a fraudulent or dishonest nature.

### Action by Other Jurisdictions

Conviction of a felony without restoration of civil rights, or the revocation or suspension of a Land Surveyor's certificate of registration by another jurisdiction, if for cause which in the State of Minnesota would constitute a violation of law or of these Rules, shall be deemed to be a violation of these Rules of Professional Conduct. Any Land Surveyor adjudged mentally incompetent shall, until he is restored to mental competency, forfeit his membership in the Association.

### Advertising and Publicity

(1) Professional Cards: The Land Surveyor, whether in private practice, in practice in a partnership with other Land Surveyors, or in practice as the employee of a firm which includes land surveying in its services, may have professional cards of a size not to exceed 2" by 3-1/2" and which contain only the following information:

- a. Name of Land Surveyor
- b. Name of the partnership or employer
- c. Office address
- d. Office telephone number
- e. Days and hours that office is open
- f. Degree and professional titles of Land Surveyor
- g. Location of records of which the Land Surveyor is the custodian
- h. Description of specific phase of Land Surveying in which Land Surveyor, partnership or employer specialize, if any
- i. The emblem of this Association or of the Firm, if any.

Further, the Land Surveyor, whether in private practice, in practice in partnership with other Land Surveyors, or in practice as the employee of a firm which includes Land Surveying in its



services, may add the following information:

- a. The name of the Partnership or that of his employer
- b. The office address
- c. The telephone number of the office
- d. Days and hours this office is open
- e. Description of the specific phases of Land Surveying in which the partnership or the employer can prove itself competent
- f. The emblem of the Association
- g. The emblem of the Company.

(2) Letter-Heads: Letter-heads may contain the information permitted on professional cards, and, in addition, a listing of those members and employees of the partnership or firm who are currently registered by the State Board for Registration for Architects, Engineers and Land Surveyors.

(3) Yellow Pages: Registered Land Surveyors may list their name, address and telephone number in the classified section of their local telephone directory, in lower case type, only under the heading: *Surveyors, Land*. A Land Surveyor who is also registered to practice in another field of practice may also list such information under the appropriate heading.

(4) Signs or Placards: A land Surveyor may display signs on the interior or exterior of his office or survey vehicles, provided, however, that such sign may contain only the name of the Land Surveyor or that of the partnership or firm, its address, phone number, and the emblem of this Association. The size of the lettering on such signs shall be limited to six inches. The sign may not be of the luminous type and may not be larger than six square feet.

(5) Journals, Bulletins or Periodicals: Listings in professional journals, bulletins or periodicals only, shall be permitted, provided that said listing is limited in size to 16 square inches and contains only such information as is permitted under subparagraph (1) above.

Changes in and additions to professional personnel may be announced by the publication in professional journals, bulletins or periodicals of the fact of such change and a brief biography containing the information described in subparagraph (1) above which may be accompanied by a photograph (head and shoulders only) of not more than four inches square.

As a matter of professional information, a Land Surveyor may also prepare for publication in professional journals, bulletins or periodicals, technical or professional articles describing land surveying projects of special interest to the profession in which he has a particular interest, provided, however, that such articles shall not contain information which may be detrimental to the interest of a client for whom work was done by the Land Surveyor.

(6) Professional Brochure: The Land Surveyor may prepare a brochure to inform prospective clients of the work of which his office is capable. Such brochure may contain photographs, illustrations and such other technical information as will permit a prospective client to evaluate the experience and capability of the Land Surveyor.

The Land Surveyor, before using any such form of descriptive material shall submit the proposed brochure to the Board of Directors of the Association for its approval and, in the event of approval, may display that fact on the brochure.

Indiscriminate mailing or mass distribution of the brochure is not permitted.

(7) Radio and Television: Advertising by means of radio or television is not permitted. However, a Land Surveyor may participate in informative interviews or similar programs to discuss technical and professional matters concerning the profession provided that he receives no compensation for such participation.

(8) Use of the Individual Seal of the Land Surveyor: Use of this seal is forbidden in all publicity.

(9) Other Publicity: For all publicity not covered above, the Land Surveyor must consult with, and obtain the approval of the Board of Direction of the Association.

#### **Standards for Conducting Property Surveys**

All land survey work shall be performed in conformity with the accuracy required in Minnesota platting requirement in Section 505.02 or as such requirements be further amended from time to time; and such standards for property surveys as may be adopted by the Minnesota Land Surveyors Association.

#### *Note:*

1) In 1971, these rules were prepared by the Ethics Committee of the Minnesota Land Surveyors Association. The rules were adopted by majority vote of the Minnesota Land Surveyors Association members in 1972.

2) In 1972, these rules were approved by majority vote of the land surveyors registered in Minnesota, as recited in the 1971 Roster published by the State Board of Registration for Architects, Engineers and Land Surveyors.

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## EXCERPTS FROM U. S. FOREST SERVICE MANUAL

In Arkansas, we have large areas of land in our national forests. The United States Forest Service is responsible for surveys of these lands and in connection therewith has published a manual dated September 1977, a portion of which deals with land surveying. Since the Arkansas surveyor often finds himself in the position of surveying lands adjacent to national forest boundaries, the section of this manual dealing with land surveys is incorporated in order that a better understanding of the methods and procedures used will be available.

7153 - LAND SURVEYS. Land management objectives require the legal identification, accurate location, and proper marking of National Forest boundaries. Applicable Federal, State, and local laws must be followed. The professional Forest Service surveyor shall research survey records, evaluate evidence, interpret deed descriptions, utilize proper technical and legal survey methods, and make decisions consistent with applicable laws.

The Forest Service land survey program includes:

1. Inventory of corners controlling land ownership.
2. Recovery, restoration, and perpetuation of corners.
3. Establishment or reestablishment of property or controlling corners which are part of the original survey system.
4. Marking, posting, and maintenance of land corners and property boundaries.
5. Documentation of all land surveys with plats, certificates, and/or affidavits by prescribed format to be filed with the local public authority.
6. Maintaining a permanent file of survey records in Forest Service offices.

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\*- 7153.01 - Authority. The Forest Service relies on two authorities to execute land surveys of National Forest land:

1. Bureau of Land Managment. The Bureau of Land Management creates and identifies the limits of the public domain. The locations of the public domain are defined either by actual surveys or protraction based on official surveys. Public domain means lands where the title has always been in the name of the United States, or lands which were reconveyed to the United States under the General Exchange Act.

2. Individual State Authority. After title has passed from the public domain into private ownership, jurisdiction over the property, including survey authority, passes to the State. Generally, lands acquired by the United States are surveyed under State survey jurisdiction. These acquired lands fall into two categories:

a. Private land, formerly public domain, acquired for National Forest purposes.

b. Private land, acquired for National Forest purposes, where title was never held by the United States, such as the Thirteen Colonies. State authority, however, applies to any boundaries between private land and National Forest System lands. Any boundary disputes on these federally-owned land must be heard in the Federal court system.

7153.02 - Objective. The land survey activity provides the land manager with the legal and technical capabilities to properly identify and delineate property lines for the management, protection, and utilization of all National Forest System lands. This will be accomplished by the establishment or reestablishment and maintenance of all National Forest property corners and boundaries.

Qualified land surveying personnel shall be available for use by all National Forests.

7153.03 - Policy. The Forest Service requires employees who are directing land surveying activities to be registered as land surveyors in their respective States. In addition:

1. Standards established herein will be complied with.

2. Land surveys accomplished for the Forest Service must be performed in accordance with applicable statutes, laws, and regulations, and must be certified by a registered land surveyor.

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- \*- 3. Land surveys will be reviewed and/or approved by the Regional Forester.
4. Records of land surveys will be prepared and maintained as permanent records.
5. Property lines will be located and marked to standard. Any management activity near or adjacent to a property line which creates a false or misleading boundary line is not acceptable. False boundary lines come into existence by utilizing old use lines, setback fences, timber cutting line setbacks, mutual temporary boundary agreements, timber cutting line agreements, improper surveys, and improperly placed boundary signs. All of these invite trespass, serious boundary conflicts, adverse public relations and possible litigation. All land management practices occurring near or adjacent to National Forest boundaries must comply to the true property line.
6. Seek the cooperation and participation of adjoining landowners in legally locating and maintaining mutual boundaries.
7. Ensure that new boundaries are effectively delineated and included in maintenance plans following landownership adjustments.
8. The Forest Service, in accord with the National trend, will systematically convert its surveying measurements to the metric system. Direction and implementation will be developed and programmed at the Regional level.

7153.04 - Responsibilities

1. Chief. The Chief provides policy and national direction for the land survey program. He has delegated to the Deputy Chief for the National Forest System overall direction and coordination of the program. The Engineering and Lands Staffs share responsibility for furnishing program justification statements and supporting data. This material is used for the budget and congressional hearings, formulating the budget, allocating funds, promoting an understanding of program objectives, and obtaining cooperation of others in accomplishing program objectives.

a. Engineering Staff. This Staff shall provide leadership and guidance for the technical aspects of the program. These include inventory, action plans, accomplishment, preparation and maintenance of records and reports, recruitment, training and certification programs, and coordination of survey operations with or between Regions and other agencies. Engineering shall assist with information and technical direction to Lands in the planning and programming.



- \*- b. Lands Staff. This Staff shall provide leadership in planning, programming, and financing. They shall develop priorities, plan landownership adjustment, and coordinate broad phases of the program with other resource and land management agencies.

2. Regional Foresters. The Regional Forester shall:

a. Coordinate Regional formulation and direction, functional assistance, and activity reviews. The Engineering Staff will provide technical direction and assist with information in the planning. The Lands Staff will provide the planning, programing and finance direction, and coodinate with other land and resource activities.

b. Cooperate and coordinate with Federal and State agencies and other interested parties.

c. Issue supplemental instructions and standards.

d. Conform with applicable Federal, State, and local laws.

e. Coordinate the recruitment, training, and certification program.

f. Review and/or approve all land surveys prior to official filing and/or recording.

3. Forest Supervisors. Forest Supervisors shall plan, budget, finance, and administer the land survey program on their respective units. A registered land surveyor shall be available to provide such services to each Forest.

4. District Rangers. The District Ranger shall monitor and maintain property boundaries. The Ranger must coordinate planned activities with needs for boundary establishment and reestablishment. He also coordinates the planning and execution of boundary surveys on the District.

5. Land and Resource Management Planners. Planners shall consider all previous and possible future land survey investments in allocating lands or resources. For example, silvicultural treatments, timber sales, roads, or other construction, in units with mixed public and private ownership, will always require the establishment and/or protection of property corners and lines.

6. Field Personnel. All field-going personnel shall report any conditions that may contribute to or create boundary problems, such as:

\*- a. Damage to property line marking and posting or to property corners, resulting from activities on land in the National Forest System.

b. Evidence of trespass or potential trespass either by or against the Forest Service. All field personnel shall report trespass claims to the appropriate line officer, as outlined in FSM 5450. It is not the responsibility of field-going personnel to decide upon the legal implication of their findings.

7153.1 - Planning. The Supervisor and his staff will review to obtain information needed to establish Forest-wide priorities. A systematic plan will be formulated to ensure that the land survey program will meet the short- and long-term land management objectives of the Forest.

7153.11 - Inventory. The Forest Supervisor shall annually update the land survey inventory, showing survey and maintenance needs and accomplishments for the Forest. This inventory shall be compiled in the national format, and will be integrated with the 5-year plan.

7153.12 - Priorities. The following priorities shall be observed:

1. Locate, monument, post, and maintain those boundaries where known litigation is pending or a title claim has been asserted.
2. Locate, monument, post, and maintain those corners and boundaries where significant resource values or improvements are planned. This includes the location, by survey, of easements necessary for resource management.
3. Locate, monument, post, and maintain those corners and boundaries where occupancy trespass is suspected, or where the probability of occupancy trespass can be reduced.
4. Locate, protect, restore, or reestablish property controlling corners.
5. Locate and protect remaining noncontrolling and interior corners.

7153.13 - Public Relations. Forest Service personnel must explain the objectives of the land survey program to the public and other agencies. The following points shall be stressed:

1. Accurately marked and accepted property corners and property lines enhance the value of the land and are essential to effective management.

- \*- 2. Perpetuating corners and marking property lines help protect the property rights of others as well as those of the Government.

3. All work complies with applicable Federal and State laws.

7153.2 - Survey Requests. Requests for all land survey projects shall be prepared and submitted through the Forest Supervisor. Requests requiring services from the Bureau of Land Management or other agencies shall be prepared by the Forest Supervisor on form 7100-54 and submitted to the Regional Forester for necessary coordination. All contacts with other agencies shall be made at the Regional level.

7153.3 - Training. The Chief will develop a national training and certification program that will ensure land surveying capabilities for the National Forest System. The Regional Forester shall implement the Chief's program.

The effectiveness of the program depends on good communications between land managers and the technical specialists. Presentations are needed at Forest and District staff meetings to promote understanding of the land survey program.

Training will be conducted as needed. An adequate training program should provide:

1. Knowledge of program needs, size, operating procedures, benefits, and problems.
2. Knowledge about Forest Service management objectives, other Government agencies' programs, and adjoining landowners' activities.
3. Opportunities for Forest Service professional land surveyors to maintain and increase their technical competence, professional development, and administrative and management ability. Current developments in surveying equipment and procedures will be emphasized.
4. Encouragement of State registration for land surveyors.
5. Opportunities and experience for Forest Service surveying technicians, with the objective of creating and maintaining a pool of qualified talent to meet future personnel needs.

\*- Training can include paid attendance at colleges, universities, technical institutions, suitable extension courses, special on-the-job training, short surveying courses, and participation in professional surveying and engineering societies.

7153.4 - Marking and Maintenance. Marking and maintenance of existing land survey corners and lines must be performed by qualified District and/or Forest personnel. All maintenance shall be accomplished to published standards. Property lines and land survey corners, once established, shall be marked and maintained to standard.

7153.41 - Planning. Management will establish the priority, class, and scheduling of all boundary lines for marking and maintenance (FSM 7153.1). The Forest survey specialist should be involved in all planning. A current inventory of boundary needs and accomplishments shall be maintained at the District and Forest level.

7153.42 - Corner Search and Evaluation. The basic component of the boundary marking program is the location and perpetuation of existing land survey corners. Highest priority is given to property and property controlling corners where activity is planned. Other corners should be searched for prior to any activity which may result in their destruction.

Details of corner search and evaluation will be recorded on Land Corner Record Cards, Form 7100-52, and maintained at the Forest level.

#### 7153.43 - Monuments and Accessories

1. A property corner is a geographic point on the earth's surface usually denoting the intersection of two or more property boundary lines.

A monument is the physical object used to mark or reference a corner position. Accessories are identifiable physical objects whose spatial relationship to a property corner is known, and is a matter of public record.

Undisturbed monuments and accessories provide the best evidence of original corner positions. The courts attach major importance to physical evidence relating to the original position of a corner; it is given far greater weight than the record relating to bearings and lengths of lines.

- \*- Frequently, original survey evidence is in a deteriorated condition and may be inadvertently destroyed by inexperienced personnel. Only qualified surveyors will be permitted to examine, evaluate, and testify as to the authenticity of evidence. This includes the opening of suspected bearing trees or the disturbing of corner mounds.

2. The placing of a new monument and accessories to perpetuate a corner is a land survey function. The preparation and disposition of records required by State and Federal law and administrative direction are also part of this function. Remonumentation of land survey corners will be executed under the direct supervision of a registered land surveyor.

3. The perpetuation of a land survey corner and its accessories by new signs, guard post, paint, or flagging are considered maintenance and can be accomplished by knowledgeable field personnel.

7153.44 - Boundary Lines Standards. The boundary line phase of the program is the location by survey, and the identification by posting and marking to standard, of the true property lines between controlling property corners.

1. Property lines will be located to within 1 foot of the true line between two consecutive property corners.

2. Accessories used to identify this line must fall within 3 feet of the true line between two consecutive property corners.

3. In areas of sparse timber, the distance may be extended to include accessories within 5 feet of the true property line.

4. All boundary signs mounted on trees, fences, or posts and/or all line monuments must be placed within 1 foot of the true property line.

5. All markings on private lands will be done only with the consent of the landowner.

7153.45 - Marking and Posting Standards. Three posting standards are approved for defining National Forest property boundaries. Any one, or a combination of the three, constitute property line standards. These standards will give flexibility to the land manager in marking property boundaries so that they are esthetically compatible with his land management objectives. Each manager has full responsibility, once a line has been marked to standard, for implementing an adequate maintenance program.



- \*- 7153.46 - Property Line Standard. Standard means a property line located on-the-ground to full standards of accuracy, and sufficiently marked and posted to ensure that the line is obvious to normally alert and prudent persons. The amount of clearing and marking, and the spacing of signs along the property line necessary to meet the above requirements varies with local conditions, ground cover, and topography. Consideration also must be given to land and resource values, land use, and the attitudes of adjoiningers.

General instructions for marking and posting to Forest Service Manual standard follow.

1. Clearing. The property line is to be cleared of small trees, brush, and debris for a distance of about 2 feet on each side of the line, unless the line is defined by such features as a hedge, fence, lane, or road. The maximum size of small trees to be cut must be determined by a Regional, Forest, or District official. Under certain conditions, mechanized equipment or chemical sprays may be used to facilitate the clearing and control of vegetation. Owners of private land seldom object to having their side of a boundary line cleared; however, it is advisable to obtain written agreement when there is reason to believe objections may be raised. Under no circumstances should clearing be done on private land if the owner objects.

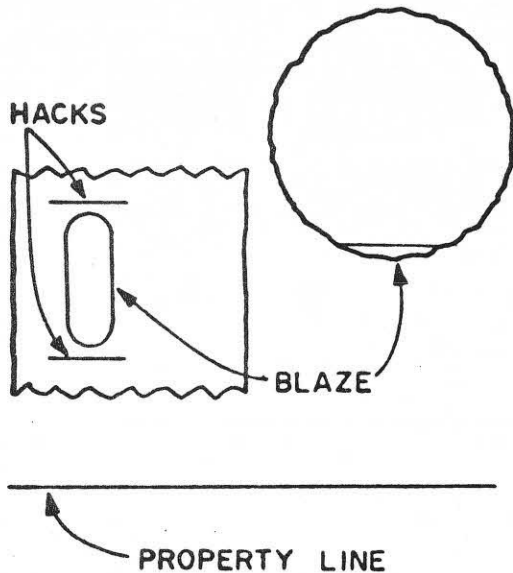
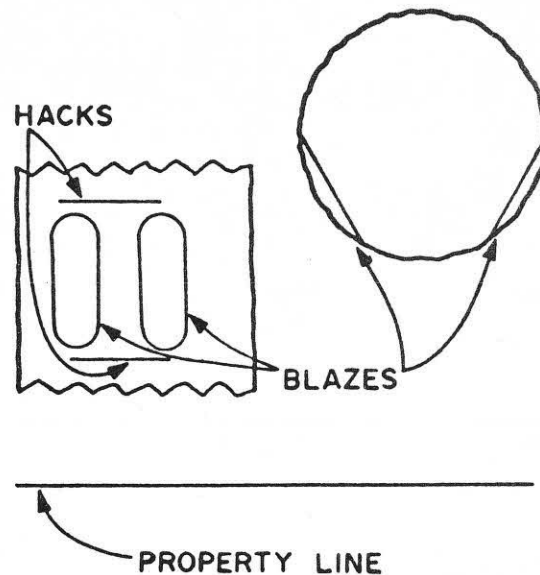
2. Blazes and Hacks. These are the marks made on trees with an ax in such a way that they will remain as long as the trees exist.

A blaze is made by cutting off, at breast height, a vertical strip of bark and a very thin layer of the underlying live wood tissue. The strip should be about 6 to 8 inches long, 2 to 4 inches wide, and the top and bottom ends should be smoothed out.

A hack is a single horizontal cut made with an ax slanted upwards. Hacks should be located about 4 inches above and below the blaze. The cut should go through the bark and penetrate well into the wood.

Illustrations of the two kinds of markings used by the Forest Service on trees along property lines, referred to as face and quarter blazes (in these terms, hacks are considered part of the blaze), follow:

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\*- FACE BLAZEQUARTER BLAZE

Face or quarter blazes will be used as follows:

a. Trees on Property Line. Place face blazes on opposite sides, along the direction of the line, so that the blazes face a person proceeding along the line in either direction.

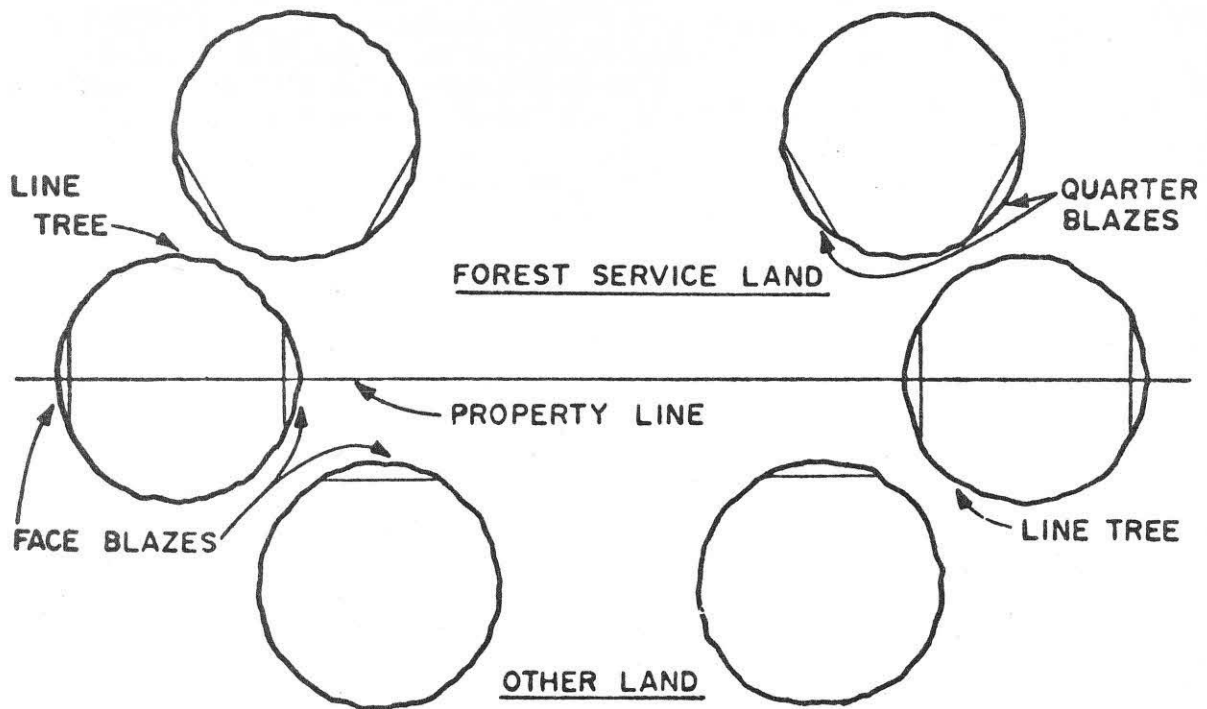
b. Blazes on Forest Service Side of Property Line. Place quarter blazes on every suitable tree within 3 feet of the line. They should be easily visible to any person traveling in either direction along the property line.

c. Trees on Opposite Side of Property Line from Forest Service Side. Place a face blaze on every suitable tree within 3 feet of the line on the side of the tree facing the line. Written permission should be obtained from adjoining owners before trees on private lands are marked.

There will be instances when it will be obvious that clearing or marking should not be done on private land. Examples include property owned by persons known to be hostile to the Forest Service, property lines of resorts, and summer home sites.

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## USE OF FACE AND QUARTER BLAZES



3. Painting. All blazes and posts will be painted with a heavy-base red enamel implement paint. Paint should also be applied at random to some of the rocks which are used to make cairns or which are piled around the bases of monuments and posts.

An insecticide may be mixed with the paint to protect the blaze from insects and disease.

4. Posts. These should be at least 6 feet long and must be made of metal, treated wood, or other approved material. They are to be firmly set, with about 4 feet extending above the ground. Posts with appropriate signs attached will be set near corner points and on property lines as follows:

a. As a guard post near each corner monument. If the corner monument is a tree, a post is not required.

b. Where property lines cross roads or trails. Generally, wood posts should be used at road crossings.

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- \*- c. At all other locations where property boundary signs are needed and there are no other suitable objects, such as trees, to which the signs can be attached.

#### 7153.47 - Classes of Marking

1. Class A, High Visibility. All property corners are permanently monumented. All trees and other suitable accessories on the true line should be blazed or marked on both sides. Trees on the Forest Service side of the true line will be quarter blazed and hacked. Trees on the private side of the true line will be face blazed and hacked. All blazes and marks will be painted with durable red paint.

Line posts with appropriate signs will be placed on the property line no more than 600 feet apart. Posts must be intervisible. A person standing at one post must be able to see the next post in both directions on the line. Posts with signs will also be placed at all roads, ridgetops, trails, streams, and other areas of use. Property boundary signs (54-2) will be placed only on posts and trees within 1 foot of the true line.

2. Class B, Moderate Visibility. In areas of visual impact, lines will be identified without detracting from the esthetic values.

Posts of suitable materials will be selected to blend with the natural surroundings. Forest Service boundary signs (54-2) will be permanently attached to posts or trees located selectively along this line. They do not have to be intervisible, but the distance between posts must not exceed 300 feet. Posts with signs will be placed at all roads, streams, ridgetops, and trails, but the blazing and painting of trees may be restricted.

All new and existing blazes should be painted in a discreet manner. Line clearing is still required, but discretion can be used to determine the amount of clearing necessary.

3. Class C, Subdued Visibility. This standard requires Regional Office approval. Its use is limited to management areas, such as campgrounds, summer-home areas, and line paralleling scenic roads, where environmental and esthetic considerations call for reduced marking. The line will be cleared to class B standards, but blazing and marking may not be necessary.

Standard line markers may be substituted for blazing and marking. Line markers will be accurately positioned by survey and will represent boundary points along the true line. They must be intervisible to allow perpetuation of the line.

- \*- If, in the opinion of the surveyor, these points are subject to destruction, they will be referenced and recorded on a Corner Record Card, Form 7100-52.

When class C marking is utilized, the marker rods or pipes used will be not less than 5/8 inch in diameter, not less than 18 inches long, and identified by a cap not to exceed 3 1/4 inches in diameter.

Caps will be permanently attached to the rods or pipes and will not extend more than 6 inches above the ground. Line markers must be identified to prevent their being confused with property corners. The cap will be marked with the words "Line marker" and with a stamped line through the center of the cap, to be oriented along the boundary line.

7153.48 - Boundary Maintenance. Boundary maintenance will be performed only on those lines identified. Maintenance shall meet the standards of FSM 7153.47.

Maintenance will consist of inspecting and rehabilitating all lines and corner to ensure continued compliance with FSM 7153.47. Maintenance schedules will be established and will ensure periodic inspections so that lines and corners do not become obliterated.

7153.5 - Boundary Surveys. A boundary survey is made to establish or reestablish, on the ground, the limits, areas and boundaries of rights, titles, or other interests in lands which are administered by the Forest Service. Usually, this type of surveying is restricted to the delineation of parcels of land. The term "cadastral survey" is used for surveys of the public lands of the United States as related to land boundaries and subdivisions made to create units suitable for transfer or to define the limitations of title. The terms "cadastral," "land," and "boundary surveying" are used interchangeably.

Boundary surveying includes, but is not limited to, proclamation, acquired lands, special administrative, special interest, and management unit boundaries. A registered land surveyor must perform those surveys where the boundaries are controlled by law and subjected to court action. The Forest Service does not have the authority to negotiate the position of any property boundary. This authority is vested solely in the courts and the Congress of the United States.

Administrative boundary surveys involving only National Forest lands, where title to the surface and subsurface is vested in the United States, do not necessarily require the service of a registered land surveyor.

7153.51 - Systems of Surveys. Two basic systems of surveys are used in the United States:

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- \*- 1. Rectangular. This is the system of surveys adopted for the division of public domain lands.

2. Metes and Bounds. This is a method of describing land by measures of length (metes) and direction of the boundary lines (bounds). The most common method is to recite direction and length of each line as one would walk around the perimeter. The metes and bounds can be recited by reference to record natural or cultural boundary lines. This system is generally used to describe irregular parcels of land.

7153.52 - Types of Surveys. The land surveyor will determine the type of survey needed. Depending on the particular need, existing conditions and/or previous surveys, any one of the following types of surveys may be required:

1. Original Survey. An original survey is the first legal survey that locates, describes, and monuments land for the purposes of identification, administration, and possible title transfer.

2. Retracement Survey. A retracement is a survey made to verify the direction and length of lines, and to identify the monuments and other marks of a previous survey.

3. Resurvey. A resurvey is a reconstruction of land boundaries and subdivisions by rerunning and remarking the lines recorded in field notes or on the plat of a previous official survey.

a. Dependent Resurvey. A dependent resurvey is a rerunning and remarking of the lines of an original survey in their true original positions, according to the best available evidence.

b. Independent Resurvey. An independent resurvey is an establishment of new section lines, independent of and without reference to an original survey.

4. Subdivision Survey. A subdivision survey is the use of legal boundaries and their controlling corners to divide a known parcel of land into smaller parts, aliquot parts, lots, or tracts. Careful consideration must be given to prior record surveys to ensure use of the proper controls and intent during subdivision.

7153.53 - Boundary Survey Standards. Boundaries other than property boundaries may be surveyed to any appropriate standard. Property boundary surveys must satisfy the accuracy standards established by Federal, State, and local regulations. Property boundaries must be established by an accepted survey method that will position all points between two true corners to within 1 foot of their true line position.

\*-The complexity and amount of survey work required, and the survey methods to be used, depend upon the land value, terrain, and vegetative cover. Use those surveying methods that will accomplish the work required at the lowest cost. Staff compass survey methods will usually not be sufficient. Higher order surveying methods are more reliable and may be faster and more economical. See FSM 7153.4 and 7174.3 for survey boundary and positional error and accuracy tolerance.

7153.6 - Special Surveys. There are numerous types of special project surveys which Forest Service surveyors may be required to accomplish. Specific instructions for each type will be in forthcoming FSH 7109.15, Land Surveying Handbook. Special surveys include the following:

1. Special Use, Leases, and Other Partial Interest Surveys. These are similar to easements surveys in that they establish boundaries for interests having less than fee title in the land. The objective is to provide accurate descriptions for use in legal documents. Boundaries must be marked sufficiently to identify them on the ground. Boundary survey standards (FSM 7153.53) apply, but marking and posting requirements may be modified to protect esthetic values.
2. Special Management Area Surveys. These are surveys of intra-Forest boundaries needed to identify National recreation areas, research natural areas, or experimental forests. Many boundaries of this type have only a general description in the documents, proclamations, act, and/or laws that establish them. Accuracy is usually not as crucial when surveying private ownership boundaries.
3. Mineral Surveys. These surveys are made to mark the legal boundaries of mineral deposits or ore-bearing formations on the public domain, where boundaries are determined by lines other than those of normal subdivisions. Original surveys are authorized by the Bureau of Land Management and performed by United States deputy mineral surveyors. Retracement surveys, resurveys, and remonumentation of patented mineral surveys, however, may be performed by registered land surveyors. Patented mineral survey boundaries, when common with Forest Service land, must be accurately reestablished and identified to full boundary line standards.
4. Land Exchange Survey. It is often necessary to survey offered and/or selected lands in a land exchange in order to locate them on the ground and prepare adequate descriptions for title purposes. This is particularly true when the use of aliquot part descriptions is not appropriate. Procedures and requirements for these surveys are the same as for identification of any other land-ownership boundaries.

- \*-Land exchange surveys involving segregation of public domain lands require prior authorization from the Bureau of Land Management.

5. Mineral Segregation Surveys. This type of survey involves lands classified as mineral bearing, which have not been covered by a patented mineral survey. When such a survey is justified, it can be arranged for through the Bureau of Land Management. The Bureau is responsible for these official surveys. Forest Service input may provide corner search and evaluation and other preliminary work.

See the Bureau of Land Management's 1947 Manual, sections 504-509, pages 364-366; and its 1973 Manual, sections 9.76-77, pages 206-208, for additional details.

6. Withdrawal Surveys. The Congress and the executive branch have authority to withdraw certain lands from mineral entry and other uses by the public and retain them for specific uses, such as recreation areas, administrative sites, or power and water production sites. Areas selected for withdrawal must be capable of being described and located on the ground.

Withdrawals of lands that have not been surveyed under the rectangular United States public land survey system should be based on a metes and bounds survey, tied to an existing public land survey monument or a prominent natural or manmade feature.

Metes and bounds descriptions may also be desirable for withdrawals in surveyed sections. The expense of rectangular surveying of small aliquot parts greatly exceeds that of metes and bounds. The Forest Service has responsibility for making and posting the boundaries of withdrawals so that they are easily recognizable. Surveys for withdrawals should be performed to boundary survey standards (FSM 7153.53).

7153.61 - Special Survey Standards. Before initiating a special survey, the land manager should consult the land survey specialist, especially if a boundary problem is suspected.

1. All special surveys involving property boundary lines and minerals shall comply with the boundary survey standard as set forth in FSM 7153.53.

2. Boundary lines delineating special management areas located entirely on National Forest land shall meet a standard dictated by project needs.

3. Other standards, as needed, shall be developed and incorporated in forthcoming FSH 7109.15, Land Surveying Handbook.

\*-7153.7 - Legal Aspects of Boundary Surveys. Land surveys conducted either by or on behalf of the Forest Service must be governed by applicable Federal, State, and local government laws and regulations, as well as recognized surveying methods and procedures. The legal interpretation of property descriptions and evidence is the fundamental controlling factor in the execution of land surveys. There can be no deviation from legal and technical principles by line or staff personnel. However, the line review and approval process provides for the consideration and resolution of differences prior to acceptance of the work.

Because of the possibility of dispute, every boundary survey should be treated as a potential litigation case. Surveys must satisfy the requirements for legal evidence to be acceptable to the court. Land surveys must be performed under the direction and supervision of a registered land surveyor.

Special recognition and emphasis by the land manager must be given to those cases that are clearly subject to court action.

All personnel should be conscious of and refrain from engaging in conversation, correspondence, and decision making that may be interpreted as injurious to the Government's case.

Forest Service personnel should be aware of the liability involved in unauthorized trespass on lands of an adjoiner. Prior to entry on private lands for survey purposes, a vigorous effort should be made to notify and obtain permission from all affected adjoiners.

Land surveyors are not judicial officers, but in many cases they act in a quasi-judicial capacity and must exercise good sense and sound judgment when dealing with boundary and title matters.

The registered land surveyor, in the execution of his survey work, acts as an agent of the Forest Service. He is responsible for performing his work in a professional and ethical manner, and is personally liable for gross negligence.

7153.71 - Federal Laws. The Bureau of Land Management is authorized to make rules and regulations to implement the land laws of the United States. These laws and policies, which are applicable to most Federal lands, are contained in the Manuals of Surveying Instructions. Most States have a law requiring that surveys under State jurisdiction be performed in accordance with manual procedures.

In the Thirteen Original States, Texas, Hawaii, the Virgin Islands, and Puerto Rico, individual State and overseas territory statutes provide the legal standard for surveys.

\*- Acquired lands usually come under the State survey jurisdiction.

Numerous other Federal laws either require, refer to, or indirectly relate to the need for surveys. Some of those laws are cited herewith:

1. Act of October 25, 1972 (Adjudication of Real Property Quiet Title Actions), Public Law 92-562.

2. National Forest Management Act of 1976, Public Law 94-588.

3. Federal Land Policy and Management Act of 1976, Public Law 94-579.

4. Forest and Rangeland Renewable Resources Planning Act of 1974, Public Law 93-378.

5. USDA Handbook 453, The Principal Laws Relating to Forest Service Activities.

6. FSM 1020, 2700, and 5400.

7153.72 - State Laws. The statutes and laws of the various States regulate the survey of patented and acquired lands within their borders.

All States have provisions for the registration of land surveyors. Forest Service employees engaged in land surveying activities will work under the guidance, technical supervision, and direction of a registered land surveyor when private adjoiner property lines are being defined.

7153.73 - Local Laws and Customs. Line and staff officers should be aware of local laws and customs affecting land surveys. Any conflicts between Federal, State, and local laws will be resolved by the Regional Forester in consultation with the Office of General Counsel.

7153.8 - Plats, Descriptions, and Notes. These items represent the primary written record of survey. They should be prepared in the prescribed format, filed as Forest Service permanent records, and filed or recorded, when appropriate, with the local public authority.

7153.81 - Plats. Plats will be prepared for all surveys in conformance with the requirements of the State concerned, and to accepted -\*



\*-standards of the survey profession. They will be certified by the person responsible under the property survey laws of the State and filed or recorded as public documents when applicable. Regions may stipulate additional approvals by line or staff officers.

7153.82 - Legal Descriptions. Plats may be referred to in deeds, and when attached to the deed, become a part thereof. In such cases, a metes and bounds legal description may not be necessary. Descriptions will be prepared from the plat by the responsible surveyor, and may be included on the face of the plat. Descriptions should include all essential items compiled during the survey and/or contained in the chain of title for the parent property.

7153.83 - Survey Notes. Survey notes provide the basic information necessary to retrace the survey. They have legal significance and must be preserved as project records. Survey notes should be neat, legible, and understandable to another competent surveyor.

7154 - RIGHTS-OF-WAY AND EASEMENTS. A right-of-way or easement for any specific use consists of the right to do an act, otherwise unprivileged, on the land of another. The requirements may be much the same for conveying rights both to and from the Government, but, for the purposes of this section, only rights acquired by the Forest Service are considered. Rights granted by the Forest Service, such as to USDA, USDI, DOT, and other easements, have been affected by the new Bureau of Land Management Organic Act of 1976 and controlling regulations should be reviewed to ensure proper compliance. Generally, easements acquired by the Forest Service may be created by:

1. Conveyance or deed.
2. Reservation or exception in a deed.
3. Condemnation by an agency or government.

The term "rights-of-way" is a general term covering right of use of a parcel of other land with or without compensation. The term "easements" is a specific type of rights-of-way where a partial interest for a definite use is held by a second party generally for a fee. Most so-called rights-of-ways in the Forest Service are, in fact, easements. The two names are often used synonymously.

Easements may be obtained for a definite time period or in perpetuity. The deed for an easement must be executed with the same formalities as any other deed and must convey those rights intended by both parties. The wording must not be uncertain, vague, or so indefinite

\*- as to prevent reasonable identification of the rights conveyed. In other words, a deed must contain an adequate description of the land covered by the easement. An adequate legal description has been defined as one that can be located on the ground by a land surveyor either with or without additional evidence and which conforms to the laws of the State.

Generally, easements are conveyed by deed, condemnation, or occasionally by reservation. All of these require a written description or plat to identify the location and nature of the grant (FSM 5461.12c).

7154.02 - Objectives. Rights-of-way or easements are surveyed to:

1. Determine the position of an existing or proposed easement in relation to land monuments and property lines in order to prepare a legal description for a conveyance.
2. Mark the location of the easement on the ground, as necessary.
3. Provide a record description for use in the conveyance document, from which a satisfactory retracement of the limits of the easement can be made.
4. Determine the size of the easement for value estimates.

7154.03 - Policy

1. Surveys for easements shall be accomplished in accordance with the laws of the State in which the land is located.
2. The land manager must obtain permission from the owner prior to any on-the-ground activity.
3. Surveys for easements will be retraceable on the ground by a land surveyor.
4. A record and/or plat will be prepared and filed in the local public record.

7154.04 - Responsibilities. The responsibilities designated for land surveys (FSM 7153.04) also apply to easement surveys.

7154.05 - Definition. A right-of-way easement gives a right or permission to use an area of land for a designated purpose. It is the right to do an act, otherwise unprivileged, on the land of another. An easement restricts, but does not abridge, the rights

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\*- of the fee owner to the use of his land. Easements are usually obtained for roads, ditches, canals, powerlines, telephone lines, pipelines, and other construction and maintenance improvements.

7154.1 - Planning Right-of-Way and Easement Surveys. Surveying easements (FSM 7153.61) requires a high degree of planning and coordination with other activities. Some considerations are:

1. What class of survey will be used? Will it provide the information and achieve the accuracy necessary to meet the standards?
2. Have necessary property corners been found? Are ties made to sufficiently control the easement or is additional cadastral survey needed?
3. What lead time will be necessary to deliver the plat and description to the negotiator?

7154.2 - Procedures. Easement surveys are generally considered property surveys because they are used to prepare a description for a deed. The survey must locate the property being conveyed by the deed and show its relationship to surrounding properties, to an accuracy commensurate with the value of the land and the improvements to be constructed on the easement. Any method of measurement which produces the required accuracy is permissible (FSM 7153.46). Survey procedure must conform to applicable State and Federal laws. Retracement of property lines and subdivision of sections must be executed in accordance with Bureau of Land Management Manual methods and applicable State requirements.

The survey must show where an easement enters a given parcel, where it leaves that parcel, and its location within that property. It is not necessary, in many cases, to monument the perimeter of the property crossed by the easement. It is essential that the description represents a clearly defined parcel that can be easily retraced on the ground.

Existing facilities may serve as a monument to the location of the easement, but additional monuments to mark its limits may be necessary. In areas with intensive use, and depending on the nature of the rights being conveyed, it may be desirable to install monuments, fences, or boundary markers on the limits of the easement.

It is essential to remember that the grantor has the right to continue to use the easement area for any uses not prohibited by the conveyance or that do not interfere with the grantee's permitted use. Fences or other structures may be prohibited by the language in the deed.

- \*- Raw land easements present an additional problem in that the language of the conveyance sometimes specifies that the centerline of the facility, as finally constructed, is accepted by grantor and grantee as the centerline of the easement. Since it may be necessary to procure the easement prior to construction, and since the limits of the easement must be known in order to describe it for the conveyance, the situation can exist where one or both parties may determine that the facility is not located on the easement described. Where major differences between the proposed and actual location occur, additional surveying will be necessary to redescribe the facility and to amend the deed. Use of this clause shall be avoided when possible.

7154.3 - Standards for Right-of-Way and Easement Surveys. Standards of precision for right-of-way surveys differ. For some rights-of-way, such as cooperative use permit, special uses, right-of-use permit, temporary uses, and other limited uses, the conveyance document may be nothing more than a line on a map, or plat defining the general location. For most easements where continuing rights are conveyed for a permanent improvement, a standard field survey may be required.

Some of the elements of risk are:

1. The quality of the existing survey to which the easement is tied, including monumentation and legality.
2. Present ownership, whether public or private, and, if private, the nature of the owning party. The risk is higher if the land is owned by a development corporation than if it is owned by an agricultural organization.
3. Proposed or possible future use, such as agricultural, recreational, industrial, or residential.
4. Adjacent property use, present and future.
5. Danger of the easement encroaching on other than the grantor's land.
6. Likelihood of the basic land value appreciating rapidly. Land underlain by significant mineral resources has such a probability.
7. Likelihood of condemnation procedures being required.
8. Easement already occupied by existing improvement.

\*- Easement standards are represented by a two-dimensional array combining the elements of value and risk.

Table 1 shows minimum standards for error of closure for traverse, before adjustment, for the combination of elements and rights-of-way.

Table 1 - Value of land and improvements in parts per thousand

	<u>High</u>	<u>Medium</u>	<u>Low</u>
High	1:10,000	1:5,000	1:3,000
Medium	1: 5,000	1: 3,000	1:1,500
Low	1: 3,000	1: 2,000	1: 700

Table 2 shows maximum positional error (probability ellipse) in feet for points determined by traverse or photogrammetry.

Table 2 - Value of land and improvements in feet of error

	<u>High</u>	<u>Medium</u>	<u>Low</u>
High	$\pm 0.3'$	$\pm 1'$	$\pm 2'$
Medium	$\pm 1'$	$\pm 2'$	$\pm 3'$
Low	2'	$\pm 5'$	$\pm 10'$

Once the value for the maximum positional error has been decided upon, based on an analysis of risk and value, a survey method with sufficient precision to achieve that value can be selected.

The following table of precision value for different survey methods commonly used is included as a guide in selecting a survey method.

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\*- Table 3 - Precision value for different survey methods

<u>Method</u>	<u>Instruments</u>	<u>Procedures</u>	<u>Precision</u>
Compass and tape	Survey quality staff compass and tape.	Angles to $1/4^\circ$ , slope chaining.	$\pm 10$ feet per mile of traverse
Transit steel tape.	1-minute transit standardized steel tape.	Angles to 30 seconds chain with standardized pull and temperature. Angles doubled.	$\pm 1$ foot per mile of traverse.
Electronic distance measurement.	1-second theodolite and E. D. M.	Angles to 10 seconds. Two sets of direct and reverse angles. Electronic distance with vertical angle slope reduction.	$\pm 0.3$ feet per mile of traverse.
Photogrammetry	1st order plotter. Metric camera.	2nd order control 1:6,000 scale photos. Targeted corners. Block adjustment.	$\pm 1.0$ foot
Photogrammetry	1st order plotter. Metric camera.	G. L. O. control 1:18,000 scale photos. Targeted corners. Single strip of photos with 4 or less models.	$\pm 10$ feet

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\*-7154.4 - Plats, Descriptions, and Notes

7154.41 - Plats. Plats will be prepared for all surveys where required by State laws, and to accepted standards of the survey profession. They will be certified by the person responsible under the property survey laws of the State and will be filed or recorded as public documents when applicable. Regions may require additional approvals by line or staff officers.

7154.42 - Legal Descriptions. A plot which contains all the figures and measurements needed to describe the easement and which is acceptable under State law is the preferred form of description in easement conveyances. Narrative descriptions which describe the centerline of the easement with specified widths on each side, or a metes and bounds description of the easement area, are also acceptable and may be used when authorized by State law. Both a narrative description and a plat description should not be used in the same easement conveyance, unless required by State law. The Department of Justice requires both a written description (narrative) and a plat as part of the declaration of taking filed in condemnations. Legal descriptions should be prepared from the survey plat. Descriptions should include all the essential items compiled during the survey and/or contained in the chain of title for the parent property.

7154.43 - Survey Notes. Survey notes provide the basic information necessary to retrace the survey. They have legal significance and must be preserved as project records. Survey notes should be neat, legible, and understandable to another competent surveyor.

7155 - ROAD RIGHTS-OF-WAY. Road rights-of-way are a special class of easement. Easement surveys are discussed in FSM 7154, but since road rights-of-way have such wide application and some unique requirements, additional direction is necessary.

7155.02 - Objectives. The objective of this section is to provide information and guidance to Forest Service personnel engaged in the various phases of right-of-way surveying to ensure that the cadastral requirements are properly understood and accomplished.

The basic objectives for road right-of-way surveys are to:

1. Determine the existing or proposed location of the easement relative to established land monuments and boundaries.
2. Mark the location of the line or corridor on the ground as necessary.
3. Determine the land area involved for value estimates.

- \*- 4. Prepare an adequate legal description for title purposes, appraisal conveyance, and recording.
- 5. Provide records and plats necessary to satisfy retracement requirements at some future date.

#### 7155.03 - Policy

1. Land survey corners and property lines adjacent to or within the right-of-way boundary will be recovered, protected, and perpetuated. The land surveyor for rights-of-way and easements that require a type of property survey will review all prepared plats, notes, and descriptions.

2. Road and other improvement right-of-way surveys must be monumented and tied to authentic monumented land survey corners. This ensures that the position of the right-of-way is known and adequately documented by survey plats and notes and can be recovered on-the-ground if and when additional improvements are made within or adjacent to the right-of-way.

3. Official cadastral survey work done in connection with rights-of-way will be accomplished to standard under the appropriate State or Federal authority as required.

4. All survey notes, plats, and descriptions will be accomplished in accordance with applicable State and Federal laws.

5. Records of official cadastral survey work done in connection with rights-of-way locations will be prepared and filed or recorded as public documents.

7155.04 - Responsibility. Regional and Forest land survey personnel are expected to provide guidance to planning units concerning cadastral survey requirements for rights-of-way work. They will also design the needed cadastral survey and recommend methods and equipment best suited to the work. As requested, they will also prepare instructions, provide training, and, if desirable, assume general supervision for the search, verification, and remonumenting of property corners and retracement of property lines. Such requests must provide sufficient lead time for proper planning and programing.

When corner search, evaluation, verification, monumentation, or property line retracement is required for a right-of-way survey outside those areas scheduled for attention in the current annual work program, Forest Service expense will ordinarily be financed from funds allotted for the improvement project. However, improvement -\*

- \*- project funds are not expected to finance salaries or incidental travel expense of Regional and Forest staff normally financed from cadastral engineering program funds.

Funds available for road construction and other improvements are available for the purchase of rights-of-way needed for such improvements (FSM 5460.11b). These funds are also available for financing the cadastral work required to properly locate and mark the right-of-way on-the-ground, and to prepare and file as official documents the resulting survey notes and plats.

7155.1 - Planning. Adequate lead time for right-of-way survey requests is of prime importance. Two years is often the minimum lead time necessary to obtain final approval and conveyance of a road right-of-way where ground survey is involved. The survey is only one of many steps in a long chain of events that must take place before final conveyance takes place. A review of FSM 5461.1 and 5461.2 should be made prior to starting the right-of-way action plan. Once the survey work has begun, priorities become fixed. They can be deferred, but generally, cannot be accelerated.

7155.2 - Procedures. Surveys for easements are property surveys because they are used to prepare a description for a deed or other legal document. The survey must locate the property being conveyed and show its relationship to surrounding properties to an accuracy consistent with the value of the land, the investments to be made, and the risk of loss. Any method of measurement which produces the required accuracy is acceptable. Survey procedures must conform to applicable State and Federal law. Retracement of property lines and subdivision of sections must be executed in accordance with Bureau of Land Management methods and applicable State requirements.

The survey must show where the easement enters a given parcel, where it leaves that parcel, and its location within that property. It is usually not necessary to monument the entire perimeter of the property crossed by an easement, but this would be desirable in some cases. A detailed survey may not be necessary, but the essential requirement of an easement and its description is that it can be retracable.

Raw land easements for cost shared roads (FSM 5467.2) provide that the centerline of the road as constructed is accepted by the grantor and grantee as the true centerline of the easement granted. Thus, the easement actually conveyed may be identical with the easement described in the conveyance. Such language should not be used in conveyance of rights-of-way except in the special circumstances of cost-shared roads.

- \*- 7155.21 - Improvement Monumentation. Only a few existing roads have sufficient permanent ancillary improvements, such as high-type pavements, fences, curbs, or gutters, to adequately serve as monuments to their location. Native or gravel-surfaced roads do not, in general, adequately identify easement limits. Additional monumentation should be accomplished to properly locate these easements on the ground. A good centerline description with adequate land corner tie and references may be sufficient on many roads, but the Forest Service must be able to identify and protect both the Government and private rights at all times.

It is essential to remember that the grantor has the right to continue to use the easement area for any use not prohibited by the conveyance or that does not interfere with the grantee's permitted use.

7155.22 - Descriptions, Plats, and Notes. Plats, notes, and legal descriptions will meet the requirements specified in FSM 7153.8.

7155.23 - Conveyance Description Language. The description used in the conveyance document must be definitive, clear, complete, and not subject to multiple interpretations. It must fully define the parcel of land to be conveyed.

7155.3 - Standards for Road Right-of-Way Surveys. The standards for easement surveys specified in FSM 7154.3 apply fully to road rights-of-way. Any acquisition made on a raw land easement will require a standard cadastral survey to satisfy both property location and conveyance of the intended parcel.





# A GUIDE FOR ARKANSAS

## Boundary Surveys and Plats

**Prepared By**  
**ARKANSAS ASSOCIATION**  
**OF**  
**REGISTERED LAND SURVEYORS**  
P.O. BOX 392  
NORTH LITTLE ROCK, ARKANSAS 72115

Act 645, 1969

For an Act to be Entitled: "An Act to Require That all Licensed Engineers and Surveyors File a Copy of Certain Surveys Made by Them in the Office of the Circuit Clerk of the County Wherein the Survey was Made: And for Other purposes."

Be it Enacted by the General Assembly of the State of Arkansas:

*Section 1.* Hereafter, all licensed engineers and surveyors in this State shall file a plat of all surveys of property boundary lines made by them in the office of the circuit clerk of the county wherein such survey was made within thirty (30) days after such survey is completed. The sole purpose of filing such plat shall be to identify the person or persons who made such plat and survey and placed the survey markers and shall not be used to evidence adverse possession or as evidence in boundary disputes. Provided, however, the provisions of this Act shall not be applicable with respect to surveys hereafter made of subdivided property located in a municipality where such property has previously been surveyed and a plat filed.

*Section 2.* Any licensed engineer or surveyor who shall fail or refuse to file such survey as provided by this Act shall be guilty of a misdemeanor and upon conviction shall be subject to a fine of not less than fifty dollars (\$50.00) nor more than one hundred dollars (\$100.00) or imprisonment for not less than thirty (30) days nor more than six (6) months, or both such fine and imprisonment.

*Section 3.* Act 257 of 1969 and all laws and parts of laws in conflict with this Act are hereby repealed.

# A GUIDE FOR ARKANSAS Boundary Surveys and Plats 1977

## PREFACE

*This guide has been prepared by the Arkansas Association of Registered Land Surveyors membership, various committees, State Land Surveyor, and other interested parties. A word of thanks to all who have helped with this document is in order.*

*The guide is not binding upon any surveyor to use. However, it is hoped that by using this document surveyors throughout the State will develop a standardized plat that will not only be valuable to surveyors in years to come, but to the other disciplines that use our work. By developing a guide for our use it is hoped that certain data and information will be available on all plats. After this document has been field-tested, it will then be necessary to further update and make any needed changes.*

*Your comments will be needed at this time.*

## I. BOUNDARY SURVEYS

### 10.010. Type of Boundary Surveys.

These standards for Property Boundary Surveys shall apply to surveys made for the purpose of establishing or reestablishing the boundary of any lot, tract or parcel of real property in the State of Arkansas.

### 10.011. Land Survey.

Land survey is defined as the determination of boundaries and areas of tracts, lots or parcels of real property. Land surveying includes the reestablishment of original boundaries and the establishment of such new boundaries as may be required in the partition of land.

### 10.015. Land Surveyor.

Land surveyor is defined as any person engaged in the practice of land surveying being registered in accordance with ACT 101 of 1967.

### 10.020. Research and Investigation

Prior to the survey the land surveyor shall become familiar with the instructions and methods used in the original survey and acquire and analyze all survey data that can be obtained including, but not being limited to, a copy of the original field notes, plats, deeds, maps, subsequent survey information, survey data from county and state records, title certificates, abstracts, local vicinity section lines and recorded certified corners. The land surveyor shall use the acquired recorded information to make the correct determination of the legal boundaries.

The survey shall start from a proven corner, preferably an original corner, that cannot be disputed. The survey shall be executed by traversing and connecting all monuments necessary for correct location. The surveyor shall cause monuments marking the corners to be set in accordance with the most satisfactory analysis. Measurements will be taken with the accuracy necessary to be consistent with accuracy standards in effect. The plat must contain all required information, be filed for record with county recorder and a copy furnished to the client requesting the survey. In order to keep the state repository of survey records current, a copy should be forwarded to the Department of Commerce - Land Survey Division, 4200-B Asher Avenue, Little Rock, Arkansas 72204. This copy will be returned to the owner after being photographed, if it is so desired.

### 10.030. Survey.

The Registered Land Surveyor shall, under his personal direction, cause a survey to be executed, traversing and connecting all available monuments appropriate or necessary for the location, and coordinate the facts of such survey with the predetermined analysis. He shall cause monuments marking the corners of such parcel to be set, and such monuments shall be set in accordance with the full and most satisfactory analysis obtainable.

Measurements will be taken to a precision compatible with the size and geometric shape of the parcel involved, and consistent with the accuracy desired for the area in which the survey is located, and in accordance with the accuracy standards that follow (10.040).

**10.040. Accuracy Standards**

**Type "A" Property** — Small lots where buildings may be erected along property lines or where land values warrant high accuracy.

**Type "B" Property** — Parcels or tracts normally encountered in survey work other than Type "A" or Type "C", the surveyor should select the positional accuracy within the range given according to the value and expected use of the land.

**Type "C" Property** — Parcels or tracts with all sides 1000' or longer, and those having a periphery of 5000' or more.

	Property Type	Positional Accuracy	Error of Closure
Urban Area	A	± 0.10'	N/A
	B	± 0.25' to ± 0.50'	N/A
	C	± 0.75'*	1:10,000*
Resources Development Areas	A	± 0.15'	N/A
	B	± 0.25' to ± 0.67'	N/A
	C	± 1.5'*	1:5,000*
Rural Areas	A	± 0.20'	N/A
	B	± 0.25' to ± 1.0'	N/A
	C	± 3.0'*	1:5,000*

\*Use either positional accuracy or error of closure, depending upon which gives the smaller value.

**II. MONUMENTATION****20.010. Location.**

The land surveyor shall establish, or confirm the prior establishment of permanent monuments, at each and every controlling corner on the boundaries of the parcel or tract of land being surveyed, and in addition shall establish at least two (2) permanent monuments for each and every block created in a new subdivision. In such cases where the placement of a required monument at its proper location is impractical, it shall be permissible to set a reference monument or mark close by that point, and if such reference monument or mark is set, its location shall be properly shown on the survey plat; where any point requiring monumentation had been previously monumented, the correctness of the existing monument shall be confirmed by the land surveyor, and in any event it shall be shown and referenced by measurements on the survey plat. When conditions warrant setting a monument or mark on an offset, the locations shall be selected so the monument or mark lies on a line of the survey or on a prolongation of such line. Offsets shall not be in fractional feet from the corner unless a physical obstruction affects their location.

**20.020. Identification of Monuments.**

All monuments must show the proper identification of the corner and shall be marked in accordance with the Bureau of Land Management's manual. These standards of marking are included in the *Handbook for Arkansas Surveyors* and will be included in the *Corner Restoration Program* booklet. Other information that must be shown includes the year, date and registration number of the land surveyor or the corporate registration number or name. All information must be legibly stamped or imprinted thereon.

**20.030. Type of Monuments.**

The type of permanent monument to be placed shall be selected from the following types. The surveyor shall select a type providing the degree of permanency consistent with that of the adjacent terrain and physical features.

1. Concrete monuments consisting of reinforced concrete at least four (4) inches in width or diameter and no less than twenty-four (24) inches in depth with its precise position marked on a metal cap, by a formed cross or metal rod.
2. Metal markers shall be no less than twenty-four (24) inches in depth unless encased in concrete with its precise position marked by a point or cross. These monuments shall be placed so as to be solid and free from movement and below normal frost level.
3. Iron pipe not less than ½ inch in diameter and/or solid or coated steel rods not less than 3/8 in diameter and not less than 24 inches in length. These monuments shall be solid and free from movement and below normal frost line. All monuments shall have the precise position of the corner marked by a point or cross.
4. Brass disk not less than two (2) inches in diameter, countersunk and well cemented in a drill hole in either solid rock or concrete with its precise position marked by a point or cross.

### III. PREPARATION OF PLATS

#### 30.010. Introduction.

THE SURVEYOR'S PLAT REPRESENTS ALL OF THE WORK THAT HAS BEEN ACCOMPLISHED IN RESEARCH AND THE FIELD SURVEY. THIS PLAT OR DOCUMENT SHOULD BE PREPARED IN A MANNER THAT REFLECTS UPON HIMSELF AND THE PROFESSION OF SURVEYING OF THE HIGHEST STANDARDS. The following parameters should aid in producing a plat that will serve the client, attorneys, abstractors, and surveyors who will again be working upon said tract.

30.020. The plat shall be neat and legible.

30.030 The plat shall be dated and should state the name of the person for whom the survey was made.

30.040. The plat shall state the surveyor's name, registration number, and address (or Company address).

30.050. The plat shall depict north arrow and state reference to direction (true north, assumed north, grid north, etc.). If bearings are based off of true north, the method of determining true north should be stated.

30.060. The plat shall have a legal description, with area, and if appropriate, a surveyor's certification worded as necessary and signed on the plat by the surveyor.

30.070. On each plat a drawing shall be included to reflect the following items:

- a.) Boundaries with bearings and distances.
- b.) A land tie to a specific land corner.
- c.) Point of Beginning.
- d.) Where applicable, recorded distances should be shown along with actual measured distances.
- e.) All observed encroachments shall be depicted with distances. At corners, distance from existing apparent property lines such as fences, walls, etc.
- f.) Area within boundary.

30.080. Any existing monuments which are discovered along the boundary shall be tied and shown with dimensions, even if not accepted on the survey. Also, any reference pins set should be shown by distance and direction from actual line or corner.

30.090. The physical makeup of all monuments found or set on the survey should be shown either through a legend or specific notes.

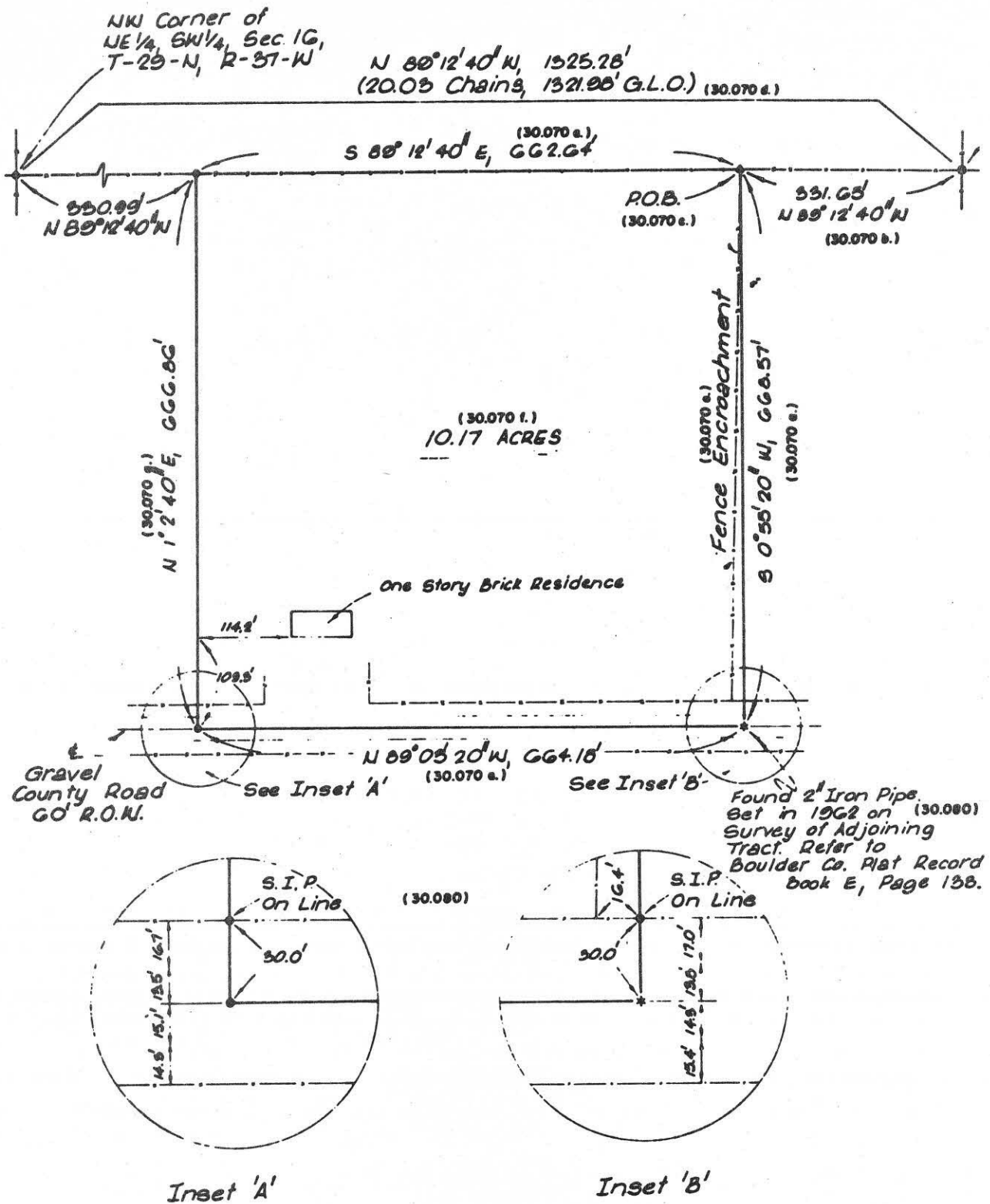
30.100. When convenient, surveys should be tied to state plane coordinate control and position of all corners on the survey be shown or tabulated whenever such ties are made.

#### 30.110. Revised Plats.

- a.) Where applicable, revised plat should clearly show the book and page number where the original was filed.
- b.) Any changes made on the plats by the surveyor in the record books at the courthouse should be initialed, dated, and witnessed by the surveyor.

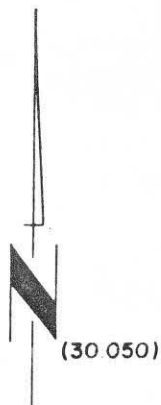
30.20. Sample Plat. The enclosed typical plat is provided for use. The original plat was 18 x 24 and has been reduced for this printing. The format of this survey is recommended, however, you may have to change it to fit your particular needs.





(30.070 b.)

Center of Section 16,  
T-29-N, R-37-W



Bearings Refer to  
True North as Determined  
by Solar Observation.

LEGEND (30.090)

- Found Stone
- Found Iron Pin
- ▲ Found Concrete Monument
- \* As Noted
- Set Iron Pin
- — — — — Fence

LEGAL DESCRIPTION (30.060)

A PART OF THE NORTHEAST QUARTER (NE¼) OF THE SOUTHWEST QUARTER (SW¼) OF SECTION SIXTEEN (16), TOWNSHIP TWENTY-NINE (29) NORTH, RANGE THIRTY-SEVEN (37) WEST, IN BOULDER COUNTY, ARKANSAS, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO WIT:

FROM A STONE WHICH IS THE CENTER OF SAID SECTION SIXTEEN (16), RUN  
NORTH 89° 12' 40" WEST FOR 331.65 FEET,

TO A CONCRETE MONUMENT WHICH IS THE POINT OF BEGINNING; THENCE  
RUNNING

SOUTH 00° 55' 20" WEST	668.57 FEET, THENCE
NORTH 89° 03' 20" WEST	664.18 FEET, THENCE
NORTH 01° 02' 40" EAST	666.86 FEET, THENCE
SOUTH 89° 12' 40" EAST	662.64 FEET TO THE POINT

OF BEGINNING, AND CONTAINING 10.17 ACRES, MORE OR LESS, SUBJECT TO THE  
RIGHT-OF-WAY OF A COUNTY ROAD CENTERED ALONG THE SOUTH LINE.

SURVEYOR'S CERTIFICATION (30.060)

I HEREBY CERTIFY THAT THE HEREON PLATTED AND DESCRIBED SURVEY WAS  
COMPLETED UNDER MY SUPERVISION ON THE 7TH DAY OF APRIL, 1977, AND THAT  
CORNERS WERE SET, AS SHOWN, TO THE BEST OF MY KNOWLEDGE AND ABILITY.

THIS SURVEY IS MADE FOR THE EXCLUSIVE USE OF THE PRESENT OWNERS OF  
THE PROPERTY, AND ALSO THOSE WHO PURCHASE, MORTGAGE, OR GUARANTEE  
THE TITLE THERETO, WITHIN ONE YEAR FROM DATE HEREOF, AND AS TO THEM  
I WARRANT THE ACCURACY OF SAID SURVEY AND MAP.

*John P. Doe*  
JOHN P. DOE, R.L.S. #99984, ARKANSAS



(30.030) BOUNDARY SURVEY For MR. JOE M. SMITH		
SCALE: 1"=100'	APPROVED BY:	DRAWN BY
DATE: 4/8/77		REVISED
by: XYZ SURVEYING CO. (30.040)		
207 W. Oak, Boulder, Ark.		DRAWN BY: NAME

## THE ARKANSAS GEOLOGICAL COMMISSION – LAND SURVEY DIVISION

The Land Survey Division of the Arkansas Geological Commission, created by Act 458 of 1973, (see Chapter III, page 13), offers services to the general public of the State of Arkansas through the following programs:

The **CORNER RESTORATION PROGRAM** is designed to assist the registered land surveyor in permanently monumenting original land corners. Registered land surveyors recovering government corners cannot always justify the cost of a permanent monument for them. This program provides the monuments and accessories and a fee for installation at the GLO corner satisfying one or more of the following requirements:

1. Corners established by the original government surveyors under contract from the General Land Office or its successors in title, for which sufficient original evidence exists to definitely locate the position of said corner.
2. Corners perpetuated by county or other surveyors as marking the location identified by that surveyor as the original corner established by the government surveyors, for which sufficient original evidence exists to definitely locate the position of said corner.
3. Corners reestablished according to the Bureau of Land Management regulations or extensive resurveys, as the location of a government corner which was lost or destroyed, or original and perpetuated corners for which sufficient written and/or parol evidence exists to show the general acceptance of such corner for a long period of time.

Requests for participation in the cooperative corner restoration program may be submitted to the Arkansas Geological Commission-Land Survey Division by any land surveyor registered in the State of Arkansas.

The Arkansas Geological Commission-Land Survey Division will review all requests for re-monumentation and will submit a Professional Services Contract to the Department of Finance and Administration for approval. Upon approval, a contract will be issued and appropriate monuments and accessories will be furnished to the surveyor. After installation work is completed, the surveyor will complete the *CERTIFIED LAND CORNER RESTORATION* form, file it in the office of the proper county agency, and send a copy to the office of the Land Survey Division. After review and approval, the Division will pay the surveyor the amount of money specified in the contract.

The **STATE SURVEY RECORDS REPOSITORY PROGRAM** maintains, preserves and provides safe storage facilities for a comprehensive system of recordation of information respecting all monuments established by the United States Public Land Survey within this State and such records pertinent to the Land Survey Division's establishment or maintenance of other land corners, Arkansas coordinate system stations and accessories, and monuments in general.

The **REPOSITORY** collects and preserves information obtained from surveys made by those authorized to establish land monuments or land boundaries and assists in the proper recording of the same by the duly constituted county official or other appropriate officials. All records are maintained on 35 millimeter film and recorded in the master index. Certified copies of records

created or maintained by the Division are offered to any person, entity, or agency, upon request for a nominal fee. All records certified by the State Surveyor or a designated assistant, shall be admissible in evidence in any court of this State.

The office of the **STATE SURVEYOR** has the responsibility of extending throughout the State a triangulation and levelling net of precision, whereby the Arkansas State Coordinate System may be made to cover to the necessary extent those areas of the State which do not now have enough geodetic control stations to permit the general use of the system by land surveyors and others. Geodetic control is in cooperation with the federal agencies and is now in the planning stage. Horizontal and vertical data is on file in the State Repository.

The State Surveyor prescribes reasonable rules and regulations, not inconsistent with law, designed to establish uniform professional surveying and mapping methods and standards in this State; receives and investigates complaints against any surveyor and presents the results from the investigation of such complaints to the Arkansas State Board of Registration for Professional Engineers and Land Surveyors for such action as the Board shall deem appropriate; assists County Assessors in establishing accurate land descriptions and the public and private surveyors in obtaining land ownership information for surveying purposes; and promotes the training and the increase in number of quality surveyors in this State.

In cooperation with the Arkansas Association of Registered Land Surveyors, engineering firms and interested individuals, the Land Survey Division has established calibration stations located in North Little Rock, Jonesboro and Springdale. Additional stations are being planned for the southern part of the State.

The address of the Arkansas Geological Commission-Land Survey Division is 2915 South Pine, Little Rock, Arkansas 72204. Telephone (501) 371-2631.

#### **ARKANSAS AFFLIATE OF THE NATIONAL CARTOGRAPHIC INFORMATION CENTER**

A cartographic information center linked with the U. S. Geological Survey National Cartographic Information Center (NCIC) was established in the fall of 1980 at the Arkansas Geological Commission, Little Rock, Arkansas. The center expanded the Commission's current service of providing topographic, planimetric, orthophotographic and other Arkansas maps.

The center provides the public with information on the availability of maps, charts, aerial photographs, space images, and other cartographic products and data produced and held by Federal, State, and private agencies. Services will include assisting users to find where products are located, how to obtain them, and in collecting cartographic information from local sources for the addition to the NCIC system.

National Cartographic Information Center headquarters is at the USGS National Center in Reston, Virginia. There are regional offices at USGS Mapping Centers in Rolla, Missouri; Reston, Virginia; Denver, Colorado; and Menlo Park, California.

The Arkansas NCIC outlet is at the offices of the Arkansas Geological Commission, Vardelle Parham Geology Center, 3815 West Roosevelt Road, Little Rock, Arkansas 72204. Telephone (501) 371-1646. The office is open from 8:00 a.m. to 4:30 p.m., Monday through Friday.

## DEFINITIONS

**SURVEY.** The orderly process of determining data relating to the physical or chemical characteristics of the earth. The orderly process of retracing upon the ground the exact bearings and dimensions of a property description.

**AERIAL SURVEY.** A survey utilizing aerial photograph; the taking of aerial photographs for surveying purposes; and the photographs taken of an area for surveying purposes. The co-ordination of aerial photography with ground control to such an extent that bearings and dimensions can be accurately determined. (Not to be confused with aerial photography which is simply the process of photographing a portion of the earth's surface.)

**AREA SURVEY.** A survey of areas large enough to require loops of control or a survey solely for the computation of area within a set of boundaries.

**BOUNDARY SURVEY.** A survey made to establish or to re-establish a boundary line on the ground or to obtain data for constructing a map or plat showing a boundary line. The term, **BOUNDARY SURVEY**, is usually restricted to surveys of boundary lines between political territories.

**CADASTRAL SURVEY.** A survey relating to land boundaries and subdivisions, made to create units suitable for transfer or to define the limitations of the title. This normally applies to the survey and sub-division of public lands.

**COMPASS SURVEY.** A traverse survey which relies on the magnetic needle for orienting the sequence as a whole or for determining the bearings of the lines individually.

**CONTROL SURVEY.** A survey which provides positions (horizontal and vertical) of points to which supplementary surveys are adjusted.

**ENGINEERING SURVEY.** A survey executed for the purpose of obtaining information which is essential for planning an engineering project or development and/or estimating its cost.

**GEODETIC SURVEY.** A survey in which account is taken of the figure and size of the earth. Geodetic surveys are usually prescribed where the areas or distances involved are so great that the results of desired accuracy and precision can be obtained only by the processes of Geodetic surveying.

**GEOLOGIC SURVEY.** A survey of investigation of a character and structure of the earth, of the physical changes which the earth's crust has undergone or is undergoing, and the causes producing those changes.

**GROUND SURVEY.** A ground survey made by ground methods (as distinguished from an aerial survey).

**HYDROGRAPHIC SURVEY.** A survey having for its principal purpose the determination of data relating to bodies of water.

**JOINT SURVEY.** The running, the marking, and establishment of a new boundary, or the retracement of resurvey of lines fixed by a prior survey. The survey is made in conformity with an agreement between adjoining owners, or is in accord with a Court decree which stipulates the manner of the survey. The parties must be present during the period of the field operation of the survey. A joint survey normally applies to a land survey made for adjacent landowners.

**LOCATION SURVEY.** The establishment on the ground of points and lines in position which have previously determined by computation or by graphical methods, or by description obtained from data supplied by documents of record, such as deeds, maps, or other sources. (This term is also applied to an Engineering Survey for the location of an engineering project.)

**PHOTOGRAMMETRIC SURVEY.** A survey utilizing either ground photographs or aerial photographs, in conjunction with ground control for the determination of directions and distances (see Aerial Survey).

**PRELIMINARY SURVEY.** The collection of survey data on which to base studies on a proposed project or a proposed final survey.

**RECONNAISSANCE SURVEY.** A preliminary survey. A Reconnaissance survey is usually executed rapidly and at a relatively low cost. The information obtained is recorded, to some extent, in the form of a reconnaissance map or sketch.

**RESURVEY SURVEY.** A retracing on the ground of lines of an earlier survey, in which all points of the earlier survey that are recovered are held fixed and used as a control. If too few points of the earlier survey are recovered to satisfy the control requirements of a resurvey, a new survey may be made. A resurvey is related directly to an original survey although several resurveys may enterpose between them.

**ROUTE SURVEY.** Surveys for linear construction such as railroads, highways, canals, and transmission lines which include the lay-out of lines and grades for those projects.



**STANDARD SURVEY.** A survey which in scale, accuracy, and content, satisfies criteria prescribed for such a survey by competent authority.

**SUBDIVISION SURVEY.** A land survey consisting of the location of legal boundaries of an area; the division of the area and the parcels of lots, streets, rights-of-way, and other accessories; the marking or monumenting of all necessary corners or dividing lines; the preparation of proper maps or plats for record showing all information regarding the location above mentioned and the joining boundary areas affecting the location of the legal boundaries; including all necessary certificates required for the proper statement of ownership dedications of areas for public use or other affidavits required by law; performing any other acts or services ordinarily taken by a surveyor to co-ordinate the ground work and the record.

**TOPOGRAPHIC SURVEY.** A survey which has for its major purpose the determination of the configuration (relief) of the surface of the earth (ground) and the location of natural and artificial objects thereon.

**TRANSIT-AND-STADIA SURVEY.** A survey in which directions, horizontal and vertical, are observed with a transit (engineer's) and distance are measured with a transit and stadia.

**SURVEYING.** Specifically, the science or act of making such measurements as are necessary to determine the relative position of points above, on, or beneath the surface of the earth, or to establish such points. Generally, the art of making a survey.

**LAND SURVEYING.** The determination of boundaries and areas of tracts of land. Land boundaries are usually defined by ownership, commencing with the earliest owners through successive ownerships and partitions. Land surveying includes the re-establishment of original boundaries and the establishment of such new boundaries as may be required in the partition of the land.

**PLANE SURVEYING.** A branch of the art of surveying in which the surface of the earth is considered a plane surface. In plane surveying, curvature of the earth is neglected, and computations are made using the formulas of plane geometry and plane trigonometry. In general, plane surveying is applied to surveys of land areas and boundaries (land surveying) where areas are of limited extent or the required accuracy is so low that corrections for the effect of curvature would be negligible as compared with the errors of observation. For small areas, precise results may be obtained with plane surveying methods, but the accuracy and precision of such results will decrease as the areas surveyed increase in size. The above are only a very few of many types of surveys that may be executed and in the execution of these surveys certain terms, procedures and definitions are common to most surveys. Some of these are as follows:

**ANGLE.** The relationship of lines or surfaces which is measured by the amount of relation necessary to make one coincide with or be parallel to another.

**ADJUSTED ANGLE.** An adjusted value of an angle. An adjusted angle may be derived wither from an observed angle or from a concluded angle.

**AZIMUTH ANGLE.** An angle is a triangulation or in a traverse through which the computation of azimuth is carried.

**CONCLUDED ANGLE.** An interior angle between adjacent sides of a closed figure, which is obtained by subtracting the sum of all other interior angles of the figure from the theoretical value of the sum of all interior angles.

**DEFLECTION ANGLE.** A horizontal angle measured from the prolongation of the preceding line, right or left, to the following line.

**EXTERIOR ANGLE.** The angle between any side of a polygon and an adjacent side extended. Exterior angle is also used to designate the outside angles formed by a line intersecting two parallel lines. It has also been used in surveying, though rarely, to designate the explement of an angle, (the difference between an angle and four right angles).

**INTERIOR ANGLE.** An angle between adjacent sides of a closed figure, measured by the art connecting those sides on the inside of the closed figure. The three angles of a triangle are interior angles.

**MEASURED ANGLE.** An angle as read directly from an intrumental observation and without any application of corrections or legal condition.

**VERTICAL ANGLE.** An angle in a vertical plane.

**APPROXIMATE.** Approaching closely but not attaining a specified accuracy or a precision conformable with the quality of the observations.

**ARC.** A part of a mathematically defined curve. A circular arc is part of a circle; an elliptical arc, part of an ellipse; etc.

**AREA.** In general, an area is an aggregate of plane spaces to be considered in an investigation; especially the quantity projected on an horizontal plane enclosed by the boundary of any polygonal figure.

**ARITHMETICAL MEAN.** The value obtained by dividing the sum of a series of values by the number of values in the series.

**AZIMUTH.** The horizontal direction reckoned clock-wise from the meridian plane.

**BACKSIGHT.** (General) A sight on a previously established survey point or line.

**BALANCING A SURVEY.** Applying corrections corresponding to the closing errors in latitude and departure so that they are distributed according to the proportion-length of line to total length of traverse.

**BASELINE.** (General). A surveyed line established with more than usual care, to which surveys are referred for co-ordination and correlation. Baselines are always established for specific purposes.

**BASELINE (UNITED STATES PUBLIC LAND SURVEYS).** A line extending East and West along the astronomic parallel passing through the initial point, along which standard Township, Section, and Quarter Section corners are established.

**BASE NET.** A part of a triangulation net starting with a measured base and expanding that relatively short distance to a larger distance comparable to the average length of the triangulation sides.

**BACK BEARING.** A bearing along the reverse direction of a line.

**TRUE BEARING.** The horizontal angle between the meridian line and a line on the earth. The term, TRUE BEARING, is used in many of the early descriptions of land boundaries in the United States. It is associated with True North, referring to the direction of the North point as determined by astronomical observation.

**BEARING OF LINE (PLANE SURVEYING).** The horizontal angle which a line makes with meridian of reference adjacent to the quadrant in which the line lies. Bearings are classified according to the meridian used as astronomic bearings, true bearings, magnetic bearings or grid bearings.

**BEARING TREE (UNITED STATES PUBLIC LAND SURVEYS).** A tree used as a corner accessory; its distance and direction from the corner being recorded.

**BENCHMARK.** A relatively permanent material object, natural or artificial, bearing a marked point whose elevation above or below an adopted datum is known.

**LAND BOUNDARY.** A line of demarkation between adjoining parcels of land. The parcels of land may be of the same or of different ownership, but distinguished at some time in history of their descent by separate legal description.

**BOUNDARY LINE.** A line along which two areas meet. In specific cases, the word, "boundary" is sometimes omitted, as in "stateline", sometimes the word "line" is omitted, as in "International Boundary", "County Boundary", etc.

**BOUNDARY MONUMENT.** A material object placed at or near a boundary line to preserve and identify the location of the boundary line on the ground. Where it is impractical to establish a monument on or very close to a boundary line, the position of the boundary line on the ground is preserved by reference marks.

**CALL.** A term sometime used as a reference to, or statement of an object, course, distance, or other matter of description in a survey or grant requiring or calling for a corresponding object, or other matter of description, on the land.

**CARDINAL.** The astronomical directions on the surface of the earth-north south-east and west. The term, cardinal, without qualification, is sometimes used to indicate any or all the above directions, the context giving the exact meaning to its use.

**CARTOGRAPHY.** The science and art of expressing graphically, by the use of maps and charts, the known physical features of the earth's surface, often including the works of man and his varied activities. Specifically, cartography is the art of map construction and the science on which it is based.

**CENTERLINE (UNITED STATES PUBLIC LAND SURVEYS).** The line connecting opposite corresponding quarter corners of opposite sub-division of section corners or their theoretical position.

**CHAIN.** The unit of length prescribed by law for the survey of public lands of the United States. The chain is equivalent to 66 ft. or 4 rods, poles or perches. The chain derives its name from the Gunter's Chain, which had the form of a series of links connected together by rings, a form which has been superseded by metal tapes or ribbons graduated in chains and links. The Bureau of Land Management uses steel tapes with links 1, 2, 5 or 8 chains.

**GUNTERS CHAIN.** A measuring device used in land surveying composed of 100 metal links fastened together with rings, the length of the chain being 66 ft. It was invented by an English Astronomer, Edmund Gunter, in 1620, and is the basis for the chain and link units of lengths used in the survey

of public lands in the United States. An advantage in measuring in chain is that 10 sq. chains equal 1 acre.

**CHAIN OF TITLE.** A term applied metaphorically to the series of conveyances, or other forms of alienation, effecting a particular parcel of land, arranged consecutively from the government or original source of title down to the present holder, each of the instruments including being termed a "link".

**CHAINING.** The operation of measuring a distance on the earth, using a chain or tape.

**SLOPE CHAINING.** Taping wherein the chain or tape is held, by design, out of the horizontal and usually with, or parallel to, the slope of the surface being measured.

**CHAINMEN.** The men who mark the tape ends in chaining.

**CLOSING TOWNSHIP CORNER (UNITED STATES PUBLIC LAND SURVEYS).** The point of intersection of a guide meridian or any range line with the previously established standard parallel, or base-line, when these lines are surveyed in the normal rectangular plan. Also, the point of intersection of any Township boundary line, either running north and south, or east and west, with any previously established line, such as that of a State boundary, grant boundary, Indian Reservation boundary, or other surveys irregular as to plan.

**ERROR OF CLOSURE (TRAVERSE).** The amount of which the computed position of the last point of the traverse fails to coincide with the initial point; that is, the length of line necessary to close the traverse.

(Angles). The amount by which the sum of the measured angles fail to equal the true sum. (Azimuth). The amount by which the azimuth of the first line of the traverse fail to equal the initial measurement after completing the circuit. (Level Circuit). The amount by which the last computed elevation fails to equal the initial elevation; or the amount by which the difference of elevation in a circuit fail to add up (algebraically) to 0.

**CONTOUR.** An imaginary line on the ground, all points of which are at the same elevation above a specified datum surface.

**CONTROL STATION.** A point on the ground whose position (horizontal and vertical) is used as a base for a dependent survey.

**STATE CO-ORDINATION SYSTEM.** The plane-rectangular co-ordinate systems established by the United States Coasts and geodetic survey, one for each state in the United States, for use in defining positions of geodetic stations in terms of plane-rectangular (X and Y) co-ordinates.

**CORNER.** A point determined by the surveying process, usually at the intersection of two or more lines, generally the position of turning point or angle point that has been or is to be monumented to mark the boundary or boundaries of 1, 2, or more city, town, or village blocks or lots, or rural quarter section, section, or township subdivision, or similar tracts.

**CORNER (UNITED STATES PUBLIC LAND SURVEYS).** A point on the surface of the earth, determined by the surveying process, marking an extremity of a boundary or subdivision of a public land, usually at the intersection of two or more surveyed lines; often incorrectly used to denote the physical structure, or monument, erected to mark the corner point. Corners are described in terms of the points they represent.

**CLOSING CORNER. (UNITED STATES PUBLIC LAND SURVEYS).** A corner at the intersection of a surveyed boundary with a previously established boundary line. In the survey of the public lands of the United States, when a line connecting the last section corner and the objective corner on an established township boundary departs from the astronomic meridian by more than the allowable deviation, the line being surveyed is projected on cardinal to an intersection with the township boundary, where a closing corner is established and connection made to the previously established corner. Closing corners are established at the intersection of a line being surveyed with a previously established township boundary in order to avoid excessive deviation from cardinal which might be required to connect with the objective corner on that boundary. Closing corners are also established at the intersection of a township, range, or section line with the boundary of a previously surveyed and segregated tract of land, such as private land claim, mineral claim, etc.

**EXISTENT CORNER (UNITED STATES PUBLIC LAND SURVEYS).** A corner whose position can be identified by verifying the evidence of the monument, or its accessories, by reference to the description that is contained in the field notes, or where the point can be located by an acceptable supplementary survey record, some physical evidence, or testimony. Even though its physical evidence may have entirely disappeared, a corner will not be regarded as lost if its position can be recovered with a testimony of one or more witnesses who have a dependable knowledge of the original location.

**LOST CORNER (UNITED STATES PUBLIC LAND SURVEYS).** A corner whose position cannot be determined, beyond reasonable doubt, either from the traces of the original marks or from acceptable evi-

dence or testimony that bears on the original position, and whose location can be restored only by reference to one or more interdependent corners.

**OBLITERATED CORNERS (UNITED STATES PUBLIC LAND SURVEYS).** An obliterated corner is one at whose point there are no remaining traces of a monument, or its accessories, whose location has been perpetuated, or the point for which may be recovered beyond reasonable doubt, by the acts and testimony of the interested landowners, competent surveys, or qualified local authorities, or witnesses, or by some acceptable record evidence.

**WITNESS CORNER (UNITED STATES PUBLIC LAND SURVEYS).** A monumented survey point usually on the line of survey near a corner established as a reference mark where the corner is so situated as to render its monumentation already used impractical.

**COURSE (LAND SURVEYING).** The bearing of a line; or the bearing and the length of a line.

**COURSE (TRANSIT TRAVERSE).** The azimuth and length of a line, considered together.

**CROSS SECTION.** A vertical section on the surface of the ground, or of underlying stratus, or both, taken at right angles to centerline or across a stream. A horizontal grid system layed out on the ground for determining contours, quantities of earth work, etc., by means of elevation of the grid points.

**CURVATURE OF EARTH (OBSTRUCTION TO LINE OF SIGHT).** The off-set from the tangent to the curve, as a result of the curvature of the earth and refraction combined, is approximately 0.574 ft. for a point of 1 mile away and varies as the square of the distance.

**DEGREE OF CURVE.** In railroad practice, the number of degrees of angular measure at the center of a circle suspended by a cord 100 ft. in length. In Highway surveying, a 100 ft. arc is usually used instead of a 100 ft. cord in defining degree of curve.

**POINT OF CURVATURE (P.C.).** The point in a line survey where a tangent ends and a circular curve begins. It is the point where a straight line in a survey changes to a circular curve.

**POINT OF TANGENCY (P.T.).** The point in a line survey where a circular curve ends and a tangent begins.

**SPIRAL CURVE (ROUTE SURVEYING).** A curve of varying radius connecting a circular curve and a tangent, or two circular curves whose radii are, respectively, longer and shorter than its own extreme radii.

**DATUM.** Any numerical or geometrical quantity or set of such quantities which may serve as a reference or base for other quantity. (Geodetic). A datum consisting of five quantities; the latitude and longitude of an initial point, the azimuth of a line from this point, and two constants to define the terrestrial spheroid.

**LEVELING.** A level surface to which heights are referred.

**DECLINATION ARC (SURVEYOR'S COMPASS).** A graduated arc attached to the alidade of a surveyor's compass or transit, on which the magnetic declination is set off. When the magnetic declination is set off on the declination arc of a surveyor's compass or transit, a reading of the needle will give a bearing corrected for that declination.

**DEED.** A sealed instrument in writing, executed and delivered, containing some transfer, bargain, or contract, as in conveyance of real estate. A deed normally contains therein a retraceable description of any land conveyed.

**DEPARTURE (PLANE SURVEYING).** The orthographic projection on a line on the east-west axis of reference. The departure of a line is the difference of the meridian's distances of longitudes of the ends of the line.

**DESCRIPTION (UNITED STATES PUBLIC LAND SURVEYS).** The description of a unit or units of land according to the approved township plats; for example, Lot 5 and the SW $\frac{1}{4}$  of the NW $\frac{1}{4}$  of Section 6, Township 18 North, Range 10 East of the Fifth principal meridian, Dunklin County, Missouri.

**DOUBLE CORNERS (UNITED STATES PUBLIC LAND SURVEYS).** Normally the two sets of corners along a standard parallel; the standard township, section, and quarter section corners placed at regular intervals of measurement; additionally, the closing corners established on the line at the points of intersection of the guide meridians, the range and section lines of the survey as brought in from the south. In other cases, not fully in conformity with the rectangular plan, two corners, each common to the two corners, each common to two sections; and two quarter section corners, each referring to one section only. The term is sometimes used to denote two lines established on the ground although the field note record indicates only the one line.

**DOUBLE MERIDIAN DISTANCE.** The algebraic sum of the perpendicular distance from the two ends of any line of a traverse to the initial, or reference, meridian.



**EASEMENT.** In a deed or conveyance. A right of use or operation over a parcel of land specifically or generally described, operating as a servient tenement to other land or an incumbrance against a described land. (Sometimes called a servitude).

**ELEVATION.** Vertical distance from the datum, usually means sea level, to a point or object on the earth's surface. Not to be confused with altitude which refers to points or objects above the earth's surface.

**ADJUSTED ELEVATION.** The elevation resulting from the application of an adjustment correction to an orthometric elevation. Also, the elevation resulting from the application of both an orthometric correction and an adjustment correction to a preliminary elevation.

**STANDARD ELEVATION.** An adjusted elevation based on the Sea Level Datum of 1929.

**ERROR.** The difference between an observed or computed value of a quantity and the ideal or true value of that quantity.

**ACCIDENTAL ERROR.** An area for which it is equally probable that the sign of the error is plus or a minus.

**ACCUMULATIVE ERROR.** A constant error which is always plus or always minus. A number of readings under these conditions will have an accumulative error equal to the number of readings multiplied by the error in one reading.

**ACTUAL ERROR.** The difference between the true value and the measured value of a physical quantity.

**AVERAGE ERROR.** The mean of all the errors taken without regard to sign. Average error is sometimes defined as the mean without regard to sign of the mean of the plus errors and the mean of the minus error. Because there will be about the same number of plus errors as of minus errors in a well-balanced series of observations, the two methods of obtaining the average error will give almost the same result. In computing the average error, the residual errors (residuals) are used.

**COMPENSATION ERROR.** An error that tends to off-set more or less a companion error so far as closure of an error or other verification can determine, and neither of which may thus be detected. The re-running of the runs by accidental checks are ordinarily required if the compensating error is to be located.

**CONSTANT ERROR.** A systematic error which is the same in both magnitude and sign through a given series of observations. Constant errors are sometimes considered as forming a class from systematic errors, but the distinction is unimportant and in practice constant errors are treated as a type of systematic error.

**GROSS ERROR.** A material discrepancy in the survey such as a mistake or inaccuracy, and so left without the correction of the fault or blunder. This discrepancy is excessive, palpable, serious and unwarranted in its effects; the result is the same whether arising from mistake, incompetence or fraud.

**PROBABLE ERROR.** An indication of the precision obtained in a series of measurements on a given object such as baseline or an angle. The final result of the measurements (which cannot be exact because it contains the effects of the errors of measurements) is called the most probable value of the quantity observed. The probable error may be defined as that quantity which, added to and subtracted from the most probable value, fixes the limits within which it is an even chance that the true value of the measured quantity must lie.

**ERROR OF CLOSURE (ANGLES).** The amount by which the actual sum of a series of angles fails to equal the theoretically exact value of that sum.

**ERROR OF CLOSURE (LOOP).** The error in the closure of a survey itself. The magnitude of a loop closure is not a good indication of the accuracy of the work because it does not reveal the effect of systematic errors.

**ERROR OF CLOSURE (BLUE PRINTS).** The error in the closure of a survey on itself. The magnitude of a loop closure is not a good indication of the accuracy of the work because it does not reveal the effect of the systematic errors.

**ERROR OF CLOSURE (TRAVERSE).** The amount by which a value of the position of a traverse station, as obtained by computation through a traverse, fails to agree with another value of the same station as determined by a different set of observations or route or survey.

**ERROR OF CLOSURE IN AZIMUTH.** The amount by which two values of the azimuth of a line, derived by different surveys or along different routes, fail to be exactly equal to each other. Generally, one value is derived by computations carried through the survey (triangulation of traverse); the other is an adjusted or fixed value determined by an earlier or more precise survey, or by independent astronomical observations.



**ERROR OF CLOSURE IN LEVELING.** The amount by which two values of the elevation of the same bench mark, derived by different surveys or through different survey routes or by independent observations, fail to be exactly equal to each other. The closure may be developed in a line of leveling which starts and ends on different bench marks whose elevations are held fixed, or it may start and close on the same bench mark.

**EXCEPTION (IN A DEED).** The operation of an exception in a deed is to retain in the grantor some portion of the former estate, which, by the exception is taken out of or excluded from the grant; whatever is thus excluded remains in him as of his former right or title because it is not granted.

**FIELD CORRECTION.** An adjustment made to field measurements, such as angles or distances, to correct for geometric or length discrepancies. Some field corrections such as an adjustment when measuring angles around the horizon at a station, are final in nature. Others, such as corrections applied to precise leveling, are subject to office correction.

**FIRST-ORDER WORK (CONTROL SURVEY).** The designation given survey work of the highest prescribed order of precision and accuracy. Such surveys are formerly termed primary. In 1921, representatives of the various federal map-making and map-using organizations changed the designation to precise; in 1925, the Board of Surveys and Maps adopted the present (1954) designation (first-order) and established standards for it by prescribing criteria for acceptable work.

**FLAGMAN.** A man in a survey party who carries the flag or rod and gives sights to the instrumentman.

**FORESIGHT.** (a) A point set ahead to be used for reference when resetting the transit on line or when verifying the alinement. (b) An observation of the distance and direction to the next instrument station. (c) **LEVELING.** The reading on a rod that is held at a point whose elevation is to be determined. A foresight is often termed a minus sight because it is subtracted from the height of instrument to obtain the elevation of the point. It is not, however, essentially a negative quantity. When the rod is held inverted, as in taking levels on overhead shafting, the reading is of opposite sign to that read in the usual position because it is measured in the opposite direction from that normally used. The term, "minus sight" is recommended as preferable; but the older term foresight is still in general use.

**EXTRA FORESIGHT (LEVELING).** The rod reading made at an instrument station in a line of levels and on leveling rod standing on a bench mark or another point not in the continuous line of levels. In spirit leveling there may be one or more extra foresights from a single instrument station or setup, but there can be only one backsight and one foresight from any one instrument station.

**GEODETIC.** Signifying basic relationship to the earth in which the curvature of its sea-level surface is taken into account.

**GEOGRAPHIC CENTER.** The geographic center of an area of the earth has been defined as that point on which the area would balance if it were a plate of uniform thickness. That is, it is the center of gravity of that plate.

**GEOGRAPHIC CENTER OF NORTH AMERICA.** The geographic center of North America is Pierce County, North Dakota, a few miles West of Devils Lake.

**GRADE STAKE:** A stake upon which a grade (elevation) has been marked. The top of the stake may be driven to the desired grade, or, more commonly, a horizontal crayon mark with arrow or "crows-foot" is used to make the grade. If the grade is below reference mark, the distance below is marked C for cut. If the grade is above the stake, the distance up to the grade is marked F for fill. Grade stakes are frequently placed on an offset line, with the amount of offset and its direction from the survey line indicated on the side of the stake.

**GRANTEE.** A person, firm, or corporation to whom land, easements, or other habiliments thereof are conveyed or granted.

**GRANTOR.** A person, firm, or corporation granting or conveying land, easements, or other habiliments thereof.

**GUARANTEE OF TITLE.** A certificate which insures that the title exists in fact as described. Often assumed by title guarantee companies or by the state, as in the case of a Land Court certificate.

**HAND.** 1 hand — 4 inches.

**HIGH-WATER LINE.** The place on the bank or shore up to which the pressure and action of water is so usual and long continued as to impress on the bed of the stream a character distance from that of the banks with respect to vegetation and the nature of the soil. In tidal waters, the high-water line is, in strictness, the intersection of the plane of the mean high water with the shore. The high-water line is the boundary line between the bed and the bank of a stream. The mean high-water line usually determines the boundary of the land of the riparian proprietor.

**INITIAL MONUMENT (UNITED STATES PUBLIC LAND SURVEYS).** One of thirty-four positions and

points of origin of the principal meridians and base lines established for the control of the township boundary surveys of the rectangular system designed for subdivision of the public lands.

**INITIAL POINT (UNITED STATES LAND SURVEYING).** The point from which is initiated the survey of the principal meridian and baseline controlling the survey of the public lands within a given area. For a list of initial points, principal meridians, and baselines, and the areas governed thereby, see Section 139, Bureau of Land Management Manual of Surveying Instructions. 1947.

**ISLAND.** A body of land extending above and completely surrounded by water at mean high water.

**JACOB'S STAFF.** A single staff or pole used for mounting a surveyor's compass or other instruments. Used in place of a tripod, a Jacob's staff is fitted with a ball-and-socket joint at its upper end, by means of which the instrument is adjusted to a level position; the foot is fitted with a metal shoe with facilities pressing the staff firmly into the ground. Many of the early land surveys in this country were made with the surveyor's compass mounted on Jacob's staffs.

**JUNCTION (LEVELING).** The place where two or more lines of levels are connected together.

**LANDMARK.** Any monument or metal mark or fixed object used to designate the location of a land boundary on the ground. Any prominent object on land which can be used in determining a location or a direction.

**LATITUDE (PLANE SURVEYING).** The perpendicular distance in an horizontal plane of a point from an east-west axis of reference. The difference of latitude of the two ends of a line is frequently termed the latitude of the line and is defined as the orthographic projection of the line on a reference meridian. The latitude of the middle of a line is also referred to as the latitude of the line.

**GEODETIC LATITUDE.** The angle which the normal at a point on the spheroid makes with the plane of the geodetic equator. Geodetic latitudes are reckoned from the equator, but in the horizontal-control survey of the United States they are computed from the latitude of station Meads Ranch as prescribed in the North American datum of 1927. In recording a geodetic position. It is essential that the geodetic datum on which it is based be stated. A geodetic latitude differs from the corresponding astronomic latitude by the amount of the meridional component of the local deflection of the vertical (station error) which, in the United States, may be more than 25". Latitude as shown on topographic maps and navigator's charts is geodetic latitude.

**LATITUDE DIFFERENCE (PLANE SURVEYING).** Length of the projection of a traverse course onto a meridian (length of the course times the cosine of the bearing).

**FIRST ORDER LEVELING.** Spirit leveling conforming to the following criteria: All first-order leveling to be divided into sections of 1 km 2 km in length; each section to be leveled over in both forward and backward directions; the results of two runnings over a section not to differ by more than 4.0 mm times the square root of the length of the section in kilometers (4.0 mm/K), the equivalent of which is 0.017 ft. times the square root of the length of the section miles (0.017 ft/M).

**MAIN CHANNEL.** The middle, deepest, or best navigable channel. This term applied to water boundaries in sounds, bays, straits, gulfs, estuaries, and other arms of the sea — also to lakes and land-locked seas in which there are deep-water sailing channels.

**ASSESSMENT MAP.** Maps made or used by taxing authorities showing size and location of properties and improvements thereon.

**CADASTRAL MAP.** A map showing the boundaries of subdivisions of land, usually with the bearings and length thereof and the area of individual tracts, for purpose of describing and recording ownership. A cadastral map may also show culture, drainage, and other features relating to the value and use of land.

**CONTOUR MAP.** A topographic map which portrays relief by the use of contour lines.

**ENGINEERING MAP.** A map showing information that is essential for planning an engineering project or development and for estimating its cost.

**GEOLOGICAL MAP.** A map showing geological structures.

**SCALE MAP.** The relationship which exists between a distance on a map and the corresponding distance on the earth.

A map scale may be expressed as an equivalence, as a numerical fraction or ratio, or as a graph. On large scale maps, the distance on the earth is on a designated datum, as sea level or ground level.

**MARK.** A definite object (such as an imprinted metal disk) used to designate a survey point.

**MEAN HIGH WATER.** The mean height of tidal waters at a particular point or station over a period of time to such length that increasing its length does not appreciably change this mean. For tidal waters the cycle of change covers a period of 19 yr. and mean high water is defined as the average of the high waters over a 19-yr. period.

**MEAN LOW WATER.** The mean height of tidal low waters at a particular place over a period of such length that the increasing its length does not appreciably change the mean. For tidal waters the cycle of change covers a period of 19 yr. and the mean low water is the average height of the low waters over a 19-yr. period.

**MEANDER LINE.** A traverse of the margin of a permanent natural body of water, along the locus of the bank or shore line at the elevation of mean or ordinary high water, upon which the bank or shore line a riparian may be predicted.

**MEMORIAL (UNITED STATES PUBLIC LAND SURVEYS).** A durable article deposited in the ground at the position of a corner to perpetuate that position should the monument be removed or destroyed. The memorial is usually deposited at the base of the monument and may consist of anything durable, such as glass or stoneware, a marked stone, charred stake, or a quantity of charcoal.

**SECOND ORDER LEVELING.** Spirit leveling which does not attain the quality of first-order leveling, but does conform to the following criteria: Lines between bench marks established by first-order leveling to be run in one direction, using first-order instruments and methods (or other lines to be divided into sections, over which forward and backward runnings are to be made); the closure in either case not to exceed 8.4 mm times the square root of the length of the line (or section) in kilometers (8.4 mm/K), the equivalent which is 0.035 ft. times the square root of the length of the line (or section) in miles (0.035 ft/M).

**THIRD ORDER LEVELING.** Leveling which does not attain the quality of second-order leveling, but does conform to the following criteria: Lines of third-order leveling shall not be extended more than 30 miles from lines of first-order leveling or second-order leveling, and must close upon lines of an equal or a higher order of accuracy; closing errors must not exceed 12 mm times the square root of the length of the line in kilometers (12mm/K), the equivalent of which is 0.05 ft times the square root of the length of the line in miles (0.05 ft/M).

**GRADE LINE SURVEYING.** A line usually marked by stakes or other monuments having elevations referred to a common datum; by measurement or computation from such elevation and stakes, a line of slope or grade is established between termini — for example, the grade line of a center of a paved street or curb.

**TRANSIT LINE.** Any line of a traverse which is projected, either with or without measurement, by the use of a transit or other device. It is not necessarily an actual line of final survey but may be an accessory line.

**LINE TREE (UNITED STATES PUBLIC LAND SURVEYS).** A tree intersected by a surveyed line, reported in the field notes of the survey, and marked with two hacks or notches cut on each side of the sides facing the line.

**LOT.** (a) A plot of land, generally a subdivision of a city, town or village block, or some other distinct tract, represented and identified by a recorded plat. (b) United States Public Land Survey: A subdivision of a section which does not conform to an aliquot part, normally described by a lot number, as represented and identified by the approved township plat.

**MAGNETIC DAILY VARIATION.** The transient change in the earth's magnetic field associated with the apparent daily motions of the sun and moon. In most places the solar daily variation follows approximately a consistent pattern, although with appreciable and unpredictable changes in form and amplitude.

**MAGNETIC DECLINATION.** The bearing (reckoned east or west from the north branch of the celestial meridian plane) of magnetic north as determined by the positive pole of a freely suspended magnetic needle which is subject to no transient artificial disturbance. In nautical and aeronautical navigation the term magnetic variation is used instead of magnetic declination, and the angle is termed "variation of the compass or magnetic variation".

**AUXILIARY GUIDE MERIDIAN (UNITED STATES PUBLIC LAND SURVEYS).** A new guide meridian established, when required, for control purposes where the original guide meridians were placed at greater intervals than 24 miles. Auxiliary guide meridians may be required to limit errors of old surveys or to control new surveys; they are surveyed in all respects as are regular guide meridians and may be assigned a local name, as "Grace Valley Guide Meridian" or "Twelfth Guide Meridian West".

**GUIDE MERIDIAN (UNITED STATES PUBLIC LAND SURVEYS).** An auxiliary governing line projected north along an astronomical meridian from points established on the base line or a standard parallel, usually at intervals of 24 miles east or west of the principal meridian, on which township, section and quarter section corners are established.

**PRINCIPAL MERIDIAN (UNITED STATES PUBLIC LAND SURVEYS).** The meridian extended from an initial monument, or the north-south line as surveyed, upon which regular quarter-section, and township corners have been or are to be established.

**MONUMENT (LEGAL SURVEYING).** This may be a recited position of a line, a corner, or an intersection in a description contained in a conveyance or other document, which may be physically nonexistent; for the purpose of associating adjoining interests it will have the full effect in title as though such physical existence were a fact.

**MONUMENT (UNITED STATES PUBLIC LAND SURVEYS).** A physical structure which marks the location of a corner or other survey point.

**NATURAL AND ARTIFICIAL MONUMENT.** Natural monuments are permanent objects which are the works of nature, such as streams, rivers, lakes, ponds, shores, beaches and trees. Artificial monuments, such as stone bounds or corners of pipe markers, are objects of lesser stability and endurance placed to mark points on the ground.

**NAVIGABLE WATERS.** The question of navigability in law, where there may be controversy, is a matter to be decided by the courts, based on the facts and conditions in each case as these prevailed at the dates of statehood. The opinion of the Supreme Court of the United States establishes the guiding principle, as follows:

The rule long since approved by this court is applying the condition and laws of the United States is that streams or lakes which are navigable in fact must be regarded as navigable in law; that they are navigable in fact when they are used, or are susceptible of being used, in their natural and ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water; and further that navigability does not depend on the particular mode in which such use is or may be had — whether by steamship, sailing vessels or flatboats — nor on an absence of occasional difficulties in navigation but on the fact if it be a fact, that the stream in its natural and ordinary condition affords a channel for useful commerce.

**OBSERVER.** One who makes observations. The instrumentman who operates and makes readings with a surveying instrument, such as a theodolite or a precise level.

**OCCUPY (SURVEYING).** To set a surveying instrument over a point for the purpose of making an observation.

**OFFSET.** A short line perpendicular to a surveyed line, measured to a line or point for which data are desired, thus locating the second line or point with reference to the first or surveyed line. An offset is also a jog in a survey or other line, the line having approximately the same direction both before and after passing the jog. Offsets are measured from a surveyed line or lines to the edge of an irregular shaped body of water, or to any irregular line which is desired to locate.

**OFFSET LINE.** A supplementary line close to and roughly parallel with a main line, to which it is referred by measured offsets. Where the line for which data are desired is in such position that it is difficult to measure over it, the required data are obtained by running an offset line in a convenient location and measuring offsets from it to salient points on the other line.

**ORIENTATION.** The act of establishing the correct relationship in direction with reference to the points of the compass; the state of being in correct relationship in direction with reference to the points of the compass.

**OVERLAP.** An area included within two surveys, which by the record are described as having one or more common boundary lines with no inclusion of identical parts.

**AUXILIARY STANDARD PARALLEL (UNITED STATES PUBLIC LAND SURVEYS).** A new standard parallel or correction line established, when required, for control purposes where original standard parallels or correction lines were placed at intervals of 30 miles or 36 miles. Auxiliary standard parallels are used in the extension of old surveys and for the control of new surveys.

**PARTY WALL.** A wall shared by two adjacent property owners. The boundary line usually passes through the center of a common wall.

**PLAN.** A draft or form, property drawn on a plane as a map, especially a top view or the representation of an horizontal section; an orthographic projection on an horizontal plane; graphic representation; diagram.

**PLANE, HORIZONTAL.** In land surveying a plane perpendicular to the plumb line within which or on which the angles and distances are observed. For any planimetric survey it is assumed that all plumb lines therein are parallel, and all horizontal planes therein are parallel.

**VERTICAL PLANE.** In surveying, a vertical plane is one at right angles to a horizontal plane and within which angles and distances are observed; or a plane containing a plumb line.

**PLANE TABLE (SURVEYING).** A device for plotting the lines of a survey directly from the observations.



**PLAT.** A diagram drawn to scale showing land boundaries and subdivisions, together with all data essential to the description and identification of the several units shown thereon and including one or more certificates indicating due approval.

**PLAT. (UNITED STATES PUBLIC SURVEYS).** This term as used technically by the United States Bureau of Land Management refers to the drawing which represents the particular area included in a survey, such as a township, private land claim, or mineral claim, and the lines surveyed, established, retraced, or resurveyed, showing the direction and length of each such line; the relationship to the adjoining official surveys; the boundaries, descriptions and area of each parallel of land subdivided.

**PLOT.** To place survey data upon a map or plat. In the past, no clearly defined difference existed between plat and plot. It is suggested that a difference be established by limiting plat to the graphical representation of survey, and plot to the cartographic operations involved in the construction of a map or plat.

**P.O.S.T.** Point on sub-tangent.

**P. O. T.** Point on tangent.

**PROJECTION (SURVEYING).** The extension of a line beyond the points which determine its character and position. The transfer of a series of survey lines to a single theoretical line by a series of lines perpendicular to the theoretical line. In surveying a traverse, a series of measured short lines may be projected onto a single long line, connecting two main survey stations, and the long line is then treated as a measured line of the traverse.

**PROLONGATION.** In surveying, a line is prolonged when the last segment of the surveyed line is extended in the same direction as the segment itself. A prolongation of a curve under such a definition of extension would be a line tangent to the curve at the point of extension, although the term frequently is used to mean a continuation along the curvature of the curve. The term "extension" of a curve is more properly applied to a continuity of curvature, but the preferable wording would be "along a curve and the (easterly) continuation thereof".

**PROPORTIONATE MEASUREMENT.** A proportionate measurement is one that applies an even distribution of a determined excess or deficiency of measurement, ascertained by replacement of an established line, so as to give concordant relation between all parts; that is, the new values given to each of the several parts, as determined by the measurement, shall bear the same relation to the record lengths as the new measurement of the whole line applicable in treating gross error or blunder, if the latter can be definitely segregated.

**PUBLIC DOMAIN LANDS.** The term public lands has been applied broadly to the area that was turned over to the government by the colonial states, and to the lands that were acquired later by purchase from, or treaty with the native Indians or with the foreign powers that had previously exercised the sovereignty.

**PUBLIC LAND (UNITED STATES).** Original "public-domain lands" which have never left federal ownership; also, lands in federal ownership which were obtained by the government in exchanges; and, also, original public-domain lands which have reverted to federal ownership through the operation of the public land laws.

**PUBLIC-LAND STATES.** Those states and territories created out of public domain (United States).

**RANDOM LINE.** (a) A trial line, directed as closely as possible toward a fixed terminal point which is invisible from the initial point. (b) A random traverse; that is, a traverse run from an initial to a terminal point to determine the direction of the latter from the former.

**RANGE (UNITED STATES PUBLIC LAND SURVEYS).** Any series of continuous townships situated north and south of each other; also sections similarly situated within a township. Ranges of townships are numbered consecutively east and west from a principal meridian thus, "range 3 east" indicates the third range or row of townships to the east from a principal meridian. The word range is used in conjunction with the appropriate township to indicate the coordinates of a particular township with reference to the inner point; thus, "township 14 north, range 3 east" indicates the particular township which is the 14th township north of the base line and the 3rd township east of the principal meridian.

**RANGE LINE (UNITED STATES PUBLIC LAND SURVEYS).** A boundary of a township surveyed in a north-south direction.

**RECOVERY OF STATION.** A survey station is considered as recovered when its mark (monument) is identified as authentic and proved to be occupying its original site. The recovery of a station is tested by checking the measurements for distance and azimuth (or bearing) from the station to a reference mark.

**REFERENCE MARK.** A supplementary mark or permanent character close to a survey station, to which



it is related by an accurately measured distance and azimuth (or bearing). A connection between a survey station and its reference mark or marks should be of sufficient precision and accuracy to permit reestablishment of the station on the ground from its mark, should the station be destroyed, or the use of the reference mark in place of the survey station in the extension of surveys. Reference marks are used to define positions of boundary corners which may be so situated (as in water) that permanent marks cannot be placed exactly at the corners.

**RELIEF.** The variation in elevation of the ground surface. On a topographical map it may be indicated by hachures, shading, or more accurately, by contour lines.

**RHUMB LINE.** The line which crosses successive meridians at a constant angle. The Mercator is the only map projection on which a rhumb line is represented by a straight line. Other names for rhumb line are, LOXODROME, LOXODROME CURVES, EQUIANGULAR SPIRAL and MERCATOR TRACK.

**RIGHT-OF-WAY.** Any strip or area of land, including surface, overhead or underground, granted by deed or easement, for construction and maintenance according to designed use, such as for drainage and irrigation canals and ditches; electric power, telegraph, and telephone lines; gas, oil, water, and other pipe lines; highways, and other roadways, including right of portage; sewers; flowage or impoundment of surface water; and tunnels.

**RIPARIAN RIGHT.** A legal term relating broadly to the title, possession of, or privilege of the more or less exclusive beneficial use within the shores and beds of rivers, lakes, bayous, and tidal waters, granted by state law to the owner of that land bounded by the shores of lakes and coastal waters, and applicable to all navigable waters; applicable under federal law to the meandered non-navigable streams, lakes, bayous within the territory occupied by the public lands.

**ROADBED.** The graded part of a highway, usually considered as the area between the intersections of top and side slopes, upon which the base course, surface course, shoulders, and median are constructed.

**ROADBED (GENERAL).** The part of a highway, including shoulders, for vehicle use. A divided highway has two or more roadways. In construction specifications the roadway is the part of a highway within the limits of construction.

**SEA LEVEL.** In general, the surface of the sea used as reference for elevation. In surveying and mapping, a curtailed form of "mean sea level". In surveying and mapping the use of the term sea level should be avoided; if used, it should be with the appropriate meaning of the term.

**SEA-LEVEL DATUM.** A determination of mean sea level that has been adopted as a standard datum for heights. The sea level is subject to some variations from year to year, but, as the permanency of any datum is of prime importance in engineering work, a sea-level datum after adoption, should in general, be maintained indefinitely even though differing slightly from determinations of mean sea level based on longer sides of observations.

The sea level datum now (1954) used for the United States Coast and Geodetic Survey level net is officially known as the Sea Level Datum of 1929. The year referring to the last general adjustment of the net. The datum itself can be considered to be an adjustment based on the tide observations at various tide stations along the coasts of the United States over a number of years. See "mean sea level".

**SEA-LEVEL VARIATION.** Sea level variation from day to day, from month to month, and from year to year. This variation is attributed to meteorological conditions and should not be confused with the lunar tides.

**SECANT (UNITED STATES PUBLIC LAND SURVEYS).** A great circle which cuts the true parallel of latitude at the first and fifth mile stations.

**SECANT METHOD (UNITED STATES PUBLIC LAND SURVEYS).** A method of determining the parallel of latitude for the survey of a base line or standard parallel by offsets from a great circle line which cuts the parallel at the first and fifth mile corners of the township boundary. The secant method is a modification of the tangent method, so arranged that minimum offsets need be made from the projected great circle line to the parallel. At the first and fifth mile stations on the secant the offsets are zero; between those stations the offsets are measured to the north.

**SECOND-ORDER WORK (CONTROL SURVEYS).** The designation given survey work of next-to-the-highest order of accuracy and precision. See TRAVERSE, SECOND-ORDER: TRIANGULATION, SECOND-ORDER: and LEVELING, SECOND-ORDER.

**SECTION (UNITED STATES PUBLIC LAND SURVEYS).** The unit of a subdivision of a township; normally a quadrangle 1 mile square, with boundaries to meridians and parallels within established limits, and containing 640 acres as nearly as possible.

**FRACTIONAL SECTION (UNITED STATES PUBLIC LAND SURVEYS).** A section containing appreciably less than 640 acres, usually as a result of an invasion by a segregated body of water, or by other land which cannot properly be surveyed or disposed of as part of that section. Sections are also frequently

rendered fractional in closing the surveys on the north and west boundaries of the township because deficiencies in measurement caused by error of survey or convergence of meridians are placed in the  $\frac{1}{2}$ -mile closing against these township boundaries.

**HALF SECTION (UNITED STATES PUBLIC LAND SURVEYS).** Any two quarter sections within a section which have a common boundary; usually identified as the north half, south half, east half or west half of a particular section.

**QUARTER SECTION (UNITED STATES PUBLIC LAND SURVEYS).** One of the quadrants of a section; normally a quadrangle measuring approximately  $\frac{1}{2}$  on each side, and containing approximately 160 acres; usually identified as the northeast quarter, southeast quarter, northwest quarter, or southwest quarter of a particular quarter section and section.

**SLOPE STAKE.** A stake set at the point where the finished side slope or an excavation or embankment cuts the surface of the ground. It is usually placed on a line which is at right angles to the center line at a station point.

**SQUATTER'S RIGHT.** A right to land by "adverse possession", where one acquires rights by occupying land owned by others. It is so complicated a situation that local state laws should be consulted in each case.

**STATION.** A definite point on the earth whose location has been determined by surveying methods. A point on a traverse over which an instrument is placed (a set-up). Also on a traverse, a length of 100 ft. measured on a given line — broken, straight or curved.

**STONE BOUND.** A substantial stone post set into the ground with its top end approximately flush with the ground surface. Used to mark accurately and permanently the important corners of a land survey.

**STREET.** Any public thoroughfare (street, avenue, boulevard, or park) or space more than 209 ft. wide which has been described or deeded to the public for public use.

**STREET LINE.** A lot line dividing a lot or other area from a street; or more specifically, a side boundary (or end boundary of a dead end) of a street, defined by the instrument creating that street as having a stated width. Street lines may be created inside a lot and not be coincident with lot lines.

**SURVEYOR'S CERTIFICATE.** A document furnished by a surveyor to indicate his findings to a client.

**DETAILED SURVEYS AND MAPS.** Surveys and maps which take account of the smaller features and variations of features in the area surveyed. A detailed survey implies a large scale map of a small area, with increased accuracy and precision in both field and office work.

**SLIDE RULE.** A device used for performing rapid computation involving multiplication, division, proportion, roots, and powers.

**STADIA.** A graduated rod used in the determination of distance by observing the intercept on the rod subtending a small known angle at the point of observation. In practice, the angle is usually defined by two fixed lines in the reticle of a telescope (transit or telescope alidade). The term stadia is also used in connection with surveys where distances are determined with a stadia, as stadia survey, stadia method, stadia distance, etc.; also used to designate parts of the instrument used, as stadia wires.

**STADIA SLIDE RULES.** The most rapid method of reducing stadia readings is by the use of a slide rule which has, in addition to the ordinary scale of numbers (logarithms of the distance), two scales especially constructed for stadia work, one consisting of value  $\log \cos 2a$ , and the other  $\log \frac{1}{2} \sin 2a$ , for different values of  $a$ .

**TANGENT (SURVEYING).** (a) A straight line that touches a curve at one end and only one point and does not intersect it. (b) That part of a traverse or alinement included between the point of tangency of one curve and the point of curvature of the next curve. (c) In the surveys of the public lands of the United States, a great circle line tangent to a parallel of latitude at a township corner. (d) Sometimes applied to a long straight line of traverse, especially on a route survey, whether or not the termini of the line are points of a curve.

**TANGENT (UNITED STATES PUBLIC LAND SURVEYS).** The line of a great circle normal to the meridian at a selected corner on a base line, standard parallel, or latitudinal township boundary.

**TANGENT DISTANCE.** The distance from the point of intersection (vertex) of a curve to its point of tangency or point of curvature.

**TANGENT METHOD (UNITED STATES PUBLIC LAND SURVEYS).** A method of determining the parallel of latitude for the survey of a base line or a standard parallel or by offsets from a great circle line initiated at an established township corner and tangent to the base line or standard parallel at that corner. The tangent great circle is projected at an angle of 90 degrees from the meridian at the township corner from which it is initiated, and proper offsets are measured north from the tangent to the parallel upon which the corners are established.

**THEODOLITE.** A precision surveying instrument consisting of an alidade with telescope. It is mounted on an accurately graduated circle and is equipped with necessary levels and reading devices. Sometimes the alidade carries a graduated vertical circle.

**MIDDLE THREAD OF RIVER.** The line equidistant between the low-water lines on the two sides of a river, extending from headland to headland without considering arms, inlets, creeks, and affluents as parts of the river.

**THREAD OF STREAM.** The line equidistant from the edge of the water on the two sides of the stream at the ordinary stage of the water. In some cases it has been construed to mean the median line of the main channel of the stream; the law should be consulted in any case.

**TIE.** A survey connection from one point of known position to a point where position is desired. A tie is made to determine the position of a supplementary point whose position is desired for mapping or reference purposes, or to close a survey on a previously determined point.

**TIE POINT.** Point of closure of a survey either on itself or on another survey.

**TIER (UNITED STATES PUBLIC LAND SURVEYS).** Any series of contiguous townships situated east and west of each other; also, sections similarly situated within a township.

**UNIVERSAL TIME (U.T.).** The same as Greenwich civil time (G.C.T.). The first use of universal time as a reference in the American Ephemeris and Nautical Almanac is in the volume for the year 1939.

**TOLERANCE.** The allowable variation from a standard or specified conditions.

**TOWNSHIP.** The unit of survey of the public lands; normally a quadrangle approximately 6 miles on a side with boundaries conforming to meridians and parallels within established limits, containing 36 sections, some of which are designed to take up the convergence of the east and west township boundary lines or range lines. Townships are numbered consecutively north and south from a base line.

**FRACTIONAL TOWNSHIP (UNITED STATES PUBLIC LAND SURVEYS).** A township contains approximately less than 36 normal sections, usually because of an invasion by a segregated body of water, or by other land which cannot properly be surveyed as part of that township. Townships may be rendered fractional also in closing the public-land surveys on state boundaries or other limiting lines.

**TRANSIT.** A surveying instrument composed of an horizontal circle graduated in circular measure and an alidade with a telescope which can be reversed in its supports without being lifted therefrom. Also, the act of making such reversal. A theodolite having a telescope that can be transited in its support is a transit, and is sometimes termed a transit theodolite.

**FIRST ORDER TRAVERSE.** A survey traverse which by itself forms a closed loop, or which extends between adjusted positions of other first-order control surveys and has a closing error in position not greater than 1 part in 25,000 of its length.

**FOURTH ORDER TRAVERSE.** A survey traverse of an accuracy less than third-order traverse. In fourth-order traverse, angles are observed with a transit or sextant or are determined graphically, and distances are measured with tape, stadia, or wheel.

**OPEN TRAVERSE.** A survey traverse which begins from a station of known or adopted position, but does not end upon such a station.

**RANDOM TRAVERSE.** A survey traverse run from one survey station to another station which cannot be seen from the first station in order to determine their relative positions.

**SECOND ORDER TRAVERSE.** A survey traverse which by itself forms a closed loop, or which extends between adjusted stations of first-order or second-order control surveys and has a closing error in position of between 1 part in 10,000 and 1 part in 25,000 of its length.

**SURVEY TRAVERSE.** A sequence of lengths and directions of lines between points on the earth, obtained by or from field measurements, and used in determining positions of the points.

**THIRD CLASS TRAVERSE.** A survey traverse which by itself forms a closed loop, or which extends between adjusted stations of other control surveys, and has a closing error in position of between 1 part in 5,000 and 1 part in 10,000 in its length.

**TRANSIT TRAVERSE.** A survey traverse in which the angles are measured with an engineers' transit or theodolite and the lengths, with a metal tape. A transit traverse is usually executed for the control of local surveys and is of second-order or third-order quality.

**TRIANGULATION.** A method of surveying in which the stations are points on the ground which are located at the vertices of a chain or network of triangles. The angles of the triangles are measured instrumentally and the sides are derived by computation from selected sides which are termed base lines, the lengths of which are obtained from direct measurements on the ground.

**TRUE.** A comparative term applied to astronomical values to distinguish them from corresponding magnetic values. The terms true bearing, true meridian, true north, etc., occur frequently in land survey reports, distinguishing those quantities from corresponding magnetic values. In description of land boundaries, the use of "true" has legal significance and, except in rare instances, refers to values based directly on astronomical observations. "True" should never be used to indicate geodetic values although in recent (1945) work, where the difference between astronomical and geodetic values is unimportant, the term has been applied without distinction to both values in order to distinguish them from corresponding values. The use of "true" to indicate astronomical values should be avoided as much as possible; except meanings that are conveyed by the terms "celestial meridian, geodetic meridian, magnetic meridian, etc."

**TURNING POINT.** A point on which both a minus sight (foresight) and a plus sight (backsight) are taken on a line of direct levels. Also, in topographic surveys, any point on which the rod is held while the the instrument (plane table) is moved to another station. The turning points are often marked for future use as tie or check points.

**UNRECORDED DEED.** It may not be logical to state that, after a man has literally parted with all his right and estate in a lot of land, there still remains in his hands an attachable and transferable interest in it of exactly the same extent and value as if he had made no conveyance whatever. But, for the protection of bona fide creditors and purchasers, the rule has been established that, although an unrecorded deed is binding on the grantor, his heirs and devisees, and also on all persons having actual notice of it, it is not valid and effectual as against any other persons. As to all such other persons the unrecorded deed is a mere nullity. So far as they are concerned, it is no conveyance or transfer which the statute recognizes as binding on them, or as having any capacity adversely to affect their rights as purchasers or attaching creditors. To them the person who appears of record to be the owner is to be taken as the true and actual owner, and his apparent seizing is not divested or affected by any unknown and unrecorded deed that he may have made.

**VACANT PUBLIC LANDS.** Public lands which are unappropriated and unreserved.

**ADJUSTED VALUE.** A value of quantity derived from observed data by some orderly process which eliminates discrepancies arising from errors in those data.

**OBSERVED VALUE.** A value of a quantity that is obtained by instrument measurement of the quantity.

**WITNESS CORNER.** A marker set on a property line leading to a corner; used where it would be impracticable to maintain a monument at the corner itself.

**ZENITH.** The point where the direction of the plumb line produced above the horizon meets the celestial sphere.



## RULES AND ILLUSTRATIONS

## A. General

1. Do not abbreviate or use symbols to conserve space at the expense of perfect clearness.
2. Do not use abbreviations or symbols if their meaning can possibly be misunderstood.
3. Avoid beginning a sentence or phrase with an abbreviation, symbol, or Arabic numeral.
4. Do not use apostrophes in contractions or abbreviations.
5. Hyphenated words should have the hyphen in the abbreviation; omit the period after the abbreviation of both words. ft-lb (foot-pound) amp-hr (ampere-hour) hp-hr (horsepower-hour)
6. Close up the space between letters of initial letter abbreviations of words in common phrases. Btu (British thermal unit) fpm (feet per minute) rpm (revolutions per minute)
7. Abbreviations of Metric terms and English units of weight, measure, and time have the same form for singular and plural. km (kilometer) mm (millimeter) ft (foot) bbl (barrel) lb (pound); not kms, mms, fts, bbls, lbs
8. Use three-letter abbreviations for all months of the year on all drawings.
9. The list of abbreviations and symbols on the following sheets, although not all inclusive, includes those most commonly used on drawings.
10. To abbreviate words not listed, follow the rules shown here. For future reference, insert alphabetically the word and its abbreviation in the given list.

## B. Capitalization

1. In general, capitalization in an abbreviation follows the capitalization of the word abbreviated.
2. If a sentence or phrase must begin with an abbreviation, then capitalize the first letter of the abbreviation.
3. Capitalize abbreviations of proper names.
4. Capitalize the names of geologic materials.
5. In general, capitalize one-letter abbreviations.
6. From usage, some abbreviations are always capitalized and some are always written lower case. Use the style shown for each word in the appended list.
7. Exceptions
  - (a) Write in lower-case letters, abbreviations of units of weight, measure, or time in both English and Metric systems. ft (foot) mm (millimeter) lb (pound) sec (second)
  - (b) Write in lower-case letters, abbreviations of descriptive geologic terms. dp (dip) b (broken) mi (micaceous) rd (river deposit) sy (seamy)
  - (c) Write in lower-case letters, initial-letter abbreviations combined in groups of two or more. ci (cast iron) bc (bolt circle) ef (each face) nts (not to scale) oc (on center)



## C. Use of Periods

1. Omit the period from all abbreviations except where the omission would result in a common English word or in an ambiguity. hp (horsepower) in. (inches) mph (miles per hour) pot. (potential)
2. Omit the period after a percentage (76.5 percent 84.7%) or Roman numerals (VII).
3. Omit the period after abbreviations of geologic material or geologic terms. Gr (granite) Sch (schist) Si (silica) sch (schistose) si (silicious) cgl (conglomeratic)
4. Omit the period after contracted words. arrgt asst brg ctrs contd dwg reqd
5. Omit periods and spaces from abbreviations that take the form of symbols. AAA  
NYA SEC TVA
6. Omit periods and spaces from abbreviations of technical societies when the abbreviation is used as an adjective; include periods when the abbreviation is used as a noun. "ASA Std for cast iron pipe flanges"; but "Cast iron pipe flanges to conform to Std of A.S.A."
7. Place a period after abbreviation of the name of a person or the name of a business corporation. J.E.R. (Jack Elmer Roe) J.D.Co (John Doe Company)

<u>ABBREVIATION</u>	<u>WORD OR WORDS</u>
Adj Meas	Adjusted Measurement
add.	addition
ac	acre
Asph	Asphalt
Az	Azimuth
approx	approximate
aban	abandoned
Ave	Avenue
a/p	angle point
avg	average
BC	Back of Curb
bs	backsight
bsmt	basement
blk	block
brg	bearing
Bk	Book
bldg	building
Blvd	Boulevard
bw	brickwork
BM	Bench Mark
BL	building line
CB	Catch Basin
chn	chain
Ch	Chord
cm	centimeter
c-c or C/C	Center to Center
conv	conveyance
cip	Cast Iron Pipe
chkd	checked
Q or cl	Center line
Calc Meas	calculated from measured values
cmp	Corrugated Metal Pipe
col	column
cor	corner
Conc	Concrete
cf	cubic feet
cfs	cubic foot per second
cu yd	cubic yard
cp	concrete pipe
x section	cross section
culv	culvert
const	construction
Co	County
cr	cross
cu	cubic
coord	coordinate
D	degree of curvature
deg or °	degree(s)
Dep	Departure
Dept	Department
d or dia	diameter
dist	distant or distance

dn	down
DM	Drop Manhole
dwg	drawing
Dr	Drive
Esmt	Easement
estab	establish
E	East
egr	egress
elev or el	elevation
elec	electric
equa or eq	equation
exist.	existing
est	estimate
excav	excavation
FC	Face of Curb
Fin Gr	Finished Grade
FH	Fire Hydrant
FL	Flow Line
ft	foot or feet
fl	floor
fdn	foundation
FW or frmwk	framework
fs	foresight
galv	galvanized
gr	grade
hor	horizontal
hwy	highway
HP	High Pressure
IR	Iron Rod
IB	Iron Bar
IP	Iron Pipe
in.	inch
jt	joint
Lat	Latitude
lc	long chord
lt	left
L	Line
lgth	length
lk	link
Long	Longitude
lb	pound
Mac	Macadam
mk	mark
meas	measurement or measured
MH	Manhole
max	maximum
min	minimum
m	meter
MSL	Mean Sea Level
min or '	minute(s)
mer	meridian
mont	monument (survey)
MO Coord Sys EZ	Missouri Coordinate System East Zone
MO Coord Sys CZ	Missouri Coordinate System Central Zone

MO Coord Sys WZ	Missouri Coordinate System West Zone
N	North
nts	not to scale
No.	Number
Pg	Page
par	parallel
perp	perpendicular
PC	Point of Curve
PCC	Point of Compound Curve
PVT	Point of Vertical Curve
Ppty	Property
PL	Property Line
Pt	Point
P.I.	Point of Intersection
PRC	Point of Reverse Curve
prin mer	principal meridian
prop	prop
PT	Point of Tangency
pav	paving
quad	quadrangle
R or Rad	Radius
radl	radial
R or Rg	Range
RR	Railroad
rt	right
rec meas	record measurement
RCP	Reinforced Concrete Pipe
Rd	Road
Ret Wall	Retaining Wall
R/W	Right of Way
S	South
San Sew. or San Sewer	Sanitary Sewer
sec or "	second(s)
Sect	Section
spec	specification
Sq	Square
St.	Street
St	Stone
stk	stake
Sta	Station
std	standard
sw	stonework
surv	survey
tan	tangent
telp	telephone
tc	terra cotta
Tp or T	Township
trans	transition
tp	turning point
ug	underground
UP	Utility Pole
USC & GS	United State Coast and Geodetic Survey

USGS	United States Geological Survey
VC	Vertical Curve
vac	vacated
VS	Vertical Strip
Vert	Vertical
W	West
WL	Water Line
WS EI	Water Surface Elevation
yd	yard
'	feet or minutes
"	inches or seconds
°	degrees
△	central angle
□	square foot (or feet)



UNITS OF MEASURE

<u>TO CONVERT</u>	<u>MULTIPLY BY</u>	<u>TO OBTAIN</u>
acres	10	Sq Chains
acres	43560	Sq Ft
acres	4047	Sq Meters
cm	0.03281	ft
cm	0.3937	inches
chains	66	ft
chains	20.12	meters
cubic meters	1.308	cu yd
cubic yd	27	cu ft
cubic ft	0.03704	cu yd
cubic ft	0.02832	cu meters
cubic yd	0.7646	cu meters
degrees (angle)	0.01745	radians
feet	30.48	cm
feet	12	inches
feet	0.01515	chains
inches	2.540	cm
inches	0.0833	feet
kilometers	0.6214	miles (statute)
meter	39.37	inches (By defination)
meter	3.281	ft
miles (statute)	5280	ft
miles (statute)	1.609	kilometers
minutes	0.0002909	radians
radians	57.296	degrees
radians	3438	minutes
radians	206300	seconds
rod	16.5	ft
rod	0.25	chains
seconds	.000004848	radians
square feet	0.00002296	acres
square feet	0.0929	sq meters
square feet	0.1111	sq yd
square miles	640	acres

### STANDARD PUBLICATIONS

Publishing houses will mail upon request a list of their publications related to Surveying. Listed below are a few of the texts which are considered good technical references:

A Treatise on the Law of Surveying and Boundaries; Third Edition; Frank E. Clark; Bobbs-Merrill Co., Indianapolis.

Surveying, Elementary and Advanced; Rayner and Schmidt; D. Van Nostrand Co., Princeton, N. J. (one volume)

Surveying for Civil Engineers; Phillip Kissam; McGraw-Hill Book Co., Inc.

Route Location and Surveying; Fourth Edition; Hickerson; McGraw-Hill.

Surveying, Theory & Practice; John Clayton Tracy; John Wiley & Sons, Inc.

Elementary Surveying (Vol. I) Breed and Hosmer; John Wiley & Sons, Inc.

Higher Surveying (Vol. II); Breed and Hosmer; John Wiley & Sons, Inc.

Surveying; Phillip Kissam; McGraw-Hill Book Company, Inc.

Modern Surveying for Civil Engineers; Harold Frank Birchall; Philosophical Library.

Route Surveying; Pickles and Wiley; John Wiley and Sons, Inc.

Railroad Curves and Earthwork; C. Frank Allen; McGraw-Hill Book Company, Inc.

Engineers' Field Book; Edward Butts; John Wiley & Sons, Inc.

The Engineers' Manual; Ralph G. Hudson; John Wiley & Sons, Inc.

3030 Review Questions for Surveyors; Russell C. Brinker; 4217 Norfolk Lane, El Paso, Texas.

Boundary Control and Legal Principles; Curtis M. Brown; John Wiley & Sons, Inc.

Evidence and Procedures for Boundary Locations; Brown and Eldridge; John Wiley & Sons, Inc.

The following listed publications on associated subjects will be found to be useful in a land surveyor's library:

The Engineer at Law (2 Volumes); Conde B. McCullough; Iowa State College Press; Ames, Iowa.

Business Management Handbook; J. K. Lasser; McGraw-Hill Book Company, Inc.

Business, Legal and Ethical Phases of Engineering; Canfield & Bowman; McGraw-Hill Book Company, Inc.

Legal Guide for Contractors, Architects and Engineers; I. Vernon Werbin; McGraw-Hill Book Company, Inc.

Surveying and Mapping (6 times yearly), American Congress on Surveying and Mapping, Box 470, Benjamin Franklin Station, Washington, D.C. 20004, contains valuable up-to-date information for Land Surveyors.

Bibliography of Property Surveying Literature, American Congress on Surveying and Mapping.

# GOVERNMENT PUBLICATIONS.

Many publications related to surveying are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The Superintendent of Documents will upon request furnish you with a list (and price) of available documents pertaining to any given subject, some of which are listed below:

<u>Manual of Instructions for the Survey of Public Lands of United States</u>	Department of Interior
<u>TM 5-232 Elements of Surveying</u>	Department of Army
<u>TM 5-233 Construction Surveying</u>	Department of Army
<u>TM 5-234 Topographic Surveying</u>	Department of Army
<u>TM 5-235 Special Surveys</u>	Department of Army
<u>Restoration of Lost or Obliterated Corners and Subdivision of Sections</u>	Department of Interior
<u>TM 236 Surveying Tables</u>	War Department
<u>Special Publication #242 Definitions of Terms Used in Geodetic and Other Surveys</u>	Department of Commerce
<u>Special Publication #334 Geodetic Leveling Instruments</u>	Department of Commerce
<u>FM 21-26 Map Reading</u>	Department of Army
<u>TM 5-231 Mapping Functions of the Corps of Engineers</u>	Department of Army
<u>TM 5-240 A Guide to the Compilation and Revision of Maps</u>	Department of Army
<u>TM 5-241 The Universal Grid System</u>	Department of Army
<u>TM 5-244 Multiplex Mapping</u>	Department of Army
<u>TM 5-248 Foreign Maps</u>	Department of Army
<u>TM 30-246 Tactical Interpretation of Air Photos</u>	Department of Army
<u>TM 30-245 Photographic Interpretation Handbook</u>	Department of Army
<u>FM 21-31 Topographic Symbols</u>	Department of Army
<u>TM 5-230 Topographic Drafting</u>	War Department
<u>FM 5-10 Engineers Field Manual - Communications, Construction and Utilities</u>	War Department
<u>FM 5-35 Engineer's Reference and Logistical Data</u>	Department of Army
<u>TM 5-255 Aviation Engineers</u>	War Department
<u>TM 5-360 Port Construction and Rehabilitation</u>	Department of Army

**BUREAU OF LAND MANAGEMENT  
CADASTRAL SURVEY PUBLICATIONS**

Cadastral and Mapping Training Staff, D-411  
Bureau of Land Management  
Denver Service Center  
Denver Federal Center, Bldg. 50  
Denver, Colorado 80225

"Surveying Our Public Lands" (P-25) .....	\$ .80
"Typical Field Notes and Classified Excerpts" (P-150) .....	\$5.80
"Glossary of BLM Surveying and Mapping Terms" (P-161) .....	\$1.25
"M&P Factors (24° thru 51°)" .....	\$ .90
"Selected Computations of Astronomical Observations" (T/N-318) .....	\$1.00
"Durability of Bearing Trees" .....	\$1.40

Superintendent of Documents  
U.S. Government Printing Office  
Washington, DC 20402

"Surveys and Surveyors of the Public Domain" (024-011-00083-6) .....	\$4.25
"Specifications for Descriptions of Tracts of Land" (024-011-00117-4) .....	\$2.00
"Restoration of Lost or Obliterated Corners & Subdivisions of Sections" (024-011-00012-7) .....	\$ .75
"Manual of Surveying Instructions 1973" (024-011-00052-6) .....	\$11.00