

SURVEYOR

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Spring 2014

Issue #177

Surveying for Civil Engineers

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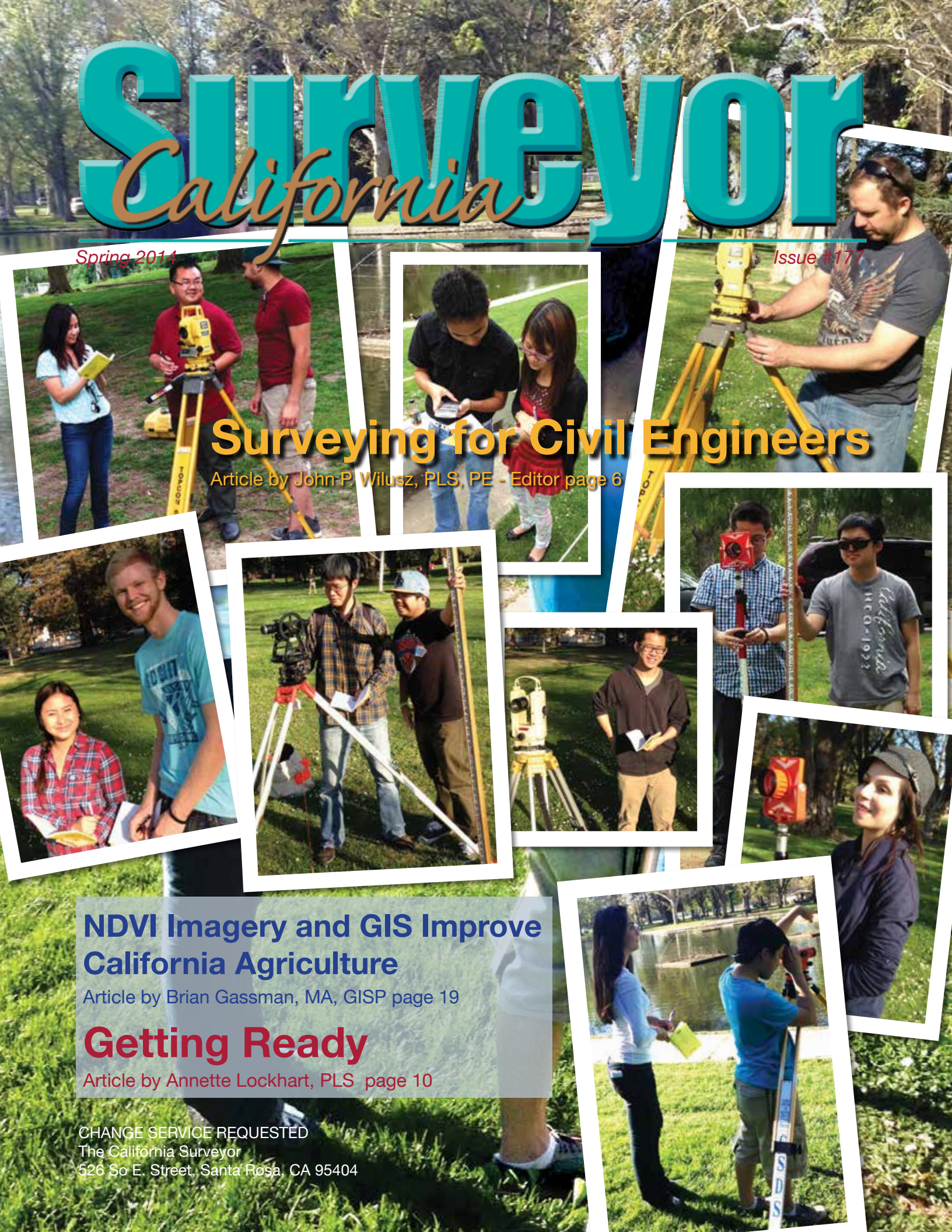
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Getting Ready

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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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CENTRAL OFFICE

526 So. E Street
Santa Rosa, CA 95404
E-Mail address: clsa@californiasurveyors.org
CLSA Homepage: www.californiasurveyors.org

EDITOR

John P. Wilusz, PLS, PE

ASSISTANT EDITORS

Paul M. Brown, PLS – Jill Van Houten, PLS

CONTRIBUTING WRITERS

Anne Hoppe, PLS
Dane Ince, PLS
Michael P. Durkee, Esq.
Richard R. Hertzberg, CPUC, ARM
Scott Martin, PLS

DESIGN AND PRODUCTION

Tony Monaco

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EDITOR'S ADDRESS

John P. Wilusz, PLS, PE
E-mail: johnwilusz@gmail.com

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Sacramento City College Civil Engineering Students: Richard Harvey, Maha Haidari, Malak Haidari, Jeffrey Mose, Lue Moua, Quynh Nguyen, Doug Ostheimer, Lee Thao, Michael Tran, Brock Whaley, Songan Wu, and Michael Yee.

From the Editor



Surveying for Civil Engineers

In January I started teaching a surveying class as an adjunct instructor at Sacramento City College. The class is called Engineering Survey Measurements, ENGR 310, and it is a requirement for the Civil Engineering Associate in Science degree. Graduates typically transfer at the junior level into a civil engineering program at a four-year institution. This is my first experience teaching at the college level. I've done a fair amount of training at the Department of Water Resources, but I'm finding this to be very different. For one thing it's a lot more work. I spend more time planning lessons and grading papers than I do in the classroom. Another thing I've noticed, and this a big change from when I was in school, students today have smart phones, and they use them for instantaneous fact-checking during my lectures. This seems like an unfair advantage.

Engineering Survey Measurements

Sacramento City College built the course to meet transfers requirements at most four-year institutions, including California State Universities and Universities of California. The learning outcomes for ENGR 310 are described like this in the college catalog:

- Operate and compare surveying equipment typically encountered by engineers.
- Interpret, evaluate, and perform calculations to solve engineering problems related to surveying.
- Construct a neat, well organized, logical presentation of problems and their solutions.
- Demonstrate the ability to work effectively with others in typical field tasks.

The 4 unit class has both lecture and lab components. For the lab, the college has plenty of survey equipment but almost all of it is old. We have transits, theodolites, steel tapes, chaining pins, tape grippers, and plumb bobs. One of my wise-cracking friends calls my class the "history of surveying." Fortunately we also have some semi-modern equipment: Two total stations and three automatic levels. At first I was disappointed with the inventory but my attitude has since improved. Students don't need battery-powered equipment to learn the fundamentals. In fact, they probably learn more by using transits and writing field notes than they would by pushing buttons on black box technology.

What do civil engineers need to know about surveying?

Early in the semester one of my students asked me this: What does a civil engineer need to know about surveying? I like the question and I think it's relevant because engineers have a big



Sculpture of the Sacramento City College Panther, shown here wearing leg warmers.

impact on the land surveying profession. Civil engineers are authorized by statute to practice many surveying functions, and engineers licensed prior to 1982 are authorized to practice all surveying functions. Surveyors and engineers rely on each other in their professional lives on a daily basis throughout the state. There is no doubt that engineers ought to know something about surveying, but just what they need to know depends a lot on who you ask.

Let's start with the Board for Professional Engineers, Land Surveyors and Geologists. The Board has an opinion on the matter and it expresses it through licensing examinations. Section 6731.1 of the California Professional Engineers Act lists certain surveying activities that civil engineers are authorized to practice. Anyone who wants to get licensed as a civil engineer in California needs to know enough about those activities to pass the Engineering Surveying examination.

Sacramento City College has an opinion too. My Dean instructed me to base my lesson plans on the items described in the course outline:

Pacing; taping; field notes; horizontal and vertical angle measurements; error theory; differential and trigonometric leveling; traversing and traverse computations; coordinate geometry; horizontal and vertical curves; topographic mapping; area and volume calculations; construction surveys; U.S. Public Lands Surveys; datums; coordinate systems; and control surveys.

But from the perspective of professional practice, what do engineers need to know about surveying to be successful in their careers? I suppose that depends on what they do. A structural engineer might not need to know anything about surveying, but engi-

Continued on next page

neers involved with land development should probably know quite a lot. I asked some colleagues, both surveyors and engineers, for their opinions. These are my favorites:

Datums! Engineers should know enough about datums to make sure their project is on the right one, both horizontal and vertical. They should also make sure their people use the correct bench mark. Two sources of error that have caused me a lot of unnecessary grief are (1) people used the wrong bench or (2) they used the right bench mark but transposed the numbers and wound up with the wrong elevation. Make sure your people check each others' work.

Engineers should be able to tell surveyors what they need from them, and that requires a fundamental understanding of surveying products and services. Meeting with your surveyor early in the process can help develop a realistic scope, schedule, and budget.

A design engineer ought to know that good topographic mapping can be critical, so he shouldn't cut corners. Of course it helps if the engineer knows how to read the map.

Surveying the Future

Sacramento City College also offers an Associate in Science in Land Surveying but the program is currently dormant for lack of enrollment. From what I gather, this is a problem statewide. I'm pretty sure there will be a need for land surveying services in the future, but with fewer students enrolling in land surveying curriculums, I wonder if land surveyors will be the ones providing them. Civil engineers are already authorized to perform many surveying functions, and the future may see more engineers becoming licensed as land surveyors to meet consumer demand. So again back to the question: What do civil engineers need to know about surveying? Looking to the future, I would say quite a lot. Problem is many civil engineers graduating today have not had the benefit of any surveying education, not even a one semester class like ENGR 310. That could spell trouble down the road for them and others.

My First TrigStar

In March my friend Annette Lockhart, PLS invited me to join her for her annual TrigStar presentation to El Camino High School in Sacramento. Annette graduated from El Camino High and has returned many times since to talk with students about careers in

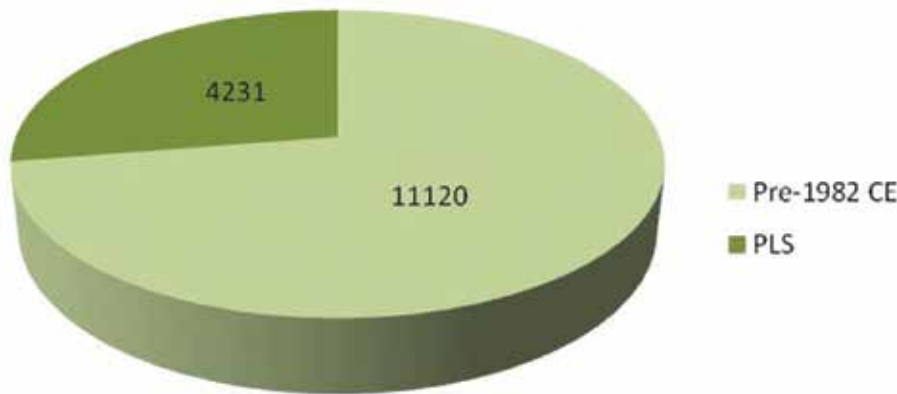
land surveying. She also invited Michael Chiara, PLS. It was my first experience with TrigStar. Over the course of about three hours we made presentations to two classrooms. In each case we opened with a 25 minute overview of the profession, followed by about 10 minutes of questions. The most popular question: How much money do surveyors make? After that we engaged the students in a hands-on activity. Michael brought a total station, tripod, and prism pole, so we set up the total station in a courtyard outside the classroom. We brought the students outside and together we measured two legs and the included angle of a triangle. After that, we returned to the classroom and Michael sketched the triangle on the white board.

Students used the law of cosines to calculate the length of the missing

side. Annette rewarded everybody in the room with chocolates.

She returned on a Saturday morning several weeks later and administered the TrigStar examination. Sixteen students showed up. The Sacramento Chapter awarded small cash prizes for first and second place. Annette assured me it's not a big deal to contact teachers and organize the event. We certainly were well-received, I can vouch for that. Teachers and students alike seemed genuinely appreciative of our efforts. I really enjoyed taking part and if you haven't had a TrigStar experience yet, I highly recommend you give it a try. ❖

Authorized to Practice Land Surveying

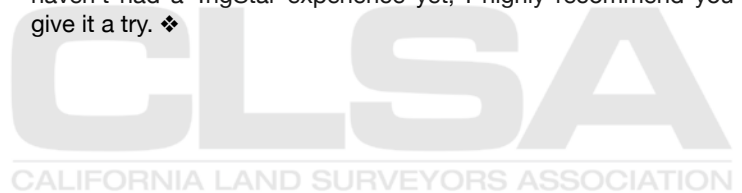


The pie chart is from BPELSG. I was surprised to learn that most people authorized to practice land surveying in California are civil engineers.

Project engineers should have a working knowledge of due diligence as it relates to land acquisition, and they should understand the impacts that easements, encumbrances, and site intrusions can have on their projects.

Make sure your students know how to use a level! That's probably the most important surveying skill I learned in college, and as an engineer I still use it today, especially for checking elevations during construction.

Engineers should know what information surveyors need to stake the design, and they should make sure it shows up on the plans. For example, it's smart to show project control with coordinates and elevations on the plan sheets, and provide coordinates on key elements, such as alignments and structures. If the project uses state plane coordinates, then the combined scale factor(s) should be clearly shown.



By: *Rolland Vandevalk, PLS*

Rolland Van De Valk has 28 years of experience and is currently serving as senior land surveyor/project manager at Diversified Project Services International, Inc. in Bakersfield, CA. Rolland has been a member of CLSA since 2002.

President's Message

Let us know

A couple of months ago I received an email from a CLSA Chapter Officer regarding a particular issue they were experiencing at the local level. Actually, their situation was one which we have all seen and experienced. The Chapter was observing an increase of surveying services being performed by non-licensed individuals. There is nothing unusual about this, it is happening all over the state. However, what caught my attention immediately about this email was the authors question – What is CLSA doing to deal with this ongoing scenario? It is great that members are interested in what CLSA is doing and a week doesn't go by without someone on the discussion board asking "What is CLSA doing about.....?" Again, it is great that members are interested, but is that really the most effective way to bring awareness to a problem? I don't think so. I believe there is a more proactive and effective approach to bring issues to CLSA. The best approach to bring issues to CLSA is to notify the Board of Directors. How do you do this? Contact the Central Office, contact an Officer, or contact the Director in your area (each Chapter has at least one Director that makes up the CLSA Board of Directors).

In the situation mentioned above, although the author was looking for direct intervention from CLSA, the problem fell right in the middle of BPELSG's enforcement jurisdiction. However, I was happy to respond to the request and provide the information regarding BPELSG authority over unlicensed activity.

The moral of the story... CLSA can be most responsive when the questions and situations are constructively brought to the Board of Directors. CLSA has vast resources, including dozens of committees that are available to review questions and recommend action to resolve that which is troublesome to the profession. The CLSA Board of Directors, as the governing body, given the opportunity, can take action. If there is a practice issue you are concerned about, let us know.

It has been a busy quarter

The CLSA/NALS Conference held in San Diego, April 12th-16th was a tremendous success! The final numbers have not yet been reported but I believe attendance was very good based upon my personal observations. I am sure that everyone that took part in this year's Conference would agree that the program had something for everyone and there was much to be gained by all that attended. In conjunction with the Conference, CLSA was pleased to host the NSPS spring meetings, NSPS Student Competition, and the FIG Young Surveyors meeting. Next year's Conference will be in Reno, NV March 21-25, 2015. The particular details will be sent out later, but I hope that you will all consider attending this worthwhile annual event which is one of the biggest benefits that CLSA has to offer.

I am very happy to report that the proposed amendments to the CLSA bylaws were approved by the CLSA Board of Directors at the April 26th Board meeting. This was a long process which included review by an attorney, the formation of an Ad Hoc Committee, and review by the Board of Directors. The bylaw amendments will now be sent to all CLSA Corporate (licensed) members in the form of a ballot for final vote.

We have taken another step forward in considering CLSA's participation in the NSPS campaign to achieve 100 percent membership by all the country's land surveyor organizations. As I reported to you last time, the CLSA Board-approved Memorandum of Understanding (MOU) was delivered to NSPS at the Conference. Officers and committee members from both organizations met to discuss the NSPS 100% membership program and present the CLSA draft MOU. NSPS has not made any comments on our submittal as of yet.

Congratulations to the following CLSA award winners! All were well deserved recognitions for outstanding dedication to the land surveying profession and to CLSA.

Respectfully submitted,
Rolland Van De Valk



Congratulations CLSA Award Winners



*Chapter of the Year – Central Valley Chapter
Chapter Newsletter of the Year – Central Valley Chapter*



Distinguished Service – Hal Davis



Member of the Year – Keith Spencer

Kids Korner



Surveyor trainee Aryelle Parrish (age 10), granddaughter of Steve & Gloria Parrish, helps recover a Von Schmidt CA/NV boundary monument. This cast iron obelisk is on the north side of the Truckee River, west of Verdi, NV. That's "Granda Steve" in the inset photograph. Item of interest: The monument appears to have been moved several feet from its original location.

Do you have a picture of a "junior surveyor" in your family that you would like to share? Send it in and we will put it in the Kids Korner.



By: Annette Lockhart, PLS

Annette works for the California Department of Water Resources in Sacramento, CA

Getting Ready

A Word About PLS Examination Preparation Classes

Surveyors are all very attached to tradition. It is as much a part of our profession as the laws and regulations that influence our practice. One tradition we hold dear involves studying for the California Professional Land Surveyor Examination. For many of us, we started studying for the April exam right around the holidays, and we spent more time with that guy Brown than we did with the rest of the human race during the months leading up to the exam. To pass, most of us had to study as if our lives depended on it. Becoming licensed professionals drives us like nothing else. In the past few years, some things have changed about the PLS exam: It is now computer-based and candidates can sit for it in more locations than before. It is currently offered twice a year. As time passes, various aspects of the exam may change, but one common thread that will continue will be the need to commit dedicated preparation time.

One of the best ways to study is to attend PLS exam preparation classes facilitated by your local CLSA chapter. I believe the first preparation classes were started by San Diego some years ago, and classes continue to be held in several of the chapters throughout the State. In Sacramento, we start our preparation classes two weeks before Christmas. We take a two week break for the holidays and we are right back to it come the New Year. Each class is 3 hours. This is what our 2014 schedule looked like:

1.	Dec. 12	Registration, Info. & Strategy	Ric Moore & Ray Mathe, BPELSG
2.	Dec. 19	Photogrammetry	John Adam - Caltrans
3.	Jan. 02*	Statistics & Error Analysis	Rob McMillan - Caltrans
4.	Jan. 09	Geodesy & State Plane Coors.	John Adam - Caltrans
5.	Jan. 16	GPS Project Planning	Bob MacKenzie - Caltrans
6.	Jan. 23	Laws for Land Surveyors	Jerry Jones- Morton & Pitalo
7.	Jan. 30	Public Lands Survey System	Tim Quincy - BLM
8.	Feb. 06	Public Lands Survey System	Tim Quincy - BLM
9.	Feb. 13	Public Lands Survey System	Tim Quincy - BLM
10.	Feb. 20	Construction Calculations	Rob McMillan - Caltrans
11.	Feb. 27	Boundary	Ian Wilson - Cardno
12.	Mar. 06	Boundary	Ian Wilson - Cardno
13.	Mar. 13	Boundary	Ian Wilson - Cardno
14.	Mar. 20	Water Boundaries	Evan Page - State Lands Commission
15.	Mar. 27	Legal Descriptions	Ian Wilson - Cardno
16.	Apr.03	Legal Descriptions	Ian Wilson - Cardno

Our instructors are very dedicated and commit long hours to preparing for their classes. We also have hard-working facilitators who make sure the learning environment is optimal. The Chapter provides cookies and drinks each night. We distribute study materials via email.

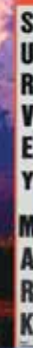
This is how Sacramento Chapter conducts their classes; other chapters do it differently. For example, the Central Valley Chapter uses CLSA-recorded classes and has facilitators on hand to answer questions from students. To assist in preparations classes, one must not have participated in the PLS exam process or taken the exam in the past two years. This is very rewarding work and I encourage all who are able to get involved. There is nothing like helping fellow professionals to become licensed.

Our traditions are precious to us. The PLS exam preparation classes around the state ensure that the professional knowledge we hold dear will be shared in a manner that will make us proud. Take part, if you can. ❖

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Geography Quiz

By: Anne Hoppe, PLS, MSCE, and Germar Bernhard, Ph.D



What is the world's largest tropical lake?
(Answer on page 29)



BPELSG Chronicles

This article will focus on Business and Professions Code (PLS Act) section 8764 as it relates to competently performing and documenting boundary surveys in California. While this section of law is commonly regarded as only applying to those situations when a Record of Survey is submitted for filing with the County, compliance with 8764 should be seen as a “best practices” anytime a boundary survey is performed and documented. For many readers, we will be reviewing section 8764 in a manner most likely different than you may have thought of it presently or in the past. The goal is to re-introduce this very important section of law so that it helps each land surveyor to demonstrate the necessary level of competence when performing boundary surveys.

For those land surveyors who perform boundary surveys in California, how often do you refer to PLS Act section 8764 when performing your boundary survey or when preparing your boundary map (or report)?

For those County Surveyors, or subordinates, who review Records of Survey submittals associated with boundary surveys in California, how often do you refer to PLS Act section 8764 during your review process?

Those land surveyors who regularly attend workshops, seminars, chapter meetings, conferences, or read surveying text books would most likely consider themselves competent in their practice. This is most likely because psychological studies consistently show that individuals who continually strive to learn more tend to more accurately recognize their own level of competence while seeking more knowledge. In a way, it can also be said that the more competent one gets, the more accurately that individual recognizes their own level of incompetence. Otherwise, why would one continue to seek additional knowledge?

8764. Record of survey - technical requirement

The record of survey shall show the applicable provisions of the following consistent with the purpose of the survey:

(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.

Important Milestones in the History of PLS Act Section 8764

- The earliest version of language relating to the modern section 8764 first appeared in the 1891 Statutes, Chapter CCLV, under Sec. 11 of the “Act to define the duties of and to license land surveyors”, approved March 31, 1891. This initial language can be considered as fundamentally equivalent to the modern day paragraphs (a), (b), (c), (d), and (g).
- This language remained substantially the same as Sec. 11 (or Sec. 11.5) through the 1930’s.
- Beginning in 1939, the statutes related to the PLS Act were first re-structured as the 8700 series that we all know today. It is also when section 8764 first appeared in this form and included language substantially equivalent to the modern day (a), (b), (c), (e), (f), and (g).
- Legislative efforts in 1957 resulted in amendments to include language referencing the required surveyor and county surveyor statements in section 8764.5.
- SB (Senate Bill) 1837, introduced during the 1984 legislative session, made substantial changes to quite a few sections in the PLS Act, including adding paragraph (d) under section 8764 in a form very close to modern day language. (Author’s note: the impact felt even today by SB 1837 is noteworthy for not only what remained in the final law, but also for what was stricken during the legislative negotiating process – another story for another day.)

When one reviews section 8764 and the manner in which it is commonly displayed in publications, it is important to understand that the title attributed to that section does not actually appear in the law and is primarily included by the publisher to help readers in quickly locating desired sections of law:

8764. Record of survey - technical requirement

In fact, and to truly be competent in applying section 8764 to common practice, the title could be also read as:

8764. Boundary Surveys – Minimum Technical Reporting Requirements

As we take an expositive look into 8764 some “Competency Principles” will be identified that can be used to assist the land surveyor in applying 8764 to common boundary surveying practices. As each aspect of section 8764 is reviewed it is important to read, understand, and not forget to relate the introductory sentence of this section:

The record of survey shall show the applicable provisions of the following consistent with the purpose of the survey:

And especially pay attention to the words “...consistent with the purpose of the survey” when reading and interpreting the

Continued page 14



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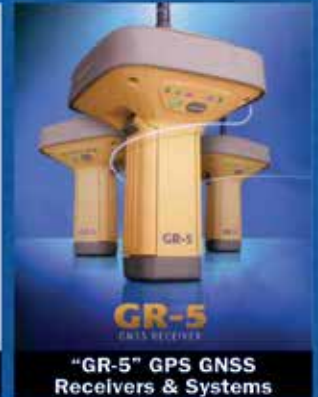
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Postcards



Kristie Achee, PLS, at "Mitad del Mundo," a massive stone monument that marks the equator in Quito, Ecuador.



No Surveyors Allowed
*Submitted by Keith Vincent, PLS.
Photograph by Alex Anaya.*

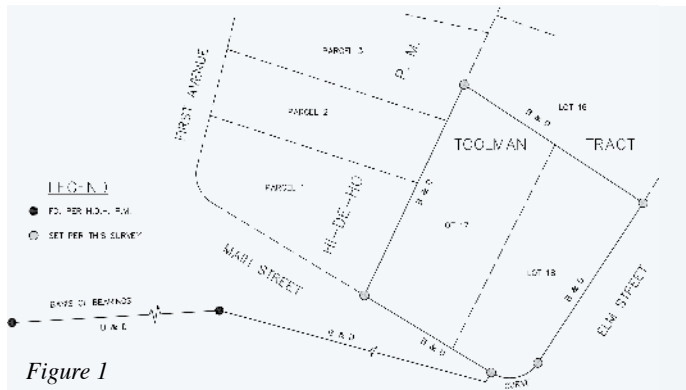


Figure 1

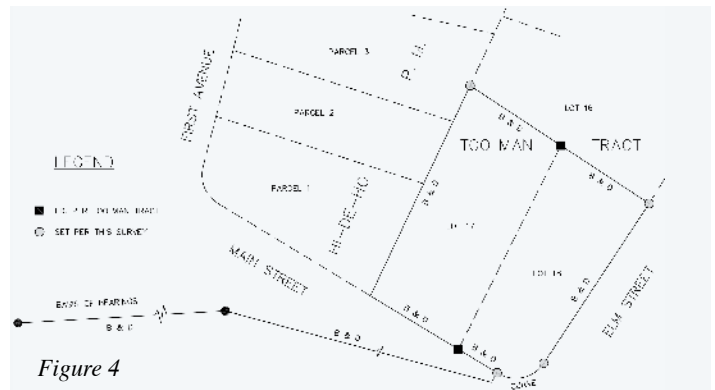


Figure 4

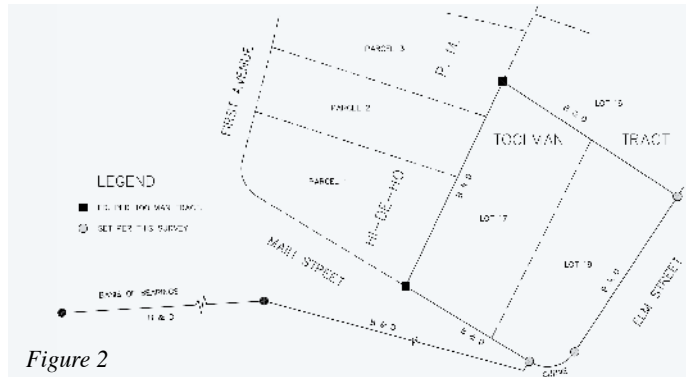


Figure 2

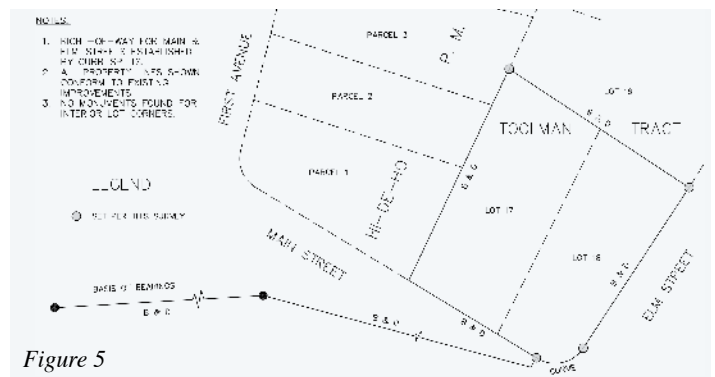


Figure 5

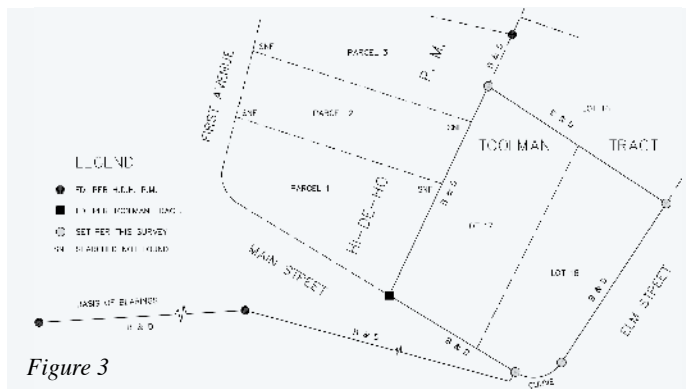


Figure 3

subsequent paragraphs (or provisions) following this introductory sentence. These words were added to law in 1985 as part of the aforementioned SB 1837. While the provisions stated in 8764 should apply to all boundary surveys, and the documenting of such, the level of depth applied could vary consistent with the purpose of the survey.

Competency Principle: What information is necessary to be reported pertaining to the survey

8764(a)

(a) All monuments found, set, reset, replaced, or removed, describing their kind, size, and location, and giving other data relating thereto.

What does this paragraph mean to the land surveyor? Generally speaking, paragraph (a) requires that all monument-related evidence recovered or uncovered during the performance of the survey and used in the decision making process by the land surveyor in issuing a determination as to the location of a property line or boundary be shown on the report documenting the survey, including specific characteristics identifying that evidence.

A couple of key concepts that tend to confuse the practicing land surveyor:

- “or removed” includes monuments the land surveyor expected to be found, based on records research, but are not found after a diligent search or no longer exists.

NOTE IT on the survey map or report. (i.e., Searched For, Not Found)

- If a found or recovered monument was used as a part of the decision making process **or** is of a different than expected character.

8764(b)

(b) Bearing or witness monuments, basis of bearings, bearing and length of lines, scale of map, and north arrow.

Simply stated, paragraph (b) lists the requirements associated with effectively communicating in such a way that anyone reading the survey map should be able to ascertain certain fundamental aspects associated with the boundary survey. What did the land surveyor base the survey on from an angular perspective, what is the drafted scale of the survey map, and how is the survey related to North. It is interesting to note that this paragraph **requires** a bearing and a length (distance) for each line of the survey, which based on the author’s experience reviewing filed maps from various regions across the state, should be a subject to be addressed by some county surveyors. It is also interesting to note that the inclusion of a “North arrow” was not added until 1985 under SB 1837.

The language “Bearing or witness monuments...” is also a perfect example for applying “...consistent with the purpose of the survey” from the introductory sentence in this section. Bearing or witness monuments are not always encountered in all surveys, and this is an example of when the practicing land surveyor must use professional judgment when applying the required laws in their day to day activities.

Continued page 16



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8764(c)

(c) Name and legal designation of the property in which the survey is located, and the date or time period of the survey.

This paragraph addresses basic information that should be familiar to all practicing land surveyors and represents data that is inherently obtained during the performance of a boundary survey. Most jurisdictions throughout California have implemented standardized criteria for depicting this information on the survey map. That being said, it is this author's experience that many times the land surveyor performing the survey and preparing the survey map fails to list all dates associated with the field visits. For example, if the field crew performed the survey on three consecutive days, the map can reflect this as "April 21-23, 2014". There are also times when for various reasons or another, the field work is performed on separate but not consecutive days: "April 21-22, May 1, and May 18, 2014", which is also acceptable. The important aspect to remember is to accurately state the dates in which the field work was performed as your survey represents the conditions on the ground at that time.

8764(d)

(d) The relationship to those portions of adjacent tracts, streets, or senior conveyances which have common lines with the survey.

Added during the 1985 revisions through SB 1837, this paragraph arguably represents one of the most misunderstood portions of the PLS Act and one that consistently serves to demonstrate the competency level of the practicing land surveyor. This language also, whether intended to or not, represents quite clearly one of the more diverse interpretations of the PLS Act across the state, both in terms of application and by standardized review at the County Surveyor's Offices state wide.

Accompanying this article are examples depicting five separate versions of Record of Surveys filed as compliant with 8764(d). While obviously simplified to illustrate the information shown for discussion within the context of this topic, it is important to understand that these examples originated from real world survey maps filed in public records across the state and ones that the County Surveyor believed and certified to as sufficiently in compliance with 8764(d) "...consistent with the purpose of the survey."

It is recommended that readers of this article evaluate the examples in conjunction with 8764(d) and ask themselves if each example complies with 8764(d):

- a) As they apply this requirement when preparing their own survey maps.
- b) As this requirement is commonly applied by other land surveyors in the counties they practice in.
- c) As this requirement is addressed by the County Surveyor when reviewing survey maps in the counties they practice in.

8764(e)

(e) Memorandum of oaths.

The authority for a licensed land surveyor to administer an oath relative to their practice first appeared in the 1891 Statutes under Sec. 9. The language used at that time is very similar to the modern day language with the exception of including a memorandum of oath on a record of survey filed pursuant to the PLS Act. When the "Civil Engineering Board" was formed and the licensing authority for land surveyors was transferred under that Board's authority in 1931

is when this language was changed to Sec. 11.1 and also when the requirement that the memorandum of oath be shown on the survey map first appeared (Chaptered in 1933). The legislative revisions of 1939 first represented this language as it appears to this day, and as section 8760 of the PLS Act and, as previously mentioned, paragraph (e) were added under section 8764 requiring an oath (if performed) to be communicated on the survey map.

8764(f)

(f) Statements required by Section 8764.5.

This paragraph references another section of the PLS Act that contains required language for the land surveyor to include when communicating the survey on the map. In this case, the required statements appear in section 8764.5, which was first introduced when statutes were revised for 1957. In prior years, a statement was required to be placed on the survey map by the submitting land surveyor and in another section, language required the County Surveyor to place a statement relative to approving the survey map to signify compliance with the PLS Act.

8764(g)

(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 first key word in this paragraph is "other" as in "Any other data necessary..." Some land surveyors may look at paragraph (g) as in lieu of complying with paragraphs (a) – (f). "If I follow (g), I don't need to worry about the others." This line of thinking doesn't stand the test of time necessary to read the paragraph.

"Any other data necessary for the intelligent interpretation of the various items and locations of the points, lines, and areas [shown on said map]" first appeared as a result of the 1935 legislative amendments. The idea being imposed with this additional paragraph was to address those occasions when the land surveyor encounters issues that are not specifically addressed in paragraphs (a) – (f) and which demand a clear communicative entry on the survey map such that any reader of the survey map should be able to "intelligently interpret" that which is shown on the map. So, the preparing land surveyor is required to determine if there is any other information necessary to be included on the survey map, in addition to the required data listed in the previous paragraphs.

The remainder of the modern day language was added in 1985 as a result of the aforementioned SB 1837 and which, among other things, clearly validates PLS Act section 8772 requiring identification of who set the monument.

Competency Principle: Make certain that the information shown on the survey map is easily understood and readable by all without benefit of having access to field notes or private records.

Competency Principle: Allow the survey map to stand on its own.

8764 – The Rest of the Story:

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 remaining language in 8764 also owes its birth to SB 1837 and corresponds with the structural changes imposed on section

Continued on next page



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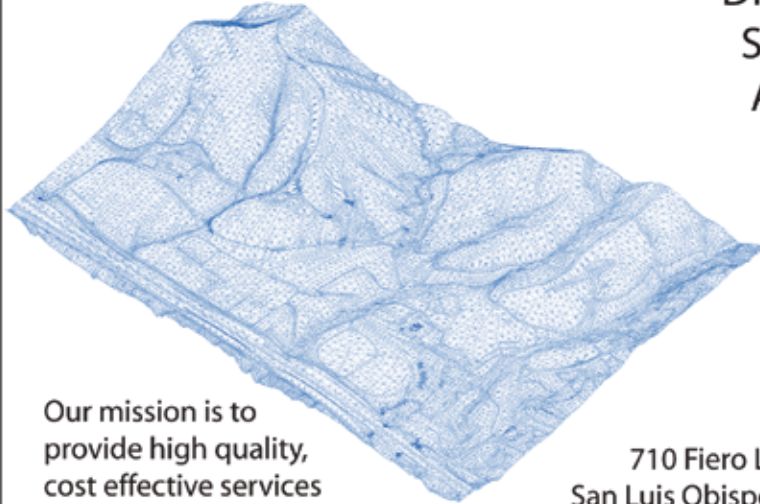
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Continued from previous page

8762 within the same bill. For reasons unknown to the author, this is one of those sections of law that tends to be mostly ignored by the land surveyor when preparing the survey map. Obviously, this language pertains to those situations where the survey map is required to be filed as a Record of Survey with the County in which the survey was made. But like the previously discussed language in this section, the responsibility to include the reason(s) for conducting the survey, "...consistent with the purpose..." should not be overlooked when preparing to document all surveys, mandated by law or otherwise.

A diligent land surveyor, competent in performing and documenting boundary surveys, should be able to easily state why the survey map was required to be filed in accordance with section 8762. A land surveyor encountering a situation that may or may not trigger the mandatory filing of a Record of Survey should be able to approach the local County Surveyor or the Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG) to seek assistance in confirming if such compliance is required. This action does not in itself demonstrate a lack of competence. On the contrary, seeking another opinion from a known authority on interpretation of mandated responsibilities actually illustrates more times than not an ability to accurately self-assess one's own limitations.

And as illustrated by the inclusion of "...shall also show...", this requirement is required to be performed in addition to the previously stated requirements found in paragraphs (a) – (g). It is equally adequate to comply with this requirement "...either graphically or by note...", but it is imperative for the land surveyor preparing the map to make this choice based on the reader's perspective and not on the preparer's perspective.

Competency Principle: The land surveyor is required to report their findings.

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

Additionally added to law by SB 1837, it is apparent that this sentence was meant to address those instances when land surveyors are contracted to establish, reestablish, retrace, or determine the location of one or more property lines without attempting to reconcile all property lines associated with the purpose of the survey. It has also been observed that there are some very real world situations where the land surveyor was prevented from physically completing their survey related to boundary surveys for several reasons (e.g., client is not happy with the outcome associated with the land surveyor's opinion on the location of the property line and requests that all worked is stopped, etc.). In these cases, if the mandatory requirement to file a Record of Survey has already been triggered by the field survey, the land surveyor is still required to fulfill the responsibility in filing the appropriate record regardless of the wishes of the client. It is important to remember that when one or more sections of 8762(b) (1)-(5) is triggered, the land surveyor is the sole party responsible for satisfactory compliance with this section. Should a land surveyor encounter a situation similar to what has been described, do not hesitate to contact BPELSG for assistance in understanding and acting on the mandatory responsibilities.

It is also recognized that there are instances when sufficient research and a diligent field survey is performed and a competent land surveyor still cannot reconcile the evidence satisfactory

Continued page 18

enough to issue an opinion as to the location of the property line(s) without recommending to the client additional consultation by a title company or legal counsel. In these instances, it is imperative that the land surveyor still comply with the PLS Act in cases where mandatory filing is required. Language simply does not exist within current law (PLS Act) that requires the land surveyor to fix the issue, only that the land surveyor shall clearly and concisely report all pertinent evidence "...consistent with the purpose of the survey..."

Competency Principle: The survey doesn't need to FIX problems that are discovered by the land surveyor.

Don't misinterpret this Competency Principle with a possible contract obligation you may have if you have represented to your client that you will provide a boundary survey and establish their property line on the ground.

8764 – Connection to 8766:

8766. Record of Survey - examination

(a) Within 20 working days after receiving the record of survey, or within the additional time as may be mutually agreed upon by the land surveyor or civil engineer and the county surveyor, **the county surveyor shall examine it with respect** to all of the following:

(1) Its accuracy of mathematical data and **substantial compliance with the information required by Section 8764.**

(2) Its compliance with Sections 8762.5, 8763, 8764.5, 8771.5, and 8772.

(b) The examination pursuant to this section shall not require the licensed land surveyor or registered civil engineer submitting the record of survey to change the methods or procedures utilized or employed in the performance of the survey, nor shall the examination require a field survey to verify the data shown on the record of survey.

(c) 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.

(d) The examination pursuant to this section shall be performed by, or under the direct supervision of, a licensed land surveyor or registered civil engineer.

When preparing a Record of Survey for submittal to the County Surveyor, why does the land surveyor care about compliance with section 8764? Primarily because the PLS Act requires the County Surveyor to examine the submitted survey map with respect to various requirements in addition to compliance with independent sections of the PLS Act including, but not limited to, section 8764.

Initially introduced with the aforementioned 1939 statutes, language was much more simplified than today's version:

8766. Within twenty days after receiving the record of survey, or within such additional time as may be reasonably necessary, the county surveyor shall examine it with respect to:

(a) Its accuracy of survey and mathematical data.

(b) Its conformity to other records or satisfactory evidence of the error of such other records.

(c) Its compliance with the provisions of this chapter.

Revisions implemented in 1957 statutes recognized section 8764 by changing paragraph (a) to read:

(a) Its accuracy of mathematical data and completeness of information as required in Section 8764.

In addition, the 1957 revisions added paragraph (d) to recognize that a Record of Survey could be used for subdivision purposes consistent with subdivision laws at the time:

(d) Whether or not it appears to be the record of survey of a subdivision as defined in Section 11535.

The 1967 statutory revisions eliminated paragraph (d).

The 1984 revisions changed 8766 to include:

Its compliance with Sections 8762.5, 8763, 8764.5, 8771.5, and 8772.

(Presumably through SB 1837 – but not confirmed)

(b) The examination pursuant to this section shall not require the licensed land surveyor or registered civil engineer submitting the record of survey to change the methods or procedures utilized or employed in the performance of the survey, nor shall the examination require a field survey to verify the data shown on the record of survey.

(c) 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.

(d) The examination pursuant to this section shall be performed by, or under the direct supervision of, a licensed land surveyor or registered civil engineer.

Competency Principle: By law, the County Surveyor must ensure compliance with section 8764

While reading this article perhaps the reader has recalled reviewing past records of survey that, at the time, clearly DID NOT provide the minimum required information discussed above and/or the County Surveyor stated on the map that the record of survey was properly examined. "How did the land surveyor perform his survey?" or "Why did the land surveyor do what he did?" or "How did the County Surveyor allow this to be filed without requiring a note?" Many times the reader would not be alone in asking themselves these questions. It is the author's experience, from survey maps provided to BPELSG, that many records of survey do not tell the entire story, or worse illustrate a low level of competence by the land surveyor involved with the performance and/or documentation of the survey. Many of the concerns received, from practicing land surveyors to staff at BPELSG, express deep concerns for this issue and those concerns are not taken lightly.

This law shouldn't be that difficult for the practicing professional to comply with after completing a diligent and competent boundary survey. Additionally, the County Surveyor's review should be equally straightforward. Collaborating to clearly communicate one of the authorities solely imparted to those with authority to perform boundary surveying here in California is a responsibility for all. After all, land surveyors are the individuals best equipped to memorialize one of the most cherished freedoms for man – land ownership. ❖

By: Brian Gassman, MA, GISP

Brian Gassman is a certified GIS Professional (GISP) working for Psomas as a Sr. Survey Technician/LiDAR Specialist. He is currently assigned to the Surveys Services Branch at the California Department of Transportation, District 4 office in Oakland, CA. He also runs his own precision agriculture business, Ingeosight, providing Normalized Difference Vegetative Index (NDVI) imagery analysis to crop managers.

NDVI Imagery and GIS Improve California Agriculture

Today, many agribusinesses rely exclusively on crop service providers for ground-based methods of crop management. In addition to sampling, analyzing and adjusting the agronomy, crop service providers oversee the health of the leaf canopy over the course of a growing season. Crop service providers are generally thorough, but checking every vital leaf within the canopy is beyond their scope of services. The information found within an aerial or satellite-acquired, high resolution, multispectral image brings more precision to the process, and thereby helps the farmer maximize each and every square inch of his farm, even if it's 30,000 acres or more. A picture is worth a thousand pixels.

A calibrated and classified NDVI image is the most cost-effective form of precision feedback available to the farmer. In even the most well-managed large farms and vineyards, satellite-acquired NDVI imagery can identify as much as 35% of a crops' vital leaf canopy to be on the brink of failure due to poor irrigation coverage, pests, or nutritional deficiencies. Ground inspecting thousands of cultivated acres with an equivalent level of precision is labor-intensive and cost prohibitive, especially since it needs to be done multiple times over the season. In the accompanying photo, NDVI imagery of safflower blocks is superimposed on Google Earth. The NDVI imagery is from a 2013 analysis of a 70,000 acre farm in the western United States. In this case the analysis revealed that the 600 acre safflower blocks were receiving an uneven distribution of irrigation and therefore in dire need of a coverage adjustment. Imagery of the farm was again acquired, processed and delivered two weeks later to verify that the leaf canopy was reviving. Layered underneath the NDVI imagery of the safflower blocks reveals more data; color, near-infrared, and grey scale imagery which can serve to better define trouble areas with a higher degree of precision.



In the accompanying image we see how a single color, red can be a valuable indicator of a serious issue worthy of a field investigation. From behind a tablet, smart phone or desktop computer, the least tech-savvy farmer can mine thousands of pixels within the photograph to precisely locate areas of concern – a picture is worth a thousand pixels. More than just a photograph, this is an intelligent image, providing real value to the farmer from the comfort of his home or office computer.

Today there remains a gap in the widespread integrated use of high resolution, intelligent imagery to provide beneficial oversight throughout a crops' lifecycle. NDVI images don't lie, and when utilized properly they can improve crop yields and bring peace of mind to the farmer. ❖

By: Rich Maher, PLS

Rich is a Professional Land Surveyor with 25 years of experience and the owner of KDM Meridian in Lake Forest, CA. He serves as a Director on the CLSA Board of Directors and as the Treasurer of the Orange County Chapter. In addition, Rich is the current Chair of the California Spatial Reference Center (CSRC) Executive Committee.



Practice Reminders

Take a moment to look yourself up on the BPELSG website: <http://www.bpelsg.ca.gov/>

Select the LICENSEES tab, then License Lookup in the list of links, and follow the process to look yourself up to check if your address is current. Board Rule §412 states you have only 30 days to notify the board of changing addresses. In the same list of links (Licensee Information) you'll find an Address Change Form that allows you to update your address online.

While you are thinking about updating your information, is the Organization Record for your firm current? You can request a current copy from the board and/or update yours with the Business & Organization Record Form Information in the same (Licensee Information) list. You must list "... the types of professional services provided through the business; the names of all of the owners, partners, or officers (both licensed and unlicensed); and the names of all of the Professional En-

gineers and/or Professional Land Surveyors who are in responsible charge of the professional services provided."

"...if you leave a business where you were in responsible charge of the professional services, then you must file a Disassociation Record form."

While I have your attention on business officers and responsible charge, have you reviewed your surveying contracts recently? There are 5 key elements that must appear, with few exceptions, on your contracts. The PLS Act has listed these five elements since 2001 in §8759. Violations continue to appear as causes of actions in board enforcement against surveyors in 2014. Review the requirements in the Contract Law Article. Be careful about who signs your contracts. If you are the surveyor in responsible charge, you could be found to be aiding and abetting unlicensed practice if unlicensed office staff or business owners are the sole signature to a contract offering to provide profes-

sional services. To protect yourself, be sure to have the licensed professional in responsible charge, also listed on your Organization Record, sign all contracts, alongside any other required persons/officers according to corporate structure.

If you are a member in good standing with the State CLSA organization, avail yourself to a free sample contract that not only complies with §8759 but provides you a lot of additional protection with contract language you may not have considered. Look for it in the member's section of the state website <https://www.californiasurveyors.org> under Member Resources / Downloads. You'll also find a short-form contract and plenty of useful resources like right-of-entry pamphlets and a monument conservation brochure.

Follow these few simple tips above and save yourself the headache of a board citation on your record, over "paperwork". ♦

MARK YOUR CALENDAR!

CLSA WORKSHOP

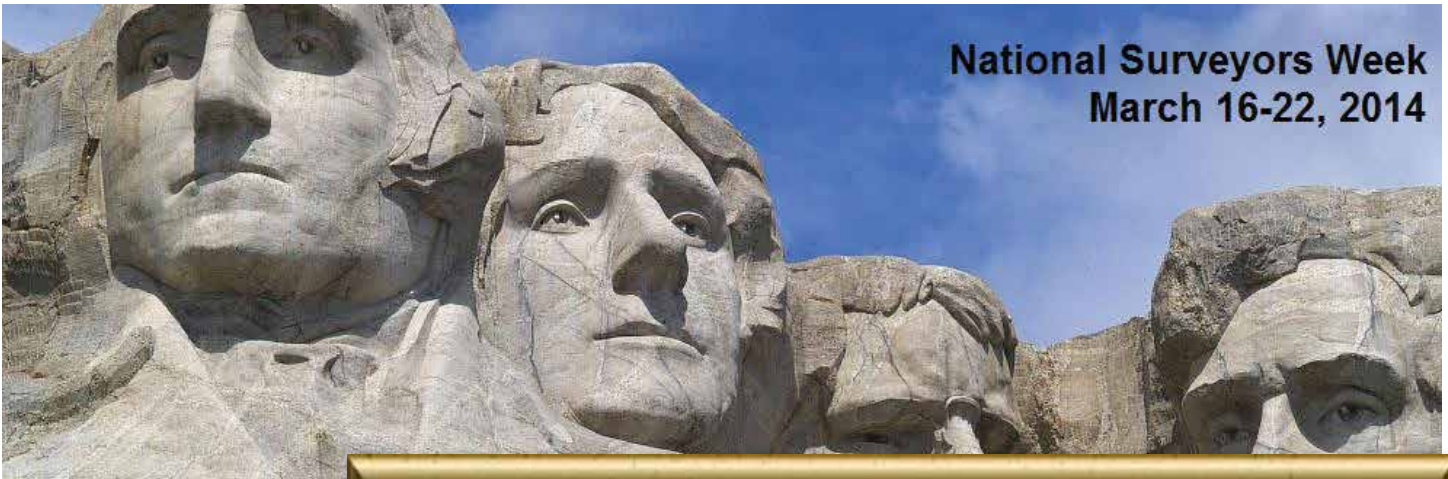
The Evolution of the North American Datum of 1983 (NAD 83) in the USA
Coping with Changing Positional Coordinates Due to Crustal Motion

Speaker: Dr. Richard Snay

September 17th (Southern California)

September 19th (Northern California)

Professional Outreach Events



**National Surveyors Week
March 16-22, 2014**

National Land Surveyors Week was held March 16-22, 2014 and was celebrated throughout California. A resolution, authored by Senator Andy Vidak, was read on the Senate Floor on March 16th. CLSA President Rolland VanDeValk and Pat Tami, LS Member BPELSG were both present to receive the resolution.

Local CLSA Chapters obtained proclamations from cities and counties. In addition, CLSA members from across the state participated in public outreach campaigns including speaking to students about a career in land surveying.

National Land Surveyors Week next year will be held March 15-21, 2015. What will you do to celebrate?



*Rolland VanDeValk, CLSA President;
Senator Andy Vidak; Pat Tami, LS
Member BPELSG*

National Surveyors Week California Senate Resolution No. 32

WHEREAS, There are over 45,000 professional surveyors in the United States, and 3,488 in the State of California; and

WHEREAS, Surveying is the art and science of accurately determining the position of points and the distances between them and is often used to establish land boundaries for ownership or governmental purposes; and

WHEREAS, Surveying has been an essential element in the development of the human environment since the beginning of recorded history and it is a requirement in the planning and execution of nearly every form of construction with its most familiar modern uses in the fields of transportation, building and construction, communications, mapping, and the definition of legal boundaries for land ownership; and

WHEREAS, In order to accomplish their objective, surveyors use elements of engineering, physics, mathematics, law, and history; and

WHEREAS, Since the colonial days of the United States, surveyors have been leaders in the community, statesmen, influential citizens, and shapers of cultural standards; and

WHEREAS, Former notable surveyors include George Washington, Thomas Jefferson, Abraham Lincoln, Lewis and Clark, Daniel Boone, and Henry David Thoreau, among many others; and

WHEREAS, It was the work of the surveyor that determined the boundaries of land, the greatest economic asset in the colonies and territories that became the United States, including California; and

WHEREAS, The nature of surveying has changed dramatically over time, as it is no longer limited to the description and location of land boundaries; and

WHEREAS, Hydrographic surveys are important to the use of all bodies of water; and

WHEREAS, Engineering surveys are utilized in the study and selection of engineering construction; and

WHEREAS, Geodetic surveys determine precise global positioning for such activities as aircraft and missile navigation; and

WHEREAS, Cartographic surveys are used for mapping and charting, as well as photogrammetry, the science of using aerial photographs for measurement and map production; and

WHEREAS, Many services are now provided through the use of sophisticated surveying equipment and techniques, including satellite-borne remote sensing devices and automated positioning, measuring, recording, and plotting equipment; and

WHEREAS, The establishment of the week of March 16 through March 22, 2014, as National Surveyors Week is a fitting tribute to all surveyors; now, therefore, be it

RESOLVED, by the Senate of the State of California, That the Senate recognizes the week of March 16 through March 22, 2014, as National Surveyors Week; and be it further

RESOLVED, That the Secretary of the Senate transmit copies of this resolution to the author for appropriate distribution. ❖

Scott works for the State of California in Sacramento and lives in the Placerville area.



My Other Hat

Editor's Note: "My Other Hat" is a new column for the California Surveyor. Look for articles by surveyors who tell us about the fun things they do in their spare time when they are wearing their other hats.

It would be a true statement to say: Scott Martin releases a lot of pressurized gas and I would be proud of it. That is because my hobby is finding, refurbishing, collecting, and running antique and vintage gas pressure appliances. Most of my collection consists of Coleman products, primarily lanterns, but I have a few stoves, lamps, and oddball pieces too. This hobby started from my love of tent camping and with a single lantern a few years ago. My collection has grown to about 100 lanterns, the earliest of which is a 1919 Coleman Air-O-Lantern with the original mica globe on it. I also have the first camp stove Coleman produced in 1925, the Model 1. It is an addicting hobby – so fair warning.

The first Coleman lantern was produced in 1914, and up until the late 20's they required an external pump to put the pressure in the tank. Most of my lanterns are in running condition unless they are unsafe to run for some reason. To me, there is something magical about finding an 80 plus year old lantern hanging in a barn in poor condition and bringing it back to life to light our camp and send out the soothing sound of pressurized gas being ignited in those amazing, don't touch them or they will break, mantles, which serve to catch the flames. The table lamps are a trip back in time too. When I run one, I imagine a child doing homework, or a mom cooking dinner in a one room house during WW I or the depression, by the light of this beautiful lamp.

I think everyone collects something. For me, the logical thing would be antique surveying equipment, and yes, I do have a Gunter chain and a 1903 brass transit, but those things are static. Nice to look at, but they don't give me anything back. My lanterns and lamps (and stoves, to some degree) talk to me. They allow me to drift back in time and think about where they have been. They live through light and sound. About half of my collection is pre-1940. The crown jewel of my collection is a USFS-issued Coleman lantern from the early 1930's – a very hard lantern to find and I have one!!! It might have even lit a survey crew camp at

one time. I have done a few customized lanterns too. My "Patriotic" lantern hangs proudly in our camp every year and runs all night to keep the bears away and to remind us of this great country.

Besides the enjoyment of seeing an old lantern or lamp run for the first time in decades, this hobby has provided me some unexpected benefits, like meeting interesting people and making friends with fellow collectors all over the world through an online collector's forum. One specific story comes to mind about an old gentleman I met when I needed a rare part repaired that required brazing with a material that could handle high heat. I decided a radiator shop might be a good option, so I looked one up and gave them a call. I spoke to the old guy for a minute and he told me to bring the part in, so I jumped in the car and headed over there. When I pulled up, I found an old building in not-so-good of condition and I couldn't find a regular door to enter through. I walked past a sliding "barn" door that was open about 3 feet and heard a voice say "come on in." I walked inside and entered a time capsule, where at least 60 years of accumulated "stuff" filled the shop, with small pathways between the high piles. In the back, there was a bespectacled man well into his 70's with a gap toothed grin and a torch in his hand. Most of the shop was quite dim, except for the small area where he was working. He introduced himself as Gilly, the owner.

I showed him the part and he closely examined it, then took it to a wheel to burnish off the crud to get a closer look. Despite the poor lighting and aging eyes, he immediately spotted the miniscule crack in the brass tube, which I found incredible. He asked me a couple of questions about the function and use conditions then quickly declared "yep, I can fix that. Come back in an hour and it will be ready." I asked him how much it would cost and he said "ten bucks" and off I went. No paperwork, no call back number, nothing, yet I felt totally fine



Optimus 930

Continued on next page



Air O restoration

entrusting this rare item to this old school character. An hour later I returned, this time knowing where to enter, and he was elbow deep in a bead blaster as I walked in. He stopped and walked over to the part. My instructions were “form follows function” meaning as long as it worked, it didn’t need to be pretty. He took those words to heart. He handed it to me and said “no charge, that was interesting to work on.” I tried to pay him anyway, but he refused to take it. I thanked him and started on my way.

As I was leaving, I noticed an old lantern hanging from the rafters and stopped and pointed to it. He told me it had been his dad’s and hadn’t moved from that nail in at least 40 years. He said he kept it around “in case he ever needed the light and it made a good conversation piece.” I asked him if he wanted me to take it home and get it running for him. He kind of cocked his head and asked “you do that kind of thing?” which seemed odd coming from a man I figured could fix just about anything. I told him I had done many of them and would be glad to work on his. He reached up and took it down from the nail and handed it to me. There was at least ½” of history in the form of shop dust and grime accumulated on this 1950’s vintage lantern. He said “now I am going to owe you” to which I replied “no you won’t. I like working on these and I expect we will become good friends because I am going to need your help a bunch more for projects.” We shook hands and just like the first transaction, no paperwork or exchange of phone numbers, just complete trust that I would keep my word and return in a few days with his lantern. When I got home, before I did anything else, I took a few pictures of the “furry” lantern with its thick coat of greasy dust, only disturbed in a couple of places where my fingers had broken the surface. Unfortunately, the make and model of the lantern is highly prone to developing cracks in the tank over time, and sure enough, once I removed the dust coating, I found two large ones, which meant the lantern could not be safely repaired and run. Although disappointed, I continued a full disassembly and cleaning of the lantern. I also decided that, because I had promised to bring Gilly back a working lantern, I would pull a similar Coleman model out of my collection and present it to him when I returned his family heirloom.

Two days later, I returned to that time capsule and presented my new friend with his cleaned up lantern and my gift of a fully tested and fueled lantern for his shop. He was surprised, pleased, and grateful. He was amazed at how well the old girl cleaned up, then promptly reached up and returned it to its nail for another lifetime of accumulation and conversation stimulation. He took my gift, smiled broadly and said “this one is going home to light my shop there.” That exchange started an emerging friendship between generations that will continue as long as both of us are able.

Another thing that this hobby has brought me is patience. If you get in a hurry, you break things that are hard to replace. I have gained a sense of patience that I never had before from working on these old lanterns that extends to the rest of my life. You can’t buy that at any price. ❖



The Patriot



Coleman Model M, circa 1917



Nulite Lamp, circa 1925

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By: Dr. Srinivasan S Dharmapuri, C.P., PMP, GISP - LiDAR Scientist,
Michael Baker Jr., Inc.

Dr. Srin Dharmapuri is an ASPRS Certified Photogrammetrist and Licensed Photogrammetric Surveyor in South Carolina and Virginia, as well as a Certified GIS Professional and Project Management Professional. He is the Chief LiDAR Scientist for Michael Baker International in Pittsburgh. Dr. Dharmapuri is responsible for management and oversight of all LiDAR processing activities involving extraction, algorithm development, quality assurance, and product delivery.

Dr. Dharmapuri has Masters of Science in Physics, Masters of Technology in Remote Sensing, and Doctorate in Satellite Photogrammetry. Srin has over 27 years of extensive, wide-ranging experience within the Geospatial industry; most notably with LiDAR, Photogrammetry, and GIS. He has worked in both the private and public sectors, as well as internationally, and is the author of numerous professional publications worldwide.

LiDAR Technology – A Synoptic View

Introduction

Light Detection and Ranging (LiDAR) is an active remote sensing technology that operates on the same principle as RADAR except it uses a laser (light) instead of radio waves. LiDAR transmits streams of light rays to the target area and measures the time it takes for the light to reflect back from the target. The time between transmission and return is used to calculate the accurate position (x,y,z) of the target areas or points in the sensor reference frame. Positioning and orientation measurement systems, and/or external control within the view scene are used to bring the positions into a known spatial reference frame. A collection of these densely-spaced-georeferenced light returns are referred as a “point cloud.”

The technology employed by LiDAR systems have been discussed and reported in detail over the past decade by countless sources. Although technological advancements have been made in sensor design to enhance accuracy, collection swath, point density, and overall capability, in principle, any LiDAR system will involve the following three (3) primary components in every LiDAR data collection:

- Airborne/ground-based Global Navigation Satellite System (GNSS);
- An inertial measurement unit (IMU); and
- An active laser sensor comprised of a transceiver and a receiver as the source to measure distances (range).

The determination of a target object’s position and elevation by LiDAR is dependent on two leading factors: 1) pointing direction (orientation) of the laser; and 2) distance (range). The distance is typically measured either by time-of-flight or phase-based. Time-of-flight LiDAR sends the laser signal in a series of known-interval pulses, then measures the time of arrival for the return pulse(s). Phase-based LiDAR sends a continuous beam where the laser signal is modulated into known phases, typically by varying the amplitude to create the phase signal. When the beam contacts a target, the phase(s) is shifted and the returned signal shift is analyzed to derive distance.

LiDAR – Data Processing

Processing of LiDAR data can be sectioned into six (6) primary steps:

1. Combining the raw data measurements from the LiDAR sensor, GPS, and IMU to generate a “point cloud”.
2. Spatial Adjustment – A semi-automated process in which the user applies established ground control to the point-cloud to spatially constrain the dataset to the desired coordinate frame, and to provide the opportunity to correct systematic errors for increased positional accuracy.
3. Quality Control Editing – Outliers and artifacts, such as vehicles or people traveling through the scene, must be trapped and isolated for removal. Just as with any other mapping technology, data sampling and testing is necessary to verify and claim an accuracy level for the resulting data.
4. Point-cloud Classification (Automated/Manual) – A process that utilizes an algorithm that considers the geometry of adjacent points, as well as, parameters set by the user to segment LiDAR returns into user-specified groupings to support more efficient product development. Additional manual classification of LiDAR returns in the point-cloud to categorize returns that were not classified during the automated process and/or to re-classify returns that were improperly categorized during the automated process.
5. Feature Extraction: This is an area, where the mobile LiDAR and static LiDAR will vary depending upon the features to be extracted and the software to be used.
6. Products/Deliverables – Development of required products or deliverables such as Digital Elevation Models (DEM), Digital Terrain Models (DTM), Triangulated Irregular Networks (TIN), planimetric features, contours, visualizations, etc.

Aerial, Mobile, and Static LiDAR

Aerial LiDAR. The aerial LiDAR is ideally suited for rapid and accurate collection of large areas and corridors towards generating topographic and elevation data. The aerial LiDAR avoids administrative land access and liability issues prevalent in extensive

Continued on next page

ground surveys. The Aerial data provides a “look down” for building roofs and rooftop structures. Alone aerial LiDAR is unable to capture break lines lying in between points, but the addition of stereo imagery or synthesized stereo imagery from multiple LiDAR passes (LiDARgrammetry) is often used to improve the resolution of bare-earth point clouds.

Mobile LiDAR. Mobile LiDAR systems are designed to scan all objects along a path (e.g., a road corridor) to generate engineering grade survey information. The systems can be operated at various speeds, which are typically dictated by a combination of driving conditions and desired pulse saturation. The LiDAR sensors operate at a continuous pulse rate. Therefore, to saturate all objects along a desired path with more points and increase the scan’s density, the equipment operator simply decreases the vehicle’s progression (speed) along the path. Conversely, to decrease the point saturation for objects, the vehicle operator merely increases the speed of the vehicle. At highway speeds, saturation is still sufficiently dense to generate an adequate amount of points for use in highway design or most other uses. Collections can be conducted night or day, and generally in most “fair weather” climatic conditions.

Static LiDAR. Static Laser scanning technology provides incredible levels of detail and yields significant value for many capital projects, especially for complex structures and surface modeling. In terrestrial static LiDAR acquisition, the LiDAR unit is mounted on a tripod. Since the range to target is dramatically less than with airborne systems, the point density and accuracy is much higher, as much as a point per square millimeter. With tripod mounted systems, GNSS control can be either from a GNSS on the unit, plus one or more control points on the ground to provide geometry, or from multiple GNSS targets on the ground. Multiple scans are combined as long as three or more common and distinct points exist between the scans. The static scanner enables the users to bring the outside world into cyberspace and allows it to be available and

usable by the most likely problem solvers; the architects, the engineers, and the environmental scientists. Using a combination of graphics, web based application and laser scan data capture information can be made more accessible and more usable than ever.

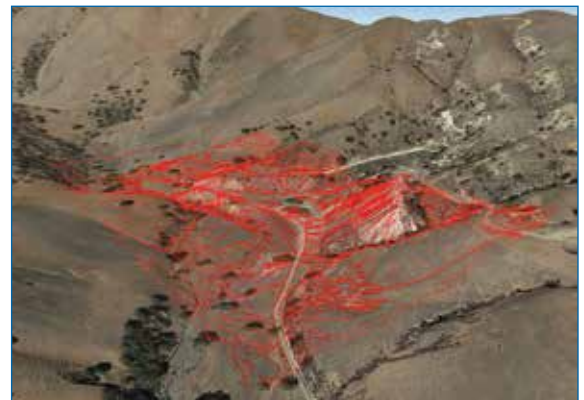
Hand-held laser scanners are something of a hybrid technology of static and mobile LiDAR. These ultra-high-precision instruments are typically used in metrology and reverse engineering applications where sub-millimeter point saturation and positional accuracies are needed. Anyone who has undergone LASIK, or some of the more advanced oral surgery methods, has had their anatomy mapped with a hand-held laser scanner.

Any successful surveying project requires not only the highest level of surveying accuracy but also information on the ground-based features. A comparison of the three complementary LiDAR technologies is summarized on the table (left):

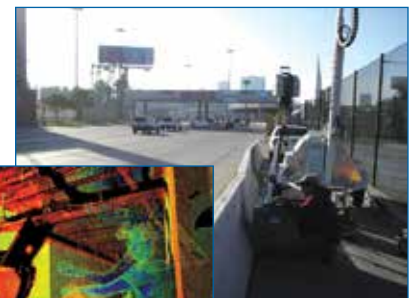
Conclusion

The LiDAR technology is constantly evolving leading to better scanners with advanced features. Another interesting aspect about the LiDAR technology is the application of fusing different LiDAR datasets (Aerial, Mobile and Terrestrial) has afforded an opportunity to leverage similar technologies captured from differing vantage points, to create a single comprehensive dataset that provides widespread coverage over a large area, but also high resolution detail where it’s needed. ❖

Operating Altitude	150 to 4000 m AGL, nominal	On the ground	On the ground
Scanner Field of View	0-50 degrees	360 degrees without obscurations	360 degrees horizontal 270 degrees vertical
Aerial Coverage	Large area projects including rough/in accessible areas can be covered in a relatively short time. Couple of hundreds of square miles of data can be collected in a day	Primarily for corridor applications on the road. Couple of hundreds of linear miles of data can be collected in a day.	Ideally suited for close-range data collection requiring extreme detail and accuracy, or remote location for access and safety concerns.
Site Accessibility	Practically none.	Proper planning will help in better collection. The range of the sensor is 200m, which is an important parameter in data collection.	Portable equipment affords the collection in and around site. The range is variable starting from 1m to few KM.
Accuracy	Vertical accuracy of better than 15 cm is easily achievable.	Better than 5 cm is regularly achieved in vertical. With additional redundancy and external control calibration, 1 cm vertical is possible.	Three-dimensional accuracy of 3 mm RMS for point cloud data. Sub-centimeter accuracy for design surfaces is typical.
Collected/Derived Features	Anything at or above ground.	Anything at or above ground. Within line of sight, anything at or above ground.	Anything at or above the ground. Within line of sight, anything at or above ground.
All Weather Capability	Yes. Cloud will be a hindrance at a higher altitude.	Yes. Barring rain, snow and cloudy conditions.	Yes. Subject to limitations for operator health and safety.
Expected Products	Digital Surface Model (including vegetation, buildings and objects) Digital Terrain Model Digital Elevation Model Triangulated Irregular Network (TIN) Contour Lines, Hill Shades, Grids Volume Calculations Cross Section Information Break lines	Digital Surface Model (including vegetation, buildings and objects) Digital Terrain Model Digital Elevation Model Triangulated Irregular Network (TIN) Contour Lines, Hill Shades, Grids Volume Calculations Cross Section Information Planimetrics	Digital Surface Model (bare earth, buildings and objects) 3D Modeled Objects (bridges, buildings, machined components) Feature Classification, BIM database



Conventional stereo photogrammetry or synthesized stereo LiDARgrammetry is needed to compile break lines for many precise digital terrain model applications.



Static LiDAR captures high levels of detail with capability to map generally inaccessible areas and features. LiDAR processing includes identification and isolation of artifacts such as vehicles or people within the point cloud.

By: Carl C. de Baca, PLS

Carl is Principal of Alidade Surveying in Elko, Nevada, and a past editor of the California Surveyor. He can be reached at: alidade.nv@sbcglobal.net.

Conference Wrap Up

CLSA/NALS Conference 2014



The image on the program for the 2014 CLSA/NALS conference of palm trees in the foreground and a city skyline in the background was apt for this year's get-together. It felt a little like paradise on the grounds of the Town and Country resort, where the conference was held. A constant 70 degree temperature punctuated by a sea breeze made the event the perfect way to say hello to spring and goodbye to winter.

The Town and Country Resort Hotel was an outstanding choice for the site of our annual conference; the conference committee and the CLSA central office should be warmly complimented for finding and securing this outstanding location. Spread over 32 acres of lush landscaping, the hotel complex featured multiple eating establishments, terrific conference facilities, great accommodations and a friendly bar for late evening discussions. It was also next door to the Riverwalk golf course, where the CLSA Education Foundation kicked off this year's activities with a charity golf tournament on Friday, April 11th.

Educational activities started on Saturday, April 12 with all day workshops featuring John Stahl and Ryan Hunsicker and concluded with a busload of participants heading to Kearny Mesa for the annual CLSA Education Foundation bowling tournament where some ten ad-hoc teams got together for bowling merriment. Gutter-ball tickets were flying around all evening and much money was raised for the foundation through the competitive nature of the bowlers. Past President Armand Marois' team won for the second straight year and his son Ian won the high score for the night. During the post-bowling raffle, the past-presidents of CLSA once again made out like bandits, at one point winning 5 raffle prizes in a row. Hmm... the raffle was run by a past-president, curious indeed. The CSU Fresno students did well at the raffle also - a little poetic justice perhaps. Each year this event gets bigger and better. It's a lot of fun, an opportunity to hang out with some friends and make some new ones; it's for a good cause and there's always room for more so make plans to go bowling at the 2015 conference in Reno.

Sunday opened three and half days of educational workshops featuring speakers such as Chuck Karayan, Bill Stone, John Stahl, Rob McMillan, Marco Cecala and the LS fundamentals Track instructed by David Paul Johnson. During a break in the afternoon, John Palatiello of JMP Consultants gave the keynote address. JMP

is the government affairs consultant for the National Society of Professional Surveyors and as such is our profession's point of contact with many federal agencies and Congress. Among other things Palatiello talked out the Map21 legislation and Congress's recent decision to repeal a portion of that act's FEMA regulations.

One of the more interesting events and one of the higher purposes for which we exist as professional organizations took place on Sunday as part of the spring meetings of the National Society of Professional Surveyors held concurrently at Town and Country. The NSPS national student competition saw eight teams competing this year with the topic being ALTA/ACSM surveys. Teams from New Mexico State University, Oregon Institute of Technology, Cal State Fresno, Southern Polytechnic State University of Georgia, Michigan Tech, Utah Valley University, New Jersey Institute of Technology and Penn State each gave 20 minute presentations followed by Q&A from the judges and the audience. They also were required to submit a binder containing elements of safety, correspondence, research, field notes, calculations, boundary analysis and a survey report, together with a plat of their survey. All eight of the teams produced exemplary reports and plats which served to put a spotlight on the state of Geomatics education in the United States. The judges had a tough time picking a winner, I assure you. The scores were tallied after the event and the results were closely guarded so that they could be announced at our awards luncheon on the following day.

Monday saw workshops and presentations by Steve Parrish, Landon Blake, William Beardslee, Jeff Hobbs and the LS fundamentals track overseen by Mike Hart. The awards luncheon saw NALS and CLSA give out their awards and scholarships for the year. Congratulations to CLSA's Hal Davis for receiving the Dorothy Categori Distinguished Service award and to Trent Keenan for receiving the NALS Meritorious Service Award. Congratulations as well, to Southern Polytechnic State University of Georgia for winning the student competition. Southern Poly barely edged out OIT, with Fresno State coming in a close third. All three of these schools put forth a superior effort and generated a superior product. Any of us would be happy to have produced a plat that was as detailed, stylish and complete as the plats these students prepared.

Continued on next page

Continued from previous page

Monday wrapped up with the live scholarship auction which saw the return of longtime auctioneer and friend of the conference, Greg Lightnin' Williams. Lightnin' was in classic form as he badgered, cajoled and outright conned the willing participants to bid higher and higher on the various items. In some cases he was highly successful as when he got \$500 for a 1940 compass that had been in a Spitfire fighter plane and \$800 for a beautiful surfboard made by CLSA's own Matt Vernon. However, even Lightnin' was unable to generate interest in a pair of Tellurometers that had seen better days and went for \$25, and a Pacific Crest PDL radio that ended up back in the silent auction the next day. Overall, the live auction brought in close to \$12,000 in future scholarship funds and everyone had a wonderful time! (And I'm through buying old instruments now - my house is full.)

Tuesday's workshops included speakers Bob Cosburn, ESQ, Landon Blake, William Beardslee, Jan Van Sickle and Mark Meade, with Robert Reese and Frank Maxim instructing the LS Fundamentals track. The luncheon featured humorous motivational speaker Charles Marshall who used unwitting audience members as props throughout his presentation while finding a way to give an uplifting message to us all. Tuesday night a pretty good crowd of conference attendees and some NSPS representatives traveled to downtown San Diego on the light rail trolley and watched the Padres play the Colorado Rockies. The weather was great, the hot dogs were hot, the beer was plentiful and everyone who went had a good time. Again the central office has to be commended for making this happen!

I thought the Town and Country resort hotel was a first rate facility, the staff was both helpful and efficient, the workshops were relevant, the special events truly exceptional. All this combined to make a most memorable conference and I can't wait to do it again next year. A special thanks to the conference committee, the central office, the student volunteers, the sponsors and especially you the conference attendees for making the 2014 CLSA/NALS Conference a resounding success! ❖

See you in Reno in 2015!



YOU ARE INVITED!

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Price and more information about this event will be announced soon. Stay tuned.

If you have any questions, comments or if you would like to be added to our mailing list please feel free to email us:

Marco Castaneda – Conference Chair

neda209@mail.fresnostate.edu

Luz Garcia- Conference Co-Chair

luz931@mail.fresnostate.edu

The Geomatics Engineering Program at Fresno State is a non-profit organization. Donations, scholarships, auction items, or any other help are welcomed and appreciated.

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Geography Quiz Answer

With a surface area of 68,800 square kilometres (26,600 sq mi), Lake Victoria is Africa's largest lake by area, and it is the largest tropical lake in the world. **Lake Victoria** is the world's 2nd largest freshwater lake by surface area; only Lake Superior in North America is larger. In terms of its volume, Lake Victoria is the world's ninth largest continental lake, and it contains about 2,750 cubic kilometers (2.2 billion acre-feet) of water. The lake was named after Queen Victoria by the explorer John Hanning Speke, who was the first European to discover it, and which he did alone in 1858 while on an expedition with Richard Francis Burton to locate the source of the Nile River. Source: Wikipedia



Conference 2014 Highlights





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SLATE OF CANDIDATES

The Board of Directors approved the following slate of candidates for 2015.

Jay Seymour, President

Roger Hanlin, President-Elect

Ian Wilson, Secretary

Jeff Steffan, Treasurer

Additional nominations may be proposed by the general membership by submitting a written petition to the Secretary containing the signatures of ten or more Corporate Members. Such petition shall be received not later than July 1st.

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By: Richard Hertzberg, CPCU, ARM, Vista International Insurance Brokers

Risk Management for Land Surveyors

How Can I Save Money on My Insurance?



This is a common question for every land surveyor wanting to keep their insurance costs down and there are many ways to do it.

Review

The first step is to get all your insurance policies out and review each one for limits, deductibles and pricing. Remember higher limits cost more but may be required by your contracts and your clients. You will, however, need the limits to cover your exposures: real and personal property, computers, scanners, GPS, total stations and robotic equipment. Be sure to match the values to the limits and remember if you buy insurance to cover your rented equipment from your equipment renter it will cost you more than covering it under your business policy.

Accurate Reports

Make sure you accurately report values, not too much and not too little. Also, review how your policy pays in the event of a loss. On your insurance application for coverage be sure to properly report your exposure since underwriters price coverage based on type of clients, type of work, experience, losses and your financial condition. When you get a contract with insurance requirements carefully review it or ask your insurance broker or agent to do it for you.

Negotiate

Many items requested can be negotiated. If you are asked for a \$2 million professional liability limit and you have a small and straight-forward job you may be able to have the client accept your \$1 million limit policy. Likewise, if they ask for higher general liability limits than your standard \$1/\$2 million limit and request a \$2 to \$3 million umbrella you can probably negotiate lower limits without the umbrella.

The same goes for your auto insurance. Since a \$1 million commercial auto policy is more expensive than a personal auto policy with a lower limit and you are not driving onto the job site or you are the first person there, you may be able to get a

business endorsement on your personal auto policy or get your client to accept your personal auto coverage anyway.

If they ask for worker compensation coverage and you have no workers or use independent contractors with their own insurance that's a negotiable item. If you do have workers compensation coverage make sure that your payrolls are accurately reported because that's how underwriters rate and price your policy.

Shop Your Coverage

Be sure to ask your broker or agent to market or shop your coverage every three or four years because underwriters and companies change pricing and appetites depending on their own loss experience. This also keeps your broker or agent sharp and up-to-date on market conditions. However, don't go to market too often, unless you have to because of losses or policy cancellations, because underwriters will not give you the best deals if you are a relentless shopper. Remember that insurance markets are cyclical. Right now rates and prices are going up since we are coming out of a low-priced market that has reflected a poor economy and moving into a higher priced market that anticipates better economic times.

Risk Management Principles

Finally, continue to buy your insurance only from A rated companies because they are financially sound- your broker or agent knows which companies are A rated. Also, remember to keep your eye on your equipment because out-of-sight remotely located equipment is being frequently stolen. Also don't forget to constantly use the "what if" approach of your best risk management principles to help you decide when and how to either *avoid your risk, control the risk, retain the risk, or transfer the risk.* ❖



Funny Bones

To the Editor of the Stealth Technology Department

Submitted by Robert Reese, PLS

Dear Sir, Please find two photographs herewith:

Now You See It

This is a photograph of a partially hidden GPS base station. If I told you where it was, I'd have to kill me. However, the NSA can readily provide that information upon presenting a FOIA request.

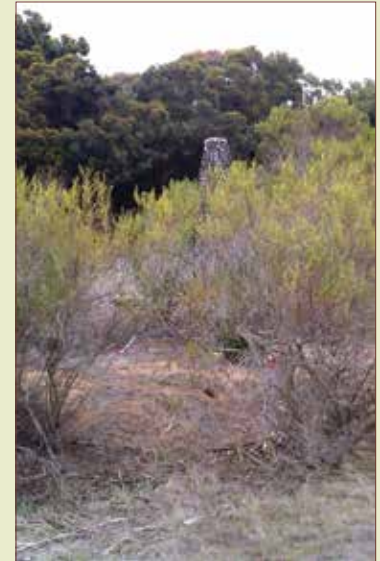
(They are ready for your request right now since they have already intercepted this letter.)



Now You Don't

This is the same base station after applying a new stealth technology (camouflage netting.)

This is available only at certain security-cleared vendors that I cannot reveal (but if you guessed San Luis Camp and Pack, you'd be right.) This technique can be highly effective in reducing the visual impact of surveying equipment, usually colored for immediate recognition, in places where the added sequestration is desired. Thank you for your consideration...wait a minute, Mr. Assange is calling...



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San Francisco Project

Submitted by: Michael McGee, PLS

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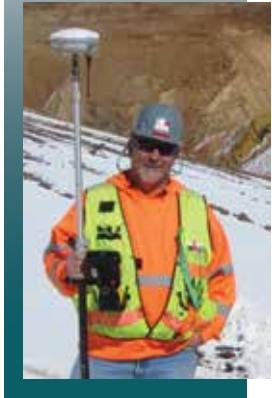
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By: Carl C. de Baca, PLS

Carl is Principal of Alidade Surveying in Elko, Nevada, and a past editor of the California Surveyor. He can be reached at: alidade.nv@sbcglobal.net.

Bad Backsights



Sustainable Development

I'm a little behind the times but when I get a spare moment I try to close the gap down to less than a decade, between myself and the rest of the world. Recently I made the astounding determination that I should seek a good understanding of the term "Sustainable Development." After all, nearly every multi-discipline consulting firm boasts of its credentials in the realm of SD and lately I have begun to wonder how I could exploit this for marketing purposes - I'm only human. So I Googled the term and discovered that the United Nations is a foremost authority on the topic and they have a large and apparently comprehensive portion of their website devoted to SD, which I could simply visit and let the learning begin! I spent the better part of a day there.

It turns out that the UN Sustainable Development website is as muddled and confused as any of their policies that one might hear about in the news. They like to talk a lot and they love to produce studies and reports. Action is a little less forthcoming from this mother of all bureaucracies. I went to the website with no little trepidation, looking for sound and clear ideas on Sustainable Development. I got lost. Each topic led to another in an endless array of potential disasters and UN 'frameworks'. Every link I followed led to another link and every report referenced another report like some sort of maze made entirely of words. I felt like I was following the neural pathways of an advanced Alzheimer's patient. I almost starting thinking like a UN wonk - not ideas but places: Kyoto! Johannesburg! Marrakech! Copenhagen! I began desperately searching for anything that looked like the clear statement of a problem followed by a solution. But it was not to be. At the end of my journey, I was sure of only one thing - the typical report writers employed by the UN could stand to read and embrace George Orwell's rules for writers, all six of them.

The UN seems determined to take the world's environmental issues, polluted oceans, shrinking fish populations, global warming, increased aridity, diminishing agricultural production, loss of Yeti habitat, and talk them to death. Form a committee! Identify critical issues to research. Get them on

the next Committee for Sustainable Development summit agenda. And write a report indicating that the committee has identified critical issues to research and report on at the next CSD summit. And so on. Of this infinity of summits and reports and position papers, I chose to look at land, agriculture, irrigation and desertification. There were plenty of proclamations and earnest statements of concern on these topics and besides, I live on land, in a desert, with poor agricultural prospects and I'm a hungry a lot so it seemed like I could connect well with these issues.

The biggest bully on the playground is the UN's Agenda 21, so called because if you print it out, it weighs about 21 kilos - no I made that up. But it does feel like the writers of Agenda 21 were paid by the word. I went to Agenda 21 ready to learn, but ultimately was unequal to the task of even figuring out what it said. I really wanted to deconstruct one of these reports and then distill it down to its essential concepts but I realize that I can't because they weren't assembled to be analyzed in that way. These are political statements masquerading as solutions to the world's problems. Here are some suggestions from Chapter 12 of Agenda 21 for combating desertification:

(a) Strengthening the knowledge base and developing information and monitoring systems for regions prone to desertification and drought, including the economic and social aspects of these ecosystems;

(b) Combating land degradation through, inter alia, intensified soil conservation, afforestation and reforestation activities;

(c) Developing and strengthening integrated development programmes for the eradication of poverty and promotion of alternative livelihood systems in areas prone to desertification;

(d) Developing comprehensive anti-desertification programmes and integrating them into national development plans and national environmental planning;

Continued on next page

That last one is a real gem – isn't the time-tested strategy to simply steal water from somewhere else (Hello SoCal, Hello Las Vegas)? And by the way, is anyone but me bothered by the way they spell programmes? Even my Microsoft spell-checker objects.

Endless work on bloviated policy for Sustainable Development is nice, but there is a more fundamental problem at work in the world. Too many people live on our planet for the resources that are available at the god-forsaken places that so many choose to live. Saying that there is too little agricultural land available to feed humanity is a bit like blaming your shirt for being too small instead of blaming your fondness for Indian food (I know what I'm talking about...). But let's say we ignore that the teeming masses are the most basic problem the planet faces and concede that, "Well, they're already here, I suppose we might as well feed 'em." There is in fact plenty of great agricultural land across the globe. A lot of it is owned by the generally uncooperative. The issue of people starving is primarily one of politics. You don't have to reflect on current affairs very long to conclude that bad (meaning 'evil' more than 'incompetent', but those are not mutually exclusive) governments are the principal obstruction to sustainable development. Bad governments are the primary environmental

challenge in many places across the globe and the UN, whose intentions were long ago compromised, is not up to that challenge. I did observe that the UN spends a lot of money utilizing technologies like false color satellite imagery and GIS to make maps and graphs that say essentially: "That patch there is a generally crappy place and there are too many people for the two inches of rainfall they get every year." But enough about the Central Valley...

After my long afternoon immersed in pompous gobble-dygoon, I have absolutely no confidence whatsoever in the UN's ability to develop anything sustainably. To my jaundiced eye the UN is a corrupt, self-serving and futile organization that can't fight hunger, can't settle sectarian violence or keep peace, can't stop genocide, can't keep rogue nations in line and can't do any of these things which it does so poorly, in anything resembling a fiscally responsible manner. So how is it going to shepherd us toward developing sustainably? Looking to the UN for strategies on how to solve our planet's environmental issues is like asking Bernie Madoff for investment advice. But I digress. Upon further reflection, I think I'm just going to add "Expertise in Sustainable Development to my company prospectus and be done with it. In a couple years I'll start catching up with some other long mature trend. ❖

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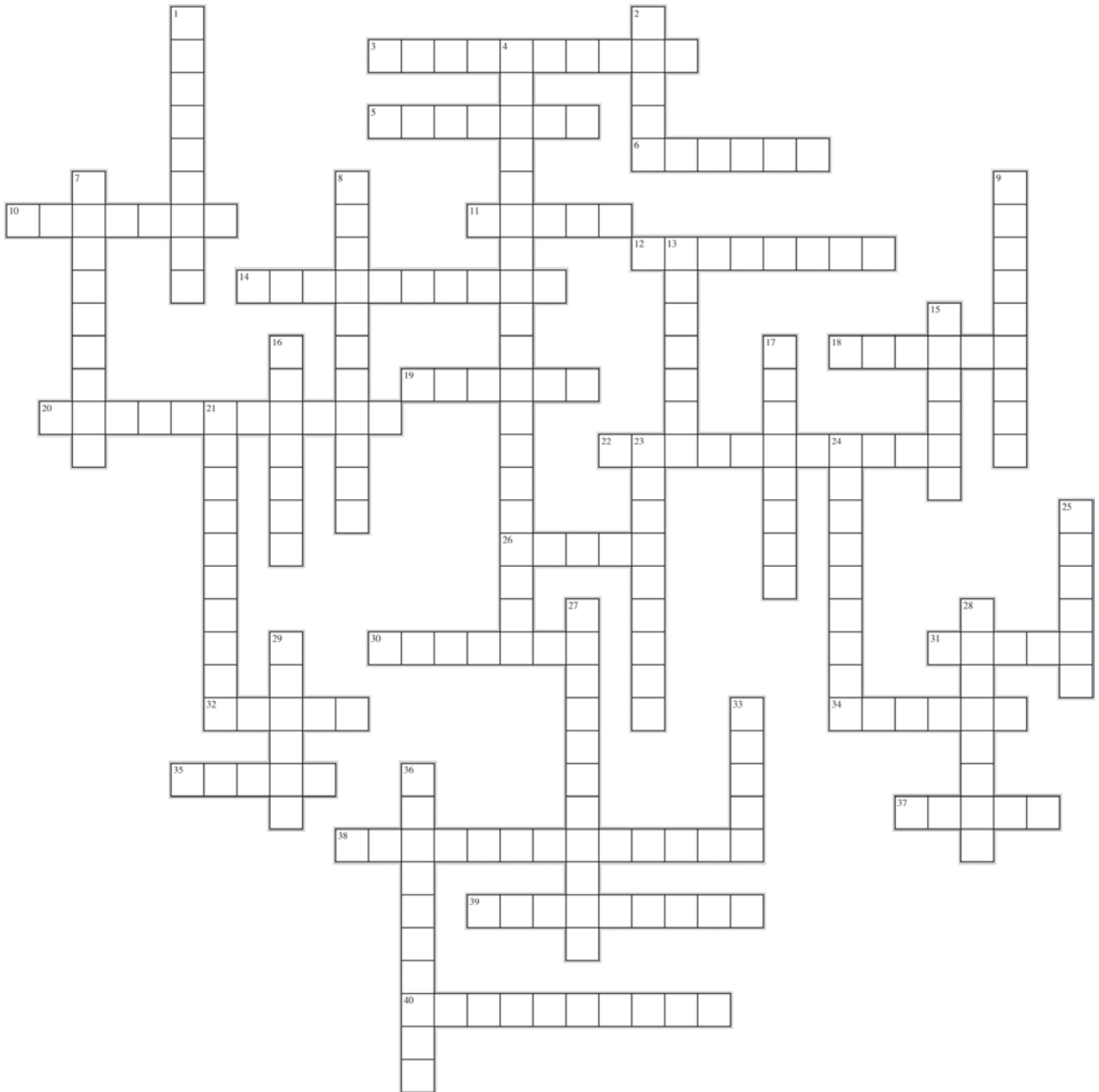
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Scott Martin has been working in surveying since 1977 and obtained his California license in 1987. He worked in the private sector until 1993 and has been employed by the State of California since then. He lives in the Gold Country of California and enjoys collecting, restoring, and using Coleman lanterns in his leisure time. The one in the picture is from 1920.

Crossword Puzzle *by Scott Martin*

CLSA Crossword Puzzle # 30



EclipseCrossword.com

Across

3. A type of leveling
5. Good place to set a bench mark
6. Also a measure of time
10. An important basis
11. Common GPS file format
12. thirty six sections typically
14. 12A is the latest version
18. 1866 ellipsoid guy
19. What a CORS station is
20. Not final
22. Three D viewer
26. Another chain of interest
30. Privilege to practice
31. Four point seven two feet
32. Cycles per second
34. Number of chaining pins in a set
35. Nickel and steel alloy
37. Used to measure slopes
38. Not the "official" foot in California
39. Necessary for GNSS positioning
40. 18.6 years

Down

1. Bearings have these
2. The Great Lakes have their own
4. A way to control aerial imagery
7. It is good to balance
8. Two highs and lows per day
9. One way to determine elevation
13. A type of aerial photography
15. leveling turning point
16. The R in LiDAR
17. Type of bounds
21. 40 equal one cubic foot of water per second in California
23. Used to measure distance
24. Render parallel
25. It's in the hole on a stake
27. Witness to a corner
28. An interest, but not fee
29. Type of natural monument
33. A datum on the coast
36. Echo sounding instrument

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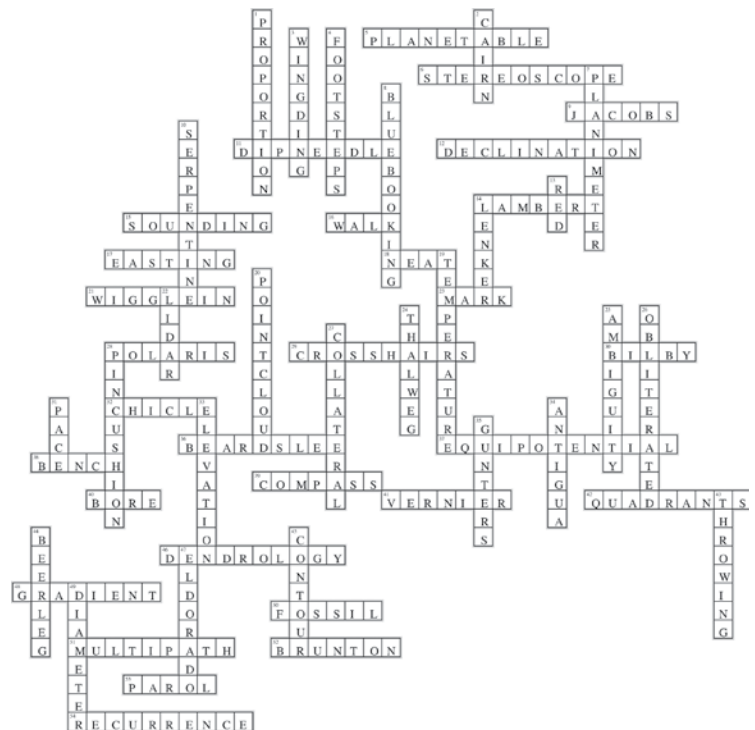
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Key to CLSA Crossword Puzzle # 29

(Surveyor Issue # 176)





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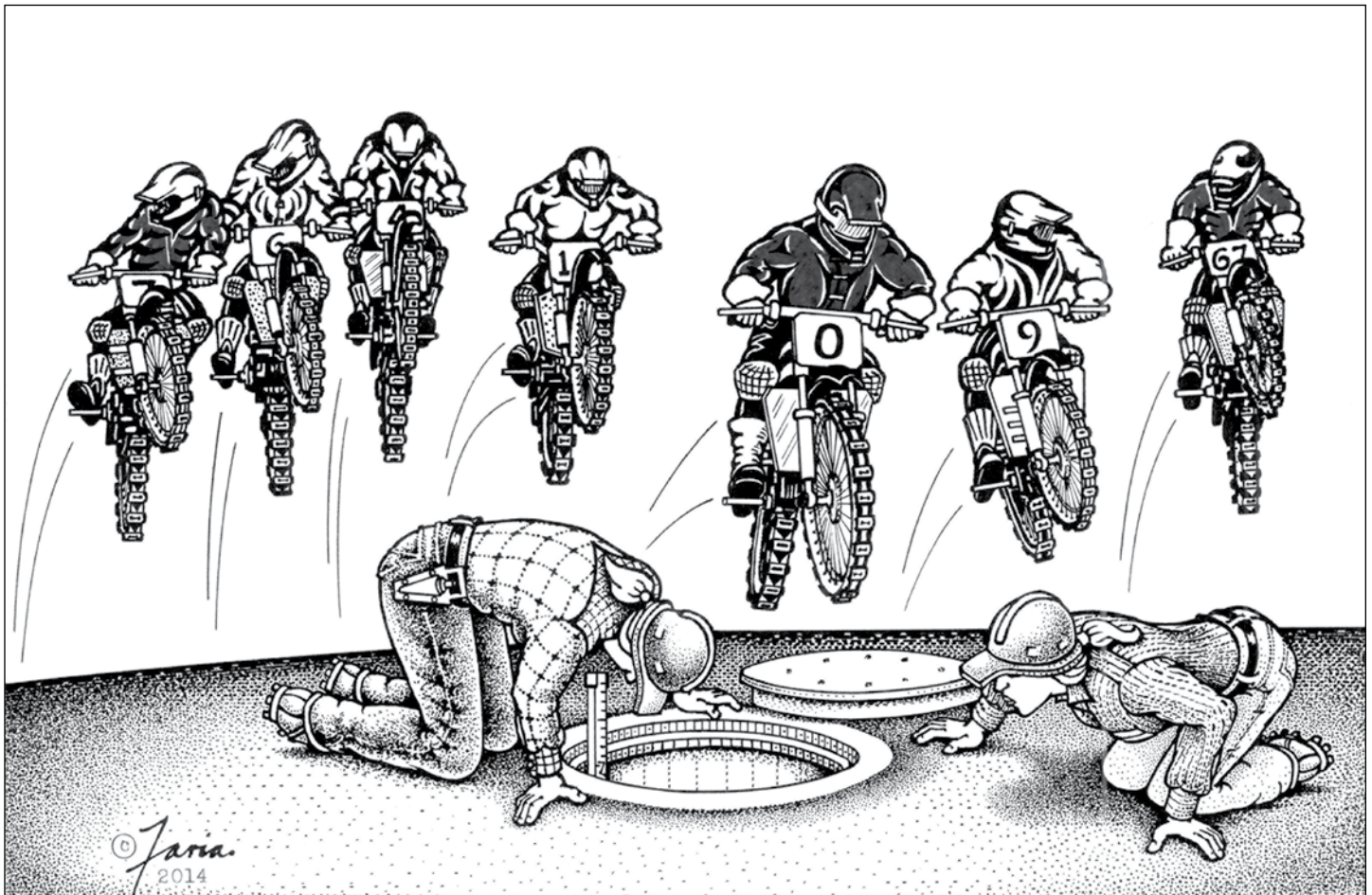
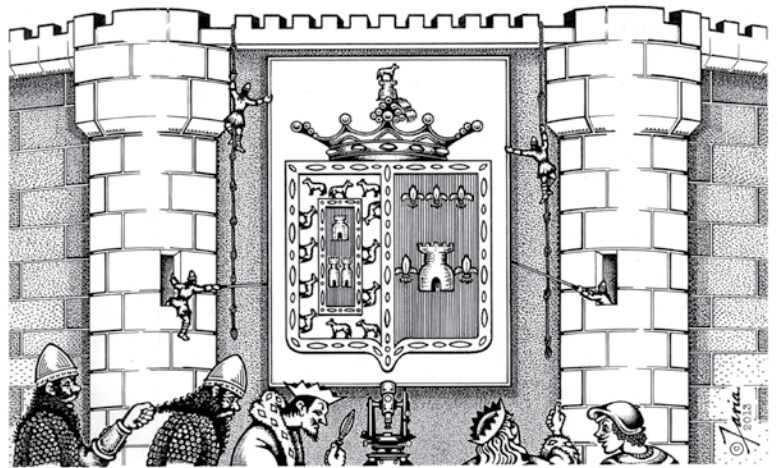
The new King's White Castle Megastore puts the finishing touches on the first megastore just a few days before the long awaited grand opening.

Submitted by BJ Tucker PE, LS

"Right a hair."

Submitted by Phil Danskin, PLS

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