

Township N^o 1 North,Range N^o 10 West,

San Bernardino Meridian.

U S DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Cadastral Survey Training Program

Public Land Surveying

A Casebook

2001 revision

prepared by
The Cadastral Training Staff
 1975

Survey designated	By whom surveyed	Date of Contract	Amount of Survey	When Surveyed
South Quarter of T ¹	Wm. H. Wright	October 20 th 1852		1855
Part of S ¹ Same above green	J. A. Gray	" "		
W ¹ Same do.	" "	" "		
Quadrants of A ¹ & C ¹ 3 ¹ 3 ¹	Amos Brock	October 17 th 1859		1859
Part of S ¹ above of T ¹ above green	W. J. Reynolds	January 18 th 1873		1873
Quadrants of A ¹ & C ¹ 3 ¹ 3 ¹	W. H. Wright	July 24 th 1875	700 4800x 5016	1875
Part of S ¹	" "	" "	70 23 22	
Section 10 10 ¹	" "	" "	36 29 31	Det. 1875

The above map of Township N^o 1 North, Range N^o 10 West, is slightly conformable to the California Public Survey which have been examined and approved. Surveyed under U. S. Com. San Francisco California, April 3rd 1870

Chapter A

Fundamentals of Corner Restoration

A1

PURPOSE

The Bureau of Land Management Cadastral Survey Training Program was established in 1970. At that time there were extremely few publications available on the subject of Cadastral Surveying. For various reasons none were entirely suitable for use as teaching materials.

In order to provide suitable materials for the training job at hand, a very considerable portion of the effort expended toward presentation of the training program involved development of training materials. This book was one such development.

Any teaching material used for training must present accurate information and correct procedures. Any instructional material for use in training cadastral surveyors must not only be correct but it cannot conflict with the instructions given in the Manual of Surveying Instructions. Because the BLM Manual of Surveying Instructions was undergoing complete revision in 1970, during development of this book, it became clear that a text consisting of instructions would unnecessarily paraphrase the Manual to be revised.

Under the conditions at that time the logical method of development of the needed materials was to present actual approved surveys. It would be necessary to provide greater detail than is usually available and to describe how the particular solution was reached. Because the material was factual and had been approved by the Washington Office, the system was adopted.

This compilation of Public Lands Surveys is intended for self-study as well as for use in classroom instruction. It is intended that anyone versed in survey technology who uses this book and the Manual of Surveying Instructions could master the fundamentals of Public Lands Surveying, particularly the resurvey of those lands (as opposed to the original surveys.)

In addition to its use as instructional materials, it is expected that this casebook can be used as a reference work for the practicing surveyor. A number of frequently occurring problems are not discussed in any other publication.

HOW TO USE THIS BOOK

In the Classroom. Law students are accustomed to learning principles of law by means of study of court decisions (cases). There is a knack to learning by this method. The secret lies in continually and actively looking for the principle during the time you are trying to understand what happened.

Another aid to learning in this manner is to digest each step of the case in sequence. If the reader tries to skim through the text or (even worse), to "look at the pictures," there can be no real expectation that the true principle will be discovered. It is suggested that the reader start with the History of Surveys text and carefully compare the Graphical History (presented as isometric drawings) with the plats reproduced in full or in part. Follow, in the given sequence, Reasons for Request of the Survey and through the Preliminary Statement of the Problem. At this point, turn to the Manual of Surveying Instructions, 1973 and read the sections referred to under Regulations. After that background you are ready to tackle the meat of the case. The inevitable side issues are discussed under Auxiliary Topics and Supplemental Topics. Remember to keep asking yourself, "What basic principle is represented here?"

As a Self Study Guide. The historic method of training a "new man" in the complexities of Cadastral Surveying was to hand him a copy of the "Manual" and tell him to read it from cover to cover. Just as the learner felt he had mastered one area, he found that the examples elsewhere showed what might be a different solution. The frustration the old timers suffered can now be avoided during self teaching.

The interested surveyor should study this book plus the Manual of Surveying Instructions in the following sequence:

- 1) "Manual" chapter 1, sec. 1-1 to 1-23
- 2) "Manual" chapter II, sec. 2-1 to 2-20
- 3) "Manual" chapter 111, sec. 3-1 to 3-23;
sec. 3-74 to 3-96; sec. 3-124 to 3-127
- 4) "Manual" chapter IV, sec. 4-1 to 4-22; sec. 4-83 to 4-96
- 5) "Casebook" section A-1, Fundamentals of Corner Restoration
- 6) "Manual" chapter V, sec. 5-1 to 5-47
- 7) "Manual" Chapter A2 and the following cases in serial order, using the "Manual" as indicated in the text, until completion
- 8) "Casebook" chapter A2 and the following cases in serial order, using the "Manual" as indicated in the text, until completion.

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PRINCIPLE I

Federal Law, including the Manual of Surveying Instructions, governs boundary location of Public Lands

General

The Secretary of the Interior, or such officer as he may designate, is authorized to enforce and carry into execution, by appropriate regulations, every part of the provisions of the Public Land Laws not otherwise specially provided for. (1, 5)

The Code of Federal Regulations and the Manual of Surveying Instructions are products of the authority vested in the Secretary of the Interior to make such appropriate regulations as to enforce and carry into execution the provisions of the public land laws not otherwise specially provided for.

Interior Decisions are regulations issued by the Department of the Interior and are considered as law by BLM employees. Some Interior Decisions pertain to methods of execution of the surveys of the public lands.

Caution: Some Interior Decisions (previously called Land Decisions) were issued between dates of issue of Manual of Surveying Instructions.

The Secretary of the Interior may, as of March 3, 1909, in his discretion, cause to be made, as he may deem wise under the rectangular system on that date provided by law, such resurveys or retracements of the surveys of public lands as, after full investigation, he may deem essential to properly mark the boundaries of the public lands remaining undisposed of: **PROVIDED**, That no such resurvey or retracement shall be so executed as to impair the bona fide rights or claims of any claimant, entrymen, or owner of lands affected by such resurvey or retracement: (4)

The general rules which control the location of all public lands and the fundamentals of corner restoration have evolved from the authority vested in the Secretary, statutory law, common law, and court decisions. These rules and fundamentals are now followed by the Bureau of Land Management.

Conflict Between Federal and State Laws

All state laws that are in conflict with the Federal statutes and land department principles concerning methods of survey have been declared void in so far as the boundaries of public lands are concerned. (6)

The survey of acquired or re-acquired lands is governed by the state laws in which the land is physically located.

Fundamentals of Corner Restoration

PRINCIPLE II

Once established, corners of the Public Lands are fixed in their monumented positions but the government may survey or resurvey its public lands as it chooses.

General

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.(3)

Lines As Marked and Surveyed

The boundaries of the public lands, when approved and accepted are unchangeable. (3).

Caution:Check for possible corrections or even a suspension or cancellation of an approved survey before any title has passed to private individuals.

Monuments

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. The distance between such corners as returned shall be held and considered as the true length thereof. The monuments set at the time of the original survey are the best evidence as to where the original boundaries were established, and as such the position of the monuments must remain unchangeable (3).

Conclusive Evidence Outweighs the Record

The actual corner monument, when found and is undisturbed, is paramount; the record (field notes and plat) is subordinate to the monument.

Resurvey

A resurvey is a reconstruction of land boundaries and subdivisions accomplished by rerunning and remarking the lines represented in the fieldnote record or on the plat of a previous official survey. The two main objectives of the resurvey are:

1. The adequate protection of existing rights acquired under the original survey in the matter of location on the earth's surface.
2. The proper marking of the boundaries of the remaining public lands.

Line Trees and Blazed Lines

All lines shall be plainly marked upon trees, and measured with chains,....(2).

1

Therefore, if a boundary line was marked by line trees and an original marked line tree is found, it still marks the boundary line (at least in alinement) and may become an angle point in the line.

Under the law, a definitely identified line tree is a monument of the original survey. As an existing monument, a line tree is used as a control point in the reestablishment of lost corners by the appropriate method of proportionate measurement. (24)

Caution:Often line trees were recorded as being on the original surveyor's random line and not on the actual true line between corners.

If a boundary line was marked with a blazed line by the original surveyor and can be definitely identified, the mean position

of the blazed line still marks the boundary line and may be used to fix a meridional line for departure, or a latitudinal line for latitude in the absence of the original monuments. (22)

Caution: Often the random lines were blazed rather than the actual true line between corners. Corrections may have been made by the original surveyor before the final acceptance of his survey or he may have blazed more than one line.

Witness Point

If a boundary line was marked by a witness point and it is found, it still marks the boundary line (at least in alignment) and may become an angle point in the line. (18)

Witness Corner

If a witness corner marked the line (was on line) of the original survey, it should still mark (control the direction of) that line and may become an angle point in the line. (17)

The position of the nearest identified control corners, including witness corners, determines the proportionate measurement of any intermediate positions between those controlling corners.

Supplemental Plats

Supplemental plats prepared by protraction to show new or revised lottings in one or more sections of remaining public domain supersede the lottings shown on the original plat. (35)

Closing Corners

Closing corners are intended to be established where a closing line intersects a boundary already fixed in position. A 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 the intersection of the two lines. (16)

Fundamentals of Corner Restoration

PRINCIPLE III

The Court will consider the intent of the parties reconstruction of deed descriptions.

General

Traditional methods employed to interpret ambiguous agreements or title documents are called Rules of Construction. These rules are to be invoked in ascertaining boundaries only when there is a conflict or inconsistency in the calls found in the field-notes or between the calls in deeds and those of the field notes.

If an accurate description can be built up from existing government monuments and field-notes, there is no uncertainty in the boundary line.

In a dispute, the courts will construe the evidence (interpretation of words) most strongly against the party who writes the deed (8, 11). The United States is considered as the writer when a patent for a parcel of land is issued.

Closing Corners

Closing corners are intended to be established where a closing line intersects a boundary already fixed in position. A 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 the intersection of the two lines.

Plats

Early platting, reproduction, and copying processes often led to errors on various plats. The Land Office copy for the Official Plat is generally the one from which patents are issued and therefore should be the one used if discrepancies (e.g. area, distances, lottings, etc.) exist on various copies thereof.

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PRINCIPLE IV

**The Plat and the field notes are considered together with,
and as part of, the grant (patent) itself.**

Original Field Notes and Plat

When lands are granted according to an official plat of a survey, the plat with all its notes, lines, descriptions and landmarks becomes a part of the grant or deed by which they are conveyed and controls, so far as limits are concerned, as if such descriptive features were written out on face of deed or grant. (12)

The copy of the official plat from which the patent was issued is the copy which becomes part of the patent itself.

Where there is a variance between the plat and the field notes of an original government survey, the plat must control. (13)

The township plat furnishes the basic data relating to the survey and the description of all areas in a particular township. The plat is developed from the field notes and is intended to be an exact pictorial representation thereof.

When the field notes are relied upon to restore a lost corner and are found to be inconsistent, and cannot be reconciled, there is no universal rule that certain ones shall be preferred to others; but, as in a case where living witnesses contradict each other, those should be accepted as correct which, under all circumstances, are most entitled to credit, and most likely to be in accordance with the actual facts. (14)

Fundamentals of Corner Restoration

PRINCIPLE V.

A resurvey restores the monuments at their original positions.

A. AN ORIGINAL SURVEYOR'S MISTAKE WHICH IS IDENTIFIED WILL BE CONSIDERED BY THE COURTS TOWARD PLACING THE ENTIRE BLUNDER WHERE IT OCCURRED.

Place the Blunder Where the Blunder Occurred

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. An example of this rule is witnessed by corrections for chaining errors.

When it is obvious or unquestionably proven that the original surveyor made a tally blunder in his chaining, the amount of the blunder is corrected before any remaining discrepancies between the retracement and original survey are adjusted or proportioned.

By placing any blunder where it occurred and weighing corroborative collateral evidence, the surveyor can make a professional decision as to whether a line tree or a blazed line is the best available evidence of the position of the original boundary line.

B. CORNERS ARE RESTORED BY THE NEAREST AND BEST AVAILABLE EVIDENCE:

Existent Corner

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 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.

Obliterated Corner

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.

Lost Corner

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.

Collateral Evidence

Collateral evidence is additional or auxiliary evidence which supports or reinforces the primary evidence of a corner point. The primary evidence is the actual corner monument or its accessories. Collateral evidence may be in the form of acts or testimony of interested landowners, competent surveyors, other qualified local authorities or some acceptable record evidence in identifying the true original position of a corner. Collateral evidence in surveying is similar to circumstantial evidence in law (by itself, it is insufficient; but an abundance of it is conclusive).

Retracement

A retracement is a survey that is made to ascertain the direction and length of lines and to identify the monuments and other marks of an established prior survey. A retracement may, also, show discrepancies of courses and/or distances which exist between the original record and the current physical findings (32). Retracements are often used to gather collateral evidence of the original survey or to develop search areas.

Identification of Monuments

After making due allowances for natural changes, a monument to be identifiable should not differ from the following:

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. (20)

Accessories are considered as part of the monument; their identification, - without finding the monument can fix the position of the: monument and restore an obliterated' corner to its, original location. A search - for a monument includes a search for all accessories. (19)

Identification of Lines Run

Where the direction of a line can be determined from the mean position of a number of blazed trees, the direction so established may- be controlling where the corner monument is lost. Sometimes a stream or canyon crossing becomes controlling, especially where the crossing is near a corner.(23)

Shoreline as Evidence

Where the official record of a government survey shows that a meander line coincides with the shoreline of a lake, as in the discussion regarding County Ditch No. 67, Murray County, 1922, 186 N.W. 711, 155 Minn. 292, it is prima facie evidence that the meander line marks the actual shoreline.

When other evidence is sparse or nonexistent, the actual shoreline which approximately conforms to the original meanders may be the best available evidence or collateral evidence necessary to reestablish an obliterated meander corner.

Using the actual shoreline, when proven to be located approximately where the original surveyor described it, coincides with the principle of following the footsteps of the original surveyor.

The shoreline as direct evidence is more conclusive where it follows a well defined bank or the distance from a surveyed line crossing or meander corner to a definite bend is relatively short. Conclusive evidence may also be provided where the line crosses a well-defined short leg (point) of water or land (e.g. an island).

Caution: This alternative for possible corner restoration is often overlooked. The use of this method should be in harmony with the original survey, concurrent survey, and the other methods of restoring corners.

Topographic Calls

When items of topography are found where described by a certain surveyor in portions of a particular township, they may substantiate the reliability of similar calls for items of topography by the same surveyor elsewhere in the township.

The topographic calls of the original field notes, when found, may fix the position of a line or corner beyond reasonable doubt. They may also be used to fix a position of a missing corner in either latitude or departure. (25)

Caution: Topographic calls may have been made on the random line rather than the true line between corners. Generally, if the restoration of a corner is dependent upon items of topography alone and appears to be questionable--don't use it! A check should be made to determine whether the results of restoring a corner from topographic calls are harmoniously related to the original and concurrent surveys.

In order for a topographic call to be used to fix the position of a corner or line, it must not be contradicted by evidence of a higher class or by other topographic calls and should have only one reasonable interpretation. In the absence of other collateral evidence, it is better practice to turn to suitable means of proportionate measurement when the specific topographic call is questionable.

Restoration of Lost Corners

Often the best available evidence of the original location of a corner is the method by which it was originally established, and its relationship to subsequent surveys. The best method or combination of methods used to restore the lost corner may be obtained by following the footsteps (or methods) of the prior surveyors. Listed below are some of those modified forms and combinations of methods for restoring lost corners.

a. One-point control

When a lost corner was originally established at the terminus of a line from one direction only, it should be restored at the record bearing and distance from the nearest regular corner with the possibility of an index correction. An example of this "situation" would be where a quarter-section corner was originally established on a section line which was never completely surveyed.

B.(Cont.) CORNERS ARE RESTORED BY THE NEAREST AND BEST AVAILABLE EVIDENCE.

b. Two-point control

When a lost corner was originally established at the terminus of lines from two directions, it should be restored at the record distances (cardinal equivalents) with the possibility of an index correction. One distance controls latitudinally and the other controls meridionally.

c. Three-point control

When a lost corner was originally established at the terminus of lines from three directions, it should be restored at single proportionate distance in one direction (between control corners in opposite directions), and by letting the record distance (cardinal equivalent) control the position from the remaining direction. Examples of this situation may exist where lost township or section corners were originally established with control lines in only three directions.

d. Irregular boundaries

There are three general types of irregular boundaries. First, irregular township lines where originally parts were possibly surveyed from opposite directions and the intermediate portion was completed later by random and true line. Second, irregular section lines where originally a partial survey was followed by a completion survey. Then a retracement would probably reveal a deflection in alignment. Third, irregular section lines or township lines where meander corners have been established from opposite directions on a section line which is intersected by a river, with a tie given across the river between the meander corners. Occasionally, the plat indicates the section line to be a straight line if the tie between the meander corners is within the allowable limits. However, a close examination of the notes may indicate a deflection in alignment of the section or township line.

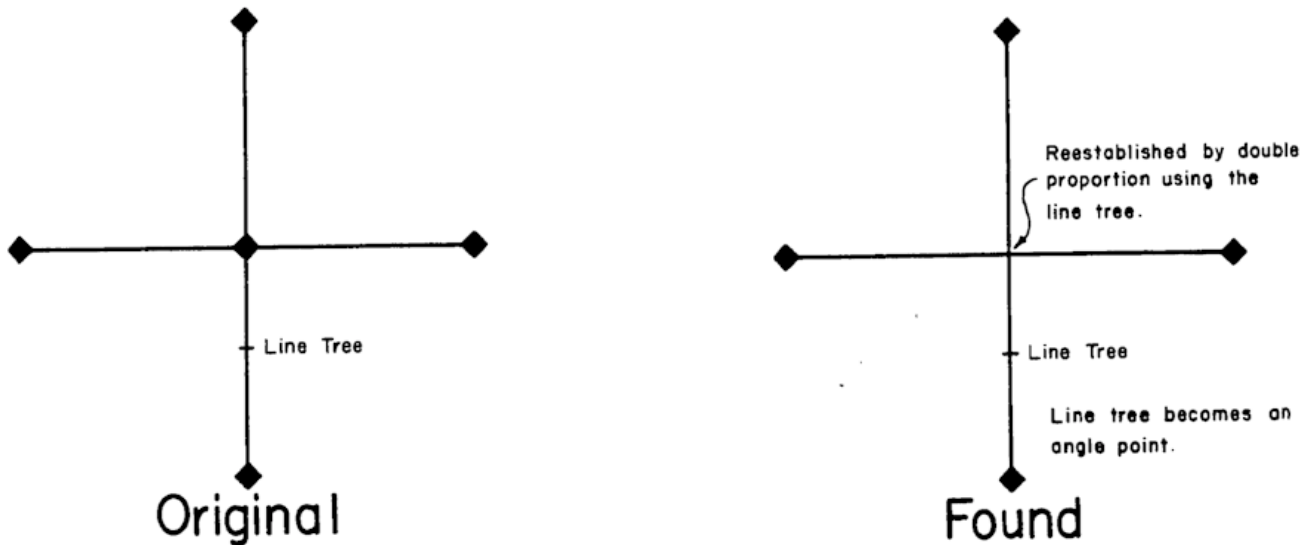
In these situations any lost intermediate corners should be restored by a modified form of single proportionate method of corner restoration. First single proportion the cardinal equivalent of the closing distance in the direction of the line. Second, single proportion the cardinal equivalent of the closing distance in the other direction based on the accumulated distances attained after the corrections for the first step are completed.

e. Line intersections

When a lost corner was originally established by intersection of surveyed lines, it should be restored at the intersection of

the same lines.

Caution: The preponderance of evidence of the actual conditions, in cases such as a center-quarter section corner, may indicate that a four-way proportion would be a better method in some situations.



Attempts to emphasize various methods, capabilities of equipment, and existing regulations by which the original corners were established have led to the use of the following methods of restoring lost corners in order to protect bona fide rights:

- Angle points of nonriparian meander lines. (Compass Rule)--based on the assumption that the angles and distances of the original were measured with equal precision.
- Grant boundaries. A rotation and scale change which retains the form of the original survey being adjusted. The interior angles are unchanged and the increase or decrease in lengths of lines is constant.

The use of the grant boundary adjustment (in the BLM) may have evolved from questions concerning original surveys such as:

What are the exact directions in terms of angular measure from a true north and south line?

What are the true lengths of lines when reduced to a common standard?

How, in the event of an obliteration of the marks of angle points, can the lines be recovered, holding to a uniform correction from record direction to that of true direction, and in the same process hold to a uniform proportional adjustment to the lengths of lines as reduced to a standard unit?

Reference Monuments

Ordinarily, reference monuments have been set in situations where the actual corner point was, or could have been, occupied. In fact, reference monuments were often set while the surveyor and his instrument were at the actual corner point.

A reference monument is an accessory to a corner. As such, when found intact, the actual corner point can be located and there is no lost corner --- which rules out the possibility of proportioning the corner.

Reference monuments are generally set (located) as if they were bearing trees or bearing objects.

CAUTION: When more than one reference monument is set to witness a corner point, they are often set at equal distances; but not always!

Some reference monuments are set at right angle offsets from the centerline of a highway or railroad.

The actual corner point can be located from one or more reference monuments in the same way it would be located from bearing trees.

Line Trees

A tree intersected by the true line of the original survey was marked as a line tree. Line trees have the same function as a witness point and, therefore, are used in the same way as a witness point for the restoration of lost or obliterated corners. (27)

(Continued) CORNERS ARE RESTORED BY B. CORNERS ARE RESTORED BY THE NEAREST AND BEST AVAILABLE EVIDENCE.

Witness Corners

The position of the nearest identified control corners determines the proportionate measurement of any intermediate positions between those controlling corners.

Caution: Not all witness corners were placed on line and, therefore, not all witness corners can be used as control points for proportionment.

Testimony

The original location of a corner may be restored at a spot pointed out by a person who saw the original corner and knows its former location. The evidence testified to should be given no more weight than would be given in court; i.e., it should not be hearsay, etc.

The following information should be included when obtaining data from a witness concerning the location of an obliterated corner point:

Name Age

Address

How long at that address?

When he first acquired knowledge of the corner position?

A picture which includes the corner point and the witness with the date, photographer's signature and the witness' signature.

An actual statement by the witness which is complete and signed.

Testimonial evidence given by disinterested parties is often more reliable than that which is given by the adjacent landowners.

All testimonial evidence should be put to the severest possible tests by confirmation relating to known original corners and other calls of the original field notes, particularly to line trees, blazed lines and items of topography. (21)

Map or Plat Reference by Others

Where an acceptable map or plat shows the found location of the original corner, the corner, if obliterated, should be relocated by said map or plat. City, county, state, utility companies, railroads and private surveyors often have maps or plats which include vital information concerning the conditions at an obliterated corner.

Local Corners

Often a corner point has been perpetuated with a monument set by a county surveyor, logging engineer or some other person. Such corners have frequently been relied upon for many years by the adjacent landowners as the actual corner. (34)

It is important that preliminary research for information concerning these local corners be thorough and should include such questions as:

- a. Who set it?
- b. When was it set?
- c. What basis was used to set it?
- d. What method was used to determine its position?

These local corners may be accepted as the best available evidence of the original corner point when supported by collateral evidence and found to be harmoniously related to the factors in the original survey.

When the proper method was used to perpetuate a corner and it was done within allowable limits of precision, and relied upon by adjacent landowners as the best available evidence of the original corner position, an indiscriminate rejection of such a corner may lead to serious repercussions.

The acceptance or rejection of a local corner should also be based upon the effect the outcome will have on the bona fide rights of the individual landowners.

Caution: Some local corners are set by landowners at arbitrary positions and others may be fake monuments which resemble the original monuments.

Common Usage

Under special conditions a corner location can be accepted by common usage of a point.

Frequently highways or fences are located along section lines. Where a road or fence has been commonly accepted as the section line and there is no evidence to the contrary, the road or fence is the section line by common report. In the absence of other means, an obliterated section corner can be restored at the centerline intersection of two such roads or intersection of fences which are commonly reported as being the section lines in question. It is far better to accept a long-standing fence corner commonly accepted as the section corner than to try to establish a different position by proportionate measurement. (9)

The acceptance of corners which are commonly agreed upon by the adjacent landowners often avoids disturbing the local conditions.

Caution: The custom of the area concerning how the fence lines were established and the value of the land should be considered.

Unofficial Records

Occasionally, a set of old field books or information concerning a private survey which was not recorded comes to the surface. Such information can and should be used to search for corners and collateral evidence necessary to restore lost or obliterated corners. The bearings and distances as stated in unrecorded surveys cannot legally be used in proportioning any intermediate corners which are missing.

Harmoniously Related

When restoring an obliterated corner or reestablishing a lost corner, an attempt should be made to harmonize the restorative process with the methods used in the original survey (following the footsteps). The following list points out some factors which should be considered in harmonizing the restorative process with existing (the original) and concurrent surveys:

- a. Is the end product in harmony with the original plat?
- b. Are the corner points, lengths of lines bearings of lines in harmony with the original and each other?
- c. Is there any harmony between the topographic calls in the retracement and those of the record?
- d. Are the evidences which are nearest the

particular corner in question given the greatest weight and are they harmoniously related to each other?

- e. Is the principle of proportionate measurement used which most nearly harmonizes surveying practice with legal and equitable considerations in determining boundaries?
- f. Is there harmony between the end product and the evident faithfulness of the original survey?

A position based upon collateral evidence should be duly supported, generally through proper relation (harmoniously related) to known corners, and in agreement with the field notes regarding distances to natural objects, stream crossings, line trees and off-line tree blazes, etc., or unquestionable testimony.

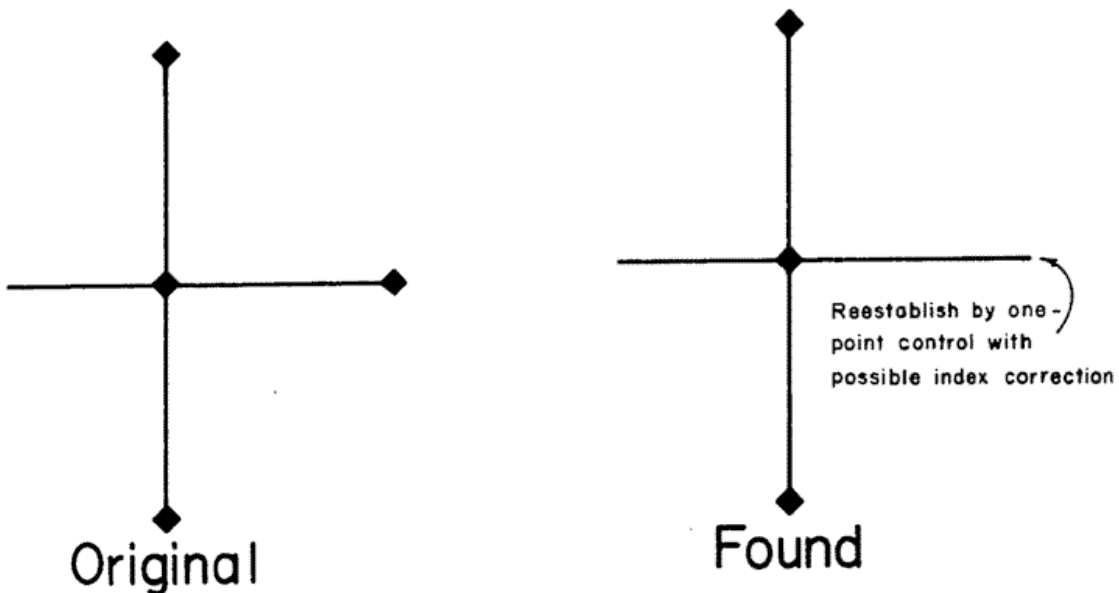
C. PROPORTIONATE MEASUREMENT AND RECORD MEASUREMENT IS APPLIED AS A LAST RESORT OR IT MAY BE USED AS A SUPPLEMENT TO DIRECT EVIDENCE.

Restoring a corner by proportionate measurement should be regarded as the last resort; all other evidence that might reveal the original location must be exhausted first. (28)

One Point Control

Generally, one point control restores a lost corner at record bearing and distance with the possibility of an index correction (when applicable). (31)

An index correction may be applicable where a retracement has been made of many miles of the original lines between identified corners and there has been developed a definite angular or linear pattern of the original survey. It is then proper to make allowance for the average difference.



Single Proportionate Measurement

Often referred to as "two-way" proportionate measurement. The position of two identified corners controls the direction of the line between those corners, and intermediate positions on that line are determined by proportionate measurement between those controlling corners.

Examples: A quarter-section corner on the line between two section corners; all corners on standard parallels; and all intermediate positions on any township boundary line.

Double Proportionate Measurement

Often referred to as "four-way" proportionate measurement. Four known corners, two each on intersecting meridional and latitudinal lines are used for the purpose of relating the intersection to both. By double proportionate measurement, a lost corner is reestablished on the basis of measurement only, disregarding the record directions. The double proportionate measurement is the best example of the principle that existent or known corners to the north and to the south should control any intermediate latitudinal position, and that corners east and west should control the position in longitude.

Examples: A corner common to four townships, or one common to four sections within a township.

Combinations of Proportionate Measurement Methods

Primary and collateral evidence often lead to abandoning general rules of proportionment and adopting modified forms and combinations of single and double proportionate measurement methods in order to restore lost corners to their original position based on the best available evidence and harmony with existing and concurrent surveys.

Witness Corner

Ordinarily an off line 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 a 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 not 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.

Witness Point

As an existing monument, a witness point is used as a control point in the restoration of lost corners by the appropriate method of proportionate measurement.

Line Trees and Blazed Lines

If line trees or blazed lines are found to be as described by a certain surveyor in a particular township, that fact may substantiate the reliability of similar evidence elsewhere in the township for use of control points in proportioning lost corners.

D. PROPORTIONMENT MUST BE APPLIED IN FULL CONSIDERATION OF THE MANNER OF CONDUCT OF PRIOR SURVEYS. (29)

Often the best available evidence of the original location of a corner is the method by which it was originally established. The best method or combination of methods used to restore the lost corner may be obtained by following the footsteps (or methods) of the original surveyors.

Proportionate Measure

If lost corners are to be relocated by proportionate measure, "the new values given to the several parts as determined by the re-measurement shall bear the same relation to the record lengths as the new measurement of the whole line bears to that record."

Importance of One Line Over Another

Not all lines are of equal importance. The method of survey used by the original surveyor often determines the future status of surveyed lines. The precedence of some lines over other lines is recognized in restoring lost corners.

Single Proportionate Measurement

In order to restore a lost corner on a line by single proportionate measurement, a retracement is made connecting the nearest identified corners (or control points) 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 reestablished 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.

Double Proportionate Measurement

An occasional exception to this rule is illustrated in the following example: If the distance along the random line was inadvertently used (even though the random bearing was corrected to the true bearing) on the official plat and in the notes rather than the corrected true line distance, the random distance is the cardinal equivalent of the true distance along the true bearing and no reduction is necessary.

Plat

There is no provision relating to the rules to be followed where corners have been lost, for a proportionate measurement based on the deficiency in acreage of adjoining parcels of land; and, where there is no question as to the establishment of a lost corner, the exact boundaries as shown on the government plat must prevail, and they will control a further description by quantity. (15) .

A deficiency or excess of actual acreage on the ground does not take precedent over the exact boundaries as indicated on the plat. Any proportionment of lost corners will be based on the plat and not on any excess or deficiency of acreage which may exist.

Closing Corners (Off-Line)

It is evident that the law provides for the lengths of the lines, as returned in the field notes, to be held as the true lengths, and the distances between identified corner positions given in the field notes to constitute proper data from which to determine the position of a lost corner; hence the rule that lost corners are restored at distances proportionate to the original measurements between identified positions. 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 the proportionate restoration of lost corners on the closing line which are 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 original corner monument. (30)

Witness Corners

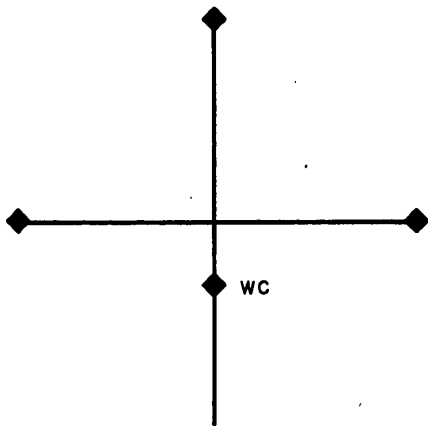
Following the footsteps of the original surveyor, by considering the Manual and Special Instructions which were current at the time of the original survey along with the field notes, may help to determine whether the true corner point is located by the method of proportionate, measurement or at record bearing and distance from the witness corner.(26)

Caution:

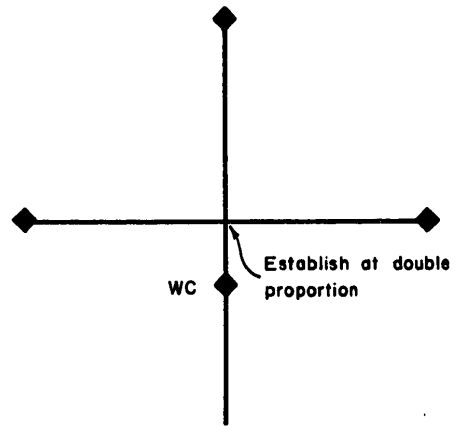
Determine whether the original witness corner was intended to be on the true line.

Determine which method would best locate the true corner point in its original position.

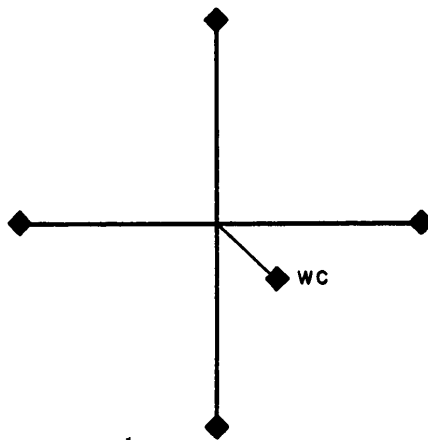
Some early surveyors have been known to use the terms witness corner and witness point interchangeably.



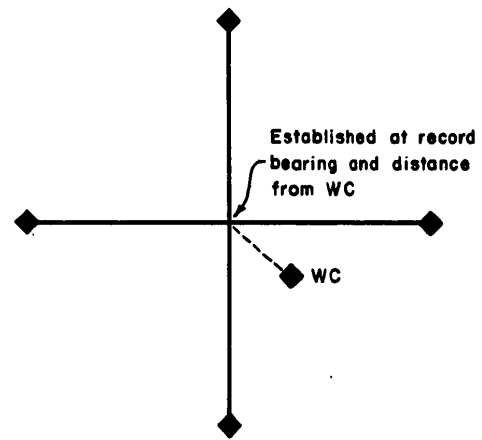
Original



Found



Original



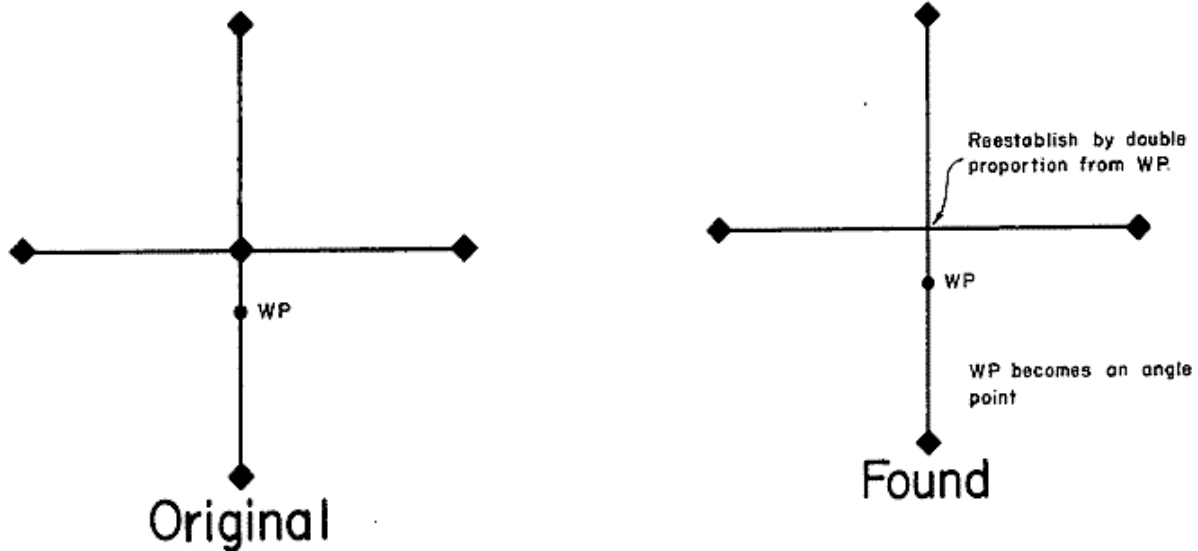
Found

D. (Continued) PROPORTIONMENT MUST BE APPLIED IN FULL CONSIDERATION OF THE MANNER OF CONDUCT OF PRIOR SURVEYS. (29)

Witness Points

Since witness points were ordinarily occupied by the original surveyor and his instrument when set and have a compliment of accessories, they are a pretty reliable source of control when they are found.

A witness point has the same function as a line tree and is used in the same manner to restore lost or obliterated corners. As an existing monument, a witness point is used as a control point in the restoration of lost corners by the appropriate method of proportionate measurement.



Evidence Outweighs the Record

The primary and collateral evidence may be such that the general rules (for single and double proportionate measurement) yield to a more equitable method or combination of methods which restores the corner to its original position.

More Than One Surveyor

Careful consideration must be exerted in situations where more than one surveyor's work may influence the restoration of a corner. Some pertinent questions which may help in determining which method of restoration to use are:

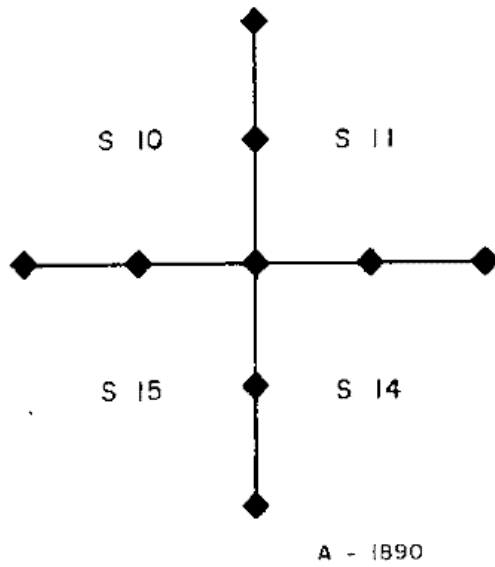
- (a) How well do the surveyors agree in bearings and distances?
- (b) How precise are each surveyors' closures?
- (c) Was the terrain comparable for each surveyor?
- (d) How long a time period between the surveys?
- (e) How recent was the last survey?

Caution:

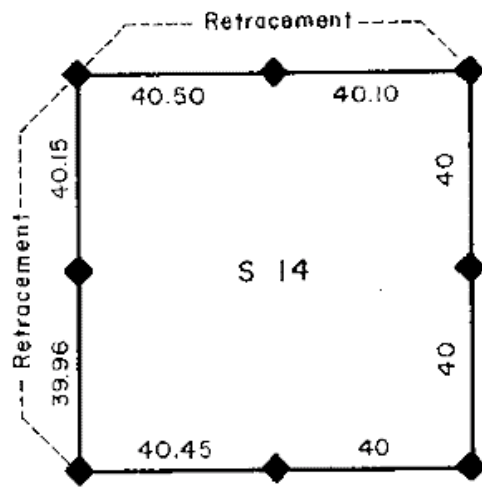
More recent surveys tend to be more accurate, but not always!

Additional retracement of each surveyor's work in the same township may help to substantiate a preference (confidence) for using his work or giving his work more weight than another surveyor's work.

Conventional methods of corner restoration may give way to the preponderance of evidence.



Surveyor "A" Called distances as 40's and 80's. Did not close any section.



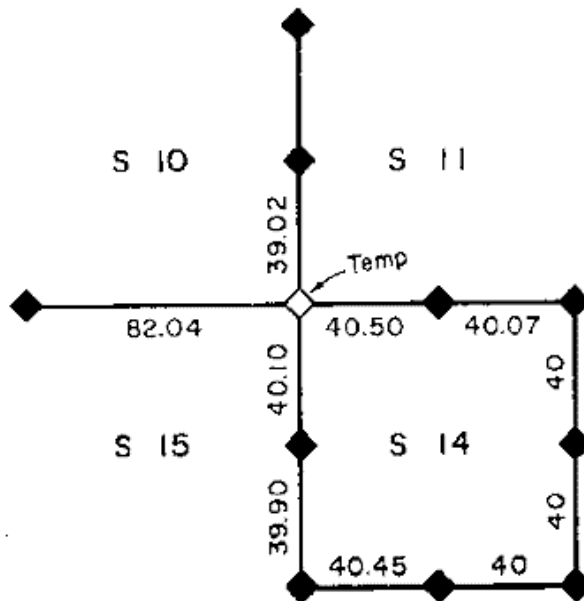
B - 1956

Surveyor "B" Returned a good closure on section 14.
 Returned a distance on the retraced W ½ mile between sections 11 and 14 as 40.50 chains.
 Returned a distance on the retraced N ½ mile between sections 14 and 15 as 40.15 chains.

Problem:

The corner of sections 10, 11, 14 and 15 is lost, as well as the 1/4 corner between sections 10 and 15. How should they be restored?

Present retracement finds:



In this example, the preponderance of evidence indicates that the reestablishment of the section corner by the method of two-point control using surveyor "B's" work is better than blindly using the conventional method of double proportionment.

D. (Continued) PROPORTIONMENT MUST BE APPLIED IN FULL CONSIDERATION OF THE MANNER OF CONDUCT OF PRIOR SURVEYS. (29)

COMPUTATION OF THE AREAS OF LOTS ADJOINING THE BOUNDARIES OF TOWNSHIPS. (PARAPHRASED FROM THE MANUAL OF SURVEYING INSTRUCTIONS, 1894)

In regular townships, the tracts of land in each section adjoining the north and west boundaries of such townships, in excess of the regularly subdivided 480 acres (except in section 6), will, in general, be in the form of trapezoids, 80.00 chains in length by about 20 chains in width.

On the plats of such townships, each of said tracts will be divided into four lots, by drawing broken lines at intervals of 20.00 chains, parallel to the ends of the tracts, which will be regarded as parallel to each other.

With the exception of section 6, the south boundaries of sections of the north tier, when within prescribed limits, will be called 80.00 chains.

The areas of the lots in any one tract (except in section 6) may be determined as follows:

Divide the difference between the widths of the ends of the tract by 4; if 3 remains, increase the hundredth figure of the quotient by a unit; in all other cases disregard the fraction; call the quotient thus obtained, "d"; then, taking the end widths of the tract in chains and decimals of a chain, the areas of the lots, in acres, will be:

Of the smallest lot: twice the width of the lesser end, plus "d";

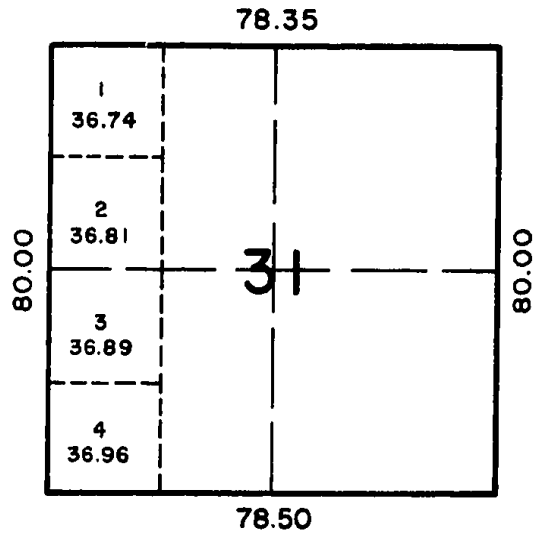
Of the largest lot: twice the width of the greater end, minus "d";

Of the smaller middle lot: sum of the widths of the ends, minus "d";

Of the larger middle lot: sum of the widths of the ends, plus "d".

A check on the computation may be had by multiplying the sum of the widths of the ends of the tract by 4: the product should agree exactly with the total area of the four lots.

The proper application of the above rules will always give areas correct to the nearest hundredth of an acre; and, as the use of fractions is entirely avoided, the method is recommended for its simplicity and accuracy.



The $\frac{1}{4}$ difference of latitudinal boundaries is 0.0375 chains; consequently, "d" is 0.04 chains; then:

$18.35 \times 2 + .04 = 36.74$ acres, the area of lot 1;
 $18.50 \times 2 - .04 = 36.96$ acres, the area of lot 4;
 $18.50 + 18.35 - .04 = 36.81$ acres, the area of lot 2;
 $18.50 + 18.35 + .04 = 36.89$ acres, the area of lot 3;

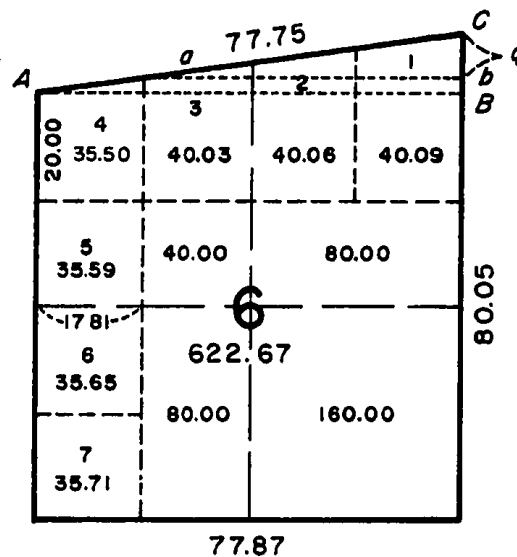
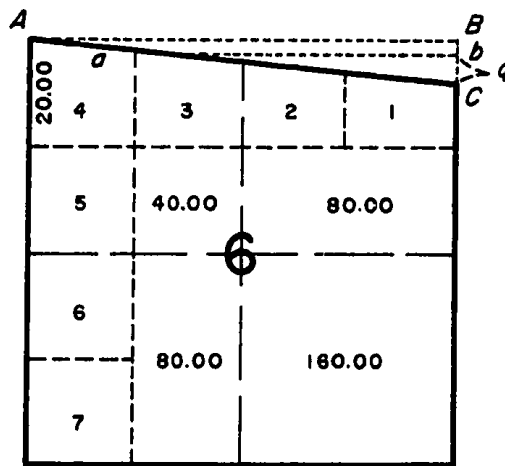
Check: $(18.35 + 18.50) \times 4 = 147.40$ acres, the area of the four lots.

The areas of the lots in section 6 may be determined as follows:

The areas of lots 5, 6, and 7 may be obtained by the foregoing rules in all cases, except when the township closes on a base line or standard parallel; also, the area of lot 4, provided both meridional boundaries are 80.00 chains in length; when the last condition obtains, the areas of lots 1, 2, 3, and 4 will be computed as follows:

Refer to the adjacent diagrams and determine +ha difference "a" between the east boundaries of lots 1 and 4 by the following proportion:

N. bdy. sec. 6.: diff. of meridional bdrs. sec. 6.: 60 chs.:q; then will E. bdy. of lot 4 = E, bdy. lot 1 + q; in which, "q" will be added when the east boundary of sec. 6 is less than 80.00 chains; but subtracted when said east boundary is greater than 80 chains.



Take one third of -q- and add it to the shorter east boundary lots 1 or 4, as conditions may require, and thereby determine the length of one of the meridional boundaries of lot 2; to which, again add "one third of "q" and thus obtain the length of the opposite side of lot 2. The areas of lots 1, 2, and 3, in acres, will be found by taking the sum of their respective meridional boundaries, expressed in chains and decimals of a chain.

The area of lot 4 may be had by multiplying its mean width by its mean length.

Finally, to test the entire work, multiply the sum of the latitudinal boundaries by 4, and to the product add the area of the small triangle CAB, if the east boundary is greater than 80.00 chains; but subtract the area of said small triangle if the east boundary is less than 80.00 chains. These operations, correctly performed, will give the true area of the section, which should agree exactly with the total area of its legal subdivisions, obtained in the preceding paragraphs.

Compute areas of lots 5, 6, and 7 of sec 6, as directed previously. Next, write the proportion for "q".

$$77.75 : 0.05 :: 60.00 : 0.0386 = q; 1/3 = 0.0129$$

$$20.0500 - 0.0386 = 20.01, \text{ the E. bdy. of lot 4;}$$

$$20.0114 + 0.0129 = 20.02, \text{ the E. bdy. of lot 3;}$$

NOTE

AB and *ab*, are drawn parallel to S.bdy. of the sec. ;
then, *CA* : *CB* :: *Ca* : *Cb*
N. bdy. sec. 6 : Diff. of meridional boundaries sec.6 :: 60 chs. : q ;
then will E. bdy. of lot 4 = E. bdy. of lot 1 ± q , as in the text , under title "Area of Lots " & c.

$$20.0243 + 0.0129 = 20.04, \text{ the E. bdy. of lot 2.}$$

Then, for the areas of lots 1, 2, 3, and 4, compute thusly:

$$20.05 + 20.04 = 40.09 \text{ acres, the area for lot 1.}$$

$$20.04 + 20.02 = 40.06 \text{ acres, the area for lot 2.}$$

$$20.02 + 20.01 = 40.03 \text{ acres, the area for lot 3.}$$

$$\frac{20.00 + 20.01}{2} \times \frac{17.75 + 17.78}{2} =$$

$$35.54 \text{ acres, the area for lot 4}$$

The area in acres of a tract 40.00 chains long, adjoining north or west township boundaries (except in NW% section 6), is equal to the sum of its parallel boundaries (expressed in chains and decimals thereof) multiplied by 2.

The area in acres of a tract 60.00 chains long, situated as above described (excluding lot 4, of section 6), may be found by multiplying the sum of its parallel boundaries (expressed in chains and decimals of a chain) by 3.

The area in acres of any section along the north and west boundaries of regular townships (except in section 6) may be had by multiplying the sum of its parallel boundaries (expressed in chains and decimals of a chain) by 4.

Subdivisions closing irregularly to the south or east exterior boundary are to be computed by similar methods.

E. THE RESULT OF PROPORTIONMENT

MUST PROTECT THE BONA FIDE RIGHTS OF PRIOR ENTRYMEN. (4)

All lost corners must be restored by proportionate measurement so that all interested parties receive an equitable share of existing excess or deficiency. Patents are equitably protected when a lost corner is proportioned between original corners (or control) which represent the survey from which the patent was issued.

Parenthetical distances and area calculations are important factors which must be considered in order to protect the bona fide rights of prior entrymen.

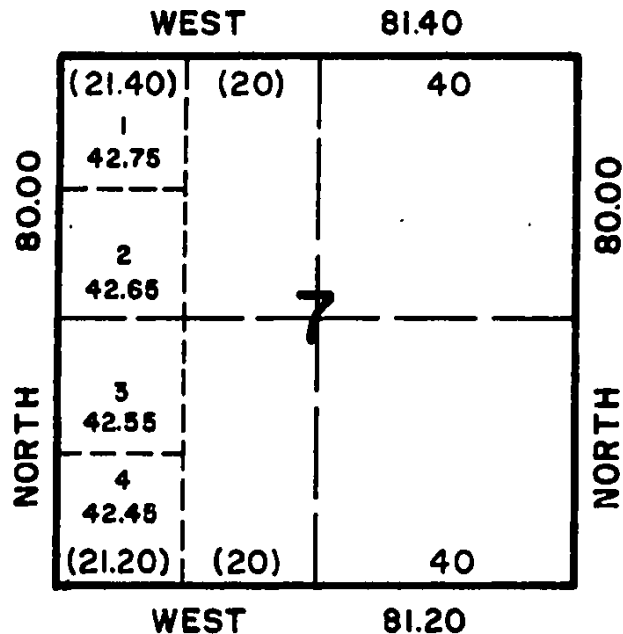
Parenthetical Distances

Parenthetical distances on the plat are implied measurements and are considered to indicate points on a surveyed line which are not monumented. Since they are on the plat and indicate a portion of a surveyed line or of a protracted line from which area can be returned, they are considered as part of the record and must be used to protect the bona fide rights of the patentees.

Where parenthetical distances are used for the calculation of areas, they are also used to protect such area by means of proportionate measurements to the indicated (calculated or implied) points which were not previously monumented.

The parenthetical distances, which are not actually shown on the plat but can be computed from the areas, are equally as important as those which are shown on the plat. The distances were originally calculated and used to compute the areas; therefore, when the areas are given, the implied parenthetical distances based on those areas can be recalculated.

Example: When it is necessary to subdivide section 7 and monument the center-west one sixteenth section corner, the implied parenthetical distance between lots 2 and 3 can be recomputed based on the areas. The distance can be used with the method of proportionate measurement along the E-W centerline to protect individual rights represented by the area on the original plat.



The implied parenthetical distance upon which the areas in lots 2 and 3 were based is 21.30 chains.

If the west one-half mile of the E-W centerline in a subdivision of section survey is found to be 41.70 chains, the

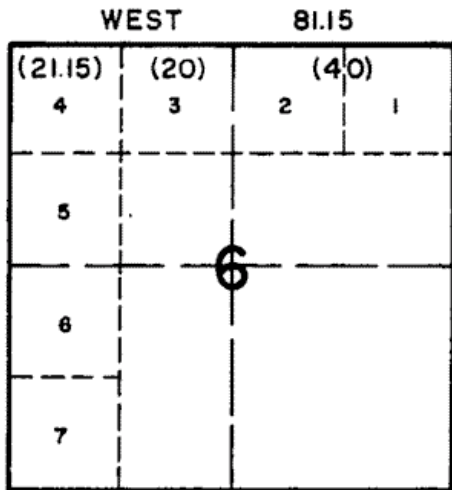
proportioned distances based upon the implied parenthetical distance to the center-west one-sixteenth section corner would be:

21.506 chains from the 1/4 section corner of sections 7 and 12.

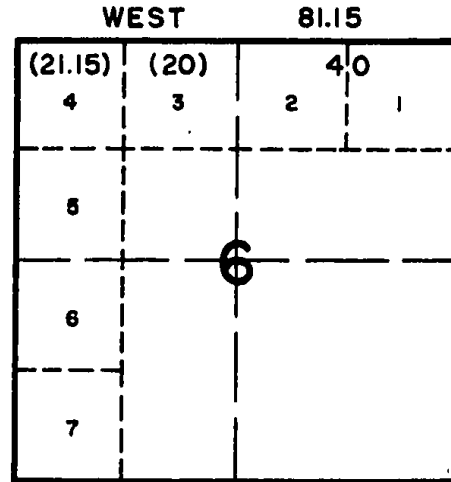
20.194 chains from the center 1/4 section corner.

Total 41.70 chains

Where the entire north boundary of a section abutting the north boundary of the township is shown as parenthetical distances on the plat, it implies that no 1/4 section corner for the section represented was set on that line.



1/4 on north boundary not set

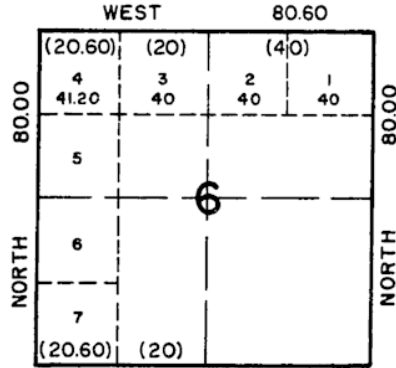


1/4 on north boundary is set

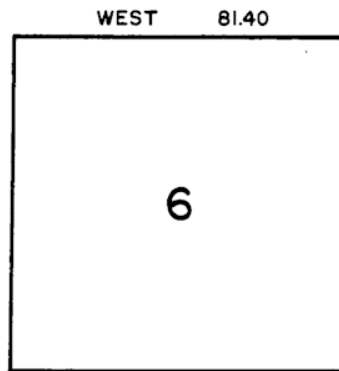
Caution: The field notes should always be checked to confirm such implications represented on the plat.

E. THE RESULT OF PROPORTIONMENT MUST PROTECT THE BONA FIDE RIGHTS OF PRIOR ENTRYMEN.
(4)

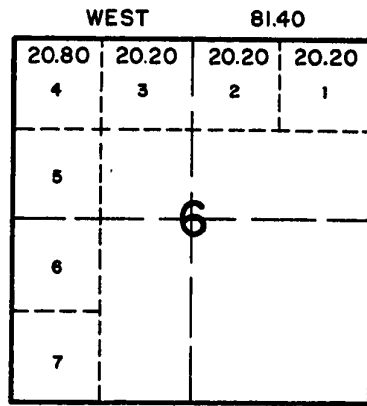
It was the practice in older surveys not to set the quarter-section corners between closing section corners along the north boundary of the township. In such cases the one-sixteenth and the quarter section corners will be established by the method of proportionate measurement based upon the parenthetical distances; PROVIDED, that the areas of the lots confirm the parenthetical distances.



Original



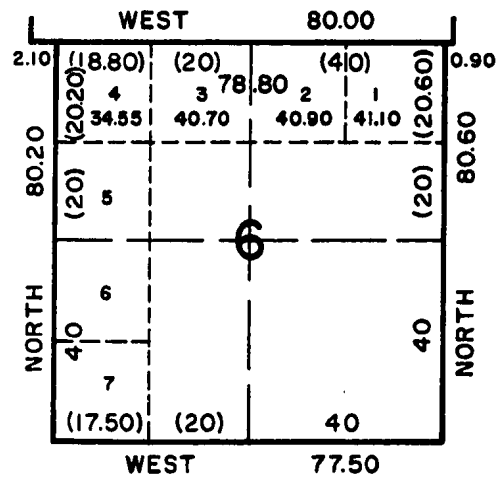
Retracement



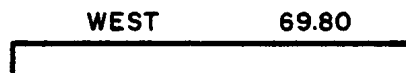
Resurvey

When the parenthetical distances on the original plat are confirmed by the area, the resurvey indicates the distances which would be the result of a retracement of 81.40 chains for the north boundary of section six. The retracement distance is proportioned based on the parenthetical distances.

Example: The ties, which are confirmed by the field notes from the closing section corners to the standard corners indicate an arithmetic error in the length of the north boundary of section 6 as shown on the plat. The parenthetical distances shown are based on the error.



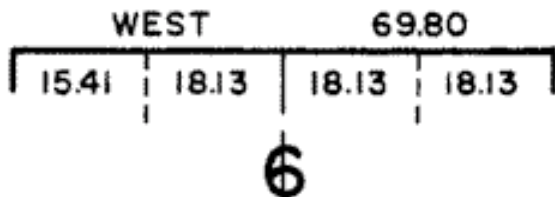
A retracement between the closing section corners on the north boundary of section 6 returns a distance of 69.80 chains.



6

Problem: What distances should the resurvey return for the north boundary of lots 1 through 4 in section 6?

Solution: In order to "protect the plat", distances westward along the north boundary are computed from the areas of the lots as (20) (20) (20) (17.00), and are used to proportion the retracement length which yields the distances shown on the *resurvey*.

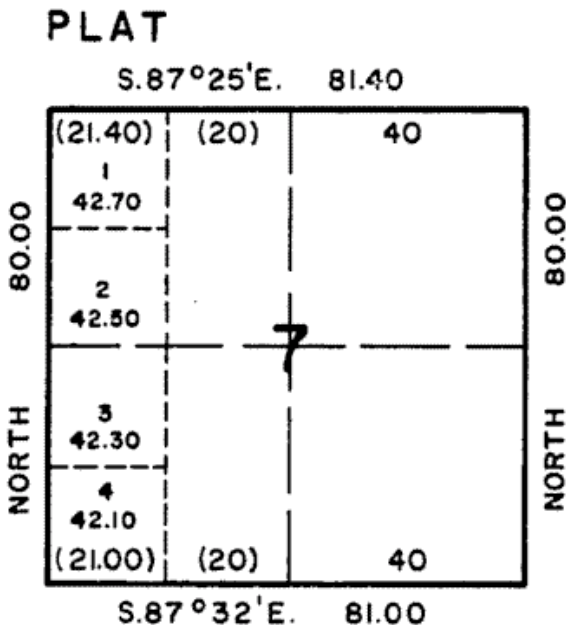


Occasionally the true line distance on the plat is in error. It may reflect the random distance rather than the reduction of the random and failing distances to the actual true line distance. In such cases, the parenthetical distances, and therefore the areas, are erroneously based upon the random distance instead of the actual true line distance.

Example: Field notes
 Run west on a random line between sections 7 and 18.
 40.00 set temp 1/4 cor.
 81.00 intersect twp. line 3.50 chains south of section corner common to sections 7, 12, 13 and 18.

Thence S. 87° 32' E on the true line between sections 7 and 18.

41.00 set 1/4 corner.
 8 1.00 sec. cor. 7, 8, 17 and 18.



The true line distance obtained from the random distance and falling should be 81.08 chains. The true line distance in the notes and on the plat are in error. The parenthetical distances and the areas are in error also.

In order to "protect the plat", the distances (20) (20) (20) (21.00) which were used to compute the areas are used to restore (proportion) the intermediate sixteenth and quarter section corners.

The field notes and the plat constitute the record and both should be examined before restoring a missing corner.

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21. *ibid.* 5-10 and 5-11 Testimony
22. *ibid.* 5-15 Line trees and blazed lines
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| 32. | ibid. 6-7 | Retracements |
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| 34. | ibid. 6-28 | Local control |
| 35. | ibid. 9-65 thru 9-75 | Plats |