

"The USPLSS for Missouri"

MSPS Webinar
Wednesday, March 18, 2026

Dr. Richard L. Elgin, PS, PE
Archer-Elgin Engineering, Surveying and Architecture
Rolla, Missouri

Webinar Outline

The early USPLSS
Review

Some Lines
Some Corners
The Original Surveys

Building the USPLSS

Standard Lines
Township Extérieurs
Subdividing the Township

Protraction

Reestablishing Lost Corners

The Six Kinds
Standard v. Closing
Rules

Calculations on the USPLSS
Proportioning Coordinates
Example Calculations

Schedule:

8:15 - 9:55

9:55 - 10:15 Break

10:15 - 12:15

Dr. Richard L. Elgin, PS, PE

Rolla, MO

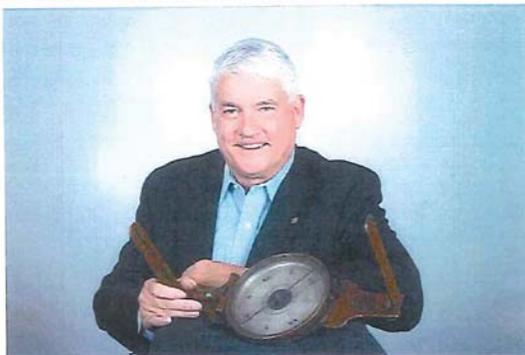
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About Richard Elgin, PhD, PS, PE Rolla, Missouri

A second generation surveyor, Dr. Elgin was raised in St. James, Missouri and in his late parents' surveying business located in nearby Rolla. After high school Dick joined the Army, went through helicopter flight school, was made a Warrant Officer, and spent 1969 in Vietnam flying the Hughes OH6A "Loach" and the ubiquitous UH-1 "Huey" with the Americal Division. Following the Army he received the BSCE and MSCE degrees from the Missouri University of Science and Technology (S&T, Rolla, MO) and his PhD from the University of Arkansas. Leaving Arkansas he joined the faculty of the Department of Civil Engineering at S&T (1984), now Adjunct Professor Emeritus. From 1984 until 2008 Dick was the owner and President of Elgin Surveying & Engineering, Inc. Semi-retired, Dick currently works for Archer-Elgin Engineering, Surveying and Architecture. He is a former member of the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Professional Landscape Architects; a Past-President of the Missouri Society of Professional Surveyors; a member of both S&T's and the University of Arkansas' Academy of Civil Engineers; a member of S&T's Order of the Golden Shillelagh; and on the Board of Directors of S&T's Alumni Association. With the late Drs. David Knowles and Joe Senne, Dick coauthored the [Celestial Observation Handbook and Ephemeris](#) and codeveloped the "ASTRO" celestial observation software products. With the late David Knowles, he coauthored [Legal Principles of Boundary Location for Arkansas](#) and [The U.S. Public Land Survey System for Arkansas](#). Dick is the author of [The U.S. Public Land Survey System for Missouri](#), [Riparian Boundaries for Arkansas](#) and [Riparian Boundaries for Missouri](#). He also wrote [Shoulda Played the Flute](#), a memoir of his year flying helicopters in Vietnam. Dick was Arkansas' surveying and mapping expert in a state riparian boundary dispute with Mississippi, decided by the U.S. Supreme Court. See *Arkansas v. Mississippi*, 471 U.S. 377 (1985).

He is an avid collector and researcher of early American surveying equipment, and owns one of the largest private collections of such equipment in the United States. Semi-retired, he and his wife enjoy touring by bicycle, RV or in their perfectly restored 1976 Alfa Romeo 1600 GT Junior or 1967 Austin Cooper 1275 S. He remains very active in Vietnam Veteran affairs.



Practitioner: Surveying and mapping business owner for 25 years.

Educator: Surveying Adjunct Professor for 38 years.

R & D: Codeveloper of ASTRO[®]ROM celestial observation.

Author: *Legal Principles of Boundary Location for Arkansas*

Sokkia Ephemeris (coauthor)

The U.S. Public Land Survey System for Arkansas

The U.S. Public Land Survey System for Missouri

Riparian Boundaries for Arkansas

Riparian Boundaries for Missouri

Shoulda Played the Flute...An Army Helicopter Pilot's Year in Vietnam

Daily Driver: 1976 Alfa Romeo GT 1600 Junior

Avid Collector/Research of Early American Surveying Equipment

A Note About This Webinar

A note about this 4-hour webinar: This presentation is a summary about the USPLSS as applied to Missouri. A comprehensive college-level course on this subject matter would require a 2-credit hour course which would have 26 fifty-minute lectures spread over a full semester (13 weeks). It would include homework assignments (numerical problems) and out-of-class assignments (survey research). As a textbook, it would use "The U.S. Public Land Survey System for Missouri" (5th Edition, 2024) and other reference materials. (See the "Further Reading" list in the book.) These lecture notes are provided as an outline of this talk and the book.

Dick Elgin
Feb. 2026

Some History of the USPLSS

USPLSS

Land Ordinance of May 20, 1785

The Seven Ranges, 1785-1787

Ohio, the USPLSS Test Bed, 1800-1816

The First Four Principal Meridians, 1803-1818

The Louisiana Purchase, 1804

The 5th Principal Meridian
Initial Point Set November 10, 1815
Missouri GLO dates: 1815-1860
Arkansas GLO dates: 1815-1849

Some Lines:

Principal Meridian

Base Line

Standard Parallel or Standard Line or Correction Line

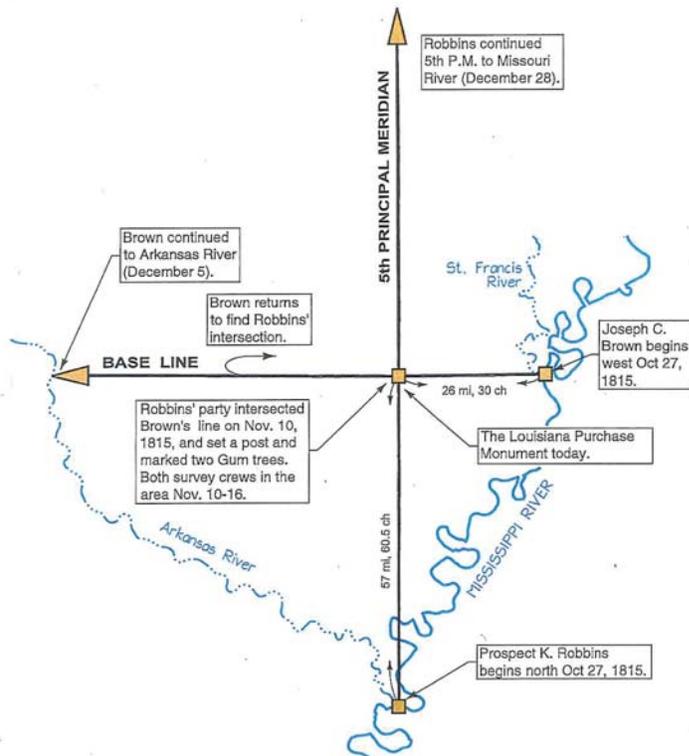
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**ESTABLISHMENT OF THE INITIAL POINT OF THE
5th PRINCIPAL MERIDIAN - November 10, 1815**



Where it all Began

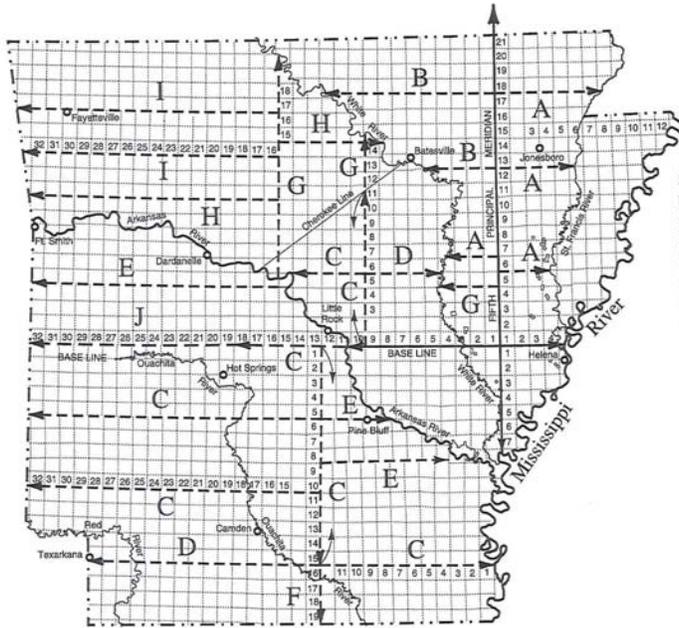
November 10, 1815



Monument marking the Initial Point
of the 5th Principal Meridian
(Photo provided by the Arkansas Society of Professional Surveyors)



Lands Referenced to the Initial Point of the 5th Principal Meridian

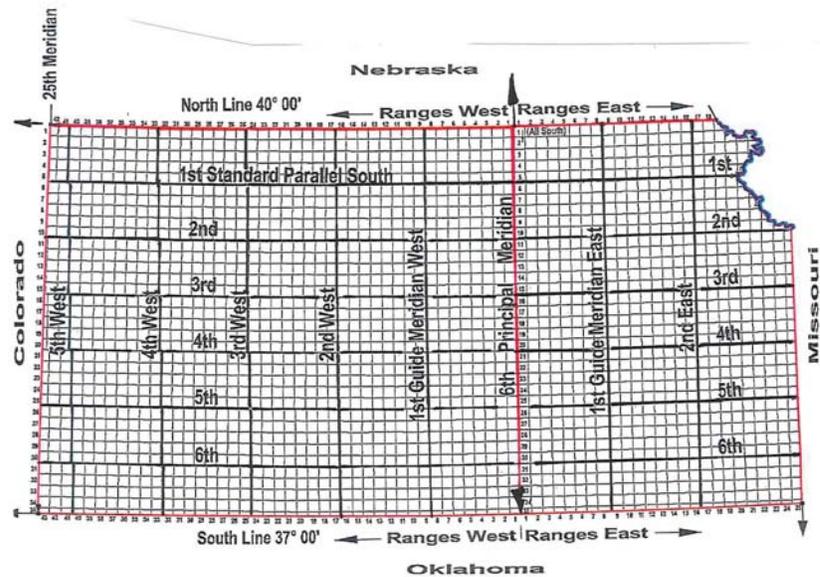


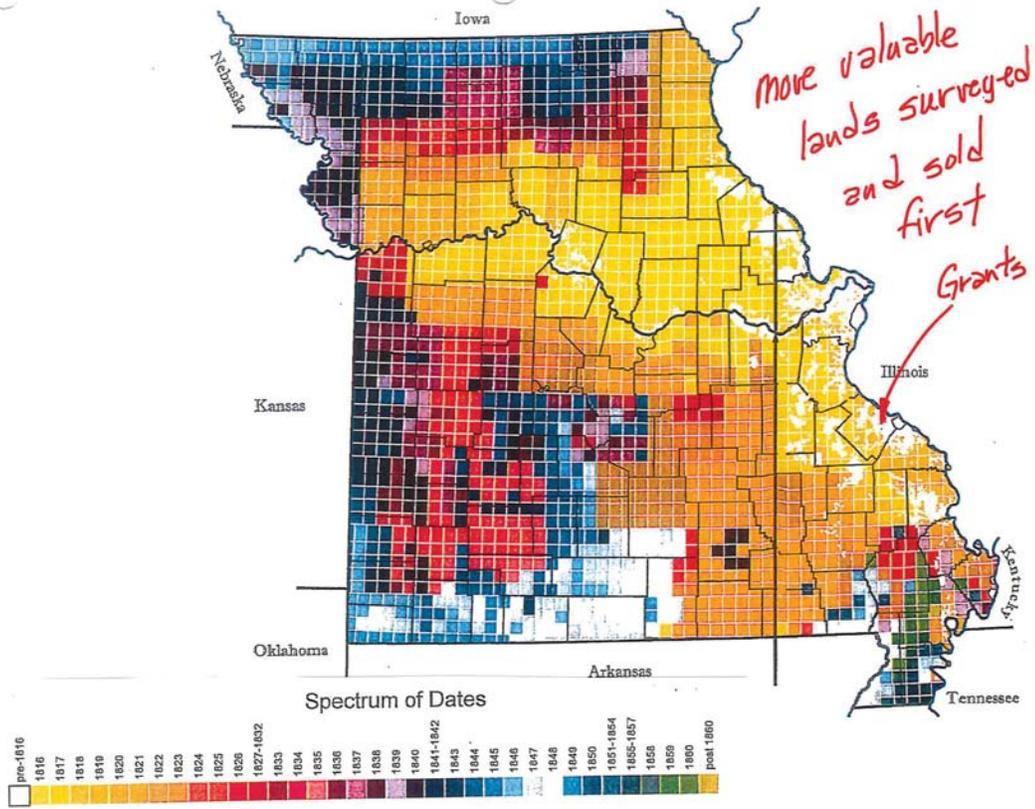
Standard Lines and Guide Meridians with Dates. The 5th Principal Meridian (Townships North and South) and the Base Line east of the Arkansas River (including Ranges East) were all surveyed in late 1815.

- A = 1816
- B = 1817
- C = 1818
- D = 1819
- E = 1825
- F = 1817
- G = 1828
- H = 1829
- I = 1831
- J = 1837
- K = 1840
- L = 1841

Arkansas Standard Lines and Guide Meridians

The Kansas Standard Parallels and Auxiliary or "Guide" Meridians GLO Surveys 1855-1875





Progression of subdivision of townships
1816-1865

“Guide Meridian” or Auxiliary Principal Meridian

USPLSS

Township Line

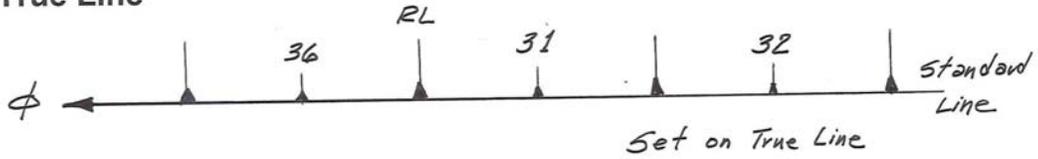
Range Line

Section Line

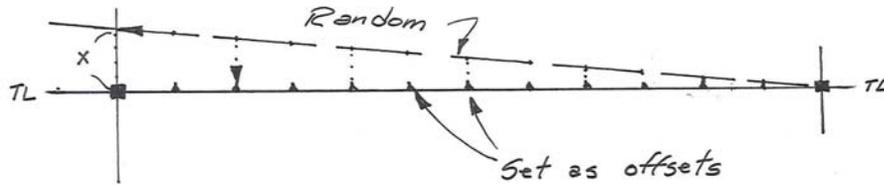
Meander Line

USPLSS

True Line



Random Line



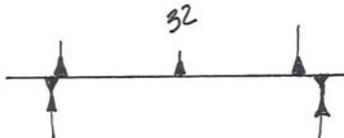
Some Corners:

USPLSS

Standard Corner



Closing Corner



Corner Set on True Line

Corner Set by Offset

Existent Corner

USPLSS

Obliterated Corner

Lost Corner

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The Original Surveys:

USPLSS

Instructions

Tiffin's Instructions of 1815

The Chain

The Compass

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Building the USPLSS in Missouri

USPLSS

The Standard Lines

The Township Extent

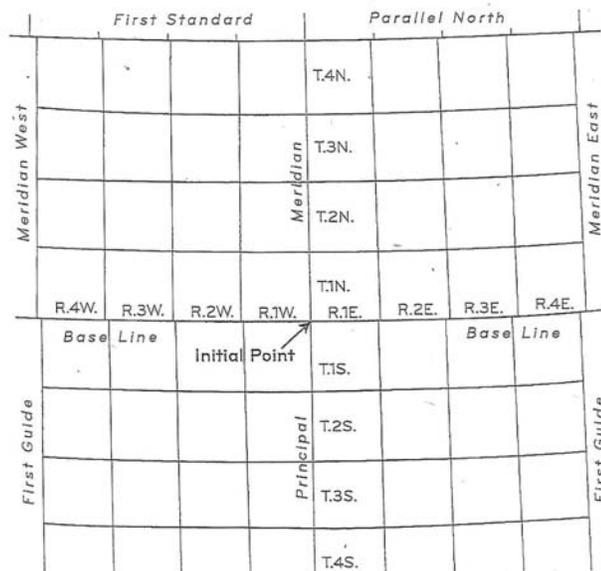
Subdividing the Townships

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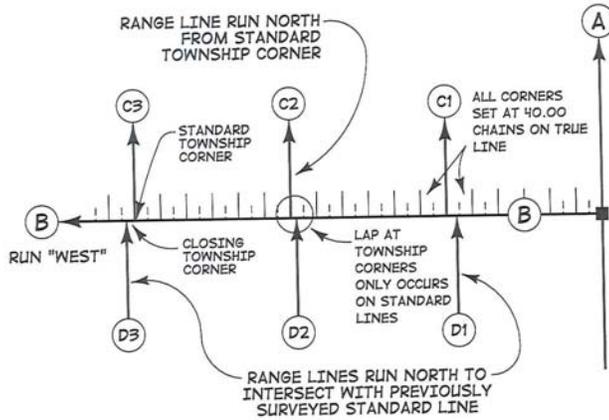
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From the BLM Manual

Not used in Missouri or Arkansas



(A) 5TH PRINCIPAL MERIDIAN OR AUXILLARY PRINCIPAL MERIDIAN

(B) STANDARD LINE SURVEYED "DUE WEST" ON A TRUE LINE, A CORNER BEING ESTABLISHED EVERY 40.00 CHAINS

(C) TOWNSHIPS TO THE NORTH OF THE STANDARD LINE SURVEYED AND SUBDIVIDED. TOWNSHIP EXTERIORS SURVEYED FIRST, THEN TOWNSHIP SUBDIVIDED

(D) TOWNSHIPS TO THE SOUTH OF THE STANDARD LINE SURVEYED AND SUBDIVIDED. TOWNSHIP EXTERIORS SURVEYED FIRST, THEN TOWNSHIP SUBDIVIDED.

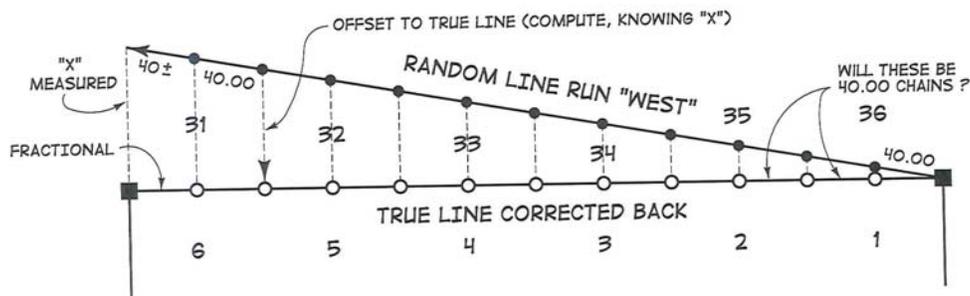
NOTE:

1. CHRONOLOGICALLY, TOWNSHIPS D MAY HAVE BEEN SURVEYED BEFORE TOWNSHIPS C.

2. ONLY ON STANDARD LINES WILL THERE BE LAPS AT TOWNSHIP CORNERS.

Typical Standard Line for Missouri and Arkansas

Surveying the Usual Township Line



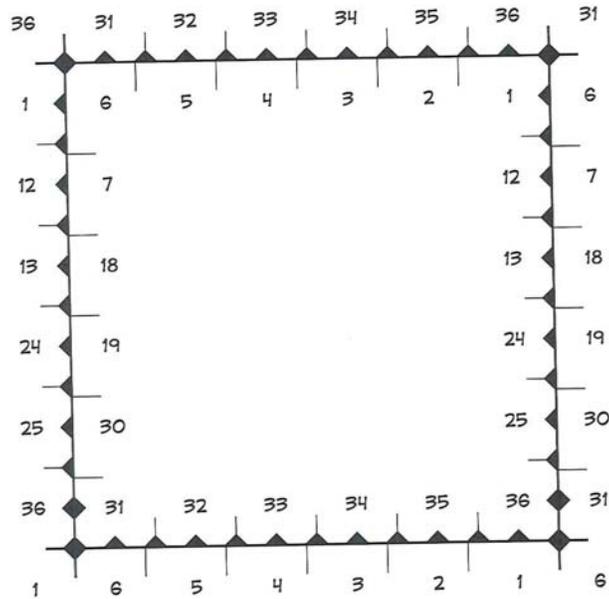
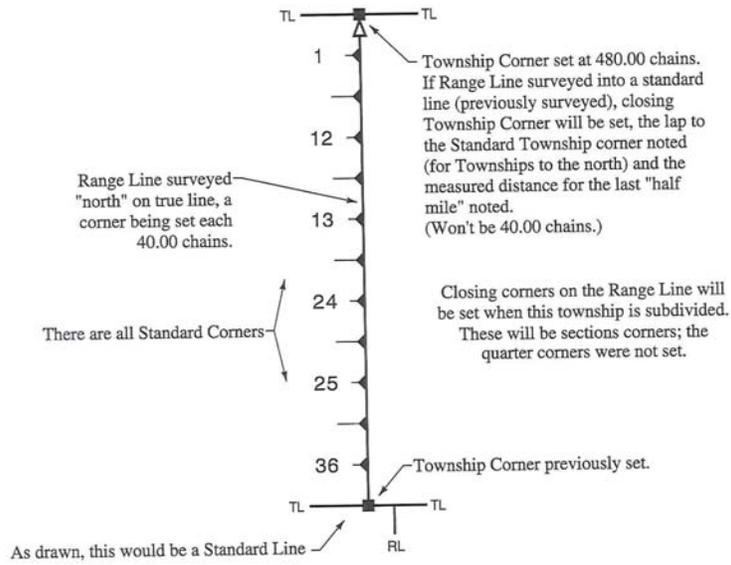
THIS IS THE TYPICAL SEQUENCE, THE RANDOM LINE BEING SURVEYED FROM EAST TO WEST. THERE ARE INSTANCES WHERE THE RANDOM LINE WAS SURVEYED WEST TO EAST. IN THESE CIRCUMSTANCES THE "FRACTIONAL" IS STILL PLACED IN THE MOST WESTERLY "HALF MILE."

■ PREVIOUSLY SET TOWNSHIP CORNER MONUMENT.

● TEMPORARY QUARTER SECTION AND SECTION CORNER POINTS SET EVERY 40 CHAINS. ALL ERROR IN LAST HALF MILE.

○ STANDARD QUARTER SECTION AND STANDARD SECTION CORNER MONUMENTS SET BY OFFSETS FROM RANDOM LINE. THESE MARK CORNERS TO SECTIONS TO THE NORTH OF THE TOWNSHIP LINE. THE CLOSING SECTION CORNERS TO SECTIONS 1 THROUGH 6 WILL BE SET WHEN THE TOWNSHIP TO THE SOUTH IS SUBDIVIDED.

Standard Corners on Range Line, How Set

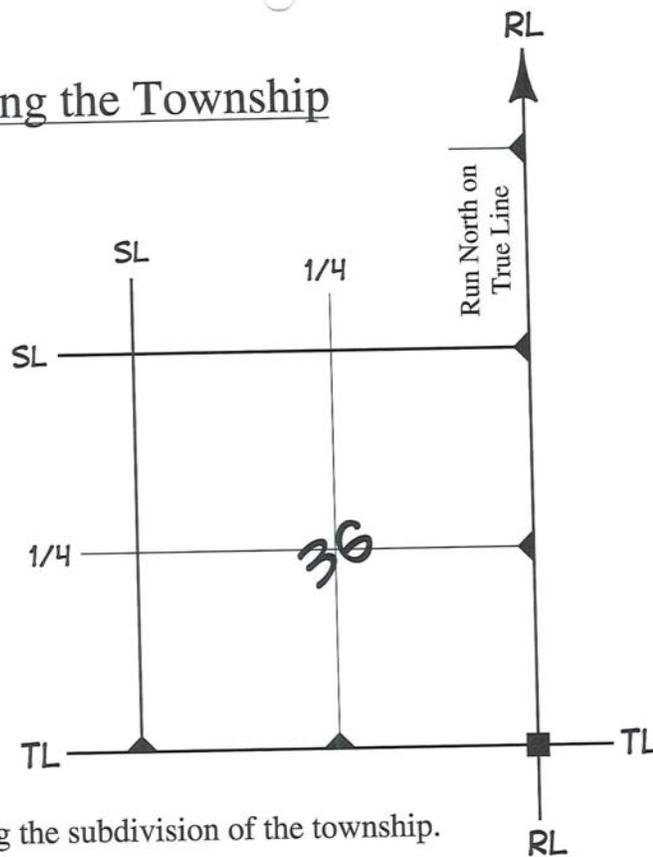


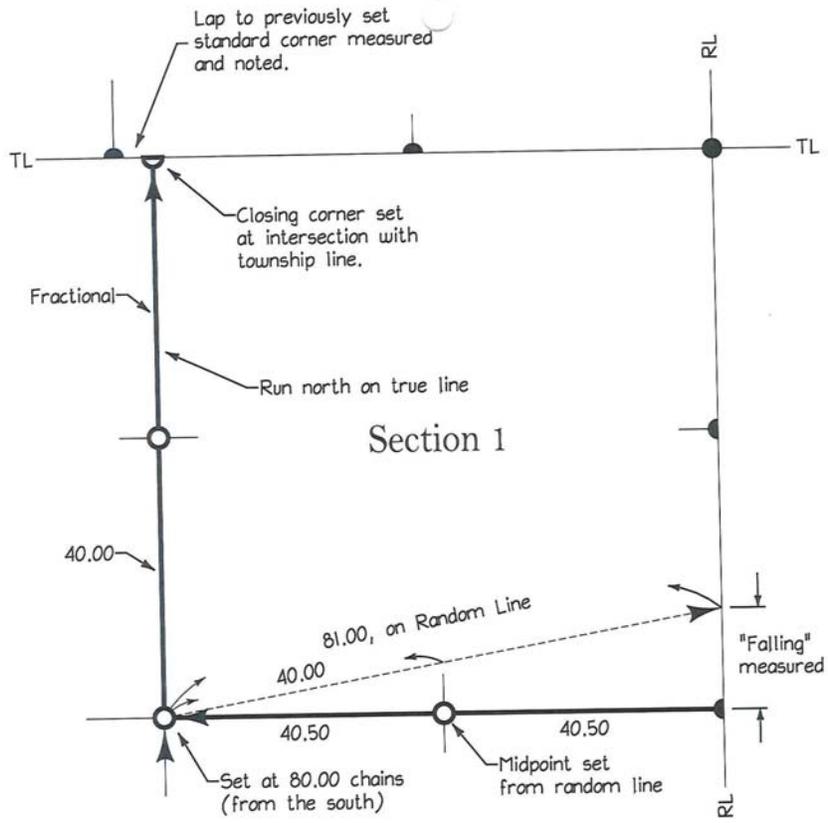
Monuments Set by GLO Along Typical Arkansas or Missouri Township Exterior Prior to Subdivision of the Township

6	60	5	44	4	33	3	22	2	11	1
59		58		43		32		21		10
7	57	8	42	9	31	10	20	11	9	12
56		55		41		30		19		8
18	54	17	40	16	29	15	18	14	7	13
53		52		39		28		17		6
19	51	20	38	21	27	22	16	23	5	24
50		49		37		26		15		4
30	48	29	36	28	25	27	14	26	3	25
47		46		35		24		13		2
31	45	32	34	33	23	34	12	35	1	36

Idealized Sequence of Section Lines
Surveyed in Subdividing a Township

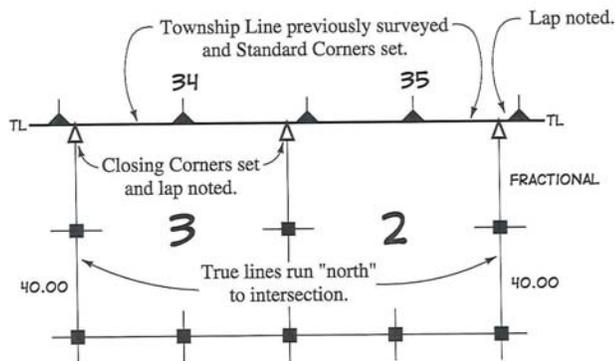
Subdividing the Township

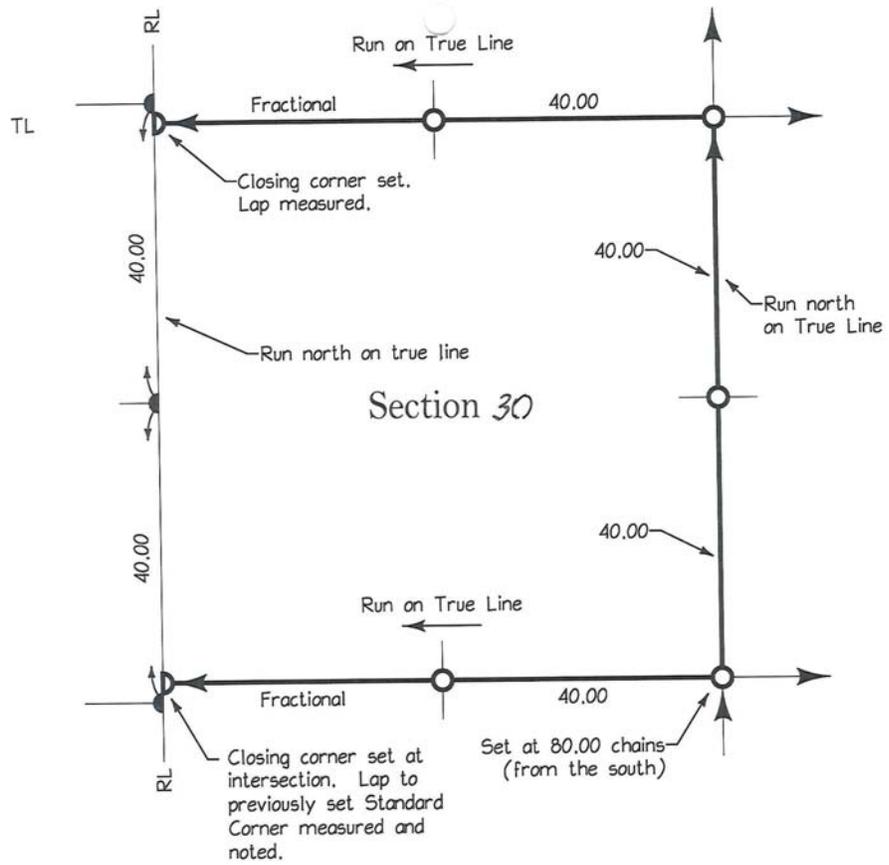




Setting a North Row Section

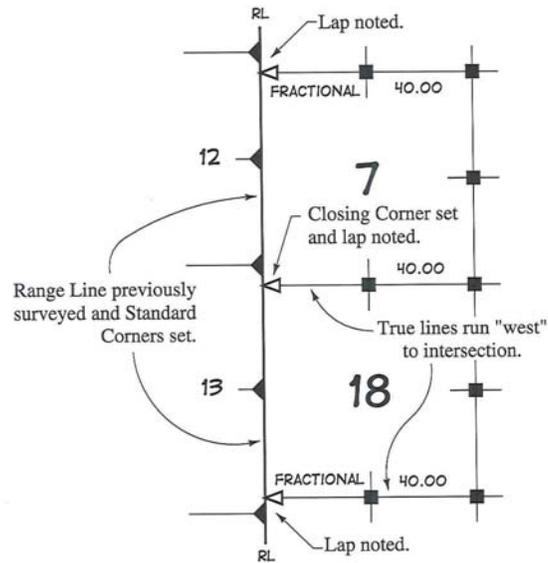
Closing Corners on Township Line, How Set

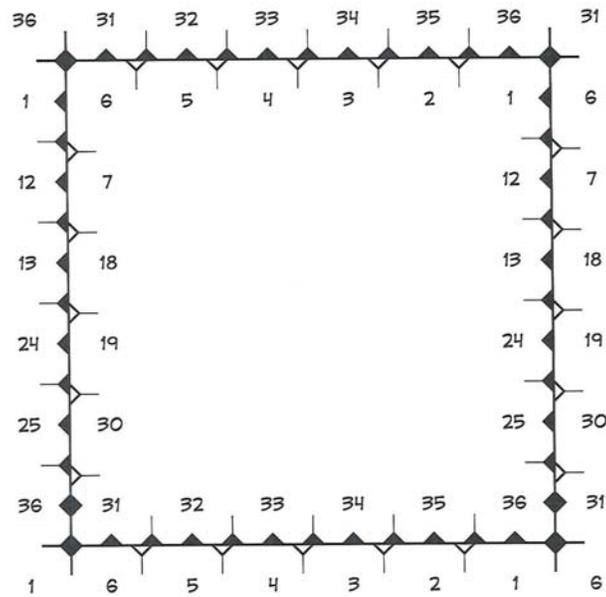




Setting a West Column Section

Closing Corners on Range Line, How Set





Darkened symbol: Monument set when township exterior surveyed.
 Open symbol: Monument set when township subdivided.

Monuments Set by GLO Along Typical Arkansas or Missouri
 Township Exterior After Township Subdivided

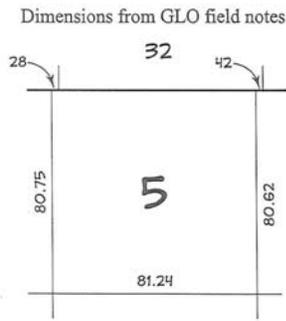
Protraction

USPLSS

- 1.) Creation of aliquot parts and lots, usually in fractional sections on the GLO plat.
- 2.) Created from field-measured dimensions.
- 3.) An on-paper subdivision created on the GLO plat. Not monumented in the field.
- 4.) No protraction methods mentioned in Tiffin's Instructions.
- 5.) Protraction schemes are very uniform in Missouri and fairly uniform in Arkansas. Study the plat. In some instances, look at the patent.
- 6.) Protraction and the protracted distances are important because every township in Missouri and Arkansas has been protracted. This is not true in all states surveyed later.

Protraction of Northern Row Fractional Section

From: "The U.S. Public Land Survey System for Missouri" by Elgin, 5th edition, copyright 2024

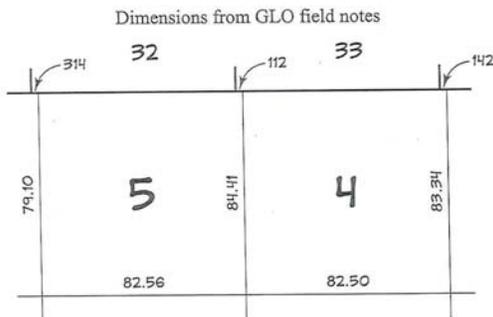


Protracted Section

32				
20.75	39.24 LOT 2 81.67 AC 39.59	20.89	40.62 LOT 2 83.90 AC 40.62	20.62
20.00	LOT 1 79.53 AC 39.94	20.00	LOT 1 81.24 AC 40.62	20.00
40.00	161.12 AC	40.00	162.48 AC	40.00
	40.62		40.62	
Acreages Computed				

Protraction of Northern Row Fractional Section

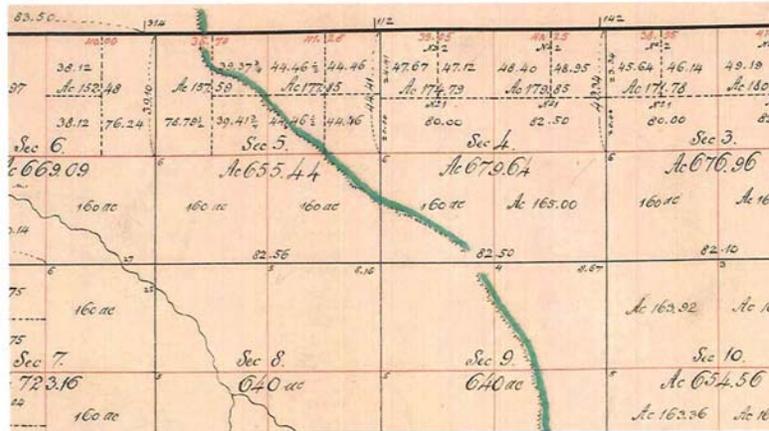
From: "The U.S. Public Land Survey System for Missouri" by Elgin, 5th edition, copyright 2024



Protracted Sections
Taken from T50N, R8W. See facing page.

32				33						
39.10	36.70 39.3775 10.35	20.80	41.28 21.50	22.205	21.41	39.05 LOT 2	41.25 LOT 2	23.89	48.40 AC 48.95 AC	23.34
78.795 AC	44.465 AC	44.46 AC	47.67 AC	47.12 AC	39.69	LOT 1 80.00 AC	41.25	20.00	82.50	20.00
38.96	39.4175	44.465 AC	21.50	22.205	20.00	40.21	41.25	40.00	165.00 AC	40.00
40.00	160 AC	40.00	160 AC	40.00	160 AC	40.00	165.00 AC	40.00	165.00 AC	40.00
41.28	41.28	41.28	41.28	41.25	41.25	41.25	41.25	41.25	41.25	41.25

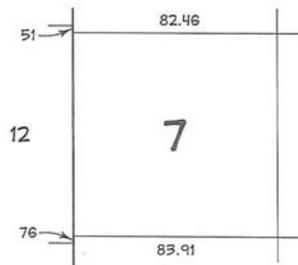
Different lotting schemes, adjacent sections.
Acreages from GLO plat. Lands in north half of Section 5 conveyed as aliquot parts (not lotted).



TOWNSHIP 50 NORTH,
RANGE 8 WEST

Protraction of Western Column Fractional Section

Dimensions from GLO field notes



From: "The U.S. Public
Land Survey System for
Missouri" by Elgin,
5th edition, copyright 2024

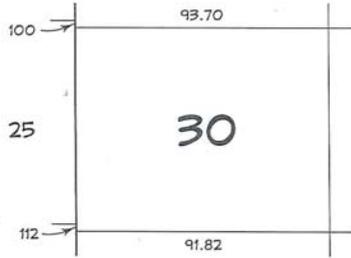
Protracted Section

	22.46	20.00	40.00	
38.73	LOT 2 88.76 AC	39.08	LOT 1 78.46 AC	158.76 AC
12	23.17	20.00	40.00	40.00
40.00	LOT 2 91.16 AC	40.00	LOT 1 80.00 AC	160.00 AC
	23.91	20.00	40.00	40.00
	Acreages Computed			

Protraction of Western Column Fractional Section

From: "The U.S. Public Land Survey System for Missouri" by Elgin, 5th edition, copyright 2024

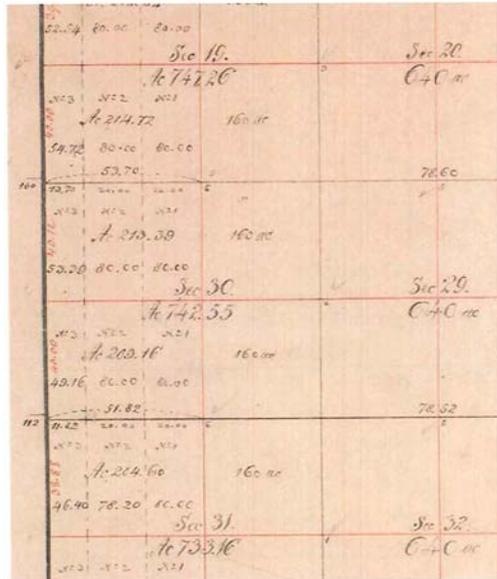
Dimensions from GLO field notes



Protracted Section
Taken from T34N, R9W. See facing page.

	13.70	20.00	20.00	40.00	
40.12	LOT 3 53.39 AC	40.10	LOT 2 80.00 AC 40.08	LOT 1 80.00 AC 40.05	160 AC
12.76	20.00	20.00	30	40.00	40.00
40.00	LOT 3 49.16 AC	40.00	LOT 2 80.00 AC 40.00	LOT 1 80.00 AC 40.00	160 AC
11.82	20.00	20.00	40.00	40.00	40.00

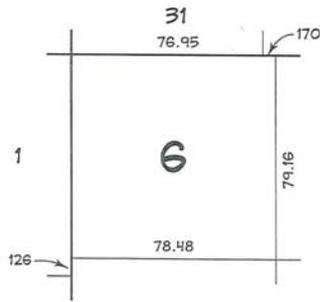
Acreages from GLO plat



TOWNSHIP 34 NORTH,
RANGE 9 WEST

Protraction of a Fractional Section 6

Dimensions from GLO field notes



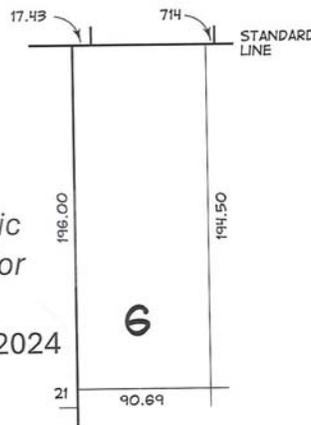
From: "The U.S. Public Land Survey System for Missouri" by Elgin, 5th edition, copyright 2024

Protracted Section

31			
18.74	38.65 LOT 2 72.80 AC 38.61	18.15	40.00 LOT 2 76.22 AC 40.00
20.00	LOT 1 77.18 AC 38.57	20.00	LOT 1 80.00 AC 40.00
18.57	20.00	20.00	40.00
40.00 LOT 2 71.10 AC 40.00	LOT 1 80.00 AC 40.00	160.00 AC	40.00
18.48	20.00	40.00	40.00
Acreages Computed			

Protraction of a Fractional Section 6

Dimensions from GLO field notes



Protracted Section
Taken from T34N, R4W. See facing page.

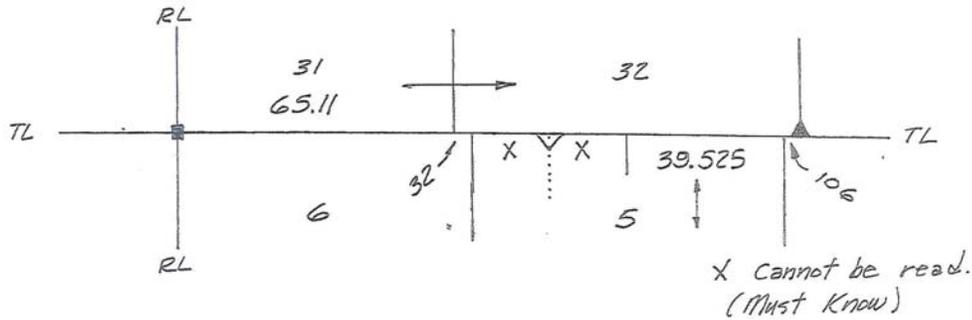
50.29 LOT 10 60.56 AC	40.00 LOT 8 59.28 AC	41.50
LOT 9 80.00 AC	LOT 7 80.00 AC	20.00
LOT 8 80.00 AC	LOT 6 80.00 AC	20.00
LOT 7 80.00 AC	LOT 5 80.00 AC 619.28 AC	20.00
780.56 AC	LOT 4 80.00 AC	20.00
LOT 6 80.00 AC	LOT 3 80.00 AC	20.00
LOT 5 80.00 AC	LOT 2 80.00 AC	20.00
LOT 4 80.00 AC	LOT 1 80.00 AC	20.00
LOT 3 80.00 AC	LOT 1 80.00 AC	20.00
LOT 2 80.00 AC	LOT 1 80.00 AC	20.00
LOT 1 80.00 AC	LOT 1 80.00 AC	20.00
LOT 3 42.12 AC	202.12 AC	40.00
LOT 2 80.00 AC	LOT 1 80.00 AC	40.00
LOT 1 80.00 AC	160 AC	40.00
40.00	20.00	40.00
20.00	20.00	40.00
10.69		

From: "The U.S. Public Land Survey System for Missouri" by Elgin, 5th edition, copyright 2024

Acreages from GLO plat. Protracting lots to be 80.00 acres places laps at lot corners on quarter line. Only the dimensions and acreages shown hereon are given on the GLO plat. A survey of, say, Lot 6 NW1/4 would be very difficult. It would be a proportion of today's total acreages of the NW1/4. Note that the north-south protracted distances for the lots in the NW1/4 are not given, but cannot be 20.00 chains, given the 80.00 acres.

WHY IS PROTRACTION IMPORTANT?

FROM THE PREVIOUS ARKANSAS GLO PLAT:



$$X = (80.00 - 1.06 - 39.525 - 0.32) / 2 = 19.5475 \text{ chains}$$

Proportioning West to East the proportioning fraction will be:

$$\frac{65.11 + 0.32 + 19.5475}{65.11 + 80.00} = \frac{84.9775}{145.11} = 0.58560747$$

This factor times the Δ coordinates

Reestablishing Lost Corners

USPLSS

Three Kinds of Corners
Existent Corner
Obliterated Corner
Lost Corner

All Three Defined in:
RSMO Chapter 60
BLM Glossary of Terms and Manuals

Guided by:
Statute Law
Case Law
Administrative Law

Lost Corners

USPLSS

“Lost Corner,” a corner 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;

RSMo Chapter 60

LOST CORNER – A corner whose position cannot be determined, beyond reasonable doubt, either from the traces of the original marks or from acceptable evidence or testimony that bears on the original position, and whose location can be restored only by reference to one or more interdependent corners.

BLM Glossary

But...

USPLSS

“The restoration and utilization of the existent corners of the United States public land survey is a prime objective of every survey. Every means shall be undertaken to determine the position of the original corner before deciding that the corner is lost.”

RSMo, 60.311

Standard Corners v. Closing Corners:

USPLSS

What's the difference?

How were they set?

What weight?

Why does it matter?

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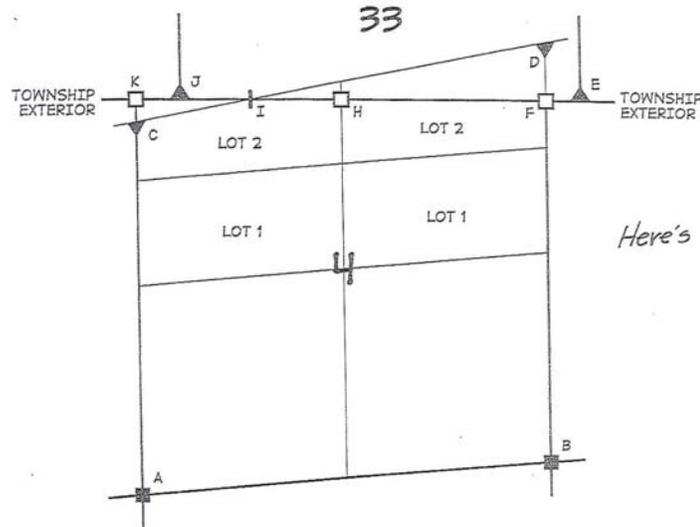


FIGURE IS EXAGGERATED

EXISTENT CORNERS

What Does BLM Manual (2009) say?

USPLSS

494 pages

10 Chapters

Chapter VII "Resurveys and Restoration" (17 pages)

Not written for USPLSS per Tiffin (MO & AR).

Not written for double corners on each township exterior.

However, Section 7-46 addresses blank quarter corner.

Chapter VII is only 17 pages long.

Chapter VIII, Water Boundaries is 99 pages long.

GLO/BLM "Manuals of Instruction" published in
1855, 1871, 1881, 1890, 1894, 1902, 1930, 1947,
1973, 2009

USPLSS

"Restoration of Lost and Obliterated Corners" first published in 1883.
This edition best describes reestablishment
procedures for Arkansas and Missouri.

To reestablish lost corners for

Arkansas

1883 "Restoration" manual
Fully described in Chapter 5
of Elgin & Knowles' "Arkansas"
USPLSS manual.

Missouri

RSMO Chapter 60 (2025).
Statute law is "modern"
version of 1883 manual.
Fully described in Chapter 5
of Elgin's "Missouri" USPLSS
manual.

The example problems herein apply these procedures.

OK, Finally, Methods to Reestablish Lost Corners

USPLSS

But first...

The following rules for the reestablishment of lost corners shall be applied only when it is determined that the corner is lost: (The rules utilize proportional measurement which harmonizes surveying practice with legal and equitable considerations. This plan of relocating a lost corner is always employed unless it can be shown that the corner so located is in substantial disagreement with the general scheme of the original government survey as monumented. In such cases the surveyor shall use procedures that produce results consistent with the original survey of that township.)

...Existent original corners shall not be disturbed. Consequently, discrepancies between the new and record measurements shall not in any manner affect the measurements beyond the existent corners; but the differences shall be distributed proportionately within the several intervals along the line between the corners;

RSMo, 60.315

The Reestablishment of Lost Corners

USPLSS

OK, how many different corners are there?

- 1.) Quarter Corner, interior of township
- 2.) Quarter Corner, closing section
- 3.) Section Corner, interior of township
- 4.) Corner on township exterior
- 5.) Corner on Standard Parallel
- 6.) Corner to four townships

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Example Calculations
Chapter 6
Missouri and Arkansas

These example problems were taken from "The U.S. Public Land Survey System for Missouri" (by Dr. Richard Elgin). There are five editions of the book. The 5th Edition is the latest (printed 2019). It is available from MSPS and Amazon. Or, these examples were taken from "The U.S. Public Land Survey System for Arkansas" (by Drs. Elgin and the late David Knowles). There is one edition of that book (softbound, printed in black and white, 2011). It is available from the Arkansas State Surveyors Office.

Answers are given on the last sheet of this problems set.

There are additional example problems given in both books. In both books, the example problems are given in Chapter 6.

These example problems are specific to Missouri and Arkansas. They are applicable in both states. These sketches and solutions may not be correct for other states.

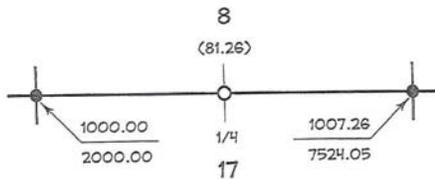
This set of problems are copyright, 2026, Dr. Richard Elgin.

In these problems, found, existent, accepted corners are noted with solid symbols. The coordinates shown are your measured coordinates in feet, north over east. All intervening corners have been declared lost. Closing corners noted with solid symbols have been accepted.

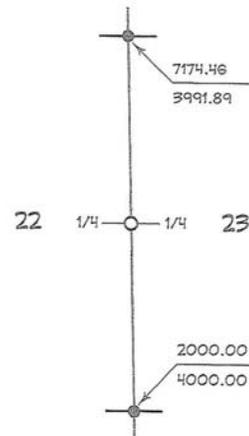
Lost Quarter Corner, Interior of Township

RSMo 60.315(7)

1.) Dimensions:



2.) Dimensions:

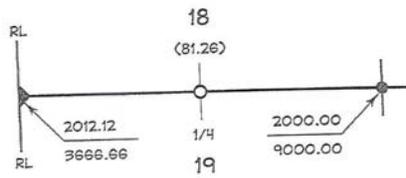


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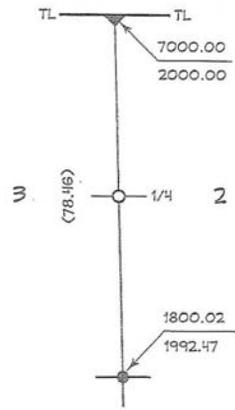
Lost Quarter Corner, Closing Section

RSMo 60.315(7)

3.) Dimensions:



4.) Dimensions:

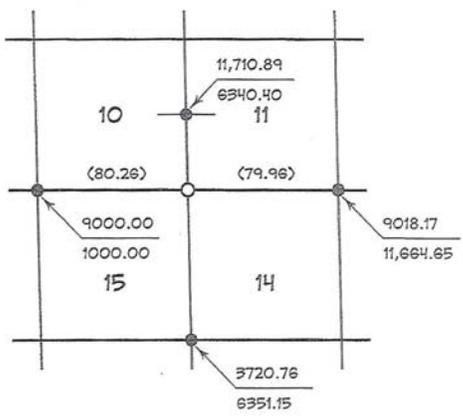


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Lost Section Corner, Interior of Township

5.) Dimensions:

RSMo 60.315(6)

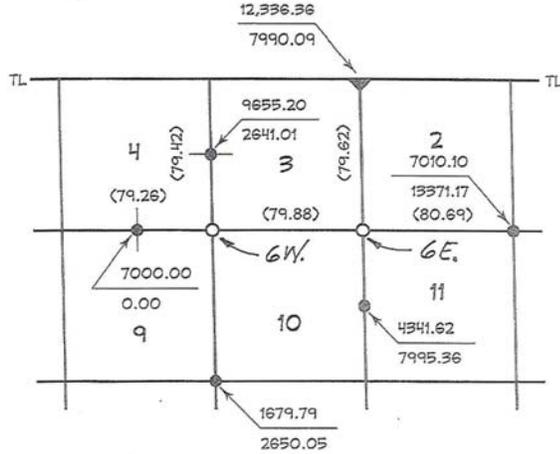


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Lost Section Corner, Interior of Township

RSMo 60.315(6)

6.) Dimensions:

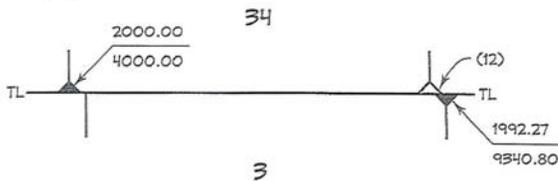


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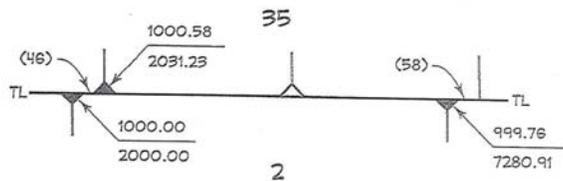
Lost Corner on Township Exterior
Closing Corners Accepted

RSMo 60.315(5)

7.) Dimensions:



8.) Dimensions:

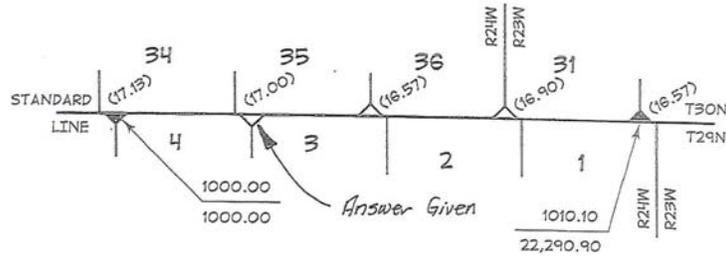


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Lost Corner on Standard Line
Closing Corners Accepted

RSMo 60.315 (5)

9.) Dimensions:

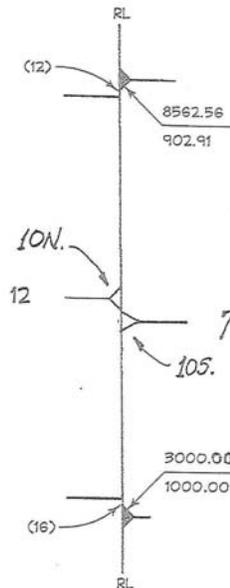


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Lost Corner on Township Exterior
Closing Corners Accepted

10.) Dimensions:

RSMo 60.315 (5)

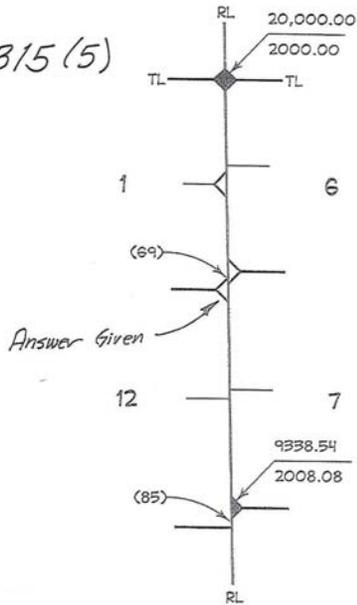


Lost Corner on Township Exterior
Closing Corners Accepted

11.) Dimensions:

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RSMo 60.315 (5)

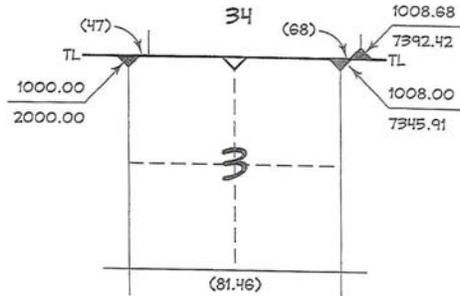


The Blank Quarter Corner

See RSMo 60.345

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12.) Dimensions:

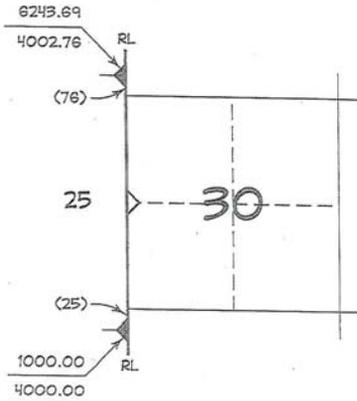


The Blank Quarter Corner

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RS Mo 60.345

13) Dimensions:



Dr. Richard L. Elgin, PS, PE

Rolla, MO

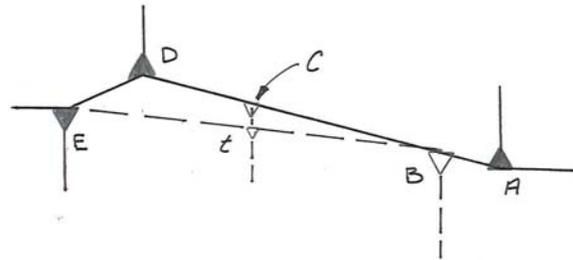
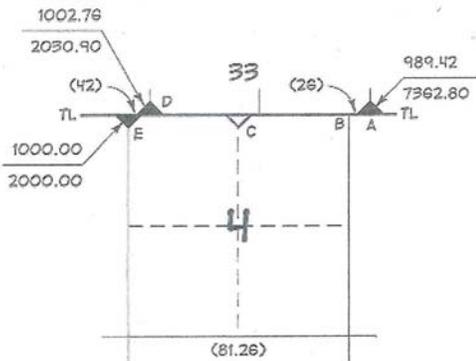
elgin1682@gmail.com

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The Blank Quarter Corner

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Dimensions:



The solution is to single proportion the northeast closing corner (B) between A and D, then compute the temporary blank quarter corner position by single proportioning between B and E, then offset that position north or south to intersect with the township line defined by AD, for the blank quarter corner position, C.

The Blank Quarter Corner to Section 4

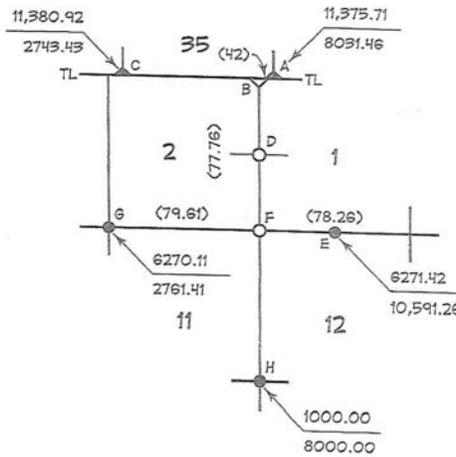
Answer: $\frac{996.24}{4636.06}$

(c)

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Combination Problem:

AN EXTRA

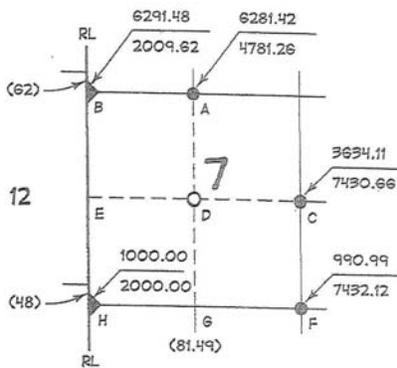


CORNER	METHOD	NORTHING	EASTING
B	Single Proportion AC	11,375.74	8003.70
F	Double Proportion HB, GE	6261.53	8010.98
D	Single Proportion FB	8892.30	8007.23

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The Center of Section

ANOTHER EXTRA



CORNER	METHOD	NORTHING	EASTING
E	Single Proportion BH	3650.38	2004.82
G	Single Proportion HF	995.41	4765.72
D	Intersect AG, EC	3642.08	4773.50

Answers to Previous Example Problems

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14

Problem	North	East
1.	1003.63	4762.03
2.	4587.23	3995.95
3.	2005.97	6374.68
4.	4451.04	1996.31
5.	9047.51	6342.31
6W.	6996.73	2646.85
6E.	7015.00	7981.96
7.	1992.27	9332.80
8.	1000.17	4675.24
9.	1002.66	6614.63
10N.	5782.67	951.43
10S.	5771.58	951.62
11.	14,640.80	2004.06
12.	1003.92	4617.01
13.	3638.23	4001.39