THE MISSOURI SURVEYOR

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President's Message

Sharon Herman, PLS

It has been a pleasure and honor to serve as the President of MSPS this past year. The time has flown by and I am pleased with the accomplishments our society has achieved in the past 12 months.

Just last fall the proposed revisions to the Minimum Standards were presented to the membership. With a few changes suggested at the annual conference and others by the board of registration. These changes are on their way to being implemented. Hopefully we will have a new set of standards within the next year.

In November 2012, the membership voted to join with other states to become members of NSPS. Now all PLS members of MSPS are automatically members of the National Society of Professional Surveyors also. Nationally, this has been a very successful endeavor for NSPS. As Missouri Land Surveyors we should all feel proud to be a part of this strong national organization.

After a number of years of MSPS working towards protecting the State Land Survey Program, a lasting change has finally been accomplished. Thanks to a House Bill proposed by our newest State Representative, Robert Ross, PLS, legislation has been passed and signed into law transferring the LSP to the Department of Agriculture.

The Handbook Committee has completed and published the long awaited updated version of the Surveyors Handbook. It is now available to members in paper or digital form through the MSPS office.

I cannot take credit for any of the many accomplishments of our Society this past year. They have been the results of the many hours and sometimes years of hard work by the dedicated members of our State organization. Those committee chairmen and members that work tirelessly, year after year on protecting and improving the surveying profession for all of us.

There is still work to be done. MSPS is proposing some needed changes to the education requirements for licensure. This will be discussed with the membership at the annual business meeting in October.

A committee has been working on reviewing the current laws governing the recording of surveys and plats. Their goal is to introduce legislative changes to the recording requirements that will clarify what kinds of surveys should be recorded and when.

Sadly, John Holleck is retiring. This will be the final issue of the Missouri Surveyor Magazine with John as Editor. For the past 17 years John has done an excellent job of providing Missouri Surveyors with an award winning professional magazine. Many thanks go out to John for his years of service and his large contribution to our surveyor's organization.

Our Annual Meeting is fast approaching. This year it will be held in October at the Tan-Tar-A Resort in Lake of the Ozarks. Once again the Education Committee has put together an interesting and informative lineup of speakers and topics. I look forward to seeing all of you there.

Front Cover: History: Surveys under the joint contract of Lionel Browne and Wm. H. Lashley of 15th, April 1817. GLO Survey; Volume 206, page 77, set a post; December-29-1817 marked a 10" Cedar, S55E, 45 links and a 8" Post Oak, N15W, 39 links. Gerald Bader PLS, Ste. Genevieve County Surveyor and Myron Naeger; February, 2011 found stone 20" x 3" x 20" set 12" into ground. 20" Post Oak (dead with window scare) bears N15W, 25.7 feet (39 links)

MSPS Members:

As many of you know last fall at the annual meeting we discussed increasing the education requirements for licensure as a PLS in the State of Missouri. A few hurdles were encountered while proposing legislative changes. I would like to take a few minutes of your time to explain why MSPS Board of Directors felt education changes were important.

In the late 1700 's Colonial America embarked on the most ambitious surveying project ever attempted, the Northwest Ordinance of 1787. Northwest Ordinance of 1787 established a rectangular survey system designed to facilitate the transfer of Federal lands to private citizens. This was the first time in history that the principle of "survey before settlement" and "standard land unit" creating townships of 6-miles square and sections of 640 acres were utilized. The early surveyors were astronomers, mathematicians and frontier woodsmen taking measurements with two pole chains and a compass. Early surveyors took meticulous notes describing not only their measurements and direction but also specific information noting calls to streams and rivers, rock outcroppings and other natural land formations.

While the method of measurement used by surveyors today is much different than our predecessors, the founding principle of defining our land boundaries has not changed. It is the land surveyor's duty to correctly locate and mark property lines as described in a deed and to relate the lines of possession to title lines. The surveyor is a fact finder. He goes upon the land armed with documentary evidence to search for markers, monuments and other facts. After all the facts, measurements and observations are assembled, the surveyor must come to a conclusion based upon the facts on the ground and his knowledge of the laws of evidence and property law. The land surveyor has a massive responsibility, one that requires significant field experience and education.

Those considering land surveying as a profession generally enjoy the outdoors, thus field experience is easy to obtain. With the technological advancements in surveying it is easy to collect massive amounts of field data in a short amount of time without ever understanding what you are collecting. Technology has been both a great benefit and hindrance to the land surveying profession. Land Surveying disconnect between field experience and education has resulted because of this. Lost is the basic understanding of geometry and trigonometry, verbal and written client communication skills, surveying calculations, and legal principles.
Applicants are capable of passing areas where information can be memorized and regurgitated, but struggle with mathematical computations, data analysis, and sectional breakdown. The USPLSS (United States Public Land Survey System) as applied in Missouri is an important subject area, but one which is not sufficiently understood by many examinees and could be better understood with increased educational opportunities.

Proposed changes are not intended to discourage individuals from becoming Professional Land Surveyors, but to comply with 20 CSR 2030-2.010 (3) "….licensees shall be cognizant that their primary responsibility is to the public welfare, and this shall not be compromised by any self-interest of the client or the licensee." Better educated and knowledgeable surveyors can better serve the needs of the general public.

MSPS is proposing the following education requirements for enrollment as a Land Surveyor in Training

327.315. 1. Any person may apply to the board for enrollment as a land surveyor-in-training who is twenty-one years of age or older, who is of good moral character, who is a high school graduate, or who holds a Missouri certificate of high school equivalence (GED), and:
(1) Has graduated and received a baccalaureate degree in an approved curriculum as defined by board regulation which shall include at least thirty semester hours of approved surveying course work of which at least six semester hours shall be in the legal aspects of boundary surveying; or
(2) Has earned at least sixty hours of college credit which shall include at least thirty semester hours of approved curriculum as defined by board regulation of which at least six semester hours shall be in legal aspects of boundary surveying and has presented evidence satisfactory to the board that in addition thereto such person has at least one year of combined professional office and field experience in land-surveying projects under the immediate personal supervision of a professional land surveyor; or
(3) Has earned at least thirty semester hours of approved surveying course work as defined by board regulation of which at least six semester hours shall be in legal aspects of land surveying and has at least two years of combined professional office and field experience in land surveying projects under the immediate personal supervision of a professional land-surveyor. Under this section, not more than one year of satisfactory postsecondary education work shall count as equivalent years of satisfactory land-surveying work as aforementioned.
2. The board shall issue a certificate of completion to each applicant who satisfies the requirements of the aforementioned land surveyor-in-training program and passes such examination or examinations as shall be required by the board.
3. The provisions contained in subdivisions (1), (2), and (3) of subsection 1 of this section shall become effective January 1, 2018.
4. The provisions contained in subdivision (3) of subsection 1 of this section shall expire January 1, 2022.

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The Brown Partition of Hill County

by Michael Hoover, RPLS, LSLS, CFM, Reprinted from *The Texas Surveyor*, May 2013

A CASE OF OBLITERATED MONUMENTS AND A DISPUTED AGREEMENT
Kyle v. Clinkscales et al. (No. 824)
Court of Civil Appeals of Texas
Waco - November 14, 1929
22 S.W. (2d) 729

EARL Y HISTOR Y OF THE LAND

We have here an interesting boundary suit dating from the late 1920s. The land in question concerns the approximate south half of the Hiram H. Deaton Survey, Abstract Number 226, in Hill County, Texas. Containing a reported 433 acres, this Survey is near Itasca, Texas and is located about 43 miles South 17 East from Fort Worth. The grant to Mr. Deaton was a 3rd Class Headright, one of two he received as a member of a colonization enterprise that eventually became known as Robertson's Colony in central Texas. These two surveys were later patented to Mr. Trezevant C. Hawpe in 1857. Mr. Hawpe was a farmer, Confederate Officer and politician who served as sheriff of Dallas County from 1850 to 1852. A quick visit to the Texas General Land Office Interactive Land Lease Mapping Programs (a terrific site - see http://gisweb.glo.texas.gov/glomap/index.html) shows the survey today to be almost wholly agricultural with a big swath of it traversed by modem day Interstate 35. (See color Exhibit "A") The southerly boundary of the survey near the subject of this column is now bordered by Hill County Road 4251.

BACKGROUND TO SUIT

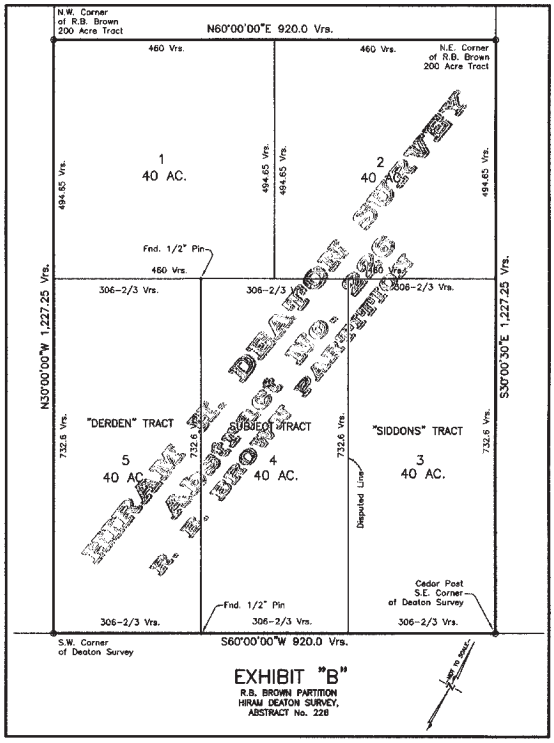
In 1915 R. B. Brown and his wife subdivided the 200 acre tract of land out of the southern half of the Deaton Survey. The subdivision consisted of 5 separate tracts of 40 acres each in two tiers. The upper tier enclosed tracts 1 and 2 and the lower tier enclosed tracts 3, 4 and 5. The south line of the lower tier was the south line of the Deaton Survey with the southeast corner of tract 3 being (allegedly) the southeast corner of the Deaton Survey and the southwest corner of tract 5 being (allegedly) the southwest corner of the Deaton Survey. (See exhibit "B"). It is reported that Mr. Brown had all of the tract corners monumented with iron pins. We don't know much about the disposition of tracts 1 and 2, but we do know a little about the others. Tract 3, the easterly tract, was known as the Siddons Tract. Tract 5, the westerly tract, was owned by Ida Brown Derden and was known as the Brown Derden tract. Tract 4, the middle tract, was owned by Mr. Alva Underwood, and, on December 13, 1922, was conveyed to one of the parties to this suit, Mr. A. O. Clinkscales (*appellee*), by Deed recorded in Volume 204, Page 341 of the Hill County Deed Records (H.C.D.R.). Mr. Clinkscales and his wife also acquired the easterly tract 3 shortly thereafter. R. C. Kyle (*appellant*), the other party to this suit, acquired the westerly tract 5 during this same time frame. So, what we had in the early part of 1927 was the Clinkscales owning the easterly tract 3 and the middle tract 4 and Kyle owning the westerly tract 5. On February 5, 1927, Clinkscales and his wife entered into a contract to sell to Mr. Kyle by Warranty Deed tract 4, the middle 40 acre tract. The language of the contract read *"40 acres of land out of the H. H. Deaton Survey in Hill County, Texas, being the* identical *tract conveyed to A. O. Clinkscales and wife by deed dated December l3th, 1922, and recorded in Vol. 204, Page 341 of the Deed Records of Hill County, Texas."* (Underline mine) The legal description in the Deed reads as follows:

All that certain tract or parcel of land in Hill County, Texas being a part of the Hiram H. Deaton Survey, Patent No. 1592, Volume 9, Abstract No. 226, and more fully described by metes and bounds as follows: Beginning at the S. W. corner of a tract of 40 acres conveyed by R. B. Brown and wife to R. F. and W. W. Siddons, which corner stands in the south line of said Deaton survey, 306-2/3 varas S. 60 W. from the S. E. corner of said survey; thence N. 30 W. with the west line of said Siddons tract 732.6 varas to its N. W. corner; thence S. 60 W. 306-213 varas to a stake for corner; thence S. 30 E. with the east line of a 40 acre tract conveyed to E. B. Brown and wife to Brown Derden, 736.2 varas to a stake in the south line of said Deaton survey; thence N. 60 E. with said south line, 306-2/3 varas to the place of beginning, containing 40 acres of land.

POINTS OF CONTENTION

A significant component and probable progenitor of this suit is that Clinkscales, prior to conveying tract 4 to Kyle, had removed the iron pins which had originally been placed by Brown marking the line between tracts 3 and 4. It is unclear

why Clinkscales removed these monuments. As he had owned and cultivated both tracts of land for 6 years prior to the conveyance to Kyle one can speculate that perhaps he pulled the monuments because he considered them "unnecessary" or perhaps they were destroyed through the working of the land. Whatever the case, these missing original monuments spelled trouble. As part of the contract of sale, Clinkscales expressly agreed to have the property surveyed and monumented at his own expense. Accordingly, on December 6, 1927, Clinkscales engaged John F. Wright, County Surveyor of Hill County, to make the survey and set the corners. It is contended by Clinkscales that both he and Kyle were with Surveyor Wright when the survey was made. It is further contended by Clinkscales that Kyle assisted in "running the lines and establishing the corners" between tracts 3 and 4. As we will see, Surveyor Wright based his survey of tract 4 on the original iron rods recovered for the northeast and southeast corners of tract 5. After the northeast and southeast corners of tract 4 were thus established, on or about December 28, 1927, Clinkscales delivered the Deed to Kyle, who apparently accepted it.



AGREEMENT?

The case was submitted to the jury on *just one* special issue: Did the parties *agree* that the two monuments (iron rods) marking the northeast and southeast corners of tract 5 also mark the northwest and southwest corners of tract 4? No other issue was requested, except Clinkscales asked for peremptory instruction.

DECISIONS

The jury in the original trial found for Clinkscales - they found that there had indeed been an agreement. The appeals court agreed with Clinkscales and here's why: (note the *cardinal rules* cited by the court!) (*Some paraphrasing by the author; all italics, underscores and bold lettering by the author.)*

- "The universal test in fixing a boundary line is, first, natural objects, such as rivers, trees, and other objects of nature; second, artificial marks that were placed on the ground by the surveyor; and third, course and distance." *Stafford v. King, 30 Tex. 257, 94 Am, Dec. 304, Phillips v. Ayers, 45 Tex. 601.*

- "Another *cardinal* rule is that, where there are descriptive or directory calls, same will yield to locative calls where the locative objects are actually found." *Hamilton v. Blackburn, 43 Tex. Civ. App. 153, 95 S. W. 1094.*

- "Another *cardinal* rule is that the beginning corner of a survey or plat is of no higher dignity than any other corner of the survey, and the field notes of a tract of land may be constructed from any corner found on the ground, regardless of whether it is the beginning corner as called for in the survey." *Cox v. Finks (Tex. Civ, App.) 41 S. W. 95; Crosby v. Stevenson (Tex. Civ. App.) 156 S. W. 1110; Phillips v. Ayres, supra; Kennard v. Maxwell (Tex. Civ. App.) 28 7 S. W. 60; Taft v. Ward, 58 Tex. Civ. App. 259, 124 S. W. 43 7; Ramseaur v. Ball, 59 Tex. Civ, App. 285, 125 S. W. 590.*

- "Another *cardinal* rule in establishing boundary lines is that calls for course and distance always yield to natural or artificial locative calls when same can be definitely and surely found upon the survey." *Duren v. Presberry, 25 Tex. 513; Kennard v. Maxwell, supra; Hamilton v. Blackburn, supra.*

Kyle contended that the land in question (Tract 4) should have been located from the southeast corner of tract 3 (the southeast corner of the Deaton Survey). He based that contention on the fact that the Deed recites that *"Beginning at the S. W. corner of a tract of 40 acres conveyed by R. B. Brown and wife to R. F. and W. W. Siddons, which corner stands in the south line of said Deaton survey, 306-2/3 varas S. 60 W. from the S. E. corner of said survey;"* . Clinkscales responded that since the iron rods which marked the corners of the land between tracts 4 and 5 were original corner monuments, and that since the jury (as we will see) found all parties recognized the same iron rods as the true corners between tracts 4 and 5, and that since the iron rods which had marked the corners between tracts 3 and 4 had been obliterated, the true boundary line between tracts 3 and 4 was properly ascertained by beginning at the recognized and accepted corners found marking the line between tracts 4 and 5. He further contended that the line and corners as fixed and marked by the County Surveyor (Surveyor Wright) between tracts 3 and 4 were by all parties at said time accepted as the true boundary line between said tracts.

(continued on next page)

The Brown Partition of Hill County *(continued)*

- "Another cardinal rule is that, where a corner of a survey or tract of land is established, and the location thereof as made by the surveyor is positively identified, same will control and take precedence over course and distance for the corner or lines of other or adjoining surveys and same must, when conflicts arise between said calls, yield to the established corners as fixed by the surveyor." *Stafford v. King, supra; Hays v. Clawson (Tex. Civ. App) 286 S. W. 857.*

- They further agreed that..."Kyle was bound by the alleged agreement found by the jury to have been made by him and Clinkscales just a short time prior to the time that he (Kyle) accepted the Deed. The courts hold that, where there is a disputed boundary line, the parties at interest may by agreement establish said line, and same will be binding upon all who were parties to said agreement." *Lecomte v. Toudouze, 82 Tex. 208, 17 S. W. 1047, 27 Am St. Rep. 870; Harn v. Smith, 79 Tex. 310, 15 S. W. 240, 241, 23 Am St. Rep. 340; Hill v. Walker (Tex. Civ. App.) 140 S. W. 1159.* "The record shows without dispute that just a short time before Kyle accepted the deed to the land he purchased from Clinkscales, and before he paid the purchase price, he (Kyle), together with Clinkscales and the County Surveyor, went on the ground for the sole purpose of establishing the boundary line and making corners thereof, and after same had been established and the corners marked, with full knowledge of the actual location of the corners as made by the surveyor, Kyle accepted the deed and paid the purchase price. Kyle has been awarded 40 acres of land, the amount called for in his deed. We think, under the facts of this case, the easterly boundary line thereof was correctly established by the Surveyor Wright."

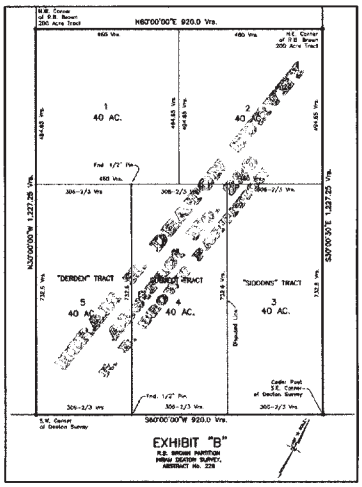
So the judgment of the trial court was affirmed. Pretty strong staff! After reading this decision I was pretty well convinced the majority had it right. But wait! There is a dissenting opinion. Mr. J. Stanford, not being able to agree with his associates in the disposition of this case, filed a rather lengthy dissenting opinion. Here are the highlights (pay close attention to the testimony of Surveyor Wright):

- "In the deed from Clinkscales to Kyle, the description is identical with the description given in the deed from Alva Underwood to Clinkscales above. The majority opinion proceeds upon the assumption that the true location of the line between tracts Nos. 3 and 4 is in dispute. *This is not the issue involved.* There is no contention but that the southeast corner of the Deaton survey is also the southeast corner of the Siddons 40 acre tract No. 3. There is no controversy but that the southwest corner of the 40 acre Siddons tract is also the southeast corner of tract No. 4, the one in controversy, and that this corner is 306-2/3 varas S. 60 W. from the southeast corner of the Deaton Survey. The southeast corner of the Deaton survey is a well established corner, marked by a cedar post set in the ground, well known by all the interested parties."

- Surveyor Wright testified in part: "The southeast corner of tract No. 3 here also marked the southeast corner of the Deaton survey ... it is my information that the southeast corner of tract No. 3 is the southeast corner of the Deaton survey ... Mr. Clinkscales may have pointed out to me a cedar post, at any rate, I think he pointed out the southeast corner of the forty acres (No. 3) east of the tract in question as the southeast corner of the H. H. Deaton Survey."

- There is no evidence to the contrary. As a matter of fact, the records shows conclusively that Surveyor Wright *did* begin at the southeast corner of the Deaton survey and ran 306-2/3 varas S. 60 W. to a point in the south line of the Deaton survey, for the southwest corner of tract No. 3 and the southeast corner of tract No. 4, and from this point he continued S. 60 W. 306-2/3 varas along the south line of tract No. 4, *and said he found he then lacked about 10 varas being to a stake,* which Clinkscales contended was the southeast corner of tract No. 5 and the southwest corner of tract No. 4. He then began at said stake, reversed his calls, and ran back, he said, 306-2/3 varas N. 60 E. along the south line of the Deaton survey, and at said point put down a wooden peg for the southeast corner of tract No. 4 and then went to a stake claimed to be the northeast corner of tract No. 5 and the northwest corner of tract No. 4, and did likewise, and put down another peg for the northeast corner of No. 5 and northwest corner of No. 4. *Surveyor Wright was unable to find his field notes, if he had made any,* and so furnished none, and none are of record anywhere, but the following excerpt for his evidence reveals the real issue here: "The field notes call for beginning at the southeast corner of the Deaton survey and going 306-2/3 varas S. 60 W.; that wasn't hard to do. Then the field notes call for making the northerly run 732-6/10 varas; that wouldn't have been hard to do. The field notes then call for making the next run 306-2/3 varas S. 60 W. I did not run that line S. 60 W. 306-2/3 varas except to reverse it. I run (sic) that line in the opposite direction. I am just trying to tell you what I did ... If I had set a peg 306-2/3 varas S. 60 W. from the southeast corner of the Deaton survey, *I would have set it nine or ten varas further (sic) east than I did.* If I had followed the field notes in the deed just as they were called for in the deed and not in some reverse order, and had set a peg there with that call 732-6/10 varas form the first call, *I think I would have set a peg nine or ten varas further east than I did...*If I had set a peg there at the end of that third call, as the deed called for it, it would have been at the point that is contended for, there would have been a difference of about nine of

ten varas. It would have been nine or ten varas further east I think. I did not follow the next call. *If I had done that I think I would have come out at a point eight or ten varas further (sic) east in the south line of the Deaton survey than is contended for*...If I had driven the pegs down at the end of each call, starting from the southeast corner of the Deaton survey as Mr. Clinkscales pointed it out and as I found it on the ground, and gone the course and distance as the deed called for in the very direction the deed called for, *I don't guess there would have been a single peg set where I left them. Each one of them would have been in the neighborhood of nine of ten varas from where I set them — that is nine or ten varas further to the east.*"



- The controversy should be determined by the provisions of the contract of sale and the deed made in pursuance thereof. There is no ambiguity in the description of the land Clinkscales and wife were obligated to convey, and did convey, to Kyle. Clinkscales does not contend there was any obscurity in such description. Clinkscales does not contend there was any mistake, mutual or otherwise, in the execution of said deed. Clinkscales did contend that, when the sale was agreed upon, Kyle agreed to have his 40 acres measured off immediately east of the line between the stakes on the northeast can southeast corners of tract No. 5, but there was no attempt to prove such agreement.
- If a party to a warranty deed in a collateral proceeding be permitted by parol to prove the land described in such deed was not the land intended to be conveyed, deeds would be of little value, and no title would be safe. J. C. Penney Co. Inc. v. Grist (Tex. Civ. App.) 13 S. W. (2d) 936 (writ refused); Morgan v. Mace et al. (Tex. Civ. App.) 259 S. W. 1095; Henry v. Phillips, 105 Tex. 459, 151 S. W. 533.
- A deed cannot be collaterally attacked by the parties to it, or their privies, by parol evidence tending to show an intention different from that which its language unmistakably expresses. Davis et al. v. George et al., 104 Tex 106, 134 S. W. 326; Scheller v. Groesbeck (Tex. Com. App.) 231 S. W. 1092; Browne v. Gorman (Tex Civ. App.) 208 S. W. 385 (writ refused).
- Where deed is plain and unambiguous, parol evidence is not admissible to show the intention of the parties thereto, but such intention is determined by the court as a matter of law from the terms of the instrument. Graham's Estate v. Stewart (Tex. Civ. App.) 15 S. W. (2d) 72 (writ refused).

(continued on page 11)

MO Colleges/Universities Where Land Surveying Coursework is Available

The following list will be updated quarterly as new information becomes available.

Longview Community College — Lee's Summit, Missouri
Contact: David Gann, PLS, Program Coordinator/Instructor — Land Surveying MCC — Longview, MEP Division
Longview Community College
Science and Technology Bldg.
500 SW Longview Road
Lee's Summit, Missouri 64081-2105
816-672-2336; Fax 816-672-2034; Cell 816-803-9179

Florissant Valley Community College — St. Louis, Missouri
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Florissant Valley Community College
3400 Pershall Road
St. Louis, Missouri 63135
314-513-4319

Missouri State University — Springfield, Missouri
Contact: Thomas G. Plymate
Southwest Missouri State University
901 So. National
Springfield, Missouri 65804-0089
417-836-5800

Mineral Area College — Flat River, Missouri
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Mineral Area College
P.O. Box 1000
Park Hills, Missouri 63601
573-431-4593, ext. 309

Missouri Western State University — St. Joseph, Missouri
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Wilson Hall 193
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School of Technology
3950 E. Newman Rd.
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1-800-606-MSSC or 1-417-782-MSSC

The Brown Partition of Hill County *(continued)*

There's more in the dissent, but I think you get the gist of it. Based upon Surveyor Wright's testimony there may have been an excess in the 3 tracts, or at least an excess in tracts 3 and 4. That wouldn't be a big surprise; it is a recognized fact that many original surveys are excessive. Also, Mr. Stanton, I believe, makes a fairly strong case in attacking the validity of the alleged agreement.

SO...WHAT?

After reading this case several times (which is mandatory when reviewing any case law), several lingering questions dwelled in my thoughts.

Could this have been a case of simultaneous conveyance? Should proration have been considered in the resolving the dividing line between tracts 3 and 4? Should Surveyor Wright have testified as to what he did or didn't do — and where were his field notes, anyway? Why did the jury only consider the one special issue: the alleged agreement between Clinkscales and Kyle? Why didn't they consider any of the other facts at hand? The majority opinion is strong, but so too Stanton's commentary: why wouldn't Surveyor Wright (or any other surveyor), despite the agreement, take a look at the overall distance between the southeast corner of tract No. 3 and the southeast corner of tract No. 5? 1 think that is what I would have done. Easy for me to say — I've got so many more tools to work with — and a decent budget (most of the time) to go with them. Not so much in the late 1920s. As in most cases we study there are many more questions than answers. That's OK, though — we don't study the cases just for the answers, we study the cases for a variety of reasons. For me, two of the most important reasons are: (1) the paramount importance of case law and the historical ebb and flow thereof; and (2) to form a more direct link between how I actually do practice and how I actually should practice.

Sources:

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BHC RHODES Hires Former Kansas City, MO Assistant City Engineer to Lead Their Public Works Services

Mr. Tom Degenhardt, P.E., P.L.S. joined BHC RHODES as the new Public Works Services Team Leader. He was a former Assistant City Engineer for Kansas City, Missouri's Public Works department and brings twenty years of experience in large municipal government. Degenhardt will oversee engineering initiatives including street design, road and highway design, traffic engineering, storm water and drainage and construction services.

BHC RHODES has a strong and established public works team which will allow Degenhardt to focus immediately on customer care, evaluating business operations to enhance efficiencies and explore new market opportunities. "Tom's simultaneous roles as a leader in City Public Works and as a customer to professional service providers, places us in the unique position of having a former customer provide our "No Problem" customer service, said BHC RHODES President, Kevin Honomichl. "There is no greater testimony."

Degenhardt is a licensed professional engineer in Kansas and Missouri and a registered professional land surveyor in Missouri. He graduated from the University of Missouri with a Bachelor of Science in Civil Engineering and later received his Master of Science in Civil Engineering from the University of Kansas.

BHC RHODES, civil engineering and surveying firm was founded in 1992 and is based in Overland Park, KS. They perform work nationally and internationally for telecommunications, public works, and development customers. BHC RHODES was recognized in 2013 as one of the Kansas City area's fastest-growing companies, ranking in the Kansas City Business Journal and Ingram's Magazine Corporate Report honor rol1. BHC RHODES has been voted one of the best places to work both locally and nationally. For more information visit their web site at: http://www.ibhc.com.

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May 28, 2013

WHY SURVEYORS ARE DIMINISHING

When I started my surveying career we had a three man crew, measured with a steel tape and hunted for original corner markers. Research was sketchy because we did not have many resources.

Times have changed, we now have one man survey crews, many resources for research, but are we finding the original corners, are we mentoring or training new people for our profession? Most surveyors got into the business working in the field with someone, decided they liked the business, and wanted to learn more and get licensed.

We do not have the mentoring, teaching, and field learning aspect anymore. We have one man crews and when the crew is gone so is the knowledge and career. All of the technology and education may make us better business people and more profitable, but is it making us better surveyors? Is it making more surveyors? Office education does not show how to accomplish the research and field work. It does not show how to find evidence and original corners. We can subdivide a whole section with GPS and a computer program, but the result is the corner is not where the original surveyor placed it which is the true corner.

We do need more education to understand the technical aspects of the equipment, adjustments, business aspects of business today, but we also need mentoring to teach how to find the original corners and how to use this as evidence of the property monuments.

If we do not mentor and train new people will our profession be replaced by machines, and educated people in the office? We already have the issue of our public saying surveyors never agree. If we do not promote the original corners we will be replaced with GIS and computers.

Respectfully,

Daniel L. Govero, PLS
President

In Memory of Douglas E. Ubben, Sr.

Douglas E. Ubben, Sr., 57, of Shawnee, Kansas, passed away Wednesday, July 17, 2013.

Doug was born in Oceanside, California, and lived most of his life in the Kansas City area. He was a Professional Land Surveyor and Partner for Phelps Engineering for the last 17 years. Prior to that, he was with Larkin and Associates. He was a member of St. Joseph Catholic Church, a member and past Treasurer of the Sons of the American Legion in Shawnee, and was past President and Treasurer of the KC Metro Surveyor's Association.

He is survived by his wife, Marcia, of the home; a son, Douglas E. Ubben, Jr. (Megan), of Shawnee, Kansas; daughter Erin (Joel) Morgan, of Overland Park, Kansas; grandchildren Kayleigh and Rylee Ubben; his parents, Ivan and Ardith Ubben, of Raytown, Missouri; brothers Greg (Cindy) Ubben, of Shawnee, Kansas, and Robert (Mandy) Ubben, of Raytown, Missouri; and a sister Laura (Bud) Davis, of Raytown, Missouri.

Doug's greatest moments in life were times spent with family and friends. He enjoyed going to the lake, playing with his grandkids, and spending time outdoors.

In Memory of Ed Cleaver

(November 27, 1936 - August 2, 2013)

Edward Austin Cleaver, 76 of Atlanta, MO passed away Friday night, August 2, 2013 at Macon Health Care Center.

Ed was born on November 27, 1936 in Atlanta, the son of the late Harley and Mary (Richardson) Cleaver. On August 14, 1955 at the Macon First Baptist Church, he was united in marriage to Johnnie Sue Cooper, who preceded him in death on November 21, 2010.

Ed is survived by 4 daughters: Elizabeth Anne Cleaver of Macon, Christi & Jon Perkins of Paducah, KY, Mary Grace & Robert Varadin of Chandler, AZ and Victoria & Chris Barton of Knob Noster, MO; 10 Grandchildren: Jessica Perkins, Jonathan Perkins and wife Christina, David & Matthew Barton, Grace, Eddie, Andrew, Anna Marie, Joy & Hope Varadin; 3 Great-Grandchildren: Landon, Jack & Adelaide Perkins; a sister, Mary Lou Cozad of Kansas City, MO; nieces, nephews, other relatives and a host of friends.

Ed was a 1954 graduate of Macon High School. While living in the St. Louis area in the 1960s he served as an alderman for the City of Brentwood. He owned & operated Cleaver & Associates Land Surveying Company in Atlanta for more than 40 years and also served Macon & Adair Counties as their county surveyor for many years. Ed was a member and deacon of the Atlanta First Baptist Church where he taught Sunday School for adults and youth and also drove the church bus. He had served on the Atlanta C-3 school board of education and his hobbies included farming and gardening.

Funeral services were at 11 a.m. Saturday, August 10, 2013 at Elliott Funeral Home in Atlanta with Pastor Chance Glenn officiating. Visitation was from 6-8 p.m. Friday at the funeral home. Burial was at Mt. Tabor Cemetery east of Atlanta.

Memorials are suggested to the Atlanta First Baptist Church. Submitted by J. Michael Flowers, PLS.

Many Thanks to John Holleck, PLS #2227

After 17 years and 70 issues of the Missouri Surveyor, John is stepping down as editor. He took the publication from a 12-page black and white newsletter to a 44-page full color magazine that has won national awards for "Excellence in Journalism" from the National Society of Professional Surveyors.

John's dedication to the profession and to providing the members with a quality publication will be missed.

Taking over in December 2013 will be MSPS past president Donald R. Martin, PLS. Don will be retiring from the Missouri Department of Conservation and will assume the position of editor of the Missouri Surveyor.

Printed below is excepts from the 1996 first publication by editor Holleck.

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The Selling of Our Professional Souls

by Dennis J. Mouland, PLS, Reprinted from *The Texas Surveyor*, July 2013

The profession of land surveying is a strange mixture of science and law: It involves the ability to interpret either of those in the context of the other. Many other professions cannot do this, including many lawyers, engineers, and title insurance staff. The capacity to think in both technical measurement terms in a spatial relationship, and then overlay it with complex laws and legal principles is what makes the profession so enjoyable. I am quite sure none of us are in it for the big money!

Dennis J. Mouland, PLS

During my career I have often seen persons who use our data in some capacity; who try to allow one of these elements to dominate the other. A classic example is the person who thinks all measurements are perfect, and therefore all bearings and distances in a deed must be true. Thus, they attempt to annul any legal considerations in a boundary location. Some GIS personnel find themselves in this category if they have not had broader training in the law.

What has scared me more, however, is when I see those in our own profession selling out one or both parts of this specialty we claim. This can come in one of two ways:

First, there are those who believe their measurements are so precise, that they no longer rely on the law or legal principles that guide us in actual boundary determination. In other words, it's all about measurement. Ignore the evidence, intent of the deed, previously done surveys which were well done for their time. Finding a plethora of monuments at a corner point is one classic example of this flawed thinking. And since many of our graduates from Universities are engrained with this approach, it is no wonder we have these issues increasing as time goes by.

A second way we sell out our own profession is the thinking that deeds, records and previous surveys are all second class information; what the clients occupy is all that matters. While occupation can be a part of the evidence, and the law allows for such things as acquiescence and adverse possession, we cannot throw out our measurements and the record evidence that created the lines we want to retrace. The fact that a portion of our profession is too lazy or incompetent to search for and identify written and field evidence does not truly change who we are and what it is we are supposed to be doing.

In the first example we find us selling out the law for high-order measurements, adjustments, and the inability to accept what anyone else before us has ever done. Such a "geodetic approach" to boundaries is dangerous; the law must not just be momentarily considered .... it must be used with all its weight.

> "Looking for justification to short-cut surveys and the evidence used to create and sustain real property rights is not part of who we are, and should not be tolerated by the rest of the profession."
>
> ***- Dennis J. Mouland, PLS***

The second example is one of us selling out the law and measurements, and simply becoming "professional as-builters." If what they occupy is all that matters, why do we have deeds, original surveys, title insurance, and resurveys? We should just license the fence builders and let it go; no surveyors needed anymore.

Either one of these approaches, or mixtures of the two, is a complete sell-out of our professional souls. It shows a great deal of ignorance of how land ownership rights work and what our role in them actually is. It doesn't just cheapen or cut out real surveying, it robs people of their fundamental land ownership rights. Arrogant measurers or as-builters do no one any good. We are licensed to protect those land ownership rights.

I encourage all of us to be total experts in the science and measurements, as well as the law involved. We need to practice both on every survey. Looking for justification to short-cut surveys and the evidence used to create and sustain real property rights is not part of who we are, and should not be tolerated by the rest of the profession. Don't sell your professional soul!

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The Original Survey of the Pennington and Lawrence County Line in Dakota Territory – 1879

by Warren L. Fisk, PE, LS, Reprinted from *Backsights & Foresights*, May 2013

Having noted recent interest in the location of the northern Pennington County and southern Lawrence County lines by the Rapid City GIS Department, it brought to mind some questions. For instance, why does the line appear to be inconsistent with its relationship to nearby section lines and also inconsistent with modern geodetic measurements? Where should the line be and how does one go about locating it on the ground today? The following is some of what I know and some of what I suspect.

The south boundary of Lawrence County is defined and described in South Dakota Codified Law 7-1-41 as being ten miles north of the 44th parallel of North Latitude. It extended east from the Dakota/Wyoming territorial line to the Cheyenne River. Meade County had not yet been formed.

The survey of this line was started in June of 1879 and was led by Charles Scott, US Deputy Surveyor. According to Scott's notes, the survey was authorized (and probably paid for) by the commissioners of both Counties. Included in Scott's initial oath are R.H. Kelb, County Surveyor of Lawrence County and C.W. Somes, County Surveyor of Pennington County. Oddly, neither were the elected County officials at that time. They were probably appointed to protect the interest of their respective jurisdictions. The oaths of the remaining crew included: C. (Charles) M. Prickett, a Chainman and Compassman who had served Scott a year earlier on the survey of the Black Hills Base Line; S. (Samuel) W. Coates, Moundman; R.W. Clark, Flagman; J.W. Post, Moundman; H. Gillett, Axeman; W.D. Chadwick, Chainman; and another whose name I was unable to read. There were probably others like a teamster, cook and woodsmen to supply the mileposts. However, those were not directly involved with the effort and their oaths were not required.

The greatest question that I had was how Scott knew where to begin his survey. His notes do not show any astronomical observations either at the 44th parallel or at a calculated latitude 10 miles north. I found that there was no such effort. So how did he know where to start? The answer lies in the history books and other sources.

The only mention of an astronomic observation I could find was on the Nebraska/Wyoming Territorial line about 10 miles south of the northwest corner of Nebraska. Oliver Chaffee performed that survey and those observations in 1869. He based his location for the 43rd parallel and relied on his chaining for 10 miles to mark his end point.

With no reliable observation within 90 miles of Scott's starting point, why wasn't one made within a reasonable distance? I speculate that time and expense were likely factors. Scott probably did not have the equipment and expertise to make such an observation. The importance of a mere County line didn't justify the time and delay this would cause. So how did they know where to start?

In fact, they (not sure exactly who) decided to rely on a chained distance north of the Chaffee monument. The calculated distance between the 43rd and 44th parallels was 69 miles 2.38 chains. While this might seem more costly and time consuming, the fact is that it had already been done two years earlier by Rollin J. Reeves in his survey of the Dakota/Wyoming Territorial line. Reeves surveyed north from the Chaffee monument, setting wooden mileposts to the 45th parallel on the south boundary of Montana Territory.

Knowing how unreliable the chaining methods of that day were, it seems risky to me that a County line survey would be based on such a long distance. Just how good was it? To begin with, more modern measurements place the Chaffee monument about 230 feet north of where it should have been. Reeves work was retraced in 1908 by Edward Stahle, who replaced the wooden mileposts, with quartzite monuments. Stahle's records show that between Chaffee's monument and milepost 56 the measure was 249 feet short, which would have compensated for the error in the Chaffee location. Stahle stopped at milepost 56 because W.A. Thorn had already retraced Reeves work from milepost 81 southward to milepost 56, replacing the wooden monuments with brass capped Forest Reserve monuments. Between mile posts 79 and 56, Thorn found only two miles in excess of 80 chains, with one of those being 628 feet long. The remaining miles were short by 980 feet.

Between Chaffee, Stahle and Thorn, the 79th milepost was probably in the range of 350 feet from where it should have been. Not good, but not bad either. Does that mean the line should be moved today? No! The early work was done in good faith by reasonably equipped men and was marked on the ground. The rights of the adjoiners that have relied on those marks for more than 130 years remain unchanged. To attempt to do so invites unending chaos.

Scott starts his survey on June 15, 1879 at the point ten miles north of the 44th parallel on the Territorial line by marking it with a pine post five feet long, six inches square, set two feet in the ground. As a further (and perhaps more permanent) landmark he erects a pile of stone three feet high and six feet at the base nearby. He then dug three pits, each two feet square and 18 inches deep to the north, south and east. Finally, he calls out the direction and distance to three bearing trees, noting their species and diameter.

Scott then proceeds east, apparently with one set of chainmen (instead of two as is the case for most of the important surveys) deeming that accuracy in measurement was secondary to remaining on the correct alignment. This is not as easy as one might think as a line following a parallel will curve slightly similar to the lines of latitude as seen on a globe. At this latitude, the radius of that curve is roughly equal to the earth's radius of 3960 miles. Scott calls the distance along the line to physical features such as ridges and ravines whenever they were crossed. At a half mile, he sets a slightly smaller post (four inches square) five feet long, two feet in the ground with County identification on the north and south sides. There were no rock mounds or pits but an aspen bearing tree is called out. At one mile a similar post is set and marked with "1 M" scribed on the west side. He proceeds eastward in a similar manner to milepost 5 where the days work ended.

The posts described were likely not squared throughout their entire length. The top foot or two was squared with an axe or machete to provide a flat surface for inscription with a timber scribe. I have found such posts while retracing other projects.

In the Black Hills, the post species are of pine, spruce and aspen. In the foothills to the east, Scott uses mostly oak. On the plains he resorts to cottonwood. These were cut on site from the nearest trees available. With the passing of time and prevalence of wild fire, the posts would be lost or difficult, if not impossible, to find. Posts would also have been lost or destroyed during local cultivation.

At 82 miles 70.13 chains, Scott reaches the edge of water on "the South Fork of the Cheyenne River" on June 29th, just two weeks after he began. Scott was lax in his notes about mentioning the dates of each days work.

Finding the original monuments today will be difficult, but not entirely impossible. In the Black Hills, some bearing trees may still be alive or, if dead, still evident. The Cheyenne River breaks may also prove fruitful. In a few cases, those monuments may have been referenced by other nearby surveys in the past. Scott even mentions a tie near his 46th milepost to a township line section corner he had set one year earlier. Such references can serve to restore the original location. However, the research to find such references would be very laborious and time consuming.

Some may think that Scott's feat of measuring and marking a line of nearly 83 miles in two weeks was exceptional. Actually, Scott was slowed by the terrain, vegetation and the use of more elaborate monuments. He went on to do more section line work for the Survey General that season amounting to another 1345 miles of chaining.

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Nominations for 2013-2014 Officers & Board of Directors

President
Robert L. Ubben, PLS

Robert is a Principal at Affinis Corp., located in Overland Park, Kansas. He joined Affinis in 1988 and has been in charge of all survey department services for nearly a decade. Licensed in Missouri in 1995 and in Kansas in 1997, Robert works primarily in the Kansas City Metropolitan area and surrounding counties. He has an Associate of Science in Land Surveying from Longview Community College, located in Lee's Summit, Missouri.

Robert is a member of the Kansas Society of Land Surveyors and the Missouri Society of Professional Land Surveyors. Robert has worked as a part time instructor teaching Legal Aspects of Surveying at Longview Community College during fall semesters. Robert and his wife Amanda have two children, one grand child, and live in Raytown, Missouri. Robert and Amanda enjoy spending time with their son at high school band and sporting events, and babysitting their granddaughter.

President-Elect
Adam Teale

Adam Teale is a Principal at Midland Surveying, Inc located in Maryville and St. Joseph, MO. He is responsible for static GPS control surveys, mission planning, and post-processing of geodetic control. He is also responsible for project scheduling, research compilation and cataloging, analysis and review of field surveys, platting, and government corner registration. Adam is currently chairman of the Membership Committee. Adam has a B.S. in Geography and Surveying from East Tennessee State University. He is a licensed professional surveying in Missouri, Iowa, and Illinois and obtained certification as a Certified Federal Surveyor in 2009.

Adam and his wife Anna of 13 years enjoy supporting their two children in their various activities.

Vice President
Jim Mathis

Jim Mathis is owner and operator of a surveying/engineering business in Southeast Missouri and has practiced land surveying for over 40 years. He has extensive experience in contract cadastral surveying for state and federal agencies and is responsible for the perpetuation or establishment and registration of over 3,300 corners of the U.S. Public Land Survey System. He is a past member of the Land Surveying Division of the Missouri Board for Architects, Engineers, and Land Surveyors, and currently serves on the MSPS board of directors.

Secretary-Treasurer
Stan Emerick, PLS

Stan has been a professional land surveyor for more than twenty five years, working for some of the more prominent surveying firms in the St. Louis area. He has served as Chairman of the Land Survey Advisory Committee and is currently a Director for the Missouri Society of Professional Surveyors. He also chairs their History Committee and co-chairs the Standards Committee and contributes articles to the Missouri Surveyor. Stan is licensed in three states and currently works as a Survey Coordinator for the Farnsworth Group, located in Webster Groves, Missouri.

Secretary-Treasurer
Joe Clayton

Joe Clayton is an eighth generation Missourian with over 30 years of experience in surveying and mapping. Joe has a diverse background that includes work in high-order geodetic surveys, transportation, land surveying, photogrammetry, technical support, training and project management. Joe is the current head of surveying operations for the Missouri Department of Conservation; in this position Joe manages the statewide boundary and engineering survey programs.

Joe is a graduate of the U.S. Army Field Artillery Survey School; he has under graduate course studies from three Missouri Universities and is a certificate candidate of the Land Survey Program of the University of Wyoming.

Joe is a founding member of the Southwest Chapter of MSPS. Joe is the current MSPS Liaison to the Missouri GIS Advisory Council where he chairs their Policy and Legislation committees. He is the chair of the MSPS GIS/Vision 21 Committee and is an active member of the Legislative, Nominations and Standards committees.

Joe and his wife Michelle reside in Jefferson City and are proud parents of an adult son and three teenagers with a grandchild on the way!

Joe is honored to have this opportunity to serve the Society and the surveying profession.

Mark Your

MO-KS Joint Meeting

Overland Park,

Nominations for 2013-2014 Board of Directors

Robert J. Anderson, PLS

As a fourth generation land surveyor Mr. Anderson started his career working summers as a chainman for his father James S. Anderson. After high school he continued working at Anderson Survey Company and pursued his education in Land Surveying classes at Longview College. In 1998 Mr. Anderson was promoted to Crew Chief. He is also proficient in AutoCAD and is able to fulfill the needs of Anderson Survey Company in either capacity.

Mr. Anderson received his Land Surveyor in Training license (LSIT) in Missouri on July 6, 2004. After several years of practical experience and study he received his Professional Land Surveyor license (PLS) on January 1, 2010.

Mr. Anderson is a member of Missouri Society of Professional Surveyors, and is currently serving on the Membership and Legislative Committees.

Susanne Daniel

Susanne is owner of Daniel and Associates, Surveying and Mapping in Ozark, Missouri. She has over 20 years of experience in surveying and earned her professional surveying license in 2001. Susanne has studied chemistry and mathematics at Missouri State University and holds a B. S. in Geology degree. She is active in state and local politics and serves on the MSPS legislative committee. Susanne enjoys tennis, playing flute in her church orchestra and volunteering in a lawn care ministry. Susanne and her husband Andy currently reside in Ava, Missouri where he serves as Douglas County Surveyor.

Michael D. Gray, PLS

Michael began his surveying career in 1970 as an Artillery Surveyor in Vietnam. After leaving the Army early in 1972, he went to work for Anderson Engineering, Inc. in Springfield, Mo. He received his license in 1981 and was made survey department manager a position he held until 2007 when he left Anderson, founding Gray & Associates, LLC, partnering with his two sons Michael and Matthew. Mike is a past president of the Ozark chapter of MSPS and served 8 years on the State licensing board for Architects, Professional Engineers, Land Surveyors and Landscape Architects, survey division. He served as division chair and vice chair of the board. During his career he has worked on over 150 miles of Corps Lake boundaries, Forest Service boundaries, Conservation Commission boundaries, pipe lines, electric transmission lines, airports, bridges, right-of-way and design surveys for the Branson High Road, shopping malls, mine surveying open quarry and underground, easements, microwave and cell tower sites, subdivisions, rural surveys and lot surveys. He enjoys spending time with his three grandsons going to ball games. He is currently working with Mike and Matt building the firm for the next generation of Gray surveyors.

Mark Wiley

Mark is a Second generation Surveyor who currently manages the Surveying Department for Heideman + Associates Inc. Licensed in Missouri in 1991 he has done course work at St. Louis Community College, Mineral Area Community College, and the University of Missouri Rolla in Surveying related courses. He began his career prior to 1978 working for his father during the summers and on weekends and has continued in this profession ever since. Working for himself in Ste. Genevieve from 1994 to 1999 he set a precedent in prescriptive Road Cases. He has worked in Metro St. Louis and in the Springfield area, as well as Jefferson, Ste Genevieve, St Francois, Franklin, and Washington counties during his 35 year career.

Mark currently chairs the MSPS Recording Steering Committee in hopes that someday there will be an end to the debate surrounding this emotionally charged issue. In addition to this he is the President of the Belews Creek Watershed Partnership which is a group of local folks who are working to make a difference in the Watershed by both cleaning and stabilizing the creek.

r Calendar

Oct. 23-25, 2014

Kansas

Agrimensores: The Roman Surveyors

by Paul S. Pace, PLS, Reprinted from *The Nevada Traverse*, Vol. 40, No. 1, 2013

Five thousand heavily armed, combat-hardened Romans stood in disciplined silence, watching and waiting. Opposing them were the armies of the Silures, their faces painted red and blue for the coming battle and yelling taunts and insults at them. The Romans were the soldiers of *Legio II Augusta*, the Second Augusta Legion, one of four legions occupying Britain in AD 74. All were Roman citizens, paid professionals who volunteered for a 20 year career in the army. The legion had rightfully earned its formidable reputation, fighting in Macedonia, Spain, northern Italy and Germany before the amphibious landings in Britain.

The terrain prevented the Romans from bringing their heaviest artillery to bear on the Silures, but each legion was equipped with 60 smaller *ballistae*. These were torsion catapults capable of rapidly firing iron-tipped bolts toward the enemy with lethal accuracy at short ranges, or being launched in clusters at more distant, massed troops. On command, the *ballistae* crews shot their bolts toward the Silurian ranks, waiting beyond the Roman formations. The Romans, standing in cohorts, reformed into lines. They were given the order to advance, while the Silures braced for the cloud of bolts flying toward them.

Roman archers were in short supply in *Britannia*[1]. If the Second Augusta had them, they likely would have been axillaries from Syria. They too would have launched their hundreds of arrows now, further thinning the Silurian line. As the armies advanced toward one another, light cavalry covered the Roman flanks. A trumpet sounded, signaling the front ranks of Romans to throw their *pila*, javelins about 6 feet in length and tipped with a pyramidal iron point on a thin iron shank. Each legionary carried two *pila* and was well trained in their use. The lighter infantry of the Silures reeled under the impact. Finally the armies met head on in hand to hand combat, in another clash of civilizations.[2]

The Second Augusta landed in Britain with the main Roman invasion force in AD 43, together with three other legions: *IX Hispania, XIV Gemina and XX Valeria Victrix*. By circa AD 50 the Second Augusta had advanced across the southern portion of the island and constructed the fortress of *Isca Dumnoniorum* in Britain's southwest, the site of modern day Exeter. Together with the other legions, they went on to subdue most of the tribes in the southern two thirds of the island. But there was stubborn resistance from others in far western Britain, notably the Silures and Ordovices, Celtic tribes living in what is now Wales. They successfully withstood periodic Roman attacks for 30 years.

Newly appointed provincial governor for Britain, General Sextus Julius Frontinus was tasked with, among other things, pacifying the Silures. He was a combat veteran, a successful senior officer or possibly first in command of a legion that suppressed a revolt in Germany in AD 70. Frontinus came to *Britannia* shortly afterward and in AD 73 was elected to *consul suffectus*, a very high political appointment, adding to the prestigious posts he had held in Rome. This raised him to an appropriate rank for still higher office. Soon in fact, he was appointed governor of Britain. The new governor might have preferred a more peaceful resolution to the conflict with the tribes, given his history of leniency toward vanquished enemies. But that was not to be.

Realizing that intermittent raids on the Silures were unproductive, General Frontinus changed the game. He chose to exert pressure from a new direction by building a fortified town inside Silurian territory. That site was located at present day Caerleon, South Wales, about 13 miles northeast of Cardiff, along the tidal portion of the River Urk. Men and supplies could be brought in on ocean going transports, and sorties sent out from there into the countryside. At that point the legion's surveyors, called *agrimensores*[3], likely accompanied by an armed escort and the *augurs*, priests whose mission was to ensure the location was pleasing to the Roman deities, were sent in to locate the fortress proper and river quay. The place was named *Isca Augusta*. The surveyors were sometimes called *gromatici*[4], after the *groma*, a type of surveyor's cross in common use, or simply *mensor*, a "measurer."

The tribes of southern Britain fought the Romans with savage ferocity, but they fought as individual groups. Neither their valor nor their fierceness sufficed to turn back the legions of the Imperial generals. In the end, the *Legio II Augusta* broke Silurian resistance; the Ordovices were systematically reduced over the next few years. Later, the Roman historian Tacitus would sum up Frontinus' decision to penetrate Wales: "...on the Silures neither terror nor mercy had the least effect; they persisted in war and could only be quelled by encamping in their country."[5]

From the earliest days of the invasion the Romans began strategic planning for the occupation of *Britannia*. This work demanded systematic surveys of the occupied territories, with an eye toward building new roads, forts and towns, as well as densifying communication networks. Today there is growing evidence of these kinds of large scale Roman military surveys in Britain. Roman fortresses, including *Isca Augusta*, can be seen fitting onto a larger, systematic pattern, built predictably at multiples of Roman miles.[6] Other evidence shows forts coinciding with typical Roman land divisions, similar to those found on the

Continent and North Africa.[7] This suggests that Frontinus directed military surveys as he waged his campaign against the tribes. He anticipated the construction of new forts and other military works, based on maps by the Legion's *agrimensores*. General Frontinus, as we will see later, was among the first to write in detail about land surveying in the early years of the Empire.[8] His interest in surveying may have begun as a military necessity, but it remained with him the rest of his life.[9]

Surveyors attached to Roman legions were part of the *immunes*, those troops with special skills, who were exempt, or immune from normal fatigue duties such as road and fortification building. Together with the surveyors, the *immunes* included the engineers, armorers, medical staff, etc. They reported to the *Praefectus castrorum* or Camp Prefect, who was, in the army's highly structured establishment, the legion's third in command. Every legion had teams of surveyors, *gromatici* and *metatori*[10]. These troops were the advanced party who were to select and then stake out each *castra*, or fortified field camp, while the legion was on the march. This entailed some effort, for in addition to laying out a structured campsite for thousands of soldiers, the *castra* were always fortified by a rampart and a ditch.

The surveyors also had responsibility for staking larger and more permanent installations such as *Isca Augusta*[11], towns, numerous paved military roads, etc. All of it was accomplished with larger strategic goals in mind and based on maps the army surveyors compiled. Later, several legions including the Second Augusta, built the 73 mile long Hadrian's Wall and the 39 mile Antonine Wall. Both walls spanned the island east-west from the North Sea to the Irish Sea, and by turns marked the northern limits of the Roman Britain. Difficult to conquer with scant natural resources, the lands, and people, of the north were walled off from Roman influence, contributing one could suppose, to the distinct cultures that remain on the island today.

The Second Augusta would continue to remain a viable military force in Britain until the 4th Century AD. With such a long military presence, provisions had to be made for retiring legionaries who, though no longer on active military duty, had a residual reserve commitment to the army. Large tracts of land called *coloniae*[12] or colonies, were set aside for these veterans, all of which was surveyed and mapped. *Coloniae* were also created for civilian colonists elsewhere, on occupied lands conquered by the legions.

Early in Roman history there were certain religious commonalities between the surveyors and the *augurs*, reflecting the reverence Romans held for the land. Terminus, the god of boundary stones, was honored on February 23rd of each year, the Feast of Terminalia. Burnt offerings were made at the boundary stones in Terminus' honor. Surveyors later took the ashes from these sacrifices as evidence of original monuments.[13] Terminus was honored for not only protecting private property, but for protecting Rome's frontiers from foreign enemies, as well. By the First Century AD surveying was more secularized, and the rituals of the augurs waned. The practice of the surveyors increased, though many of the old customs remained. To move a boundary stone was regarded a civil as well as religious offense. As we do today, surveyors stressed the importance of finding original monuments in place. But they were more than technical experts, they were legal experts as well; because of their knowledge of land law, they were often called upon to arbitrate disputes.

Civilian surveyors were also referred to as *gromatici* or *agrimensores*.[14] In fact, many civilian surveyors began their careers as *gromatici* in the legions. They are generally believed to have used the same instruments and techniques as their military counterparts, but little data has survived to confirm or deny that. They both used standard Roman linear measurements although the military favored the *passus*, while civilians generally used the *pes*, particularly in urban settings. The units break down as follows[15]:

Roman Unit	English Name	Roman Equivalent	English Equivalent
Digitus	Digit	1/16 pes	.06 feet
Palmus	Palm	1/4 pes	.24 feet
Pes	Foot	1 pes	.97 feet
Gradus	Single Step	21/2 pedes	2.4 feet

Roman Unit	English Name	Roman Equivalent	English Equivalent
Passus	Double Step	5 pedes	4.9 feet
Actus		120 pedes	116.5 feet
Mille passuum	Mile	5000 pedes	4854 feet

Likewise, Roman surveyors used standardized units of area [16]:

1 sq actus (*actus quadratus*)	14,400 sq Roman feet (or about 0.312 acres)
2 sq actus = 1 *iugerum*	28,800 sq Roman feet
2 iugera = 1 *heredium*	or heritable plot (about 1.246 acres)
100 heredia = 1 *centuria*	(124. 6 acres)

The Roman system of land division was rectangular in nature and often oriented on or near cardinal directions. For this procedure, the *agrimensor* would locate south, approximately with a portable sundial, or much closer by the use of a *gnomon*, marking shadows on the ground, before and after midday, measuring and bisecting the marks and delineating a north-south line from the observer. Latitude determination was also possible with a *gnomon*, based on a ratio of the *gnomon's* height and length of its shadow.

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Agrimensores: The Roman Surveyors *(continued)*

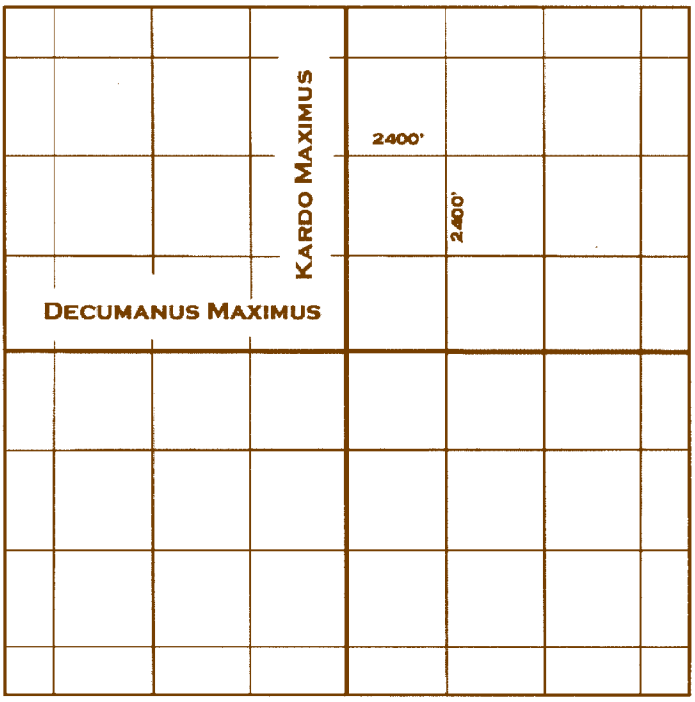

Figure 1. Typical Roman Centuriation Scheme

Often however no particular cardinal direction was applied to an axis, instead orienting the system to existing roads or terrain features. There is evidence that extensive surveys in North Africa were aligned with sunrise on the winter solstice." This rectangular form of land division is referred to *centurtatio or limitatio*, and in English as "centuriation". The land was subdivided into *centuriae* or centuries, squares of 20 x 20 *actus*, or 2400 Roman Feet on a side, for purposes of subdividing and mapping new lands, defining land status and levying taxes, as shown in Figure 1. These squares contained roughly 124 acres and could be subdivided, similar to aliquot parts, into 100 smaller squares called *heredium*. The usual size of an individual land holding in the early Empire was 50 or 662/3 *iugera*, about one quarter or one third of a century. If needed, these could be subdivided still further into smaller lots.

The *kardo maximus* (KM) was construed to be the theoretical north-south axis and the *decumanus maximus* (DM) the east-west axis of the grid. Those names also applied to the main streets in Roman towns and forts, again at 90º to one another, regardless of orientation, and were often extended out from the town, to orient the surrounding centuriation.

Figure 2. Surviving patterns of centuriation near Carthage, Tunisia. Photos dated 9/23/2012, from Google Earth website.

This scheme was used across the Empire. The *agrimensores* monumented *centuriae* intersections with stones marked with the appropriate distance from each of the axes. Much like individual townships in the US Public Land Survey System, centuries were counted right or left of the KM and above or below the DM. The surveyors covered vast areas with centuriation grids. Surviving centuriation stones in Roman North Africa indicate they extended as far as 140 centuries from the DM and 280 centuries from the KM, or about 62 miles and 123 miles, respectively.[18] Stones at greater distances from the initial point may yet be found. In the case of North Africa, the surveys were usually done by the army instead of civilian surveyors. Modern surveys of widely separated, centuriated boundaries on the Saône Plain in eastern France show a linear accuracy of 1:2500.[19]

Like certain tracts on U.S. Public Lands, rights of way for roads called *limites* were provided along or sometimes within the century lines. Because this process so profoundly shaped the Roman landscape, evidence of centuriation remains today in many places, particularly on the plains of the Po River Valley in northern Italy, the Iberian Peninsula, France and North Africa, as shown in Figure 2. And lest anyone in those places forget: beyond its practical uses, centuriation was a clear demonstration of Roman hegemony.

The Romans created *cadastres*, or land information systems, which could be based on centuriation or other irregular surveys. The external boundaries of colonies

were often irregular and if centuriation occurred within the colony, it may have been done after the colonial boundary was surveyed. Frontinus explains here how the surveyors could tie the centuriation lines to the previously surveyed irregular boundary of a colony:

"But in order to preserve the shape at all extremities, and specify the area of enclosed land, we shall measure the land with the straight lines as far as the arrangement of its features permits. Starting out from these lines we embrace each oblique (line in the) perimeter by making normals (from the straight lines) to all the angles. Then ... we transfer (the shapes) to the draft map, to scale. We calculate the area enclosed inside the lines using the system of right angles."[20] *See Figure 3.*

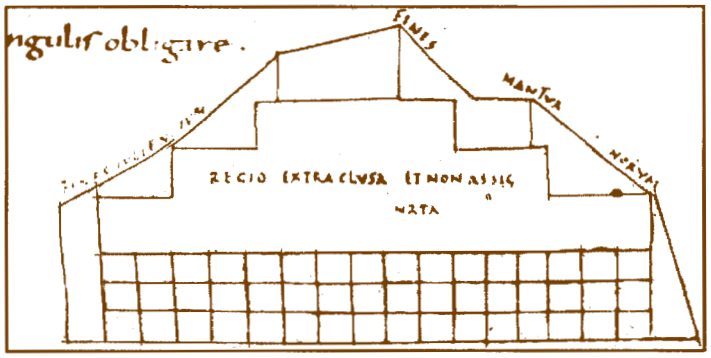

Figure 3. Location of exterior colonial boundaries in relation to rectangular system of surveys. From Hyginus Gromaticus.

No doubt detailed maps or *formae* were prepared from this work, though only fragments remain. Oftentimes maps were made on bronze sheets, but unfortunately, none of those have been found. Centuriation dates back to the 4th Century BC, but its use increased steadily with time. As a consequence, the numbers and status of land surveyors in the Roman world increased.[21] By the beginning of the Empire formal training of civilian surveyors was organized, eventually leading to a large and elaborate civil service. Other aspects of the profession, such as new rules for marking boundaries, arbitrating boundary disputes, etc., were regularly introduced.

Despite the volumes written after the fall of Rome, little survives from antiquity regarding Roman surveying instruments and techniques. But there are a few sources, including the *Corpus Agrimensorum Romanorum*[22], a collection of Latin texts compiled from the 1st through the 6th Centuries AD. Copies of the texts survived over the centuries through the efforts of Scholastic monks laboring in the monasteries of Medieval Europe. Nevertheless, there were over time errors in transcription, translation, or the proper interpretation of some of the more technical aspects. The work was first printed In France in 1554, after its discovery at the Benedictine monastery of St. Bertin, about 1545. It deals with various aspects of land surveying, including field techniques, geodesy, instruments and legal standards for the division of lands. There were several authors whose writings are found in the work, including Hyginus Gromaticus, a Second Century AD Roman surveyor whose surname is derived from "groma". The best known of them, however, is Sextus Julius Frontinus.

Frontinus returned to Rome in AD 78, after a successful tour in *Britannia*. He went into semi-retirement and began writing on a number of subjects of interest to him, including a work entitled *De Re Militari* or "On the Military". However, about AD 83 the emperor Domitian called Frontinus back to the Army. German tribes continually harassed the legions and Frontinus was tasked with building 120 Roman miles of military roads and, or fortifications through the heart of densely forested mountains, pushing out the frontier and improving security for Roman forces. It is suggested that he had a relatively small force of combat engineers and surveyors with which to execute this task, which in addition to the actual construction, entailed extensive surveying and mapping.[23]

Upon returning to Rome, Frontinus resumed his writing, including his works on surveying and land management: *de agrorum qualitate, de controversiis, de limitibus* and *de controversiis agrorum*.[24] Frontinus by his own admission only undertook tasks he had intimate knowledge of. How he obtained his extensive knowledge of surveying remains unclear. In addition to his military experience with surveys, he may have held a position of Land Commissioner, whose tasks included directing surveys of the *coloniae*, settling boundary disputes, granting title to land and other land use issues. In any case, he was a pioneer in writing about the legal and technical aspects of surveying including various types of boundary disputes[25], all of which will sound familiar to any modern surveyor:

(continued on next page)

1. *disputes about the position of boundary markers*

2. *disagreements over lines between 2 or more boundary markers*

3. *disagreements over the line of any boundary extending beyond the line as surveyed, or when a preexisting boundary cannot be reliably re-established on the ground*

4. *disputes based on a claim to a certain area of land, arising when the terms of title or ownership do not stipulate the precise boundaries of the plot in question*

or, questions of ownership, including:

1. *disputes about ownership dealing more with the validity of title than with the location, extent or boundaries of the property*

2. *disputes about possession involving the acquisition of property by means other than title*

3. *disputes about the territorial jurisdiction associated with a given community*

4. *disputes about rights of way*

as well as the use of instruments, such as the *groma*:

"Every part of a field no matter how small should be in the power of the surveyor and subject to his requirements in terms of right angle procedures. We must, therefore, be prepared to cross any obstacle that may present itself by means of the groma. We must also take care in measuring, so that a given movement can achieve a representation as close as possible to the proportion of the length of the sides."[26]

The *groma*, an alignment instrument for the surveyors, was a cruciform arrangement with suspended plumb lines to orient lines 90º apart. Remnants of these instruments have been recovered in archaeological sites around the former Empire, and a surprising amount has been written about them and their use. There is however very little remaining from antiquity about the construction of these instruments or their use. The same can be said for Roman survey instruments generally, as well as the techniques they used to employ them.

The *groma* shown in Figure 4 is patterned after the remains of one found in the ruins of the Pompeii, the Roman city destroyed by the catastrophic eruption of Mount Vesuvius in AD 79. The parts were found in the office of a surveyor. However, there is some disagreement as to the various designs used by the Romans; the one pictured here is but one of them. Several miscellaneous items and familiar tools were also found in the ruined survey office in Pompeii. They included a folding ruler, two bronze dividing compasses with iron points, a portable sundial, the bronze ends of a wooden measuring rod called a *decempeda*, parts of two wooden chests and miscellaneous hand tools, together with an ink bottle and stylus for writing.

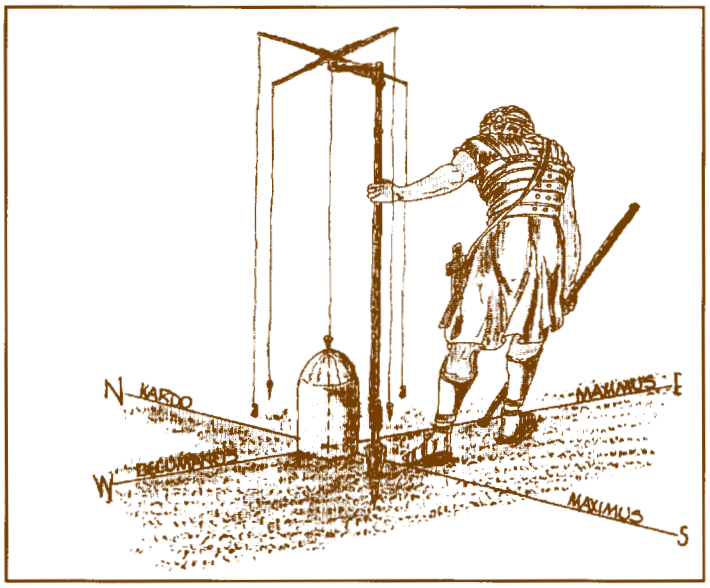

Figure 4. Army surveyor or *gromaticus* with *groma* at initial point of a survey. Drawing from M. J. Ferrar, *Cartography Unchained* website. *Used with permission.*

Surveying conventions for Roman surveyors required regular cross-checks during the layout of centuries. It seems clear that they weren't attempting complicated math in the

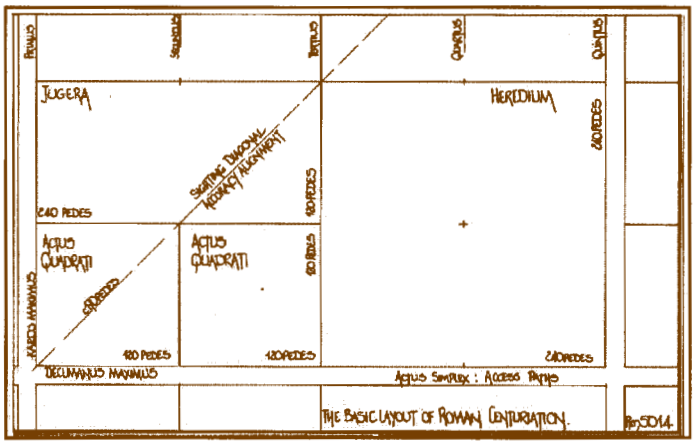

Figure 5. Subdivision of a century and cross-checks. Drawing from M. J. Ferrar, Cartography Unchained website. Used with permission.

field with Roman numerals, however field tables similar to those issued to U.S. cadastral surveyors seems a reasonable alternative. The *groma* can be seen as a convenient instrument for local surveys, such as Roman army camps, small fortifications and the subdivision of *centuriae*. It is difficult to imagine that this instrument could be used accurately over the distances centuriation extended, sometimes covering hundreds if not thousands of square miles. Some other means of surveying the vast tracts of Roman land may have been used in large scale cadastral projects. Figure 5 shows a cross-check across the subdivision of a century.

(Endnotes)

1 Latin for Britain, the island's name was derived from ancient Celtic.

2 No written account of specific battles with Silure warriors survives. The scene depicted is typical of Roman warfare during the First Century AD.

3 *Agrimensor* in Latin literally means "field measurer", or in modern parlance, "land surveyor". The word is similar to the modern Italian equivalent: "agrimensore".

4 *Gromatici* were literally "users of the groma", the principle surveying instrument of the Romans. See *A Dictionary of Greek and Roman Antiquities*, John Murray, London, 1875.

5 *Lost City of the Legion: New Discoveries on the Site of the Roman Fortress at Caerleon*, Cardiff University, 2011

6 *From the Dee / Humber to the Solway / Tyne, AD 70 The Roman Disposition of Fortresses and Forts*, from Michael J. Ferrar's outstanding website, Cartography Unchained (http://www.cartographyunchained.com)

7 *Flavian Fort Sites in South Wales: a spreadsheet analysis*, J. W. M. Peterson, University of East Anglia

8 The 500 year old Roman Republic ended in BC 27 with the ascension of Octavian who was granted the use of the names "Augustus" and "Princeps" making him Rome's first Emperor.

9 Some historians have suggested that Frontinus may have been trained in surveying at Alexandria as a young man, educated at Heron's school of mathematics, but this is speculative.

10 The *metatores* were a type of "rod and chainman" who measured out camp limits with a graduated rod. The word is sometimes used interchangeably with *agrimensore, mensore* and *gromatici*, and other words, though some scholars see the *metatores* as a separate group within the army. Various terms for "surveyor" were used over the course of Roman history, some having a connection with class distinctions, others merely reflecting the different types of work. See *A Dictionary of Greek and Roman Antiquities*, John Murray, London, 1875.

11 The true extent of *Isca Augusta*, sometimes called *Isca Silurum* after the defeated Silures, has only recently been revealed. While the site has been known since the 19th Century, and extensive archaeological work done in the 1920's to uncover portions of the fort and a small coliseum, it has only been in the last years that the exact nature of the fortress and the extensive surrounding buildings, has been determined. Caerleon later became an important medieval center. See http://www.cf.ac.uk/ hisar/archaeology/crc/, the Caerleon Research Committee website.

12 Colonia Nervia Glevensium, located in modern Glouchester, England was the *colonia* for the Second Augusta legion. Retired legionaries were given farm land and stood as a reserve force if needed.

13 *Patricians and Plebeians at Rome*, H. J. Rose, *The Journal of Roman Studies*, 1922

14 Several name changes for surveyors have transpired throughout the Roman period. See *A Dictionary of Greek and Roman Antiquities*, John Murry, London, 1875.

15 *A new classical dictionary of Greek and Roman biography, mythology, and geography partly based upon the Dictionary of Greek and Roman biography and mythology*, Sir William Smith; Charles Anthon (1851) New York: Harper & Bros.

16 *The Roman Land Surveyors, An Introduction to the Agrimensores*, O. A. W. Dilke, 1971

17 *African Cultural Astronomy: Current Archaeoastronomy and Ethnoastronomy in Africa*, J. Holbrook, R. Medupe, J. Urania, 2008

18 *Roman Large-Scale Mapping in the Early Empire*, O. A. W. Dilke

19 *Flavian Fort Sites in South Wales: a spreadsheet analysis*, J. W. M. Peterson, University of East Anglia

20 *Interpreting mapping conventions in the diagrams of the agrimensores*, John Peterson University of East Angela, Norwich, November, 2004

21 *Surveying Instruments of Greece and Rome*, M.J.T. Lewis

22 The principle surviving manuscripts of the *Corpus* are to be found at Herzog August Bibliothek in Wolfenbuttel, Germany and the Vatican Library in Rome. These are copies of the original that were made in the 5th through 9th Centuries. It is one of the very few (non-religious, non-literary) scientific manuscripts from antiquity.

23 *The Career and Writings of Sextus Julius Frontinus*, Murray K. Dahm, Univ. of Auckland, 1997

24 Some historians ascribe the book *De Arte Mensoria*, On the Art of Surveying, to Frontinus, but this is not universally accepted. That he wrote some of the works contained in the *Corpus* is not doubted.

25 *Epigraphic Evidence for Boundary Disputes in the Roman Empire*, Thomas Elliot, Univ. of North Carolina, Chapel Hill, 2004

26 *Roman Surveying*, Issac Moreno Mello, 2004

Agrimensores: The Roman Surveyors

by Paul S. Pace, PLS, Reprinted from *The Nevada Traverse*, Vol. 40, No. 2, 2013

Rome's *gromatici* typically didn't have to concern themselves with elevations on boundary surveys. However, for large scale construction projects, such as buildings, bridges, aqueducts and the like, the surveyors needed instruments that could adequately provide for grade. Among the several choices for a leveling instrument was the *chorobates*. Its description was outlined by the Roman architect Vitruvius in the First Century BC. He described a long device with plumb bobs at the corners to square up the instrument, and a trough along the top edge to level it with water if needs be, eliminating the need for the bobs on windy days.

However, several interpretations of Vitruvius' instrument exist. In more recent times the preferred version is a 20 foot long, bench-like construct similar to the one shown in Figure 6. Long experience leveling in mountainous terrain suggests this unit is impractical, in particular for preliminary surveys of substantial engineering works like aqueducts, which are outlined below. Without the means to rotate the instrument longitudinally, and given the difficulty in preparing the instrument shown in Figure 3 for an observation in difficult country, another style of instrument from an older interpretation, as shown in Figure 7, would be more practical.[27] In addition, level rods with moveable targets are frequently mentioned in works discussing Roman surveying. Regardless, the Romans had some viable means to conduct large scale leveling projects with excellent results, judging from the truly monumental works they built.

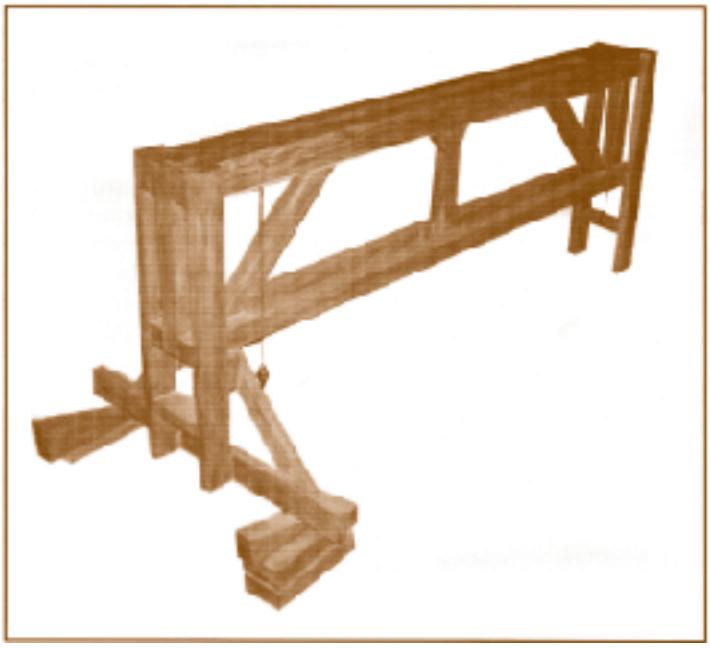

Figure 6. The Chorobates

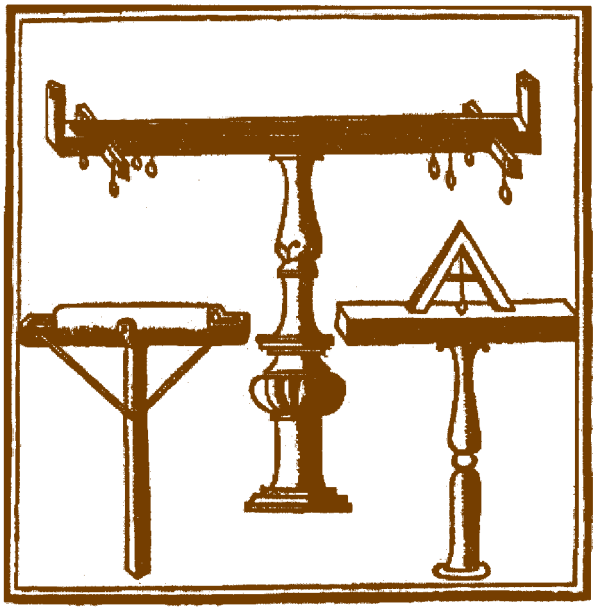

Figure 7. Alternate, older version of Chorobates. A scaled down demonstration model Fra Giovanni Jocundus, AD 1511

Another type of level mentioned, though always in vague terms, is the *libra aquaria*, or water balance. That instrument suggests a glass tube with upturned ends filled with water which allowed the water level at each end to be used as a sighting device. This kind of device would seem to have many advantages, particularly after the invention of glass-blowing in the last century BC.

An instrument, spoken of by the Greek mathematician Hero[28] but thus far not found in Greek or Roman archaeological sites is the *dioptra*. It is described as a sighting instrument that could measure horizontal and vertical angles by turning threaded screws, not unlike the familiar tangent screws on an engineer's transit. It would seem to be a very practical instrument for all manner of surveys and astronomy. While there are many interpretations, its exact appearance remains a mystery. See Figure 8.

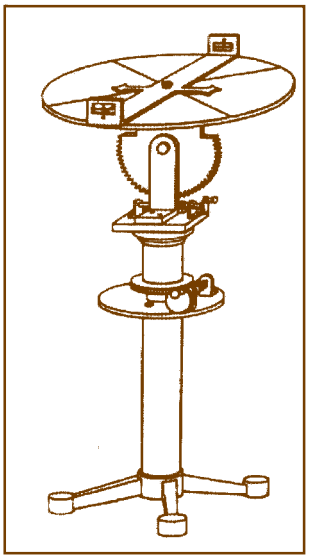

Figure 8. Reconstruction of Heron's dioptra, from Schöne, 1903.

Hero is credited with an additional instrument, a water leveler, which would fit on the base of the *dioptra*. This unit, similar to the *libra aquaria*, operated by means of water in a glass tube which seems capable of more precise leveling than a *chorobates*. See Figure 9.

The Romans used numerous methods for measuring linear distance. Pacing included several different units, as noted. They also used the familiar braided ropes or cords, which were pre-stretched and coated with wax and resin to preserve their length. Graduated rods called *decempeda*, Latin for "ten feet" and in fact ten Roman feet in length, were also used. The *decempedae* were fitted with bronze end caps and were used, in groups of two or more in leap-frog fashion, for measuring reasonably short distances. Also mentioned in the ancient texts is the *hodometer*, an early form of odometer housed in a small cart used for counting Roman miles. This may have been used to establish mile posts, a feature of important Roman roads.

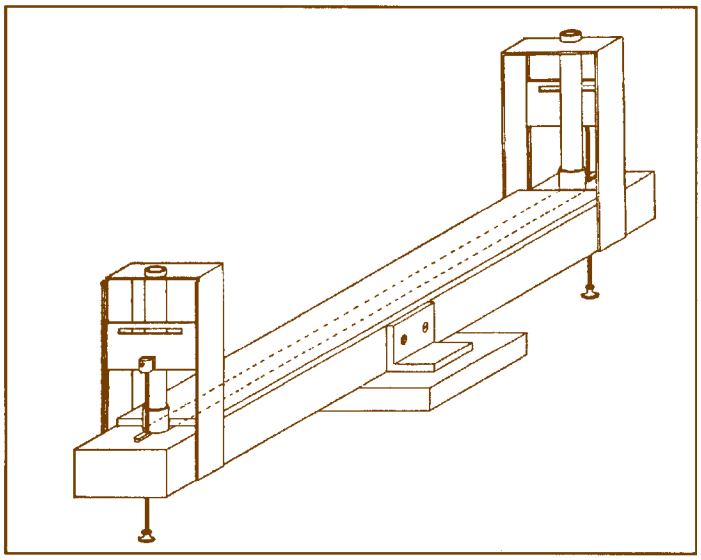

Figure 9. Reconstruction of Hero's leveler.
From *The Roman Land Surveyors, An Introduction to the Agrimensores*

Of interest in discussing measuring rods is the Italian municipality of *San Giorogio della Pertiche*. It is in an area near Padua, Italy which even today still bears the distinct imprint of centuriation. *Pertica* is the Italian word for "surveyor's rod" and a *perticatore* is a less-used alternative for surveyor, or "one who uses the *pertica*". It went into the French as *perche*, and then into English as the perch, which we recognize today as a "pole", a "rod" or 1/4 Gunter's chain, equivalent to 16.5 feet.[29]

Frontinus returned from the German campaign no doubt expecting to resume his writing full time, but in circa AD 86 he was called back into service by the emperor Domitian. The emperor named him *proconsul Asiae*, governing what is now western Turkey. He left for the city of Hierapolis to deal with, among other things, a pretender to the Roman throne. He returned one year later, capping off what most historians think was a successful tour there, somehow avoiding the complicated and sometimes lethal entanglements of high level Roman politics. His successor in Turkey was less fortunate. He was executed for his failure to suppress the ongoing threats to Rome.[30]

Frontinus went back into semi-retirement, once again taking up his pen and writing *Strategemata*, or "Stratagems", a treatise on military strategies employed by the Greeks and early Romans. It was intended for use by generals in the Roman Army. But in AD 96, Domitian was assassinated. The following year, the new emperor Nerva appointed Frontinus to the Economic Commission to Decrease Public Expenditure, *Vvir Publicis Sumptibus Minuendis*, a nod to his reputation for honesty and integrity. It was probably not a coincidence that he was soon after appointed *Curator Aquarum*, the Water Commissioner for Rome. Historians speculate he received this commission based on his knowledge of surveying.[31] Running surveying and engineering operations while directing large groups of people were his natural terrain. In AD 98, he was elected *consul iterurn*.

The Romans built monumental buildings all over their empire. They constructed a vast network of paved roads and all manner of infrastructure nearly everywhere they went. Most often the surveying and construction for these massive public works projects was done by the army. Some of the most enduring and challenging of these, from the standpoint of the surveyors, were the aqueducts. In all, the Romans built over 800 aqueducts across the Empire, with over 3000 miles of channels. The longest of these served Constantinople, at a length of 155 miles. In Europe alone nearly 200 cities were provided with potable water via aqueducts,[32] including Rome itself. No other Western, pre-industrial city attained the scale and complexity of Rome, essentially reaching the dimensions of a modern metropolis with a population approaching 1,000,000. These projects were no doubt politically motivated; Rome's rulers chose to exert the will and spend the money to accomplish them.

Most of the total length of the aqueducts, something on the order of 80%, was in covered channels. Arcades and bridges were only employed for crossing rivers and deep canyons, when siphons could not be used, or across plains to maintain a grade line higher than the existing ground level. Grades were obviously critical, so preliminary surveys were needed to determine if the proposed source of the water was feasible for use and what alignments might be best suited. Often mountainous country intervened, so tunnels were used when necessary to shorten the alignment and maintain a reasonable gradient.

Two examples of Roman aqueducts serve to illustrate the wider problems facing the surveyors and hydraulic

(continued on next page)

Agrimensores: The Roman Surveyors *(continued)*

engineers. First is the water supply for the Roman colony at *Nemausu*, now the modern city of Nîmes, France. The only useable water to be found was at Eure Springs near Uzès, over 12 airline miles to the northeast. The source of the water, as determined by a preliminary survey, was about 39 feet above the terminus of the aqueduct, the water distribution basin located in the town. The length of the aqueduct required was about 30 miles in length. The overall gradient worked out to be roughly 1 in 4000.

Furthermore, the River Gardon, situated in a canyon, had to be crossed and a siphon was ruled out. The crossing required a limestone structure of 164 feet in height and over 1000 feet long to span the river canyon.[33] Today it is called the Pont du Gard, as shown in Figures 10, 11 and 12. The Roman engineers limited the heights of the arches to about 60 feet, to maintain stability. The foundations needed to support the 50,000 tons of limestone ashlar masonry were massive. To approach the required height for the Gardon structure, three tiers of arches were constructed, the water passing through a lined, covered channel at the top.

In 1743 a road bridge was constructed on the downstream side of the structure and was not an original feature of the Roman effort.[34]

But the height of the Pond du Gardon became a limiting factor in the gradient. While the location of the river

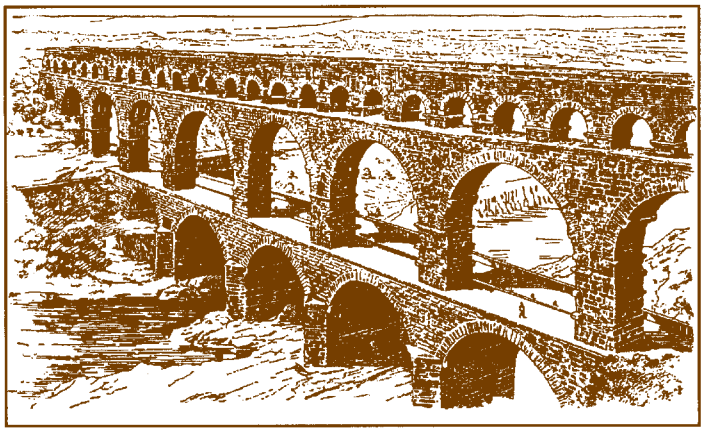

Figure 10. The Pont du Gard, the bridge and aqueduct over the River Gardon as it appears today. The 2000 year old structure is a World Heritage Site

crossing even now is regarded as the most suitable, the engineers could not risk more height, or weight, on the structure, already among the highest the Romans ever attempted. As a result about half the total fall was used in the first one third of the project.[35] With the terminus still 20 miles downstream, the surveyors had little room for error.

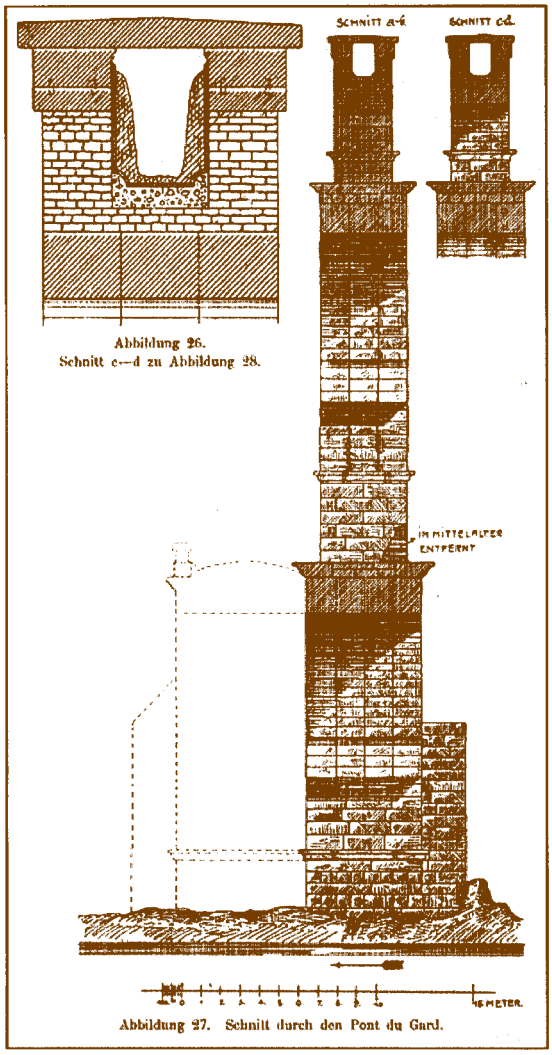

Figure 11. 1910 end section drawings by Stubinger.

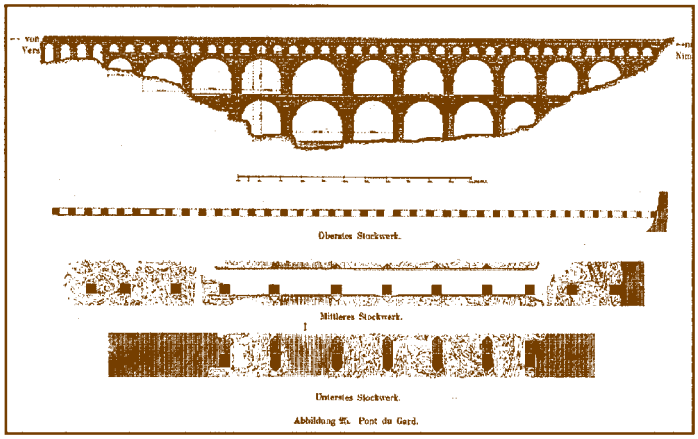

Figure 12. 1910 cross section drawings of arches by Stubinger.

(continued on page 34)

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Agrimensores: The Roman Surveyors *(continued)*

It would seem that a 20 foot long, bench-like *chorobates* was not suitable for this work. The required precision does not appear attainable and it would have been impractical in the mountains. Some other interpretation of the *chorobates*, or more likely the *libra aquaria*, would be a better choice for the surveyors responsible for the elevations on this enormous project.

The aqueduct had to negotiate mountainous country between the source and the town. In the way was a lake, with no good alternate route around it. The Romans drained the lake and constructed the aqueduct through it. Several tunnels, one 1300 feet in length, were also required to avoid lengthening the route and thereby impacting the already shallow gradient. The main channel of the aqueduct was concrete lined, with rubble masonry sides. The channel was covered and reburied after construction was completed. The alignment passes through the Forest of Rémoulins, which required clearing for construction. In addition the Forest is broken by 12 steep and narrow ridges known locally as "the combes". The valleys between the ridges were spanned with bridges of various types.[36] Modern surveys of the aqueduct reveal that the gradient varies a great deal over the length of the project. Nevertheless, the aqueduct operated successfully for 150 years. No writings on the survey methodology of the Nimes aqueduct have been found.

The second aqueduct of interest is situated in what is now southern Turkey and was constructed about AD 150. To serve the small city of Aspendos, famous now for its nearly complete amphitheater, the Romans built an 11 mile long water system. While relatively short in total length, the aqueduct crossed a broad, swampy valley before reaching the city and the engineers elected to build an inverted siphon across it. The siphon itself is over a mile long and was divided onto bridges of 505 feet, 3031 feet and 1942 feet, respectively. On each side of the valley they constructed towers where the water ascended from one bridge and descended onto another. Even with the uppermost 20 feet or so missing, the towers today are nearly 100 feet in height.[37] The two towers and central bridge are shown in Figure 13, while the bridges on either side of the towers are not.

The structures on either side of the towers, so called venter bridges, were added to reduce the pressure on the siphon by elevating it. The purpose of the towers is less clear. They may have been intended to reduce water hammer, further reduce the pressure on the pipes, or possibly to remove air from the siphons.[38] They essentially built three separate siphons for the system and the purpose for that can only be speculative at this point. But whatever the reason, precise leveling prior to the design would have been essential to the success of the project.

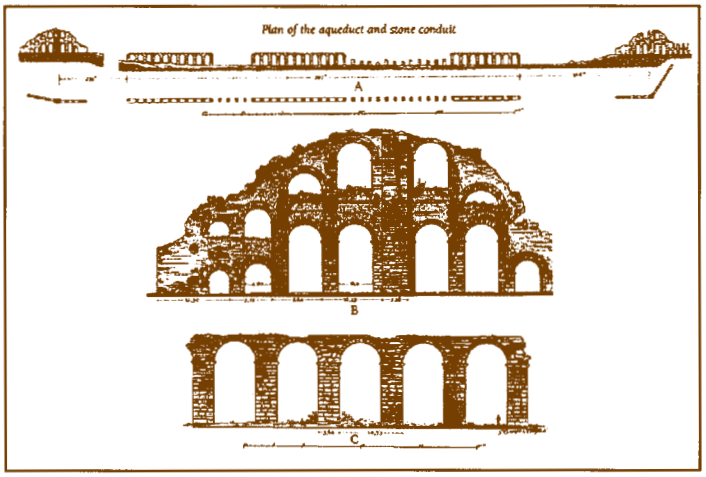

Figure 13. Towers and venter bridges for the Aspendos aqueduct. Drawing from Lanckoronski, 1890.

The system functioned for about 150 years and then was destroyed around AD 300, in what some historians think was probably a significant earthquake. Along with the aqueduct, an important bridge was also destroyed. The Romans did not rebuild the aqueduct, as it was severely damaged. Instead, they used the dressed stones from the aqueduct to rebuild the bridge.[39]

Optical instruments were obviously not available to the surveyors. All the projects the surveyors undertook were done by eye, with the most rudimentary of instruments. But, by what ever means these projects were surveyed, they are a testament to the skill of the Roman surveyors. The Romans undertook works that would remain unequaled in Europe for nearly 1000 years.

At the time Frontinus was appointed Commissioner, only 9 of the eventual 11 aqueducts supplying the city had been built. Of these, the longest was the *Aqua Marcia* with a total length of about 56 miles. It was built by the praetor Quintus Marcius Rex, for whom it is named, between BC 144 and 140. Fifty miles of the aqueduct were buried, the remaining 6 miles were above ground on arcades, etc.

As Water Commissioner, Frontinus had a staff of engineers, surveyors, clerks, and two crews of government workers totaling 700. These included inspectors, plumbers, masons, construction workers, etc., supposedly dedicated to the system of aqueducts. Instead he found that his predecessors had manipulated the system for personal gain. His crews of

(continued on page 36)

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Agrimensores: The Roman Surveyors *(continued)*

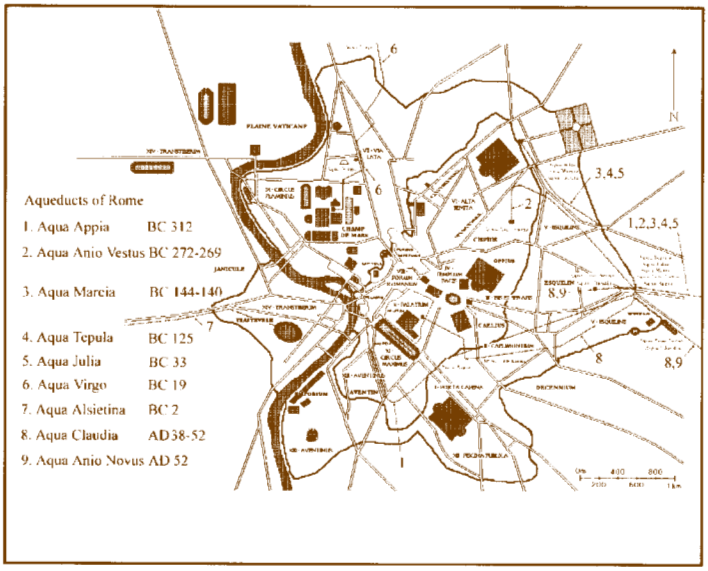

Figure 11. System of aqueducts in Rome proper at the time Frontinus was Water Commissioner for the City.

laborers were largely farmed out on the private business of others, money for the water system was diverted to other uses, the aqueducts were leaking and in disrepair and vast amounts of the public's water was stolen by private interests. The Commissioner moved quickly to end this unnecessary waste of public resources. He ordered the rights of way for the aqueducts cleared of trees and brush and called for regular inspections be carried out. Repairs were to be made during periods of low use, and the wholesale theft of the water ended. Frontinus next requested as-built maps for all the aqueducts coming into the city, sending the *agrimensores* out to map nearly 270 miles of existing works, most of it underground. From these, Frontinus was able, among other things, to direct maintenance, calculate expected volumes of water and anticipate demand.

While still in office, Frontinus once again turned his attention to writing, this time describing Rome's water system: *De aqueductu urbis Romae* "On the Water Supply of the City of Rome". This text too was saved for posterity by Benedictine monks, this time at the monastery at Monte Cassino, in central Italy.[40] His methods of determining volumes of water are flawed and difficult to follow. However, the text demonstrates that the Emperor Nerva and his successor Trajan, with the aid of talented professionals like Frontinus, undertook aggressive programs to improve the overall performance of the system. It also explains that some aqueducts were designed to provide water to public places, such as fountains and public distribution basins while others were, for a fee, distributed to private interests.[41] Frontinus may have also been involved with the planning of the aqueduct that was later begun by Trajan in AD 109.

Frontinus' text reveals him to be conscientious and competent in the administration of his office. He was the classic Roman: rational and pragmatic. In him, Romans found a faithful public servant who was dedicated to vigorously correcting the waste and abuse that proceeded him and improving the quality of life for all the citizens of Rome. That Frontinus was proud of his water system can be seen from his own words: "With such an array of indispensible structures carrying so many waters, compare, if you will, the idle Pyramids, or the useless, though famous works of the Greeks!"[42]

In AD 100, Frontinus was elected to the office of *consul tertum*, an extraordinary honor for a man not born to a royal family. He held as well the office of *Augur*. Many historians believe that he held the position as Commissioner until his death in AD 104, at about the age of 70. In a city filled with statuary and monuments to its worthy citizens, what of a monument to General Frontinus? "The expense of a monument is superfluous" he said, "My memory will endure, if my life has merited it."

Rome's surveyors reshaped the landscape of the Empire; evidence of their work is nearly everywhere in Rome's former dominions. The principles they developed survived the political, religious and social upheavals that eventually brought down the Empire and have come down through the ages to modern surveyors. Even now, Rome's legacy continues to have a lasting influence upon the societies of the West. As for Frontinus, during his own lifetime he was held in high regard by his fellow citizens, by the Roman Army, and by five emperors, from Vespasian to Trajan. 1900 years on, his memory rightfully continues to endure.

(Endnotes)

27 ibid.

28 Hero of Alexandria was a 1st Century AD Greek mathematician and inventive engineer. He describes his construction of several surveying instruments including the *dioptra*, but they are not mentioned by any writers in the *Corpus*.

29 *The Roman Land Surveyors, An Introduction to the Agrimensores*, O. A. W. Dilke, 1971

30 *The Career and Writings of Sextus Julius Frontinus*, Murray K. Dahm, Univ. of Auckland, 1997

31 *The Water Supply ofAncient Rome: A Study of Roman Imperial Administration*, Christer Bruun, 1991

32 *Surveying Roman Aqueducts*, Richard Hucker, UK, FIG Congress 2010, Sydney, Australia

33 *Roman Aqueducts*, http://www.romanaqueducts. info, a very interesting and useful site for researching Roman aqueducts.

34 ibid.

35 *Surveying Instruments of Greece and Rome*, M.J.T. Lewis

36 *Roman Aqueducts*, http://www.romanaqueducts.info

37 ibid.

38 *Roman Aqueducts*, http://www.romanaqueducts.info

39 ibid.

40 The monastery was built in AD 529 by St. Benedict, the founder of the order. During World War II it was occupied by German forces attempting to stem the Allied advance up the Italian peninsula. It was completely destroyed by Allied air raids in February, 1944. The Germans were finally dislodged from the ruins in May, 1944, at great cost in human lives. It was subsequently rebuilt after the war.

41 *The Aqueducts of Augustan Rome, How the waters from the aqueducts were distributed within the City of Rome as planned out by Caesar Augustus*, Andrew Weston, 2006

42 *Historical Encyclopedia of Natural and Mathematical Sciences*, Volume 1, Ari Ben-Menahem

Boundary Surveying

An Analysis of Three Authors Texts Frank Clark, Ray Skelton and Curtis Brown

by James K. Crossfield, LS, PhD, Reprinted from *"Wisconsin Professional Surveyor"*, June 2013

BIOGRAPHICAL SKETCH

James K. Crossfield has served as the Geomatics Engineering program coordinator at California State University, Fresno from 1991 - present. He served as chair of the Department of Civil and Geomatics Engineering from 2002-2009. He serves as Faculty advisor for the following student activities: The Fore Sight! magazine, The Student Association for Geomatics Engineering, The CLSA student chapter, the Lambda Sigma Honorary Land Surveying Society, and the Annual Geomatics Engineering Conference. Dr. Crossfield completed his masters (1997) and Ph.D. (1984) at UW-Madison. He taught at the University of Arkansas during 1978 and 1979 and joined the staff at Fresno State in August of 1984. He served as the ACSM Engineering Accreditation Commission (EAC) of ABET member from 1995-2001. An ACSM Fellow member, he also served as AAGS President in 1996. Licensed in Wisconsin and California he has worked tirelessly to attract, educate and graduate the best possible people to enter and lead this profession.

ABSTRACT

The primary books written by three great property boundary legal principle authors are compared. These works are Frank Emerson Clark's "Clark on Surveying and Boundaries", Ray Hamilton Skelton's "Boundaries and Adjacent Properties" and Curtis Maitland Brown's "Boundary Control and Legal Principles". The original works were first published (Clark 1922, Skelton 1930 and Brown 1951) over a span of just 35 years. The books are physically evaluated. Relative contents, by subject matter are compared. Readability is assessed. Several state specific laws and legal issues are mentioned. How each writer addresses similar issues like sequential conveyances, simultaneous conveyances and riparian considerations is provided. Clark delivers the most (967 pages of text) information but is almost unreadable due to long sentences and few paragraphs to facilitate readability. Skelton cites a deluge of case law. His strength is sequential conveyances, while he virtually ignores PLSS and simultaneous conveyance issues. Except for case law references neither Clark nor Skelton provide a bibliography of works cited. Brown is concise and readable. His stand alone listing of the hierarchy of deed calls represents a major breakthrough for students of the surveying profession. Brown at least provides a modest bibliography at the end of chapter one. Readers are urged to acquire, read and study these three books (or more current editions as available). Finally, anyone with enough knowledge, motivation, energy and drive is urged to create a new boundary principles book to serve our profession in the 21st century.

INTRODUCTION

A Treatise on the Law of Surveying and Boundaries, also known as Clark on Surveying and Boundaries written by Frank Emerson Clark, was copyright in 1922. The third edition, referenced for this analysis and edited by John S. Grimes was copyright in 1959. The Legal Elements of Boundaries and Adjacent Properties written by Ray Hamilton Skelton were copyright in 1930. The first edition of Boundary Control and Legal Principles, written by Curtis Maitland Brown was copyright in 1957. The second edition, copyright 1969 referenced for analysis here featured contributions by H. Frederick Landgraf and Francois D. (Bud) Uzes. These texts are henceforth referred to as Clark. Skelton and Brown throughout the discussions that follow. The following tabulation provides a summary of the comparative physical characteristics associated with these three works.

PHYSICAL COMPARISONS (page 39)

These books came out during a span of 37 years. Considering that Brown's initial boundary booklet came out in 1953, the span might be construed as being only 31 years. Yet all three first editions were published between 52 to 89 years ago. Luckily, common (court case based) boundary law changes little over time. It is also fortunate that current authors such as Robillard, Wilson and Pallamary are actively working to maintain the currency of boundary principle writings. It would be worthwhile to note the professional background and physical location of each author. Additional insights will help to understand how this all fits together.

Frank Emerson Clark, a lawyer from Minnesota (who had done survey work in his earlier years) worked in a PLSS state which was at least partly included in the Old Northwest Territory. Note that Clark's book came out just twelve years before the first Surveying and Mapping Educators Conference at Rainy Lake, Minnesota in 1934. Some contend that ACSM grew out of that meeting and it is generally known that the surveying educators group eventually coalesced around the idea that a stand alone four year surveying degree was essential.

Ray Hamilton Skelton was a Civil Engineering professor at the University of Maryland (from a time when Civil Engineering still considered Surveying to be part of the curriculum) when his book was published. Maryland was of course one of the original thirteen colonies, and therefore a state that did not enjoy the PLSS experience. Metes and bounds type survey work would predominate in Maryland. While it is perhaps easy to think of Skelton's book as somewhat outdated (now 82 years old) we need to remember

PHYSICAL COMPARISONS			
COMPARISON	CLARK	SKELTON	BROWN
Profession	Lawyer & Surveyor	Professor	Surveyor and Civil Engineer
1st Edition date	1922	1930	1959
Author Location	Minnesota	Maryland	California
Basic Original Boundary Situation	Old NW Territory (PLSS State)	Original Colony (Metes & Bounds)	From Mexico (PLSS and Ranchos)
Edition Consulted	1959	1930	1969
Pages	967	530	342
Words Per Page	≈ 350	≈ 330	≈ 440
Printed Space/Page	$6\frac{3}{8}$" x 4"	6" x4"	7" x $4\frac{1}{4}$"
Book Size	2"x 6" x8"	$1\frac{1}{4}$." x 6" x 8"	$\frac{7}{8}$"x 6" x9"
Book Weigh	≈ 24 oz	.≈ 18 oz.	≈12 oz.
Court Cases Referenced	≈ 1000	≈ 1500	≈ 300
Binding Type	Leather Bound	Leather Bound	Blue Cloth Covered Hard Back

that Maryland's charter was granted 298 years before the book was published.

Curtis Maitland Brown was a Civil Engineer (with a dual license) who practiced land surveying in the San Diego, California area. California is a PLSS state with a heavy dose of Spanish (20) and Mexican (780) land grants scattered mostly along the coastal regions. Curt cared deeply about boundary surveying issues. During the early 1950's he developed a booklet for California surveyors which was mailed to every licensed surveyor in the state. Copies of that booklet now fetch at least $200 at auction. Brown continued to expand and hone his work. He spent some time at Purdue University expanding his legal research and developing his comprehensive analysis of court case based common law. His efforts culminated in 1957 when he published his first edition of Boundary Control and Legal Principles. Note the 1957 edition was green, the second was blue while the third edition was red. Dr. Crossfield had the pleasure to meet Curt Brown in the late 1970's while teaching at Arkansas. Note that after January 1, 1982, Civil Engineers in California were required to pass the LS exam in order to obtain LS licensure.

These books provide detailed coverage of boundary issues. This coverage is divided into various chapters and sections. The following tabulation characterizes the contents of these books by comparing similar topical categories.

CONTENT COMPARISONS (page 40)

Another comparative factor involves readability. Organizational styles and word counts appear to vary greatly. The following tabulation summarizes some findings in this area when Adverse Possession is discussed.

READABILITY COMPARISON (page 40)

We see that Clark and Skelton provide few breaks in the reading with less than two breaks per page. It is hard to read complicated legal writing when sentences are long and paragraphs seemingly never end. Meanwhile, Brown appears to provide reading breaks more frequently. Almost everyone would agree that Brown is reader friendly.

SPECIFIC PRINCIPLES, LAWS, STATEMENTS AND QUOTES

Clark provides Illinois specific material in section 705 (Resurveys in Illinois) on pages 850-851.

"In the state of Illinois, the owner or owners of adjacent tracts of land may enter into a written agreement to employ and abide by the survey of some named surveyor, and after such survey is completed, a plat thereof with a description of all corners and lines plainly marked thereon, together with the written agreement of the parties, shall be recorded in the recorders office of the county where the land lies, and lines and corners of said survey so made and recorded, shall be binding upon the parties entering into said agreement, their heirs, successors and assigns, and shall never be changed."

Clark also provides some detail about the Lake Michigan boundary of Illinois. This is provided in section 764 (The Great Lakes As Boundaries) on page 946.

"So much of Lake Michigan, as is included by lines, one running north from the point where the eastern boundary strikes the southern boundary of the lake to a point in the

(continued on next page)

Boundary Surveying *(continued)*

	CONTENT COMPARISONS		
TOPIC	**CLARK**	**SKELTON**	**BROWN**
History of Surveying	Two Chapters, 25 pp.	None	3 pages in chapter 1
Surveyor Duties	One Chapter 21 pp.	None	One Chapter 14 pp.
PLSS Issues	Eleven Chapters, 290 pp.	None	Two Chapters, 102 pp.
Adverse Possession	One Chapter, 60 pp	One Chapter, 53 pp	5 pages in Chapter 2
Riparian Issues	Four Chapters 169 pp.	One Chapter, 41 pp	One Chapter, 41 pp
Roads, Highways, Streets	Two Chapters, 35 pp	One Chapter, 59 pp	One Chapter, 10 pp
Dedication	One Chapter, 22 pp.	One Chapter, 47 pp	Three Pages in Chapter 2
Descriptions	Two Chapters, 70 pp	One Chapter, 64 pp	18 pages in Chapter I
Agreements/Surveys/ Boundaries/Platting/Plats/ Land	Two Chapters 104 pp	Three Chapters 107 pp	Four pages in Chapter 2
Relative Importance of Conflicting Elements	None	One Chapter, 147 pp	102 pages in three different chapters
Terminology / Definitions	24 (indexed) items scattered about	Scattered Throughout the Book	34 items in two different chapters
Federal Mining Claims	Only scant references	None	One chapter, 9 pp
State Laws and Court Decisions	One Chapter 61 pp	Much Case Law Cited Throughout	Some Cases Cited Throughout
Coordinate Surveying	One Chapter, 56 pp	Part of one chapter 7 pp	None
Canadian Sectionalism Lands	One Chapter 11 pp	Zero	Zero

	READABILITY COMPARISON		
Readability Issue	**CLARK**	**SKELTON**	**BROWN**
Section Breaks (Adv. Poss. Topic)	1.3 pp. per section	2.7 pp. per section	1/2 page per section
Paragraph Breaks (Adv. Poss. Topic)	3.5 pp. per paragraph (pp 575-578)	1/2 page per paragraph pp 420-42i)	1/4 page per paragraph (pp. 105-106)
Combined Breaks in Text	1.5 Breaks per Page (43 Breaks per 29 pp.)	1.2 Breaks per Page (66 Breaks per 53 pp.)	2.25 Breaks per page (9 Breaks per 4 pp)
Words Used to Define "Color of Title"	63 words (pp.579)	17 words (p. 392)	38 words (Glossary)

middle of the lake, in north latitude 42 degrees and 30 minutes, and thence west along that parallel to the western border of the lake, is within the limits of Illinois."

Clark provides an interesting legal situation in Arkansas regarding the County Surveyor. This appears in Section 698 on page 843.

"... it means that the certificate of any surveyor other than the county surveyor or his deputy shall not be admissible as documentary evidence of itself, without other proof. The only effect this section gives the county surveyor's certificate is to make it prima facie evidence."

Brown provides several insightful passages. Two provided here pertain to Wisconsin. The first (section 6.40, page 234) describes a short lived state statute (passed in 1862 and rescinded in 1867) concerning the center of section.

"Whenever a surveyor is required to make a subdivision of a section, as determined by the United States survey, except where the section is fractional. He shall establish the interior quarter section corner therefore, at a point which is the same distance east quarter section corner that it is from the west quarter section corner, and the same distance from the north quarter section corner that it is from the south quarter section corner. "

When this was rescinded, the surveyors were told to follow federal guidelines.

Another Brown quote (Section 1.54, page 80) starkly describes the hardships original GLO surveyors often faced. We hear from Harry A. Wiltse in 1847.

"The aggregate amount of swamp traversed by the two lines was about one hundred and seventy five miles, a considerable portion of which might be termed windfall. During four consecutive weeks there was not a dry garment in the party day or night. Consider a situation like the above, connected with the dreadful swamps through which we waded, and the great extent of windfalls over which we clumb and clambered; the deep and rapid creeks and rivers that we crossed, all at the highest stage of water; that we were constantly surrounded and as constantly excoriated by swarms or rather clouds of mosquitoes, and still more troublesome insects; and consider further that we were all the while confined to a line, and consequently had no choice of ground ... and you can form some idea of our suffering condition. Our principal suffering however grew out of exhaustion of our provisions, coarse as they were ... Worn out by fatigue and hardship, and nearly destitute of clothes, we now had to make a forced march of three days for the lake in search of provisions, of which during the three days they had had not a mouthful. I contracted to execute this work at ten dollars a mile ... but would not again, after a lifetime of experience in the field, and a great fondness for camp life, enter upon the same, or a similar survey, at any price whatever."

Dr. Crossfield is happy he was born in Wisconsin a 100 years after that survival story occurred.

SUMMARY

A complete and thorough analysis of Clark, Skelton and Brown would require a substantial commitment. Yet, many worthwhile perspectives may be gained with a reasonable degree of effort.

Clark provides a great deal of verbiage. He cites many court cases but provides no bibliography of other works cited. His wording is tedious with long sentences and few paragraph or other breaks. Perhaps this is the lawyer in him at work. The chapter on Coordinate Surveying appears up to date for the time it was published from a geodetic point of view. The description of state boundaries with respect to the great lakes is worthwhile reading, but the rest of this chapter appears somewhat out of place, since the coordinates of property boundary points are typically construed as poor boundary determination indicators.

Skelton cites a deluge of case law, but no references to other works are indicated. The PLSS is completely ignored, but this does serve to simplify the focus of the book to what would be simply called "metes and bounds" surveys. Twenty pages in chapter one are devoted to the "Engineering Method". Skelton seems to get off target here by effectively recommending that the coordinate basis be used for boundaries. While he does mention most of the important aspects of boundary control and appears to provide a fact based hierarchy of calls (at least when compared to Brown). He does not mention coordinates as being less important than area, but this makes sense since there were probably had been few if any court cases dealing with boundary "coordinates" by 1930.

Brown has been revered for decades because he provided a concise, readable and fact based perspective on boundary control legal principles. The presentation is not cluttered or confusing. Brown indeed brought order out of seeming chaos. The text is more readable. Brown dedicates his work to William Wattles, and cites contributions by Landgraf and Uzes. A bibliography (in which Skelton is referenced) is provided at the end or chapter one. But this seems to be an odd place to put a bibliography. It could be argued that all three authors are organizationally challenged when it comes to preparing a technical book.

CONCLUSION

Every practicing surveyor in the country should own copies of Clark, Skelton and Brown. The combined wisdom of these three authors cannot be matched without years, experience, study and case law analysis. Fortunately, these three authors did the hard work for us. And their work is carried on by Robillard, Wilson, Pallamary and others. An original Clark on Boundaries (1922) is probably quite expensive now.

Yet even the 1959 version appears to be full of detailed boundary surveying insights. Skelton should be on every surveyors book shelf. A student at Fresno State just acquired one for about $75 on the internet. The Brown book continues to be reworked with new editions appearing every 4-5 years or so. Any of the first three editions would be very useful for reference purposes. The second and third edition might not be too expensive yet on the internet. Yet, it is time for someone to step forward a provide a fresh perspective on boundary law. If so, it should be someone who:

1. Can write cogently
2. Knows what an abstract is

(continued on next page)

SEQUENCE CONVEYANCES		
CLARK	**SKELTON**	**BROWN**
Where the calls in a senior survey conform to the configuration of the lot as shown by other calls, they will be honored even though there is evidence on the ground of stakes which do not correspond to the length of the call. (p. 473)	Where there is a dispute of boundaries in two conveyances from the same grantor, the calls from the senior grant must control, and no language contained in the junior grant can in case of conflict extend or change the lines of the older grant. (p. 210 part A)	Excepting senior rights of others and a valid unwritten right of possession. the intentions of the parties to a deed, as expressed by the writings, are the paramount considerations in determining the order of importance of conflicting title elements. (p 127)
This has been done by establishing certain descriptive language over other. If a metes and bounds description is used, the boundaries may be ascertained by a. Artificial monuments fixed by the surveyor b. Natural monuments c. Course and distance calls d. Abutting boundaries e. Statements of area (p. 282)	Neither weight nor effect will be given a description in a deed in terms of quantity except for the purpose of relieving some otherwise irredeemable ambiguity in the more particular description, and though a description by monuments, corners and boundaries contains more than the amount specified by acres, the specific descriptions shall control. (p. 136 part H)	Monuments called for in a deed, either directly or by survey, or by reference to a plat which the parties acted by, are subordinate to senior rights, clearly expressed contrary intentions, and original lines marked and surveyed, but presumed superior to distance. angle, and area. (p. 132)
Monuments prevail over courses and distances even where proof is necessary to establish the former location of destroyed monuments, (p. 472)	When there is a conflict between monuments, that which is most certain, least likely to mistake, and in keeping with the expressed intention will prevail (p. 113 Part M)	Excepting where area expressly states the intentions of the parties to a deed, area is presumed as subordinate to other considerations. (p. 142)

3. Knows what an hypothesis is
4. Knows when a hypothesis is proven or not
5. Has the energy to do drudge work necessary to look up and transcribe case Jaw.
6. Knows how to "brief' a case.
7. Has written a properly formatted and referenced boundary surveying article for a professional journal like SALIS.
8. Knows the difference between POB magazine and a refereed journal.

Until someone steps forward to do this, we have three great boundary surveying texts to rely upon. Written during a thirty seven year period (yet 50-90 years ago) Clark, Skelton and Brown provide the practicing boundary surveyor with the significant insights and perspectives needed to professionally function.

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REFERENCES

1. Brown, Landgraf, Wilson, Boundary Control and Legal Principles. Second Edition, 1969, John Wiley and Sons.

2. Clark, Grimes, A Treatise on the Law of Surveying and Boundaries, Third Edition, 1959, The New Bobbs-Merrill Co.

3. Skelton, The Legal Elements of Boundaries and Adjacent Properties. First Edition, 1930, The Bobbs-Merrill Co.

SIMULTANEOUS CONVEYANCES

CLARK	SKELTON	BROWN
The "common law" can only be explained as the residue of centuries of development of a set of rules designed to meet the civil and economic needs of particular periods in English history. These rules [are] the basis of law of ... in the United States today. (P. 33)	Where land is platted by blocks with intervening streets, each block should if possible be treated. as distinct, and the shortage or excess therein be distributed among the lot owners except so far as possession has fixed limits (P. 217 Part 3)	The boundaries and corners of a subdivision are determined by the lot lines of an older subdivision or by the boundary lines of a metes and bounds description. (p. 154)
It is the law that excess or deficiency can only be distributed between permanent or known monuments. It would not do to move any such points. If original monuments can be found they must remain. (p. 252)	Where an attempt to apportion the excess or deficiency would cut the land into such sized lots as to cause the boundary lines to pass through houses and improvements, for when actual possession has fixed limits the general rule may be rendered impossible (p. 217 part 8)	In lot and block description subdivision monuments called for on the plat, or monuments set by others to perpetuate the position of the original monuments called for, if properly identified and undisturbed, control the position of the original lot lines. (p. 158)
Where one party merely points out a line which he believes to be the correct one, and the other party assumes it to be true, there is no agreement. The parties to a verbal agreement establishing a boundary where its correct location is in dispute, are bound by the agreement and each is "estopped" to deny the location of the line. (p. 511)	The paraphrased essential requirements for estoppel are I. A victim was (negatively) misled 2. Victims actions were (caused) by the other party. 3. The other party knew the victim suffered a loss, 4. There was uncertainty in the contested boundary line location. (p. 358 part 2)	Estoppel by facts in pais is defined as "the preclusion of one to deny that which, by his conduct, he may have induced another to believe and act on to his prejudice." (p. 102)

RIPARIAN ISSUES

CLARK	SKELTON	BROWN
In this country, while still retaining the common law classification of navigable and non-navigable. we have adopted the [concept] of navigability in fact, [like affording) a channel useful for commerce. (p. 707)	A river is navigable if the tide ebbs and flows therein, or if it is in fact navigable during some season of the year for the floatage of boats, lighters, rafts, logs, etc. and it is not necessary that the waters be navigable in all their parts. (p. 311-312)	Navigable waters are navigable in fact when they are used, or are susceptible of being used, in their ordinary conditions as highways of commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water. (p. 289)
Where a description touches in water, the boundary line may he either[:] a. The meander line b. High water mark c. Low water mark d. Centerline of the water when the boundary was established e. The center or thread of the main current of a flowing stream. (p. 701)	It is the established rule that a riparian owner of land bounded by a stream, the banks of which are changed by the gradual and imperceptible process of accretion or erosion, continues to hold the stream as his boundary whether his land has increased or diminished (p. 332, part 2)	If there is erosion or inundation due to rising waters, the riparian owner may suffer losses. (p. 288)