

SURVEYOR

California

Summer 2008 Issue #155

Mattole Valley Monument Preservation Fund Survey

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The Surveyor and the Speed of Light

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"Recognizing that the true merit of a profession is determined by the value of its services to society, the California Land Surveyors Association does hereby dedicate itself to the promotion and protection of the profession of land surveying as a social and economic influence vital to the welfare of society, community, and state."

"The purpose of this organization is to promote the common good and welfare of its members in their activities in the profession of land surveying, to promote and maintain the highest possible standards of professional ethics and practices, to promote professional uniformity, to promote public faith and dependence in Land Surveyors and their work."

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Todd Smith crossing the Mattole River

From the Editor



Photo by: Auburn Photography

Frank Miller's crew specialized in right-of-way and control surveys. Those were fitting assignments for him because Frank was all about precision. The Connecticut Department of Transportation was my first job after college in 1986 and Frank Miller was my party chief. One day early in the process of acquiring my chops, I asked Frank to check a tribrach I'd set up. "Hey Frank, take a look at this and see if it's close enough." He made no movement in my direction but replied calmly, "John, it's either level and over the point or it's not." Frank Miller was a fine mentor. He taught me many useful things, like the difference between precision and accuracy, on a day I turned a good angle to the wrong target.

I looked up my former chief during a trip to Connecticut several years ago. We reminisced about old times of course, but he also wanted to hear how surveyors in the Golden State do their work. "Do you call highway department monuments "CHD's?," he asked (California starts with a "C" too, after all). "And how about those earthquakes," he wondered, "don't they displace your control?" I was ready for that one. "Control points in California have velocities, Frank." I figured that would get his attention and did it ever.

Connecticut surveyors may roll their eyes at it but shifting control is a fact of life for many surveyors in California. If you're one of them, be sure to read our Tech Tips in this issue of the *California Surveyor*. "Using the Scripps Epoch Coordinate Tool," by Cecilia Whitaker, PLS, is certain to be appreciated by surveyors who use continuous GPS where tectonic plates are in motion. California has long been at the head of the pack when it comes to such cutting-edge technology. Read Mike Duffy's "The Surveyor and the Speed of Light" and learn how surveying contributed to determining this fundamental constant in the early years of the twentieth century.

In Mike O'Hern's article, "Mattole Valley Monumentation Fund Survey," you'll be inspired by the efforts of long-time boundary surveyor Jim Roscoe, RCE. Jim donates his time and talent, and shares his considerable knowledge regarding original government corners, to ensure the correct perpetuation of PLSS boundaries in Humboldt County. Our colleagues in the north are lucky to have a man like Jim. You'll enjoy the bonus of seeing our Assistant Editor, Dave Ryan, hard at work recovering a GLO bearing tree. If you like surveying history don't miss "The Coast Survey in Verdi, 1872," by Paul Pace. Paul's article describes a joint effort by members of CLSA and NALS to memorialize contributions made by George Davidson to the California-Nevada boundary. We also welcome back BPELS Land Surveyor Consultant Ric Moore. Read Ric's "Common Questions Regarding Record of Survey Maps" and you're likely to learn something you didn't know, but should, about filing requirements. You'll find all that and much more in this issue of the *California Surveyor*.

Mentoring of the Frank Miller variety is increasingly rare in this high-tech age of shrinking crew sizes. In times like these it's more important than ever to share, with our colleagues young and old, lessons we've learned along the way. Again we thank our contributing writers and columnists for making the *California Surveyor* a source of useful, relevant, and edifying information for the land surveying community in California. ❖

John Wilusz, PLS, PE, is a Water Resources Engineer in the Delta-Suisun Marsh Office of the California Department of Water Resources.

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President's Message



I had the pleasure of attending the National Council of Examiners for Engineering and Surveying (NCEES) - Participating Organizations Liaison Council (POLC) meeting February 16, 2008 in Tempe, Arizona. I attended this meeting with Howard Brunner, CLSA's liaison to this organization. After attending this meeting I thought that it would be appropriate if I took a little space to talk about NCEES and what it does. So I decided to turn a brief quarterly report into a, hopefully, informative discussion about NCEES.

NCEES - POLC, what is this organization and what do they do? First, these are my thoughts and as such may not be perfectly accurate but they may help anyone who is interested in better understanding this organization. They were developed during and after the attendance of the mentioned NCEES meeting and after reading the information that was distributed at that meeting.

The mission statement of NCEES says: "To assist Member Boards in the promotion and promulgation of regulatory processes for engineering and surveying which demonstrate high standards of knowledge, competence, professional development, and ethics. To provide services to Member Boards that promotes uniform licensing procedures which emphasize quality education, examination, experience, and continuing professional competency. To coordinate and cooperate among domestic and international organizations to promote licensure of all engineers and surveyors". The NCEES vision statement says "To provide leadership in professional licensure of engineers and land surveyors through excellence in uniform laws, licensing standards, and professional ethics for the protection of the public health, safety, and welfare, and to shape the future of professional licensure."

To that end, they have 70 Member Boards that participate in NCEES. These Member Boards include every U.S. State and Territory along with the District of Columbia. They have a full time staff of 68 people and have a large office in Clemson, South Carolina. They also have a second office in Miami, Florida that was created to provide evaluations of the educational credentials of foreign applicants for licensure. Within one year, the number of applications for licensure to this office has grown to 1,500 applicants. At this office, they maintain a staff that is capable of evaluating original educational documents in many languages. They also have numerous volunteers that assist them in the exam preparation, evaluation, administration, and scoring. In the 2006-2007 year, they gave nearly 75,000 exams. These included over 44,000 exams for the Fundamentals of Engineering, over 25,000 for the Principles and Practices of Engineering, almost 3,000 exams for the Fundamentals of Surveying and almost 2,000 for the

Principles and Practice of Surveying. In 2007, NCEES became an American National Standard Institute (ANSI) Accredited Standard Developer. ANSI is the American representative to the International Organization for Standardization. This gives it international recognition and in fact, NCEES has recently administered exams in Japan.

I found another very interesting piece of information in their February 2008 Newsletter. They have taken part in the developing of an examination in Photogrammetry along with the American Society for Photogrammetry and Remote Sensing (ASPRS), the Colonial States Boards of Surveyor Registration (CSBSR), and the Management Association for Private Photogrammetric Surveyors (MAPPS). They can now support a state specific six (6) hour mapping sciences examination with full psychometric support. This examination is to be used to test the candidate's knowledge of mapping sciences, including photogrammetry and GIS. Out of that has also come an exam that will be given for the first time in April of this year by South Carolina for the licensing of a GIS surveyor. I found this most interesting.

I can tell you that you must be into acronyms to have any chance of understanding what is going on at one of these meetings and to know who is speaking. The POLC meeting is one of three yearly meetings that NCEES has. The POLC meeting is a meeting of a group of participating organizations that have a like interest in the licensing, qualifications and professional development of engineers and land surveying licensure as developed by NCEES. These organizations participate because they feel that it is in their best interests to have their thoughts and desires passed on to the NCEES Board. There are 27 members of the POLC and CLSA is fortunate to be one of those members. Most are national organizations with just a very few state organizations. There were 24 of 27 POLC organizations present at the meeting. Each organization gave a report regarding what they had been doing and what they hoped to do in the coming year. Along with this, they commented on their stand on some complicated issues that NCEES is involved with and some NCEES "Model Law" concerns.

A brief word about the Model Law. One of the objectives of NCEES is to make it easier to obtain comity in other states. To that end they are developing a "Model Law" standard for licensing that, if adopted by the Member Boards, would make it much easier to obtain comity in other states that have also adopted the "Model Law". It is important to point out here that the various Member Boards are under no obligation to adopt the "Model Law" but they are encouraged to do so by NCEES to promote the abili-

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ty to obtain a license in another state outside of where you took the licensing exam without undergoing extensive reexamination. It is also important to point out here that there cannot be any type of national license for engineers, land surveyors or photogrammetrist because the power to regulate these types of professions has been left with the State and this power cannot be usurped by the Federal government without an amendment to the United States Constitution. Since, in these highly politically charged and partisan times, there is little chance of any type of Constitutional Amendment being passed by the people, the States will continue to regulate our professions well into the foreseeable future.

The hottest topic of discussion at this meeting was the Bachelor's degree plus 30 credit hour implementation that NCEES is pushing for in order to sit for the engineering exam. This has been adopted into the NCEES current Model Law. The next step is implementation and the development of rules and guidelines for this implementation. In acronym terms, this is called B+30. The basis for this requirement comes from the fact that over recent years the course requirements devoted to developing and understanding concepts and skills necessary to practice engineering are being replaced by course requirements in non-technical areas. At the same time that this has been happening, the knowledge base needed to be competent has been constantly expanding. It was the conclusion of NCEES that in order "to continue to protect the public by ensuring that adequate standards of professional knowledge are met, then more course work is needed. Furthermore, it was not simply that more coursework should be required as a prerequisite to licensure, but that added coursework needs to address a base of knowledge that is continually growing as engineering becomes more complex." I realize that this particular item is addressing engineering issues. I include it here because I find the arguments made to be quite compelling and those same arguments could easily be applied to land surveying. Just some food for thought! When I gave my report to this organization I was and still am quite humbled by the fact that they were talking about B+30 while one of the highlights of my verbal report was that the CLSA Board had approved the proposed Voluntary Professional Development Program and I, in fact, told them that.

I hope that this has been of some help in understanding NCEES and what it is doing for both the engineering and land surveying community. We are fortunate to be a part of the POLC and I encourage our continued participation. ❖

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The Coast Survey in Verdi, Nevada, 1872

The George Davidson memorial project, described below, is a joint effort between members of CLSA and NALS. The following article by Paul Pace, PLS, will also appear in the Fall 2008 issue of the Nevada Traverse, the quarterly publication of the Nevada Association of Land Surveyors. - Editor

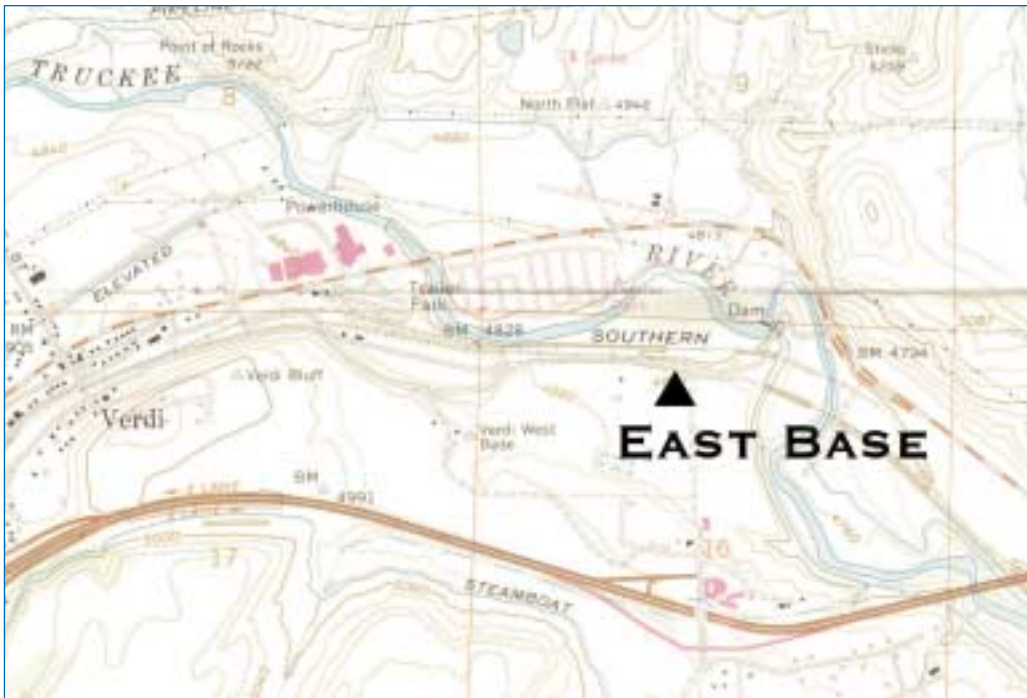


George Davidson

As with many towns along the Truckee River, the village of Verdi was closely associated with timber and railroading. But before the heyday of Verdi's box factories and lumber mills, questions arose concerning the location of the nearby California-Nevada boundary. The border had been surveyed through the area in 1863 by surveyors working under the auspices of a joint boundary commission. But that line was found to be about 4000 feet too far west, the result of an error at the survey's initial point at Lake Tahoe.

In 1872 George Davidson of the U.S. Coast Survey submitted a plan to the Survey's Superintendent Benjamin Peirce in which he outlined a scheme for geodetic work in the Sierra. Included in the work would be observations at Verdi, Nevada to determine the true location of the 120th meridian. His final report to the Superintendent included this description: "...I had for a month been making observations for transit, azimuth and latitude observations at Verdi, in connection with the determination of the one hundred and twentieth meridian...There the weather was extremely dry and hot...during part of the time in which I measured the base for the triangulation..."

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Above: Verdi, Nevada

Below:
Astronomical Station (circa 1900)



The base line he mentions is located on Verdi Bluff, above the railroad tracks on the south side of the river. The east end of the base line provided Davidson easy access to a telegraph line, which he used in his longitude observations. A masonry pier was built there and the observations conducted. A. W. Von Schmidt, who was awarded the job of resurveying the entire length of the boundary in 1872, was permitted to use Davidson's values for the marks in Verdi.

The Coast Survey returned to Verdi in 1897 to find that the masonry pier had been destroyed. They set a triangular granite column in the approximate location of Davidson's

original astronomical station, which remained in place until late in 2007. The column was removed (and preserved) during site work north of the new Cabela's store by a gentleman with long family ties to the property. Plans are being formulated to re-install the granite column across the street from its former location on the west side of old Garson Road, together with a suitable memorial to George Davidson. The memorial will be in the form of a bronze plaque explaining the significance of the column and Davidson's pioneering geodetic work in the area.



Granite Post, circa 2002

Estimates for the work approach \$3000. It is hoped that the larger portion of this sum can be raised by private donations by surveyors from NALS, CLSA, as well as others. A small plaque committee has been formed, which includes Barbara Littell, PLS, Matt Gingerich, PLS, Steve Parrish, PLS, and Paul Pace, PLS, from NALS, and John Wilusz, PLS, and Aaron Smith, PLS, of CLSA, and others outside the surveying community. A future article will address the full story of the Coast Survey's efforts at Verdi and their impact on the state line controversy. If you are interested in making a donation toward the plaque you may contact Mr. James Bedard, Treasurer of the Lahontan Chapter of NALS, who has prepared an account for the funds, at james.bedard@stantec.com. If you would like more information regarding donations, the plaque itself or the efforts to set it, please contact any of those named above or Paul Pace at pacepack2003@yahoo.com. ❖

Paul Pace, PLS, is a licensed land surveyor in Nevada and California. He worked 34 years with Sierra Pacific Power Company, a Reno based public utility, and has been with the surveying/geomatics section at Stantec Consulting for the past 8 years. Paul taught surveying classes and was the Director of the Summer Field Camp for mining engineering students at the Mackay School of Mines at UNR for nearly 20 years. He served as Chapter President and Board Member for the Lahontan Chapter of NALS. Paul is now semi-retired and lives with his wife in Sparks, Nevada.



Record of Survey *Whose map is it?*

Many surveyors have made up their minds that the last thing that they can legally do without overlap from other professions is to survey a deed described line, make a determination as to its location and file his or her opinion (map). I may or may not agree with this, but what I am referring to is commonly known as the “Record of Survey”, and for most Professional Land Surveyors, they consider it their document. During this discussion on the Record of Survey, which is reviewed by the County Surveyor’s Office and subsequently recorded in the County Recorder’s Office, I will pose the question; whose map is it? Is it a map that is prepared by you and should be recorded as is, or does it have the look and feel of your county surveyors opinion, or do you take into account the future and put together a document that will stand the test of time? I hope that the map will be a compilation of all three. I will take the position that it is the public’s map and it is my privilege to survey the lines, set the corners, and file it with the County. On March 16, 1907, the Senate enacted what would be commonly known as the Land Surveyors Act, and most, if not all of those statutes are still with us in the now current Professional Land Surveyors Act (Business and Professions Code, B&P).

Even in 1907, the body of the Senate knew the importance of the duties of the Professional Land Surveyor and set guidelines that even today we rely on. Those individuals who had the foresight to enact these statutes clearly understood the problems then, and the potential for future problems.

The purpose of the Record of Survey, in my opinion, is to review the written documents that describe land boundaries, locate the deed described lines on the ground, which may need extrinsic evidence to locate, such as parol testimony, note any possible discrepancies that may differ from the written document, and finally, make my findings of Public Record. Principle 5, Chapter 14, The Role of the Surveyor, Brown’s Boundary Control and Legal Principles, fourth edition states “A land surveyor locates boundary lines according to the description in the deed and then relates lines of possession that do not agree with these lines and reports the facts to the client, in writing.” We can also include in this concept, easements or any other written right that can be identified on the ground from the written record. In the Third Edition of Evidence and Procedures for Boundary Location, chapter 5, Evidence-General, it says, “The student, surveyor, or attorney must first make the major distinction between facts and evidence. The actual corner point is a fact, all of the information that is used to identify, describe, recover, or preserve the point is evidence of that point, the corner.” Your map can help perpetuate the evidence that can lead to facts, and the facts can lead to the corner. This map should also locate and show the relationship to any prior surveys, senior lines, or subdivisions that are near or adjoining your property. Your determinations in the location of these lines are a professional opinion, and the evidence used to locate these

boundaries should be reflected on your map. If, during the course of your survey, there is a difference in the location of previously set monuments by other surveyors, and that of the lines you have reconstructed, then it is your duty to show these positions on your map so they may be readily retraced by another surveyor. Your map should clearly show why you have disagreed with these monuments, and if needed, a statement should be made on the map for clarity. This is the essence of Perpetuating the Evidence. Each surveyor over time has been trained as to the different types of evidence used to locate boundaries, such as iron pipes, hubs, fences, old road cuts, historic buildings built at the time of the original subdivision, stones, posts in rock mounds, hedge lines...etc. Perpetuating these types of evidence on the map is of paramount responsibility to the surveyor. The evidence reflected on the map should be noted with the ability to re-establish these occupation lines by mathematical computations, or at minimum, compare the relative positions by scale.

If a Professional Land Surveyor makes measurements to locate the deed described lines, which are different from the apparent lines of occupation, and does not show these on his or her map, then one has not done their job. If there are reasons for these differences, and these reasons are not easily detected in the recorded documents, then notes should be placed on the map for further clarification.

The Record of Survey prepared by you, or under your direction, needs to reflect all the pertinent information and evidence used to establish your boundary decisions, and even that evidence you analyzed, but decided not to rely on.

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Chapter 5 of Evidence and Procedures says, “before any surveyor obtains sufficient knowledge of the available evidence, it is nearly impossible to make a correct boundary determination or location.” Unrecorded documents, previous surveys made by your firm, old files from previous land surveyors and or engineers, and any testimony from neighbors or ‘old timers,’ should be noted on your map. The location as to where those documents can be found for inspection by the land surveyor needing to review this information should also be noted in the legend, or notes made on the map. A professional land surveyor should not withhold pertinent information that was used in the final determination of the deed described lines, but should instead look for the opportunity to make that information of public record with the recording of their record of survey. The lack of showing all evidence accepted and not accepted could be the reason there is litigation over your map, or boundary resolution.

“Perhaps the worst disagreements arise from a failure of one surveyor to uncover all available evidence. Two surveyors having the same evidence, if equally educated and equally intelligent, should come to the same conclusions. Unfortunately, all surveyors are not equally diligent in their search. The one with all the evidence usually comes to the correct conclusion, whereas the one with partial evidence

makes faulty locations.” This is a quote from Chapter 5, Evidence and Procedures, and is for both field evidence and research. I hope that surveyors will take the time to uncover the evidence, document that evidence on their map, and perpetuate it for the next land surveyor, so we can have “all the evidence” available to the profession.

“A plat should be complete in itself and should present sufficient evidence of monuments (record and locative) and measurements so that any other surveyor can clearly, without ambiguity, find the locative points and follow the reasonings of the surveyor. A plat does not show the client’s land alone; it shows all ties necessary to prove the correctness of location.”, Chapter 9, Evidence and Procedures.

The map should reflect the measured bearings and distances, B&P code 8764, and compare those to the record information. The record information for comparison could be deeds, maps, unrecorded surveys, unrecorded grants, County right of way maps, survey notes from the County Surveyor’s Office, and any other document you have obtained. If these documents are not recorded in the Recorder’s Office, they should be referenced on your map. For all the monuments found, there should be a complete description of the monu-

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Record of Survey Whose map is it?

ment, including any scribings, character, type of metal, size, and its relative position to occupation, fence corners...etc. If you are noting a fence, then the type and material should be noted as well. This will assist the land surveyor to identify these lines of occupation for future retracements. "If the surveyor is delegated the privilege of remonumentation of deteriorated corners, he should also be delegated the responsibility of perpetuating the evidence." Quote from Chapter 15, Evidence and Procedures.

Now that we have discussed some of the reasonings behind the record of survey, let's look at the question posed, whose map is it? As I stated early on, I believe it is the public's map, and I have been hired to prepare this document and have it recorded with the county in which the survey was made. These maps perpetuate the location of old historic pieces of evidence, and when we can continue to use these maps to relocate these positions, then it is in the interest of the public to have the map properly documented. Land surveyors in the past and the present have felt that the map they were hired to prepare, is the record of their professional opinion and final conclusions as to the retracement of the deed described lines, and the map should be recorded as they see fit. Without a doubt that is true, the map reflects their decisions, and it should, this is the reason we sought licensure, so we can take responsibility for those decisions. If one does a proper survey and documents the map correctly, then there will be no need for comment on the record of survey before filing, which is, in my opinion, the goal that should be strived for with your survey. There is a list of items that the County Surveyor is required to review for technical correctness before they approve the map for recording, and they are listed in section 8764 of the Professional Land Surveyor's Act:

- (a) All monuments found, set, reset, replaced, or removed, describing their kind, size, and location, and giving other data relating thereto.
- (b) Bearing or witness monuments, basis of bearings, bearing and length of lines, scale of map, and north arrow.
- (c) Name and legal designation of the property in which the survey is located, and the date or time period of the survey.
- (d) The relationship to those portions of adjacent tracts, streets, or senior conveyances which have common lines with the survey.
- (e) Memorandum of oaths
- (f) Statements required by section 8764.5
- (g) Any other data necessary for the intelligent interpretation of the various items and locations of the points, lines, and areas shown, or convenient

for the identification of the survey or surveyor, as may be determined by the civil engineer or land surveyor preparing the record of survey.

The record of survey shall also show, either graphically or by note, the reason or reasons, if any, why the mandatory filing provisions of paragraphs (1) to (5), inclusive, of subdivision (b) of Section 8762 apply.

The record of survey need not consist of a survey of an entire property.

As you can see, there is not much that can be reviewed to check for consistency with this section. However, one should note subsection (g) which states "any other data necessary for the intelligent interpretation of the various items," again telling the surveyor in responsible charge to ensure that the map and its evidence as shown is in harmony with the results of the evidence on the ground. Remember, the county surveyor reviews your map based upon the information provided by the professional, and hardly ever does the county surveyor visit the subject property to inspect the results of your survey. If the record of survey is properly documented, then the evidence used in today's boundary determination will be made of record for all of time, and the welfare of the public as it relates to land boundaries are better served.

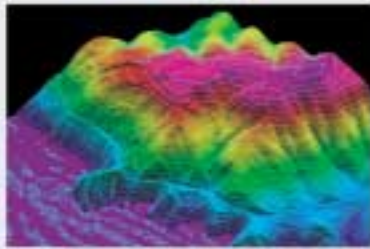
There is one other section that allows for further review by the county surveyor and that is section 8766 (c) which in part states, "nothing in this section shall limit the county surveyor from including notes expressing opinions regarding the record of survey, or the methods or procedures utilized or employed in the performance of the survey." When applicable, it is appropriate for the county surveyor to request additional information to substantiate the conclusion of the field survey performed, and I believe this section allows for the county surveyor to ask for this. And of course, we are all familiar with section 8768, which in short says the county surveyor and the surveyor preparing the map may add notes to the items not agreed upon in accordance with section 8766, and these notes are added to the map prior to recording.

I have taken the position with my maps that the agency reviewing my survey map before it records is the last set of eyes to check my work and provide me with feedback. I would rather have a comment on the review of my map, than for the map to record for all of time with my errors. I may not always agree with the comments, but rarely do I find a need to argue with them either.

One of our jobs as a professional surveyor in the state of California is to render a professional opinion on the location of a deed described line. Yes, there are those who believe we are licensed to monument and locate the unwritten transfer of title, better known as Adverse Possession or Prescriptive

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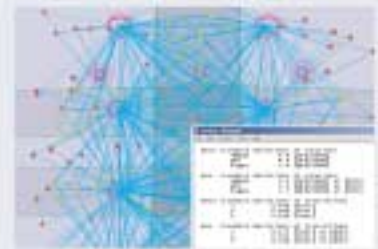
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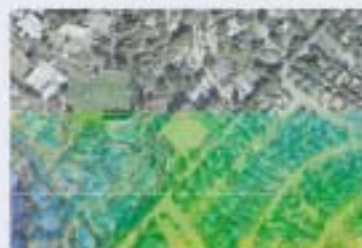
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Rights, but I still believe we should locate deed described lines and show the relationship of occupied land that is not consistent with the deed, and let the judicial system transfer unwritten rights when necessary. This can be a complicated area of surveying, and I will not render any opinions on how you or your firm should handle these situations. When there is a discrepancy between the deed described lines and the lines of apparent occupation, I believe the land surveyor has a duty to both parties to find solutions. It is unfair to the property owners, to set your corners, note the discrepancies on the map, and record it without the involvement of the neighbors. Yes, I do think Land Surveyors should play an active role in the solution, but they must also understand the laws, and which remedies are applicable to their situation. You do not want to make the situation worse by applying an incorrect solution to the already existing controversy between neighbors.

When we, as Professional Land Surveyors, perform a survey and document it to perpetuate all the possible evidence, it is then, that the public's best interest is protected, and the land surveyor has done their job, and so, the question, 'whose map is it?'

Something I feel all land surveyors should remember; the budget should never compromise the integrity of the survey work. We have been hired to perform a function, and an important one at that, one that affects not only your client,

who is paying the bill, but all of the adjoining lines you are surveying. Consider the impacts of reestablishing a section corner, the impact of that decision could affect property rights in four different sections, 2 miles by 2 miles. More importantly, most, if not all of the property owners who are affected by the field survey and establishment of the section corner, had no input to your roles and responsibilities, but the survey is now of record.

We are charged with being a Professional, so one should not step lightly into this line of work, unless they are prepared. For those surveyors who have been around awhile, they should look to pass on as much knowledge and skill as possible to those who will follow. One of the ways to perpetuate evidence, is to teach and mentor those individuals coming up through the profession, so they may learn the proper techniques and skills to allow them to be a Professional, and protect the welfare of the public as you have. ❖

This article is not a guide to performing boundary surveys and preparing Records of Survey's, but merely a reminder to remember what your job as Professional Land Surveyor is, and a very important one, at that.

I would like to thank Paul M. Brown, PLS and Lawrence A. Stevens, PLS for their mentoring efforts.

The Surveyor and the Speed of Light



Albert A. Michelson

In 1926, an aging physicist, Albert Abraham Michelson, was completing his life work on refining the measurement of the most important constant in the universe – the speed of light. To calculate the speed of anything requires knowing both the time and the distance that something has travelled. Velocity equals distance divided by time. Michelson had improved upon an ingenious way to measure the time light took to travel. But his work at

Mount Wilson Observatory in southern California required the need of a very long and precise line, a 22-mile long baseline over the mountainous San Gabriels. It would require the most accurate line ever measured to that point in human history. That is where the surveyors come in. But first, let's look at a brief history about measuring the speed of light.

The first recorded attempt to measure the speed of light was by Galileo in 1626. Up until that time, nearly all scientists and philosophers believed the speed of light to be infinite, including both Aristotle and Descartes. Though Galileo was unsuccessful in his speed of light experiments using lanterns from hilltops, he did go on to discover the planet Jupiter and its four moons which became important in the future search for the speed of light.

In 1676, fifty years after Galileo's failed attempt, the Danish astronomer Ole Roemer made great progress in proving that light takes time to travel from one point to another. He did this by observing the eclipse that 'IO,' one of Jupiter's moons, made while travelling behind the large planet. By measuring the time 'IO' moved in and out of view from behind Jupiter at different times of the year from Earth, Roemer correctly concluded that when the Earth was closer to Jupiter at certain times of the year, the light from 'IO'

took less time to get here. When Earth was further away from Jupiter, the light from 'IO' took more time to get here. Because there was a 16 minute difference between the two extreme measurements he made in one year, Roemer concluded light took 16 minutes to travel the diameter of Earth's orbit around the Sun. Since the diameter of earth's orbit was roughly known then, Roemer calculated the speed of light at 214,000 kilometers per second. This number was only about 25% less than the actual number, which took another 250 years of scientific experiments to refine. But Roemer had proven two quite remarkable facts, light does take time to travel through space and it travels at unimaginable speed. A third fact was also ascertained – space is unimaginably immense in size.

Fast forwarding to 1862, Leon Foucault, a French physicist, along with Charles Wheatstone, devised an experiment using a revolving mirror, a stationary mirror and a short baseline of some 20 meters. Foucault was able to estimate the speed of light to be 298,000 kilometers per second, within one percent of the actual speed.

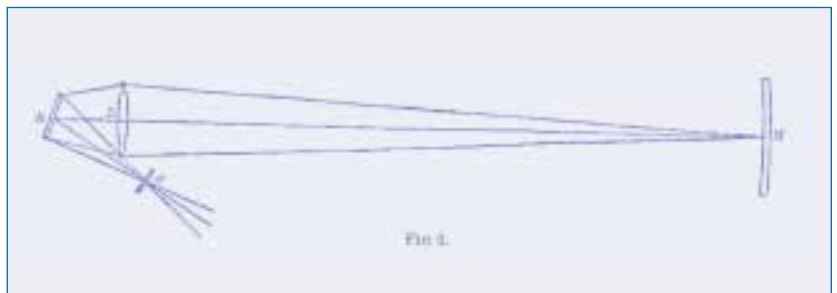


Figure 2: Michelson's Sketch of Rotating and Fixed Mirror Geometry

Next in the speed of light time line comes the American physicist, A. A. Michelson, who steps into the story in 1877, using an improved deflection angle measuring technique, a faster rotating mirror and a longer baseline (1985 feet) to improve the speed of light calculations. Working at the time for the U.S. Naval Academy in Annapolis, Michelson refines

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The Surveyor and the Speed of Light

the speed of light to 299,940 kilometers per second (+/- 50 kms). No one is able to improve on this measurement for the next 50 years.

that of the observer seeing the light. This speed was unlike any speed from any source and could not be explained by the laws of physics as they were then known. This experiment would later become the catalysis for Michelson winning the Nobel Prize in Physics in 1907, the first American ever to receive the Nobel in the sciences.



Figure 3 : Michelson's Baseline and Trapezoid

It is during this time period that the importance of the speed of light becomes even more obvious to the scientific community. In his most celebrated experiment, Michelson and his partner, Edward Morley, publish their paper in the American Journal of Science in 1887 entitled "On the Relative Motion of the Earth and the Luminiferous Ether". Their paper concludes that the speed of light appears unchanged by the movement of the source of the light or

In 1905, Einstein proposed the Special Theory of Relativity to deal with the speed of light puzzle. Einstein concluded that there is a special relationship between space and time (and matter and energy) expressed in his now famous yet simple formula ($E=mc^2$). This unique relationship has a special speed inherent to it and it appeared that light had that particular speed. Einstein proposed that at or near the speed of light the current laws of physics would not likely behave as we were accustomed to. Of course, to prove his theory would eventually require knowing the speed of light (the little 'c' in the formula) precisely.

Michelson continued to devise ways to improve on his speed of light value later in his career culminating in an experiment he began in 1922 at the Mount Wilson Observatory. Utilizing the then new invar tape, Michelson requested the United States Coast and Geodetic Survey (USCGS), later to become the National Geodetic Survey (NGS), measure a 22-mile baseline from Mount Wilson (elev. 5634') east to Lookout Mountain (elev. 6827') near Mount Baldy in southern California. This required measuring a baseline (between Stations Pasadena East Base & Pasadena West Base) of nearly the same length in the valley running along Baseline Road traversing Los Angeles and San Bernardino counties using the invar tape. Both ends of this taped baseline had to be visible to the ends of Michelson's experiment line. The USCGS used a conventional trapezoid and standard triangulation methods to establish positions at the ends of Michelson's line from their taped baseline. The USCGS established monuments near Michelson's mirrors that were constructed on concrete pillars and a metal frame. This entire process took two painstaking years to complete.

Reports of the project stated that the 22-mile line was the most accurately measured line in the world at that time. Several stated the line was established to within 1/4 of the correct distance, others stated the line was measured to one part in 1,000,000. This would calculate to 0.12' for a baseline of this length (116,050 feet). One report stated that the amount Michelson missed the actual speed of light could be mostly attributed to any error in the baseline distance. Two issues were thought to be affecting the baseline at that time as well. One was a large earthquake that occurred in June 1925 in Santa Barbara. The other was smoke from forest fires which blurred the mirror images on occasion.

As I read the old news articles about this speed of light experiment I knew this kind of survey accuracy was not possible with the methods available at the time. So I decided to

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The Surveyor and the Speed of Light

do a little experiment of my own and establish state plane coordinates using differential GPS on the same line. I wanted to see just how accurate the 'NAD 1927' and 'NAD 1983' published values were with present-day GPS measurements. I also planned to use National Geodetic Survey's Horizontal Time-Dependent Positioning (HTDP) analysis tool to better compare my current measurement to those published by the USGCS in 1923.

In July 2007, Steve Spencer and I hiked on a newly cleared trail from Bear Flats, on the main trail to Mount Baldy, to roughly where Michelson's Lookout Mountain monument should be. The trail was recently rehabilitated by a U.S. Forest Service volunteer by the name of Wayne Steinmetz. Mr. Steinmetz began the trail restoration in 2003 primarily due to his interest in Michelson's speed of light experiment. After a difficult four hour hike with an elevation change of

about 2,000 feet, Steve and I were able to recover the UGCGS monument called 'Antonio' along with an additional concrete structure with a small punched bolt.



Figure 6 : Steve at the Rotating Mirror site and Station Michelson



Figure 4 : Author at Fixed Mirror site on Lookout Mountain

This second monument appeared to be where Michelson attached his fixed-curved mirror. Using a Sokkia 2700 IO GPS receiver we collected an hour of data at both monuments.

In November 2007, Steve and I made our way up to Mount Wilson to look for the other end of Michelson's line. In the middle of several observatories, on a narrow ridge, we found the USCGS monument called 'Michelson.' We also found a bronze plaque signifying where Michelson's rotating mirror apparatus was located.

Looking east many pine trees that had been trimmed for the experiment had grown up to block the view of Station Antonio, 22 miles away. Again, we measured both monuments utilizing a Sokkia 2700 IO GPS receiver and differentially post-processed both points utilizing Continuous GPS base stations.

In researching the distance between the two NGS stations 'Michelson' and 'Antonio' the following information was compiled:

NAD27 (1923)	116,049.32 feet
NAD83 (1992)	116,052.70 feet

The post-processed distance for the same line in 2007 was established with GPS as: NAD83 (2007) 116,051.07 feet



Figure 5: Michelson Plaque at Mt. Wilson

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If you use HTDP station velocities for 'Michelson' and 'Antonio' on the 2007 GPS values to bring the baseline distance back to the length it would have been in 1923 you get the distance 116,051.41 feet. If you use station velocities (about 3.6 cm per year) generated by the Scripps Orbit and Permanent Array Center (SOPAC) and insert them into HTDP you get a distance of 116,051.15 feet. The difference between this distance and the distance the USCGS measured in 1923 was 1.83 feet. This equates to one part in 63,415. Of course, this is no where close to 1/4 error or one part in 1,000,000. The magnitude of difference is about 20 times greater than what was claimed in many of the historical articles about the baseline. In comparison, the baseline measurement in 2007 provided an accuracy of about 9 millimeters at a 95% confidence level. This latest GPS distance equates to a probable error of only about 1/3 in the baseline.

It is very likely that the survey measurement inaccuracy, and not any earthquake or forest fires, is what hindered Michelson from not establishing the speed of light more precisely in 1926. As stated earlier, the 1.83 feet error in 116,051.15 feet of the baseline distance equals an error ratio of one part in 63,415. The speed of light mis-measurements of 1926 created a velocity error of about 3.542

kilometers per second greater than the final accepted speed of light value of 299792.458 kilometers per second. This equates to an error of about one part in 83,639. You can conclude from these figures that the distance error from the 20's generally approximates the same proportion of error as the speed of light calculation from 1926 and is the primary reason Michelson was not closer to the true velocity. Also, since Michelson was using a smaller number for the baseline than it actually turned out to be, this would cause the velocity of light to be higher than the true value, which it was.

It was not until twenty years later, in 1946, that the speed of light calculation was improved upon at all. The inability to measure Michelson's line more precisely delayed knowing the actual speed of light for the next 60 years, though the capabilities to measure the line any more precisely did not exist in 1923. A valuable survey lesson can be learned in all of this – make sure you and your client are clearly aware of the accuracy limitations of your measurements before you provide them.

One final experiment that will be done on this project is to measure all four corners of the trapezoid simultaneously using GPS to establish the amount of error in the taped

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The Surveyor and the Speed of Light



baseline and the eight angles turned at the four corners. This could pinpoint where the true weakness in the trapezoid actually exists – either with the taped baseline or at the geodetic angles – or both.

Interestingly enough, in 1983 the scientific community finally adopted the official length of the meter as the “length of the path travelled by light in a vacuum during a time interval of $1/299,792,458$ of a second” which was dependent on science accepting a final value for the speed of light. The surveyors now had a precise measurement for the meter and the scientists a precise measurement of the speed of light. ❖

Michael Duffy, PLS, received his BS in Surveying and Photogrammetry from Fresno State in 1978, and has been a licensed land surveyor since 1982. He currently works for the Metropolitan Water District of Southern California as manager in the Survey Mapping Team.

Figure 7: Mt. Wilson observatory near Station Michelson

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Mattole Valley Monument Preservation Fund Survey



Jim Roscoe studying GLO notes at the Northwest corner of Section 30, Township 2 South, Range 1 West, Humboldt Meridian. The remains of a GLO bearing tree may be seen in the background.

Under the stewardship of David J. Ryan, PLS, Humboldt County Surveyor, the Humboldt County Monument Preservation Fund has sponsored seven major surveys. The stated purpose of the monument preservation surveys is for retracement or remonumentation surveys of major historical land division lines. The latest Monument Preservation Fund survey is in the Mattole Valley, part of the “Lost Coast” of Humboldt County. The valley is located in Township 2 South, Ranges 1 and 2 West, Humboldt Meridian.

In 2004 Charles M. “Jim” Roscoe, RCE 9157, contacted the County Surveyor’s Office to discuss the fact that Jim and his father, Stanley Roscoe, RCE 4588, had gathered a great deal of information regarding original government corners in the Mattole Valley. Additionally, several landowners reported family “oral histories” concerning corners in the area. Some of the history consisted of stories of settlers who found the original corner post and replaced the stake with an iron pipe or concrete monument. Jim knew these landowners, but many were getting along in years and he was concerned that the information could be lost forever.

The original government surveys in Township 2 South, Range 1 West, Humboldt Meridian were conducted by J.S. Murray in 1861, R.F. Herrick in 1878 and John Haughn in 1882. Jim’s family entered into the Mattole Valley in 1876; his great-great grandfather and great grandfather led a wagon train into the valley. They homesteaded land in Sections 26 and 28, Township 2 South, Range 1 West. The Mattole Valley lies along the lower reaches of the Mattole River. The surrounding land is steep, rough terrain. In contrast, the valley is wide, flat and suitable for grazing and agriculture. This enticed settlers to the valley, which unfortunately conflicted with its Native American residents. In fact it is likely that some of the areas of the valley were not surveyed by the original surveyor due to the “Indian Wars” of the 1860’s. Further information may be found in the book *Heydays in Mattole* by Jim’s brother, Neb Roscoe.

Some of the corner information known to Jim and his father was based on similar oral histories and from helping nearby landowners find their property corners. This

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Todd Smith preparing to tie bearing trees.

information was not part of a formal survey and is not shown on any Record of Survey map filed with the Humboldt County Recorder. Jim inquired about the possibility of writing this information in the form of a binder of pages of corner history for the Mattole Valley. The County Surveyor suggested that the Monument Preservation Fund could sponsor a survey to locate these corners, remonument as necessary, tie the corners and file a Record of Survey that would include NAD 83 coordinates for the corners. He suggested that Jim team with a local surveying firm to prepare a proposal for this work.

Jim contacted my office, Kelly-O'Hern Associates, and we enthusiastically agreed to work with Jim on this important survey. A contract for "Phase 1" of the survey was entered into for the location of 20 corners. Jim was assisted in the field surveying and office calculations and mapping by Todd R. Smith, LSIT, party chief, and to a lesser extent by Michael J. O'Hern, PLS, and Daniel T. O'Hern, chainman. Jim prepared a binder of research information with notes on all corners and accessories known to him. At each corner the binder was used to search for corner evidence and original and/or later bearing trees.

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Mattole Valley Monument Preservation Fund Survey

At the Northwest corner of Section 30, Township 2 South, Range 1 West, Jim's notes indicated that we were searching for three corner positions and seventeen bearing trees. Four men spent the better part of a day searching for and measuring to corner evidence. Since the valley is generally either flat fields or sloping oak woodlands, satellite visibility was good and many corners could be tied directly by GPS. Other corners required short traverses to the corners from control points. Jim's summer home lies near the center of the Phase 1 area and provided a great base camp.

Local surveyors know that the first step in preparing for a survey in the Mattole Valley is to contact Jim for any information that he might have. Jim is always willing to share his information and to assist in the field, finding corners. He has volunteered his time to help other surveyors and never asks for any compensation. His only desire is that surveyors tie to the proper corners. In recognition of Jim's service to the profession he was named "Humboldt Chapter Surveyor of the Year" by the Humboldt Chapter of CLSA. His goal of preserving original corners is an inspiration to all local surveyors. His enthusiasm for completing Phase 1 is only surpassed by his desire to begin Phase 2 of the survey. Jim is currently working on a reconnaissance of the Northwest portion of the township for Phase 2 of the Mattole Valley Monument Preservation Fund Survey. He celebrated his 85th birthday earlier this year. ❖



Above: Dave Ryan, Humboldt County Surveyor, inspecting the remains of a GLO bearing tree.

Below: Jim Roscoe, Todd Smith and Mike O'Hern at a control point on the east ridge of Cooskie Mountain. The easterly portion of the Mattole Valley is visible in the background.

Mike O'Hern, PLS, is a land surveyor in rural Humboldt County. He is the president of Kelly-O'Hern Associates.





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Using the Scripps Epoch Coordinate Tool On-line Resource (SECTOR) for Changing Between Epochs *The California Spatial Reference Center*

The California Spatial Reference Center (CSRC) website was designed to aid surveyors in their use of the continuous GPS sites (CGPS) in California. The CSRC website

you may need for your survey. The various coordinates are determined using the CGPS velocity model that SOPAC maintains. The velocity model is calculated based on all the CGPS site data that have been collected since the sites first started being installed, some as long ago as 1991, and others as recent as this year. The more data collected for a site, the more accurate the crustal motion velocity (magnitude and direction) can be determined. All data from all CGPS sites (real-time and static) are added to the model to provide a well defined “picture” of where the sites have been and where they are going (the crustal motion of the plates where they are located).

This SECTOR method allows you to apply the velocity model to your network as a whole. The SECTOR velocity model transforms each CGPS site position precisely, based on the actual time series of the site. This means the CGPS sites are precisely transformed to the new epoch and your GPS network ties between CGPS and project points allows your project to be precisely transformed to the new epoch.



is based on the UCSD, Scripps Orbit and Permanent Array Center (SOPAC) website (<http://sopac.ucsd.edu>), so all of the utilities that the scientific users have access to, surveyors may use as well. The Scripps Epoch Coordinate Tool and On-line Resource (SECTOR) is a very useful tool for surveyors.

The SECTOR utility can be accessed from the CSRC website (<http://csrc.ucsd.edu>) from the View Portal Resources link on the home page, and then under the Utilities link on the left side of the page. Alternatively, a bookmark at <http://csrc.ucsd.edu/cgi-bin/sector.cgi> makes finding it very easy.

SECTOR provides geodetic coordinates for all of the CGPS sites in the SOPAC archive (includes all of CA sites that have been established for scientific uses) in any epoch that

Continued on page 32



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SECTOR: Scripting Epoch Coordinate Tool and Online Resources - Windows Internet Explorer

CALIFORNIA SPATIAL REFERENCE CENTER

Time series problems? Try [how to edit data](#), or download the [Geo Java 2.0.0.0](#) (and restart your browser)

Site	X (m)	Y (m)	Z (m)	Latitude (NAD83)	Longitude (NAD83)	Height (m)	Time Series	Model
0101	-3420403.1296	-4737131.8747	3587027.4594	33.47324575	-117.26498855	470.8419	1991.35	NSRS
0102	-3420403.1296	-4737131.8747	3587027.4594	33.47324575	-117.26498855	470.8419	2004.0	NSRS
0103	-3419665.2405	-4732776.1282	3515180.8494	33.45786670	-117.26742877	470.7646	1991.35	NSRS
0104	-3419665.2405	-4732776.1282	3515180.8494	33.45786670	-117.26742877	470.7646	2004.0	NSRS
0105	-3447230.6906	-4718941.8187	3514425.7432	33.46758145	-117.41788709	520.7954	1991.35	NSRS
0106	-3447230.6906	-4718941.8187	3514425.7432	33.46758145	-117.41788709	520.7954	2004.0	NSRS

Get Epoch Specific Coordinates:

Reference frame: **WGS84** Output type: HTML CSV

For coordinate information:

- Get coordinates for all sites at any epoch, via e-mail
- Coordinates a from the most recent IOPAC weekly global file
- Download annual/semi-annual terms for all sites
- Download current site velocities
- Help with this utility
- IOPAC's homepage
- SOEST - process your own GNSS data
- Site coordinate data website

Additional information:

- All coordinates refer to the geoid reference spheroid. The difference between the geoid reference spheroid and the ellipsoid reference spheroid (WGS84) is the geoid height. Address heights can be found using IOPAC's [IGF 2000](#). Caution: in some cases, the address heights may not match those in the site log file.

This information is very helpful for surveyors in California since we have to deal with project control that moves, either continuously or episodically. For instance, in Riverside and San Bernardino Counties, there have been several significant seismic events (Landers quake (1992); Hector Mine quake (1999)) that have affected control monuments. Let's look at an example of how we can use SECTOR to make sense of project control that may have two different coordinate epochs.

Let's say we have a project that has come back to life after a long slowdown. The onsite control at that time was in 1991.35, but several new monuments need to be set. Another problem is the new work requires matching into an adjacent project that used 2004.0 control values. So we now have a mix of 1991.35, 2004.0, and the true of date survey epoch. After performing the field static control survey that includes all the old and new control monuments, we use the SECTOR utility to get all the control values for our adjustment.

When adjusting GPS data, it is always best practice to adjust them initially in the true of date (TOD) epoch or at least a semi-current epoch, like the NSRS 2007.0 epoch (although this epoch is starting to be "out-of-date" for some areas on the Pacific Plate, meaning the values on the ground have

changed from the official values enough that they don't fit as well in the adjustment). This insures that you get the best picture of how well your control fits your minimally constrained network on the day that all measurements were taken. To do this, you need to select three or four CGPS sites that surround your project (pick for good geometry, not linear sites). Run these sites through SECTOR three times, once for the 1991.35 values, once for 2004.0 and again for the TOD or 2007.0 epoch values. The example shows using the CGPS sites DVLW, BILL and ECFS that are in Riverside Co. In SECTOR

Adjusted Coordinates and Residuals

Station	Epoch	X (m)	Y (m)	Z (m)	Residual X (m)	Residual Y (m)	Residual Z (m)
DVLW	1991.35	-3420403.1296	-4737131.8747	3587027.4594	0.0000	0.0000	0.0000
BILL	1991.35	-3419665.2405	-4732776.1282	3515180.8494	0.0000	0.0000	0.0000
ECFS	1991.35	-3447230.6906	-4718941.8187	3514425.7432	0.0000	0.0000	0.0000

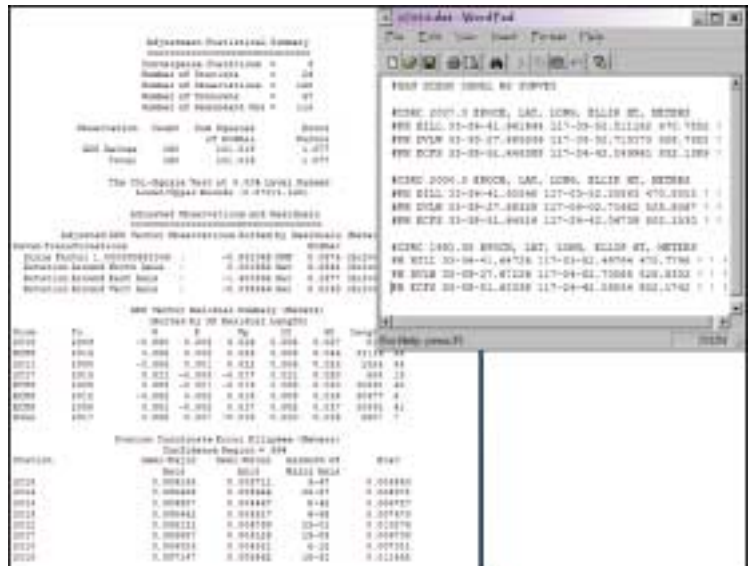
you need to select the epoch date, in this case 1991.35 is May 6, 1991 so select the year 1991 from the pulldown list and Day 127 for the Julian date. Also be sure to select the NAD83 datum or you will just get your results in WGS84. When you select Get Coordinates you will get the geodetic coordinates for your selected CGPS in both NAD83 and WGS84, in decimal degrees. Be careful to convert the correct value to degrees-minutes-seconds (if you're a StarNet user) or use as is, if your adjustment package handles decimal degrees. (I tend to print out these sheets and handwrite the converted values on them. This sheet then goes in the project folder so you have a record of where the control values came from. This has proven to be a good practice when the mappers need to find the reference for the basis of bearings for the map.)

In your least squares adjustment, constrain your minimally constrained network to the TOD NAD83 values. In the example, the NSRS 2007.0 values were used (field work performed in mid 2007). (For a complete list of the 2007.0 epoch see http://csrc.ucsd.edu/input/csrs/csrsEpoch2007_0.txt.) This first adjustment is the best estimate of how well our network fits together in "today's world". From the StarNet adjustment list file you can see that a minimal amount of transformation occurred. The residuals are the same as they were in the minimally constrained adjustment, so the current control fits well. (Note that I hold the ellipsoid heights of the CGPS sites

Continued on next page

to constrain the vertical. This is to prevent a poorly determined elevation from causing a large rotation. If you need to do a local height adjustment, you need to do a fourth adjustment, without CGPS sites, on just your local points holding your field elevations.) Now we need to rerun the adjustment in the 2004.0 epoch. In Starnet, just “pound out” the 2007.0 values and release the 2004.0 values. At this point no other changes should be made to the adjustment. We know that the first adjustment tells us everything to do with our current day measurements and controls are good. Any transformation that happens now is due to trying to hold out-of-date control on a current survey. The differences in the transformation between 2007.0 and 2004.0 in this case are very small. The control values have not changed much in this three year period relative to each other so the survey only shows slight changes in the vector residuals. (A word of warning, if you select CGPS sites with a poor overall geometry relative to your project, you will possibly see very large changes to the ppm, scale and/or residuals. Be sure to select sites that triangulate your project site.) This means there was not much transformation to fit the minimally constrained network to this older control (in other words, the velocity model has correctly determined where these control values were in 2004). So this adjustment now gives you the 2004.0 epoch values for all of your project control in the epoch that matches up to the adjacent property. Save these files and then change your fixed control to the 1991.35 epoch and rerun the adjustment. We now see a little more change in the transformation as we constrain the current network to even older control network values. The scale and rotation parameters are removing the small errors of constraining WGS84 vectors with NAD83 control values, so there will always be a little error as represented by the standard deviation. In the case of newer control values, the ppm and seconds of rotation are almost within the standard deviation, meaning no significant change due to constrained control values. In the case of the adjustments with the older constraints, a small amount of error is being added as the control itself may be introducing some amount of scale and rotation to make it fit.

The velocity model has no actual data from the 1991.35 epoch (a land based GPS survey) so the model is using the data from sites that were installed in 1991 through 2008 to calculate geodetic coordinates for a site installed in 1997 (BILL), 2000 (DVLW) and 2001 (ECFS). All of these sites were running during the 2004.0 and 2007.0 epochs so those values would be based on actual data. However, the model does an excellent job predicting the 1991.35 values as can be seen by the insignificant changes to the vector residuals. The SECTOR (velocity model) does not include the effects of the 1992 Landers earthquake on these 3 sites since they were established after the earthquake. However, the sites were far enough from the Landers epicenter so that the SECTOR prediction is still reasonable. If the sites were closer to the Landers rupture the prediction would be degraded. In that case, the NGS HTDP utility, which includes the effects of



the Landers earthquake and interpolates epoch positions from a crustal motion model, would most likely be preferable.

Note that as more data are added to the velocity model, geodetic coordinate values for the CGPS sites are updated. Although the changes in the values are very slight, it does mean that if you request the values for a particular site a second time, maybe weeks later, the values may not match exactly what you used previously (a good reason to print up the SECTOR data sheet and keep it with your project files).

I hope this example shows an easy way to solve your epoch date problems. A spreadsheet showing all points with all three epochs makes it easy to utilize the results in the field and office. SECTOR also has a link that allows the user to request a listing of all CGPS sites in a specified epoch. ❖



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By: Levi Cox, PLS

Web Wanderings!



Drive the Information Super Highway - Not your Truck

For the most part, I think everyone in California is feeling the effects of not just the downturn in the housing sector, but also the rising cost of energy. Land surveying, is similar to other industries. When an economy sours, competition comes in the form of price slashing. Couple that with the rising cost of energy, particularly the cost of fuel, and you are now finding it hard to make a profit. How can we as Land Surveyors, mitigate the current market pressures and still be competitive? The answer is one word. Efficiency. Let's take a look at one tool, that can help reduce excessive trips back to the office, the local public agency, and most of all, the gas station.

Remote Access Software

There are a few very popular software vendors out there that provide this service. It's cost ranges from free to approximately \$30 a month. What can it do for you? Let's say you are at home or the jobsite, and the office is 10 miles in the other direction. You find out that some of the data, in the way of maps or coordinates, is still at the office. Using this software you can remotely login to your office using a PDA phone, a desktop workstation or a wireless enabled broadband laptop to retrieve that data. Most software packages even enable you to print remotely. How much can this save you?

Depending upon traffic, setup time and the in between downtime, it can most likely save you 2 hours the first time you use it. Combine that time savings with the cost of fuel and the average MPG of a survey truck and you could notice another 8 to 10 dollars on top of the hourly savings. Let's take a closer look:

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MPG: 20

$(2 \text{ Hours} \times \$150 = \$300) + (20 \text{ miles roundtrip} = \$4.00) = \$304$
 $\$304 - (\text{Cost of Monthly Remote Access Subscription } \$30) = \text{First Use Savings of } \274

If you use this software more than once a month, have a less fuel-efficient vehicle, a higher hourly rate, or a longer distance to travel; your cost savings can be significant. Spread over a year's time, the cost savings could even pay to have the wireless broadband laptop in your truck. ❖

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Q&A SMA Expert



Question:

My uncle created four parcels using a parcel map approximately two years ago, and then gave me one of the parcels as a gift. May I now subdivide that parcel into four new parcels using a parcel map?

Answer:

The Basic Mapping Rules

This is an excellent question that raises the issue commonly referred to as “quartering,” or “four-by-fouring” *i.e.*, whether the activity is in fact the successive division of contiguous parcels into four parcels by the common owner of the contiguous parcels.

The Map Act sets up two different but similar mapping approaches, depending on the number of lots sought to be created: (1) A two-step approach is generally required for a subdivision that seeks to create five or more parcels - approval of a “tentative” map (non-recordable), followed by a “final” map (recordable); whereas (2) A simpler, one-step approach is generally required for a subdivision that seeks to create four or fewer parcels - approval of a recordable “parcel” map. (Gov. Code §§ 66426, 66428.) The tentative/final map process is the heart and soul of the Map Act, whereas parcel maps were not added to the Map Act’s regulations until the early 1970s. The parcel map process is designed to be simpler than the tentative-final map process because subdivisions of four or fewer parcels are generally thought to be – and hence are treated as - simpler subdivisions.

Quartering becomes a concern under the Map Act when it is used to avoid the tentative/final mapping requirements by continually subdividing contiguous parcels into four or fewer parcels in order to use the simpler parcel map approach. In response, certain rules have developed that are designed to prevent unlawful quartering. Unfortunately, the substance of these rules is not clear, nor is their enforceability.

The only rules we know of come from two published court decisions and a few California Attorney General opinions, all of which are over thirty years old.

We do know, as a rule, that the successive division of contiguous parcels by the *same* subdivider will be considered together for purposes of determining the number of parcels to be created. *Bright v. Board of Supervisors*, 66 Cal.App.3d 191 (1977). We also know, as a rule, that two or more *different* subdividers cannot *purposefully* attempt to evade the tentative-final map requirements by successively dividing parcels into four or fewer parcels. *Pratt v. Adams*, 229 Cal.App.2d 602 (1964).

However, the law against quartering becomes fuzzy in determining whether two or more subdividers are working together to purposefully evade the tentative-final map requirements. The only known legal authority addressing this question is a California Attorney General opinion from 1972 (55 Cal. Ops. Atty. Gen. 414, 417 (1972)). In that opinion, the Attorney General stated the following rule:

If there is evidence that the transfer is not an “arm’s length transaction,” for example, a sale for inadequate compensation, a transfer to a close relative or business associates, retention of control or financial interest, or generally a transfer which is part of a conspiracy to evade the Subdivision Map Act, the total number of lots should be treated as a subdivision.

In other words, it appears that the Attorney General is applying an “agency relationship” between the parties so that later subdivisions are actually counted against the original subdivider (who is acting in agency with the later subdividers). However, this rule from the Attorney General raises several questions. We note that the Attorney General opinion was issued in November of 1972, which was the same year that the legislature added parcel maps to the Map Act. Prior to 1972, the Map Act did not

Continued on next page

apply at all to subdivisions of four or fewer parcels. The opinion reads as though the Attorney General was not aware of the parcel maps legislation. It's unknown whether the Attorney General would have established a different rule, or found no rule necessary, had the Attorney General been aware of parcel maps.

In addition, the particular examples of unauthorized transactions described by the Attorney General are vague. What is inadequate compensation and why does that matter? Who would be considered a close relative or business associate and why does that matter if the original subdivider is not getting anything out of the later subdivision (money wise or otherwise)? How much control or financial interest may the seller retain or is any compensation enough to make the subsequent subdivider subject to the tentative/final rule?

Perhaps the question presented here is best answered if we consider the reasons behind the rules against quartering. The reason stated by the Attorney General is generally to prevent conspiracies to evade the Map Act; that is, to use parcel maps where tentative/final maps would and should be required. The key question becomes whether the subsequent subdivider is in reality the agent of the original subdivider, and therefore that the original subdivider is in reality the only subdivider.

For example, let us suppose that for the present question, the uncle gave the parcel in question to his nephew as a gift, but under the condition that the uncle would receive some of the profits from the sale of the parcels created by the nephew. The uncle would have given the appearance of having created only four parcels, and the nephew having created four, but in reality the nephew is the agent of the uncle and the uncle created all eight parcels. But, conversely, should the same result occur when the uncle is truly gifting the land to his nephew and wants nothing in return?

In the authors' opinion, the answer to the question depends on whether or not the nephew is acting as the agent of the uncle.

Are Concerns About Quartering Justified?

The foregoing discussion leads us to the broader question of whether express rules against quartering are necessary at all. Arguably, local governments already have all the tools they need to address the potential problem of quartering. As mentioned above, practically speaking, many local governments impose no greater or more encompassing conditions of approval on a tentative map than it would on a parcel map. Therefore, there would be no discernable difference between the two. In addition, the local government can locally require a tentative parcel map where a parcel map is otherwise required. (Gov. Code § 66428.) These tools would allow local governments to remove any practical benefit from the subdividers using quartering to avoid the requirements of the tentative-final map process.

Local governments also have the power to ask any and all questions they desire in their application for a parcel map. The application can inquire about the nature of the ownership of the property, how the property was transferred to the current owner, what entities were involved in the transaction, the nature of the transaction, and what, if any, subdivisions have occurred on the property or adjacent properties recently. In short, local government is able to obtain all the information it needs to determine whether or not a tentative map is required before an unlawful quartering occurs.

Lastly, for now, consider the typical situation in which quartering occurs. Generally, it is an unwitting subdivider who seeks to create four or fewer lots on a property, which, when considered with lots previously created on an adjacent property, would result in the creation of five or more total lots. In this situation, a tentative and final map are required for the subsequent subdivision. But one must ask what purpose is served by requiring this subsequent subdivision to go through a tentative and final map process where fewer than five lots are being created. The tentative and final map process would make sense if all of the lots, the new lots and the previous lots from the adjacent property, were subject to this process, but they are not. Only the fewer than five lots in the subsequent subdivision are subject to the tentative and final map process.



As the foregoing illustrates, quartering and the proper counting of parcels can be a complicated task. However, the Map Act, if understood and utilized properly, provides all the tools local governments need.

About the Author

Michael Patrick Durkee, a partner in the Walnut Creek office of Allen Matkins, represents developers, public agencies and interest groups in all aspects of land use law. Mike is the principal author of *Map Act Navigator* (1997-2008), and co-author of *Ballot Box Navigator* (Solano Press 2003), and *Land-Use Initiatives and Referenda in California* (Solano Press 1990, 1991). 415.273.7455 mdurkee@allenmatkins.com

"Mike wishes to thank Tom Tunny, Senior Counsel at Allen Matkins, for his assistance in writing this article."

Another Recruitment Success Story

So there I was . . . at home, devouring the latest Issue of California Surveyor magazine when I came across the article titled "Recruitment Success Story" by Robert M. McMillan, PLS. Rob ended the story with an excellent question, "What can you do to create your own recruiting success story?" I immediately thought of my own experiences and decided they were worth sharing.

As the owner-operator of a small part-time business I purposed early on to find ways of keeping my cost down. Although the type of work that I performed could be done by one man with the right equipment, I could not justify the cost of a robotic total station. Since I only needed someone to hold the rod I decided to try a temp service. The position required no surveying skills except the ability to keep the rod bubble in the center of the circle. My surveys were not demanding or time sensitive (a benefit of the type of jobs I accepted) so I had plenty of time to converse with my helpers.

I took advantage of the opportunity to educate them on the profession of land surveying and the joys that I have derived from it over the years. I told them stories about interesting projects, places, and people that I had experienced. Four wheel drive off-roading, snowmobiles, ATCs, helicopters, boats, mountain tops, scenic vistas, wildlife (up close & personal,) starry nights (celestial observations,) miles from nowhere with only the sound of a bird's wings flapping in the isolated stillness of rural America.

Because my need was so sporadic it was not often that I was able to request the same employee each time. Consequently, I didn't often see or run into the person again. However, there was one very bright young man who was not quite sure what he wanted to do in life. He took an interest in my stories and the technology that we get to utilize as sur-

veyors. I had the joy of working with him several times, encouraging him to explore the field. Then my work dried up for a period.

The next time I needed a helper I gave him a call. He apologized for not being able to assist me due to the fact that he had obtained full-time employment with a larger surveying firm. Obviously, I was thrilled to hear this and once more encouraged him in his pursuit of the rewarding, challenging, wonderfully satisfying career of land surveying. I'd call that a recruiting success story. . .


Then I started thinking. There are probably many other surveyors out there who could have a similar experience. If you are a one-man operation, who finds himself in need of help from time to time, consider using a temp service and avail yourself to the opportunity it provides to share your love of surveying with someone who's not quite sure about their future. You just may be the one who ends up helping them find their way in the world, "choosing their path, making their mark."



Frank Romano, Jr., PLS, is Relinquishment Coordinator, Right-of-Way Engineering, District 12, California Department of Transportation and an Adjunct Professor, Survey Program, Santiago Canyon College, Orange, CA

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Common Questions Regarding Record of Survey Maps

At the Board of Registration, many inquiries and complaint cases involve misunderstandings with respect to when a Record of Survey is required to be filed in accordance with Business & Professions Code (B&P), Section 8762. Some of these inquiries and complaints originate from the public consumer, or as Land Surveyors know them, clients, property owners, neighbors or even subsequent owners, while others originate from local agencies or other Land Surveyors. This article will review some commonly received statements or questions and attempt to clarify the reason(s) why a Record of Survey is or is not required.

More times than not, the answers to an inquiry depends upon other information pertinent to the specific details and conditions that tend to not be disclosed initially. The question may appear simple and an obvious answer expected until that other information is disclosed. The following is typical of this condition:

Land Surveyor: I am not required to file a Record of Survey because I did not set any monuments.

Discussion:

This is a very common misconception that setting a monument is the **only** action that initiates the mandatory requirement of filing a Record of Survey.

BPELS: It depends. The inquiry stated that you were hired to survey the deed in the title report. What did you provide your client?

LS: A sketch showing the property boundaries per the title report. Also, did a topographic survey for the engineer.

BPELS: The title report included with the inquiry lists a metes and bounds description that describes a parcel that is a portion of a previously-described parcel. Are these the property boundaries that you surveyed?

LS: Yes, those are the ones that I show on my sketch and topographic survey map.

BPELS: If any portions of the property boundaries that you surveyed are not shown on any subdivision map, official map or record of survey, currently recorded in the County Recorder's Office or filed in the County Surveyor's Office, then you are required to file a Record of Survey.

Discussion:

B&P, Section 8762(b) (5) states *The points or lines set during the performance of a field survey of any parcel described in any deed or other instrument of title recorded in the county recorder's office are not shown on any subdivision map, official map, or record of survey.* The requirement is not limited to points set during a survey. Since your survey retraced a legal description as contained in a deed that is not shown on a current map, the requirement to file is in effect. The survey depicts those lines as described in the deed. It is reasonable to expect that the property owner and neighbors sharing a common boundary will rely on your survey for the location of the boundaries. It is also reason-

able to expect the engineer to rely on the position of the boundary as you determined.

LS: But, the boundaries are shown on the Assessors Map.

BPELS: A map prepared and maintained by the County Assessor's Office for tax assessment purposes does not constitute a subdivision or official map or a record of survey as stated in the Code. Many times, a tax assessment is based on a deed recorded in the County Recorder's Office and doesn't necessarily reflect a map or survey.

Another typical inquiry

Land Surveyor: The City is requiring me to file a Record of Survey as condition to finalize a Lot Line Adjustment. Am I required to do that?

BPELS: Generally speaking, no. An actual field survey is not generally required for a Lot Line Adjustment.

Discussion:

There is a State Attorney General opinion filed as Opinion 94-518 (<http://www.ag.ca.gov/opinions>) which addresses this exact inquiry. However, in many instances, the property boundary adjustment is being performed as result of some physical condition in the field that necessitates the proposed adjustment. This opinion does not alleviate the licensed Land Surveyor of any responsibilities regulated under B&P, Section 8762. And if a survey, intended to support the adjustment, discloses any conditions as stated in Section 8762, the Land Surveyor is required to fulfill mandated responsibilities, regardless of whether the reviewing agency issues a requirement or not.

The licensed Land Surveyor, not the reviewing agency, is responsible for understanding all of the conditions that generate a mandatory filing.

Sometimes, the Land Surveyor is under contract to set monuments for the proposed boundary and this requires mandatory filing based on B&P, Section 8762(b) (5) since the monuments represent points set that are reflected in the deeds, recorded as a result of the Lot Line Adjustment.

Another typical inquiry

Land Surveyor: Do I need to file a Record of Survey if my survey discloses any physical improvements crossing a property boundary?

BPELS: No and Yes. Generally speaking, if a survey discloses a physical improvement built across a property boundary, that unto itself does not trigger a mandatory filing of a Record of Survey. However, if in the professional opinion of the licensed Land Surveyor, the physical improvement represents what the property owners purport to be their common boundary, or represents evidence of a physical change to record title ownership, then yes, a Record of Survey is required under Section 8762(b) (1) and/or (3). ❖

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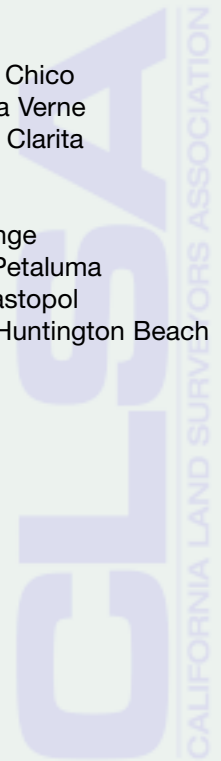
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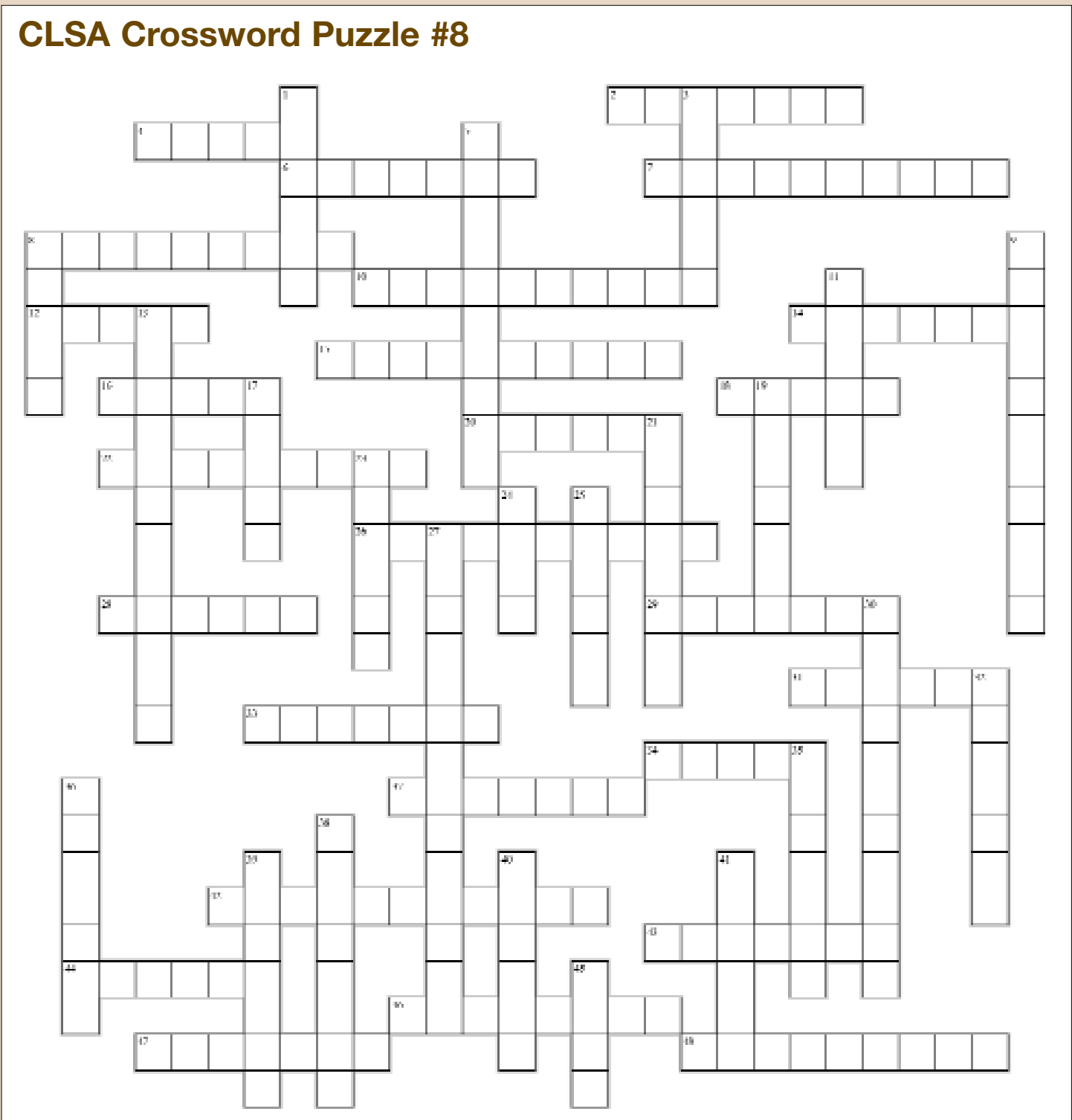
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Crossword Puzzle

By: Ian Wilson, PLS

CLSA Crossword Puzzle #8



Ian Wilson, PLS is the president of Ian Wilson Land Surveying, Inc., in Temecula, CA. His practice specializes exclusively in boundary and topo surveys. He has worked in both private and public sectors for small firms in California and Caltrans, respectively. As well as being a licensed land surveyor, he and his wife, Laura, are newly certified SCUBA divers. They are looking forward to “getting wet” on future trips along coastal California and around the world.

Across

2. HUMBOLDT COUNTY VALLEY
4. BPELS STAFF LAND SURVEYOR CONSULTANT
6. CITY IN WHICH THE NCEES OFFICE IS LOCATED
7. PERSON WHO SPLITS LAND
8. DUFFY'S SCIENTIST
10. INSURANCE POLICY TERM
12. LOCATION OF FEB. '06 POLC MEETING
14. BPELS ENFORCEMENT PROGRAM MANAGER
15. UNLAWFUL SUBDIVISION PRACTICE
16. UCSD BASED ARRAY CENTER
18. ROCK MOUND
20. CALIFORNIA'S NEIGHBOR
22. PRELIMINARY SUBDIVISION MAP
26. THE C IN CGPS
28. MATHEMATICAL INTERSECTION
29. NCEES, ASPRS, CSBSR, SOPAC FOR A FEW
31. DEFINITE BOUNDARY MARKERS
33. CALIFORNIA ___ REFERENCE CENTER
34. GPS DATE
37. HTDP MOTION MODEL
42. VERIFICATION SURVEY
43. 17TH CENTURY SCIENTIST AND AUTHOR, FIRST RECORD ATTEMPT AT MEASURING "c"
44. HUMBOLDT COUNTY ENGINEER AND SURVEYOR RCE 9157
46. MODEL CREATED BY SECTOR
47. TYPE OF POINT
48. ISSUE #150 AGREEMENT TYPE

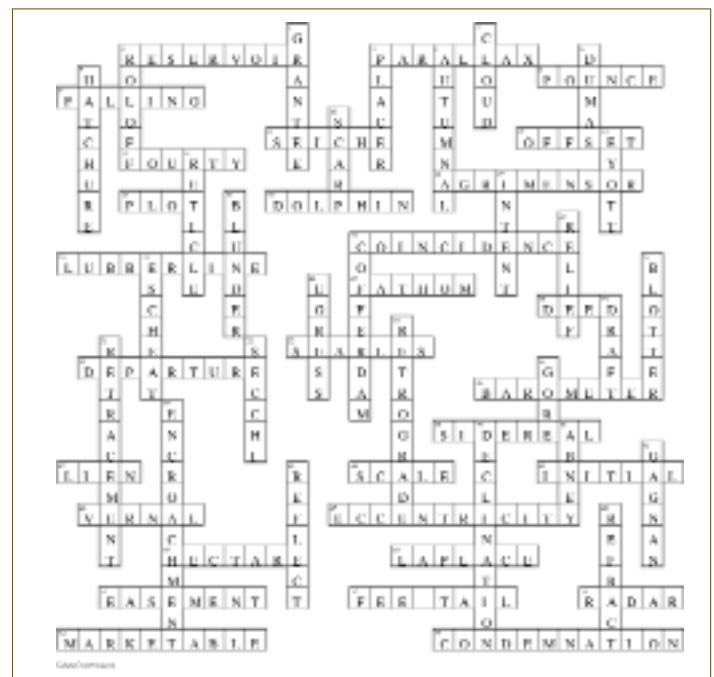
Down

1. BIG 1999 SOUTHERN CALIFORNIA EARTHQUAKE
3. RIVER THE VILLAGE OF VERDI LIES NEAR
5. TYPE OF EXPERT WHOSE WORK IS NOT USUALLY DISCOVERABLE
8. THIRTY NINE POINT THREE SEVEN INCHES
9. BPELS EXECUTIVE DIRECTOR
11. USCS SUPERINTENDENT IN 1872
13. E&O LIABILITY INSURANCE TYPE
17. FOUR POLES
19. LOOKOUT MOUNTAIN USCGS MONUMENT

21. NEARNESS TO TRUTH
23. MAGNITUDE AND DIRECTION
24. CGPS STATION LOCATED AT 33° 34' 56.0756 N, 117° 03' 52.5613 W ON THE SOUTH SHORE OF LAKE SKINNER
25. NOTED CALIFORNIA SUBDIVISION MAP ACT ATTORNEY
27. NALS QUARTERLY PUBLICATION (TWO WORDS)
30. SOUTHERN CALIFORNIA OBSERVATORY (2 WORDS)
32. 1/36 OF A TOWNSHIP
35. NORTHERN-MOST CALIFORNIA INITIAL POINT
36. PRESIDENT HERRICK'S WIFE AND WORLD FAMOUS QUILTER
38. NORTH-SOUTH LINE
39. NUMBER OF MEMBER BOARDS OF NCEES
40. SCRIPPS EPOCH COORDINATE TOOL AND ONLINE RESOURCE
41. TYPE OF DATE?
45. ISSUE #149 MANAGEMENT TYPE

Key to CLSA puzzle #7

(Surveyor Issue # 154)



If you have an idea for a puzzle theme or a clue you would like to include in an upcoming puzzle, email to clsa@californiasurveyors.org



RISK MANAGEMENT FOR LAND SURVEYORS

The Transfer Part of Your Risk Management Program

Over the past year we have written about:

- *Risk Management Basics (California Surveyor, Issue #149)*
- *Dangerous Indemnity Agreements (Issue #150)*
- *Insurance Requirement Review: It's Really Not As Bad As It Seems (Issue #151)*
- *Hot Topics You Might Have Missed From The San Diego Conference (Issue #152)*
- *Are You Covered For Electronic Information Transfer Using CADD? (Issue #153)*

Now it's time to talk about how to implement risk transfer using insurance policies. After you've identified your risks, analyzed loss potential and decided to accept the risk, you're ready to transfer as much of it as possible. Some of the risk can be transferred with indemnity agreements, but the majority of it will be transferred with insurance. So you look through the yellow pages, call your agent, call the broker advertising in your professional journal, or perhaps follow a referral from a friend. You are determined to find the best insurance at the best price.

Lots of Companies, Different Policies

But you discover that to get all the coverage you need, you and/or your agent/broker have to talk to more than one company. Some insurance companies can write your business package but not your professional liability; some will provide auto insurance but nothing else. You come across companies like Allstate, CNA, Farmers, Lloyds of London, State Farm, State Fund, Travelers and Zurich. You're on the right track because it's best to stick with A-rated companies like these. But now what?

Get the appropriate applications, dig in, fill them out and send them off. It's painful, like doing income taxes, but the better job you do filling them out and telling the underwriter who and what you are, the better quotes and coverage you will get in return. You may also consider higher deductibles to get better pricing.

Next you find you can buy your insurance directly from a company, or from an agent who represents the company or from a broker who deals with many companies. It's getting a bit complicated but don't give up. However you go about it, the end product is the same: an insurance policy, which is a promise to pay for any loss you incur. After it's all over, we suggest keeping insurance applications, summaries and issued policies handy so you know what you told insurance companies about your business and what policies you bought to insure those risks you've identified. It could prove helpful with a claim and at renewal time.

Insurance policies you can buy

- Property - This covers buildings, office equipment, surveying equipment, computers.
- General Liability - This covers claims for which you are legally liable such as slips and falls,

job site damage, or slander. Often this is part of the package or business owner's policy (BOP) and is combined with the property policy.

- Workers Compensation - This is for workers that are injured or become ill while working for you.
- Auto - For your personal and business auto.
- Professional Liability - This is for mistakes and errors or omissions in your work.

Employment Practices Liability

If you're a larger corporation you might consider Employment Practices Liability for wrongful termination or sexual harassment claims, and consider Directors and Officers Coverage for detrimental management mistakes.

Why should you buy that insurance?

"Well, I only work out of my house," you say "and I have homeowners and auto insurance policies, so the only thing I might need is professional liability, but I hear that you don't get sued for professional errors if lawyers find out you don't have any insurance. And I don't need workers comp because all my workers are independent contractors."

You better buy it.

While homeowners policies may cover some businesses, your surveying business would not be covered. The same goes with auto policies. Incidental business use could be covered, but full-time operations would be excluded. Check with your agent or broker on this to make sure your business operations are fully insured. Unless you use true sub-contractors who have their own insurance, the people who work for you are your employees and you need to insure them under a workers comp policy. Many owners and municipalities require proof of professional liability insurance before they will let you on the job site. And even if you don't work with these kinds of clients, it's a good idea to buy professional liability insurance to protect yourself against suits from inadvertent errors and outrageous awards that could ruin you financially and professionally. Good insurance and all that goes with it: company lawyers and underwriters, loss control inspectors, as well as your helpful agent or broker, will work to keep your business running smoothly and keep loss-angry people away from your assets.

What's it going to cost?

What's all this insurance going to cost you? A small firm will pay around \$5,000 to \$7,000 a year for the business package, auto, workers comp and professional liability policies, a mid-sized firm could go from \$9,000 to \$12,000, and a larger firm could pay \$20,000 to \$30,000 or more for their policies. It all depends on revenues, payroll, employees, office location, cost of equipment and vehicles, and loss experience. You don't want any claims but if you have one you'll be glad you took the time to purchase the best insurance you could find. ❖



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Photo of the Year Submissions



Photo 1

Photo 1 – taken by Dylan Crawford, PLS - Principal at O'Dell Engineering – "Control Survey for the Exchequer Dam, Lake McClure, CA"

Photo 2 – taken by Giovanni Podesto - Party Chief at O'Dell Engineering – "Construction Staking of a new Hotel at Chukchansi Gold Resort, Coarsegold, CA"

Photo 3 – taken by: Ben Gentry

This picture was taken September 2006 in Ontario. The rodman is Patrick Sloan, Hunsaker & Associates.

Photo 4 – taken by: Ken Fisher, PLS

Mt. Shasta - Sectional breakdown/boundary survey of Section 11, T.41N., R.5W., M.D.M., near Weed, CA. The point that is being occupied is the west 1/4 corner of said Section 11. The winds were howling that day (as evidenced by the cloud conditions on the summit of Shasta), and the legs on the tripod were set as low as they would go - I still thought that the tripod had a chance of being blown over!



Photo 2

To submit a photo for consideration of photo of the year, please email high resolution photo along with caption to clsa@californiasurveyors.org



Photo 3



Photo 4

CLSA PUBLICATION ORDER FORM	CLSA MEMBER	PUBLIC AGENCY	* NON MEMBER	NO. OF COPIES	TOTAL
2008 Complete Package: PLS Roster, Pre '82 CE Numerical Listing, PE & PLS Act, Board Rules, Subdivision Map Act & Index, Misc. Statutes & Binder	\$34.50	\$48.00	\$68.00		
2008 Complete Package (as above) plus CD	\$40.50	\$57.00	\$80.00		
2008 Refill Package includes: PLS Roster, PE & PLS Act with Board Rules, Subdivision Map Act and Index and Misc. Statutes	\$26.00	\$36.00	\$52.00		
2008 Refill Package (as above) plus CD	\$32.50	\$45.00	\$64.00		
2008 PE Act & PLS Act with Board Rules (5 1/2 x 8 1/2)	\$9.50	\$14.00	\$19.00		
2008 Subdivision Map Act and Index (5 1/2 x 8 1/2)	\$9.50	\$14.00	\$19.00		
2008 SMA Navigator: A Practical and Tactical Guide to the Subdivision Map Act Written by Mike Durkee, Esq.	\$42.00	\$45.95	\$49.95		
California Coordinate Projection Tables – NAD '83 By Ira Alexander, CE, PLS & Robert J. Alexander, PE	\$10.00	\$15.00	\$20.00		
Chaining the Land, Second Edition	\$65.00	\$72.00	\$95.00		
Right of Entry Cards (minimum order is 2)	\$1.50/ea.	\$2.00/ea.	\$3.00/ea.		
Right of Entry Door Hangers (includes 1 Right of Entry Card) (Pkg. of 50)	\$5.00/Pkg.	\$7.00/Pkg.	\$10.00/Pkg.		
Corner Record Forms – BORPELS 1297 (Pkg. of 25)	\$10.00/Pkg.	\$15.00/Pkg.	\$20.00/Pkg.		
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CLSA Exam Guide	\$25.00	\$35.00	\$50.00		
Standard Contract Forms Agreement for Professional Services (Pad of 25)	\$4.00/Pad	\$6.00/Pad	\$8.00/Pad		
Land Surveying for the Land Owner & Real Estate Professional, by Daniel E. Beardslee, PLS	\$8.00	\$12.00	\$16.00		
CLSA Decals or Bumper Stickers (Decals or Bumper Stickers)	\$1.50/ea.	N/A	N/A		
Land Surveying Story/Coloring Books (Pkg. of 10)	\$24.00/Pkg.	\$28.00/Pkg.	\$48.00/Pkg.		
CLSA Lapel Pin	\$6.00	N/A	N/A		
"Choose Your Path...Make Your Mark" DVD	\$3.00	\$5.00	\$6.00		
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Here's Some Important Information About CLSA

The goal of the California Land Surveyors Association is to promote and enhance the profession of surveying, to promote the common good and welfare of its members, to promote and maintain the highest possible standards of professional ethics and practice, and to elevate the public's understanding of our profession. CLSA represents all Land Surveyors, whether they are employees or proprietors, whether in the public or private sector.

Representation

LOCAL: Your local chapter represents you in local issues. Through your chapter representative to the State Board of Directors, the individual member can direct the course CLSA will take. **STATE:** The Surveyor is represented at the state level through an active legislative program, legislative advocate, and liaison with the State Board of Registration. **REGIONAL:** CLSA is an active member of the Western Federation of Professional Surveyors. This Federation is composed of associations throughout the western United States and addresses regional issues. **NATIONAL:** Through institutional affiliation with the National Society of Professional Surveyors and the American Congress on Surveying and Mapping, CLSA is represented at the national level.

Educational Opportunities

CLSA presents annual conferences which provide technical and business programs, as well as exhibits of the latest in surveying and computing technology. Seminars and workshops are presented to assist in continuing education. CLSA publishes the California Surveyor magazine and the CLSA NEWS to keep the membership abreast of changing legislation, legal opinions, and other items which affect our profession.

Business and Professional Services

CLSA provides a fully staffed central office which is available to answer questions or to provide up-to-date referrals concerning legislation, educational opportunities, job opportunities, or other issues concerning our membership. Professional liability insurance programs are available to members.

JOIN CLSA TODAY!

- **CORPORATE MEMBER** *\$159.00 + Entrance Fee. Shall have a valid CA Professional Land Surveyor or Photogrammetric license.
- **CE CORPORATE MEMBER** *\$159.00 + Entrance Fee. Any California registered Civil Engineer who is authorized to practice land surveying pursuant to Article 3, Section 8731 of the PLS Act and must be actively practicing land surveying and show sufficient proof thereof. CE Corporate membership must be approved by the Board of Directors.
- **AFFILIATE MEMBER** *\$79.50 + Entrance Fee. Any person who, in their profession or vocation, relies upon the fundamentals of land surveying.
- **ASSOCIATE MEMBER GRADE** *\$79.50 + Entrance Fee. Any person who holds a valid certificate as a Land Surveyor-in-Training.
- **OUT-OF-STATE CORPORATE MEMBER GRADE** *\$79.50 + Entrance Fee. Any person who resides in a state other than CA, who is a member of the other state's Association, and meets the requirements of Corporate Member.
- **STUDENT MEMBER GRADE** *\$15.90. A student in a college or university actively pursuing a surveying education.
- **SUSTAINING MEMBER GRADE** *Annual Dues \$318.00 + Entrance Fee. Any individual, company or corporation who, by their interest in the land surveying profession, is desirous of supporting the purposes and objectives of this corporation.

1. Member Grade Applying for _____ Date _____

2. Name (Full) _____
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3. Mailing Address _____
STREET COUNTY
CITY STATE ZIP

4. Mailing Address is: Business Residence 5. Bus. Phone _____

6. Res. Phone _____ 7. Fax _____ 8. E-mail _____

9. Name of Firm, Agency or Colloge _____

10. California License Number PLS# _____ LSIT# _____ RCE# _____ EIT# _____

11. Have you previously been a member of the State Association? Yes No Year _____

12. Signature of Applicant _____

Mail your completed application to:

CLSA Central Office
526 S. E Street
Santa Rosa, CA 95404

Questions?
Phone: (707) 578-6016
Fax: (707) 578-4406
clsa@californiasurveyors.org

*First Year Dues are to be prorated from date of application

Check Enclosed Dues \$ _____ + Entrance Fee \$ _____ = Total Amount \$ _____

Visa Credit Card # _____ Exp. Date _____

Master Card Authorized Signature: _____

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