California Surveyor

Fall 2011

Issue #167

The California High Precision Geodetic Network

A 20 Year Retrospective

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California Surveyor

The quarterly publication of the California Land Surveyors Association, Inc. and is published as a service to the land surveying profession of California. It is mailed to all Licensed Land Surveyors in the State of California as well as to all members of the California Land Surveyors Association, Inc. The California Surveyor is an open forum for all Surveyors, with an editorial policy predicated on the preamble to the Articles of Incorporation of the California Land Surveyors Association, Inc. and its stated aims and objectives, which read:

"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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California Land Surveyors Association, Inc.

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
Michael P. Durkee, Esq.
Richard R. Hertzberg, CPUC, ARM
Ian Wilson, PLS
David E. Woolley, PLS

DESIGN AND PRODUCTION
Tony Monaco

ADVERTISING
Commercial advertising is accepted by The California Surveyor. Advertising rates and information can be obtained by contacting CLSA 526 So. E Street, Santa Rosa, CA 95404,
Tel. (707) 578-6016 - Fax (707) 578-4406. Circulation: 4,800.

EDITORIAL MATERIAL
All articles reports, letters, and contributions are accepted and will be considered for publication regardless of the author's affiliation with the California Land Surveyors Association, Inc. Contributions should be emailed to clsa@californiasurveyors.org. We can accept WordPerfect or Microsoft Word files. We can accept ASCII text files or word processor files from the following programs: WordPerfect or Microsoft Word.

EDITOR'S ADDRESS
John P. Wilusz, PLS, PE
E-mail: johnwilusz@gmail.com

DEADLINE DATES

Spring	February 1	Summer	May 1
Fall	August 1	Winter	November 1

Articles, reports, letters, etc., received after the above mentioned date will be considered for the next edition.

Opinions expressed by the editor or individual writers are not necessarily endorsed by the California Land Surveyors Association Officers or its Board of Directors. Original articles may be reprinted with due credit given to the source and written notification to the California Land Surveyors Association, unless otherwise noted.

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On The Cover:

The painting on the cover is an artistic interpretation of an HPGN station near Old Point Loma Lighthouse in San Diego. The artist is Donna Hanby, my lovely and talented sister. Thank you, Donna, for doing such a beautiful job for the *California Surveyor.* - Editor

By: John P. Wilusz, PLS, PE - Editor

***John** works in the Delta Levees Program at the California Department of Water Resources in Sacramento, CA.*

From the Editor

Big Changes are Coming for the California PLS Exam

In September I interviewed Ric Moore, PLS, Executive Officer of the Board for Professional Engineers, Land Surveyors, and Geologists. We met at his office in Sacramento.

John: Ric, I heard a rumor that big changes are coming for the California PLS exam.

Ric: It's true. We're transitioning all of our state examinations, including the state specific land surveying exam, to computer based testing (CBT) delivery. For those examinations that are currently developed and offered in constructive response format, this will require a change to multiple choice. The state Geotechnical Engineer exam is the first exam offered through CBT and will be administered in October 2011, while we anticipate that the state Professional Land Surveyor exam will be available in CBT format beginning spring of 2012.

John: What is computer based testing?

Ric: Computer based testing is an exam delivery format. Instead of administering the exam in the conventional paper and pencil format, the exam is on a secure computer at a secure site. Each applicant will sit down at a dedicated station and proceed through the exam, question by question. Computer based exams are usually in a multiple choice format. One big advantage of computer based testing is that applicants will no longer be constrained to five exam sites throughout the state. We plan to have more like 15 to 20 exam sites statewide. Many applicants will not have to travel as far as they did in the past, and that should minimize the overall stress of taking the examination. Another advantage is that the computer based testing centers will provide a controlled environment, basically cubicles, with less noise and distractions, unlike being in a giant building with 2,000 people in it. We also may be able to offer the exam more often, if we can build up an adequate bank of exam questions. We're going to start out once a year, but we're working toward offering the exam twice a year as soon as possible. Hopefully that will happen within a couple years. Our plan is within the next two to three years all of our state issued exams will be the computer based testing format. The Board wants to redirect our efforts more efficiently towards development of appropriate exam content rather than spend our resources on exam administration.

John: Would examinees find out right away whether or not they passed?

Ric: At this time, no. An instantaneous result is not something we are looking at right away mainly because, at least for now, we have a limited item bank. For instantaneous results you're basically utilizing items over and over. You have to have proven statistics on those items to ensure they are performing well from a psychometric point of view in addition to being targeted correctly within the test plan specifications. For example, you can have an item that is performing well in terms of distinguishing between people that should be passing or not passing, but it may not be a valid item in terms of professional practice. We also measure the performance of each item statistically; that's where the test development experts get involved. The more items we have examined, tested, field tested, and validated, the closer we will be to offering instantaneous results.

Ric Moore, PLS

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John: Are other California boards using computer based testing right now?

Ric: The Architects Board has been using CBT for its national exam for several years. In fact, that's handled through the same vendor that we're using for our exam development. In February 2011 the California state specific Architect exam was first issued on CBT. I think the exam was available at 10 sites throughout California and about six sites nationally. The Contractors Board has been using computer based testing for a few years and it's working out well for them. There are many other licensing boards nationwide, including some engineering and surveying boards, utilizing computer based testing.

At the national level, NCEES (National Council of Examiners for Engineering and Surveying) is developing their exams to be administered through computer based testing beginning January 2014. NCEES will begin CBT with the Fundamentals of Engineering exam (FE) and the Fundamentals of Surveying exam (FS). NCEES plans to cycle administration of these exams throughout the year, two months open and one month closed, to better serve the candidates and because there are so many examinees across the nation. There are about 15,000 FE and FS examinees at any given time. Of these California accounts for approximately 6,000 FE and FS applicants, total, every year.

John: Will going to a multiple choice format "dumb down" the California PLS exam?

Ric: CBT and the need to change how the board administers the state licensing exams is what are dictating this change in format, not the other way around. It's been my experience and advice of our exam development vendor that multiple choice items can be written appropriately for the right target audience. There are other states that have achieved this with their professional level licensing exams.

John: How will this change the way we've developed professional land surveying exams in the past?

Ric: There will be some similarities because we have used the multiple choice format in the past. Before 2003 we used a combination of multiple choice and constructive response for the 8-hour PLS exam. We began using an all constructive response format for the 4-hour state specific examination in 2003. That's when California adopted use of the 6-hour NCEES Principals and Practices of Land Surveying exam.

John: What do you mean by constructive response?

Ric: When I say constructive response I mean that an item or a problem consists of a scenario that might be encountered in professional practice. Questions are asked on how the practitioner would handle the situation. The main factor with constructive response is that the answers are in a written, narrative format. A correct response might require providing a list of distinct answers, or writing a paragraph, or it might require writing a legal description. Developing constructive response exams is a time-consuming process, and the subject matter experts (SME) have to pay close attention to details like page layout and graphics. Our focus for future exams will be to have our subject matter experts concentrate solely on developing and validating appropriate items. They'll be working with the exam development vendor to make sure the statistics are valid, reliable, and fair rather than worrying about how the booklets are put together.

And now is a good time for subject matter experts to become involved. Basically anyone that is licensed in good standing is able to work on our exam development and we really encourage more people to get involved because it helps our process. A lot of licensees don't feel comfortable referring to themselves as experts but in fact we all are. We've demonstrated that we have the knowledge to protect the public and perform our practice at an appropriate level, so we are experts. Without all the hard work and effort by the SME's we've had in the past we wouldn't be where we are today, and we really need a lot more involvement, especially with the change in the technology. With the new item development process we'll probably be utilizing more SME's than we have in the past and we look at that as a good thing.

John: So how can people get involved?

Ric: From time to time we'll post a message on our website looking for experts to help out with exam development or enforcement cases, but interested parties can always contact the exam unit or send me an email.

John: And are you looking for any particular skills or experience level?

Ric: No, actually we're looking for all levels. We need to cover the broad range of practice as it is currently conducted throughout the state. Our exam is geared towards the person meeting the minimum qualifications to become licensed in California, so newly licensed persons are very important for that process. They provide a reality check for the SME's that have been licensed 10 years, 15 years, plus. We tend to forget what it was like when we first became licensed. We also like to have a mix of public and private surveyors, and we want to have surveyors from all over the state: northern, southern, and central California. We try to get that mix to make sure the exam is representative of professional practice throughout California.

John: Where does the content for the exams come from?

Ric: From the occupational analysis. Typically the Board initiates a new occupational analysis every 5 - 7 years. It's an industry standard not just in California, but across the nation. Our land surveying occupational analysis was desperately in need of updating. Fortunately we were able to find contractual means to do that, and we have just completed a new occupational analysis both for the state specific land surveying and civil engineering exams. So we're actually doing both of those at the same time. It was important to do these together to make sure that people see the differences between engineering surveying and land surveying. There was a survey posted on the BPELSG website and it was also posted on the CLSA Forum. CLSA was kind enough to send an email out to all of its members and that really helped us out. Within 24 - 48 hours of the survey being posted we had over 100 responses - that was really great…but not enough. There are some 4,200 active licensed surveyors in this state, not counting pre-82 civil engineers. The more people that participate in the survey, the more accurate our test plan and specifications will be, because that drives how we will do our exam development. (Editor's note - As of September 19, 2011 there were more than 230 completed responses to the PLS Occupational Analysis survey. The survey closed on September 28th, after the magazine went to print.)

Continued on next page

Letters to the Editor

Dear Editor,

It is my belief that there is a common misconception that technical experts for the Board for Professional Engineers, Land Surveyors and Geologists (BPELSG) have a goal to punish other surveyors. This is not at all true. I can understand where it comes from. Other surveyors don't hear about a case unless an enforcement action is taken against another surveyor. When an expert opinion is requested, the first question to be answered by the expert is if they have ever worked with the person the complaint is filed against. If they have, another expert is contacted and the first never sees the complaint. By far, the majority of the cases I have given an opinion on are complaints against a surveyor that are not valid and no enforcement action is taken. Those complaints just go away without any action taken.

Once a complaint is filed with BPELS they must investigate the validity of the complaint. Often it is from a disgruntled person who didn't like the result of the survey or thought it cost too much and didn't want to have to pay for it. Sometimes it's from a person who simply didn't understand the result of a survey. Once it is explained to their satisfaction the case is then closed. Unfortunately, there are complaints filed that have merit. Often the surveyor who the complaint has been filed against feels that he or she is being singled out for punishment. They often feel that many others use the same type of survey practice and can't understand "why me?" The answer to that question is because someone has filed a complaint against them but nobody has filed a complaint against the others. It's that simple.

Bearing in mind that the main objective of BPELSG is to "protect the public", I think they do a pretty good job with complaints from the public. The technical expert they hire to render an opinion on the merits of a complaint is never asked to prove that someone is at fault, but rather to help determine if a complaint is valid and, if so, to explain why in the form of a report to BPELSG. If you are a licensed professional surveyor and feel that technical experts working for BPELS are "ratting out" fellow surveyors I strongly encourage you to apply to the Board to be a technical expert so you can understand just what we really do. I'm proud of the work I've done for BPELSG and I believe anyone who participates would feel the same way.

Linda M. Richardson, PLS
BPELSG Technical Expert

Dear Editor,

Great debate on the higher education issue. However, like Mr. Johnson, I ran the numbers for the issue #139 of the California Surveyor (although not as complete as I would have liked) and have a hunch not enough graduate to replace those which are retiring, or have gone to that double asterisk in the sky. I like the Connecticut connection Professor Jerry Miller posed. Loved Grandpa Johnson's quotes! (Lizzard Lick quotes comes to mind.)

Although the four-year graduate may better fit a "definition" - a degree does not automatically pass intuition. It is an acquired trait such as that of our esteemed colleague, Steve Parrish. (Who I assume is as happy as a hunting dog when in the woods.) Also, those with the four-year degrees are, more likely than not, chained to an office than on onerous field searches. How would that "read" in the mind of the judge, et al?

" If everyone is thinking alike, then someone isn't thinking" - General George S. Patton, Jr.

Be careful. Cliffs can be vertical.
Best to all my cousins! And again - great work, John!
Respectfully yours,
Phil Danskin, PLS
(Phil is a past editor of the magazine - Editor) ■

Continued from previous page

Big Changes are Coming for the California PLS Exam

John: How do you like your new position as Executive Officer?

Ric: I like it. I've actually come into this position at a very good time. Two years ago BPELS merged with the Board for Geologists. I find that very exciting because, just like in private practice, I get to interact with engineers and geologist on a daily basis. I think it is really good for all of us to be more involved with each others' practice so that we understand how we affect each other and the public. At first the geologists kind of resisted the merger because it was a sudden change for them, but I believe they are realizing now that it is going to be a good thing for everybody.

When I first became involved with the Board as the Land Surveyor Consultant, like many others I wasn't entirely sure of the impact the Board had on both the licensed professional and the consumer. By observing the Board's day to day activities, I learned that this was "my board, your board, our board" and that we served a valuable role in working with everyone on a proactive level rather than the more traditional reactive one.

When the Executive Officer position opened up, I felt this could be a further opportunity to expand and enhance that role which could affect positive change in how all of the professional disciplines interact with, and are perceived by, the public. I was not the typical employee just seeking a stepping stone to higher positions in public or private practice. I would not have been interested if this position was at another agency or board, I, like all licensees, have a vested interest in ensuring this board is functioning appropriately and fairly by servicing all customers, regardless of licensure status.

Right now, the thing that I enjoy the most about being Executive Officer is that I get to be involved from a different level with enforcement cases and disciplinary actions. This allows me to utilize my experience to look at these cases in a different light than maybe others have in the past. I would like to think it is helping both the consumers and the licensees. I also very much appreciate working alongside the staff here. They're really interested in making sure they do a good job and they get concerned if someone is not being treated fairly or if something reflects poorly on them and their efforts.

John: Thanks, Ric. We appreciate your taking the time to talk with the California Surveyor. ■

Correction Notice

The article "Educational Requirements for PLS Licensure Across the United States" in TCS #166 mistakenly reported Hawaii has mandatory continuing education. While Hawaii is currently reviewing implementing mandatory continuing education, the requirement is not yet in effect.

CONGRATULATIONS NEW PLSs

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Examination Statistics

National PLS

Tested	122
Passed	69
Pass %	56.56%
Failed	53
Fail %	43.44%

State-Specific PLS

Tested	334
Passed	72
Pass %	21.56%
Failed	262
Fail %	78.44%
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By: William R. Hofferber Jr, PLS - President

***Mr. Hofferber** is the Chief of Surveying and Mapping at the Riverside County Flood Control and Water Conservation District. Bill has been involved in land surveying for over 37 years in both the private and public sector where he has worked on hundreds of projects from ALTA surveys, construction, boundary, photogrammetric mapping, and large scale GPS campaigns. He is also an instructor of land surveying courses for Riverside Community College District.*

President's Message

As I prepare to write this Presidents Message, my fourth and final message for the award-winning Cal Surveyor, I am somewhat perplexed as to what I would like to address. There have been so many important issues this year. Below is a review of just a few.

National Voice – NSPS Restructure

I would like to encourage each of you to follow what transpires in the coming months with the disbanding of the American Congress on Surveying and Mapping (ACSM) and the creation of one unified organization under the direction of the National Society of Professional Surveyors (NSPS). NSPS has committees in place to conduct financial analysis of each of the member organizations originally under the umbrella of ACSM, as well as to review the current member benefits being offered, and soon develop a 2012 budget. To quote NSPS President, Bill Coleman, "We have started the journey to a new organization where we want all professional surveyors to be a member." Think about that for a moment, how important that would be if all land surveyors would unite in support of one national voice. I have heard that there are approximately 60,000 Professional Land Surveyors in this great nation, and yet NSPS/ACSM has struggled to keep membership above 4,000. One united voice of 60,000 would carry much more impact when taken to Washington. The accomplishments that we could make would be astonishing. I feel that we are at a turning point, now is the time to support one unified national land surveying organization, NSPS, before it may be too late.

Education Requirement/Professional Development

The last issue of the Cal Surveyor included outstanding articles relating to the potential of a mandatory 4-year degree requirement for licensure. It is my belief that CLSA should play an instrumental role leading California to a milestone decision on some form of education requirements to become licensed, and to renew license registration.

Personally, I am not in favor of a Geomatics ONLY 4-year degree requirement to sit for the exam. I believe this is much too restrictive, eliminates far too many outstanding prospects educated in similar curricula, and would not draw nearly enough students into the profession to meet future demands. At the current attrition rate, we would simply run out of professionals. However, we must do something to keep pace with the balance of the nation. Additionally, with 47 of 50 states requiring some form of mandatory professional development/continuing education to renew licensure, it is time we take a hard look at what is to become of our profession if we do not institute something similar. While some argue that mandatory professional development provides no measure of better protecting the public, I would almost assure a higher level of professional service should be expected. I strongly urge each of you to take advantage of the CLSA voluntary professional development program. This is one way you can help yourself by staying current with education and/or technology changes.

Mentoring

Recently, I had a conversation with a newly licensed surveyor about survey practice. He mentioned that he sees some fellow surveyors being untrained, or not trained properly, on methods and practice procedures. This is another important issue that I would like to address and that I feel is essential for the profession to succeed. I believe, we as professional land surveyors, have all been mentored during our careers by others who took the time to help us along. As technology changes have replaced the 3 and 4 person crews to 1 and 2 person operations, some of this inherent training or mentoring has disappeared. It is now our obligation to mentor those who choose to follow our paths in this profession. Take the time, or make the time and if you can't do it on the job due to cost or scheduling, look for other available options such as teaching, volunteering to do a L.S. review session on your area of expertise, go and speak at a local high school or community college, or help out at a Trig-Star event. Remember mentoring takes place at all times, and in different capacities; how we dress and how we conduct ourselves professionally can be just as important in mentoring as the education component.

In closing, I would like to say this past year has been a true honor and a privilege to serve CLSA as your President. I have been supported by an excellent Executive Committee, an outstanding Board of Directors, and the continued excellence of our Executive Director and Central Office is unsurpassed. I feel truly blessed to have experienced all of the professional development I have gained through these past several years working beside so many outstanding and dedicated surveyors. I will be happy if my service has given you but a fraction of what I have received.

Sincerely,
William R. Hofferber Jr. CLSA President 2011 ■

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By: Robert L. Nelson, Caltrans (retired) and Don D'Onofrio, NGS (retired)

Robert Nelson, (left) *Registered Professional Engineer #10292, received a Bachelor of Science in Civil Engineering from Stanford in 1950. His subsequent career at Caltrans spanned nearly 40 years, the last 21 of which he served as Headquarters Surveys Engineer. His retirement in 1991 was precipitated by a heart attack, causing him to miss the actual completion of the HPGN project.*

Don D'Onofrio *came to California in October 1991 to assume the role of the National Geodetic Survey State Geodetic Advisor to California. Don fulfilled the same role in Alaska from 1982 until moving to California. He retired in 1999 after almost 40 years of service with NGS and its predecessor, the Coast and Geodetic Survey.*

The California High Precision Geodetic Network
A 20 Year Retrospective

Introduction by Scott Martin, PLS, Chief of the Geodetic Branch of the California Department of Water Resources

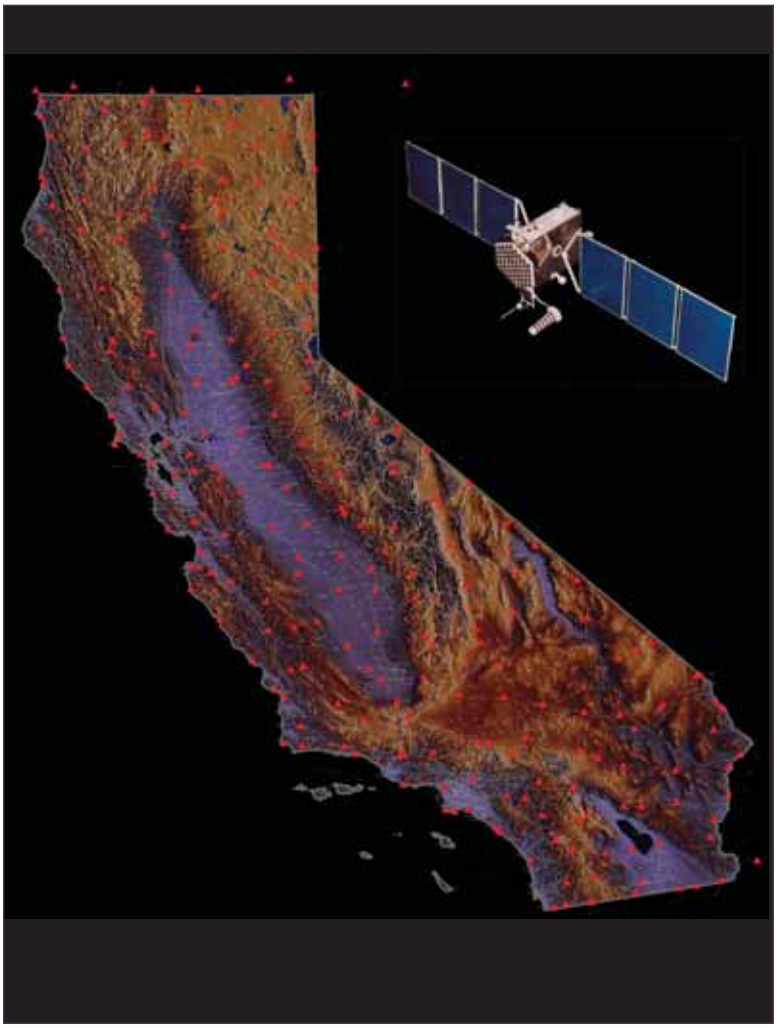

Image courtesy of Scott Martin and Kris Klima, CA Department of Water Resources

Introduction

This year marks the 20th anniversary of the birth of the original California High Precision Geodetic Network (HPGN). With the rapidly emerging use of GPS technology in land surveying, combined with the unique geological conditions constantly affecting the quality of survey control in California, a few visionaries in the industry recognized the need to undertake such a monumental project. The following article was co-authored by the two primary players in that effort, Bob Nelson, RCE (Caltrans – retired) and Don D'Onofrio (NGS – retired). Although they have done an excellent job of memorializing the effort, from the idea through implementation, the magnitude of the accomplishment cannot be emphasized enough.

Having been involved in a few Height Modernization densification surveys and re-surveys myself involving multiple stakeholders, I have some experience with the effort and energy required to take something from the "good idea" phase to the "actually do it" phase. I can't even imagine it on the scale of the HPGN. But, somehow Bob was able to convince the Caltrans Management to fund the project, and NGS decided to assign Don as the first NGS Geodetic Advisor to California to assist with the project. Together, they made it happen. Because of the leadership of these two men, with assistance and support from scores of others throughout the State and within NGS, the backbone for modern GPS based surveying in California became a reality. This backbone has facilitated the densification of high quality control throughout the State in the two decades since.

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For many younger surveyors today, the HPGN, or some offspring thereof, has just "always been here", like cell phones and personal computers. For some of us older folks, we knew it had a birth date of 1991.35, but probably knew very little more about how it actually came to be. This article will be educational and enlightening for all. I know that I personally learned a lot just through working with Don and Bob on the content and now have a much greater appreciation for their respective contributions to the surveying world in California. They are both to be commended for their lasting efforts and thanked for taking the time to write this informative article.

But wait…there's more. Coupled in this issue with the statewide HPGN article is an article authored by Steve Martin, PLS, formerly with San Diego County, chronicling the HPGN effort in San Diego County and how they integrated a much denser, county-wide control network simultaneously with the HPGN work. Talk about extreme coordination of field observations!!! And remember, geodetic quality GPS equipment was very expensive and hard to come by back in 1991. I know the readers of the California Surveyor will enjoy reading these articles as much I have, and will walk away with a greater appreciation of what was accomplished and the importance it still has today, some 20 years later.

The California High Precision Geodetic Network - A 20 Year Retrospective

The California High Precision Geodetic Network (HPGN) was completed 20 years ago. The authors re-visit the project from the relative ease and security of retirement. Both Bob Nelson of the California Department of Transportation (Caltrans) and Don D'Onofrio of the National Geodetic Survey (NGS) were major participants in the HPGN.

Bob was the primary proponent for a statewide Global Positioning System network in California. Caltrans learned from NGS that a few other states were beginning to plan and develop High Precision Control Networks. There were two primary reasons why such a network was not only necessary but mandatory in California. These were: it was obvious that the locations and accuracy of the existing horizontal control network were not adequate to obtain control survey efficiencies and accuracies that were attainable with the new GPS equipment and procedures that were becoming available; and, it was also obvious that ongoing secular crustal motions (plate tectonics) had distorted (and continue to distort) the network. In fact, episodic motions (earthquakes) made portions of the existing network virtually obsolete at the very moment of their occurrence. At the time of the original HPGN observations, there were no guidelines for the establishment of centimeter-level vertical control. Additionally, because of predicted gross errors in the GEOID model in many areas of the State in 1991, deriving accurate orthometric heights through the use of GPS was not feasible. The primary purpose of the network was to provide an accurate and unified horizontal control network. The vertical portion of the network was accurate to, and published at, the decimeter level with the above noted stipulation.

Caltrans determined that a basic control network with greater accuracy, uniform spacing and improved GPS accessibility would permit Caltrans and other surveyors to perform more accurate and efficient geodetic surveys using GPS technology. Caltrans Surveys approached its management for approval to enter into a Cooperative Agreement with NGS and to use Caltrans basic control survey fund allocations and additional funds as necessary to fund the development of a High Precision Geodetic Network for California. It was important for the HPGN to provide sufficient benefits to Caltrans to justify the expenditure of transportation funds, even though the network would also benefit virtually all surveyors and agencies in the State. To assure adequate benefits for Caltrans purposes, the network would have to be designed to provide sufficient density and accuracy while essentially following State transportation (highway) corridors. While convincing management was not the easiest hurdle to overcome, Caltrans Surveys believed this was achievable.

Network Approval and Design

Caltrans Surveys received the necessary approvals from its Management to proceed and began by developing a preliminary plan for the network layout. Most of this was accomplished in 1989. This included considerable discussion with several members of the NGS Staff. NGS provided the criteria for network design, monumentation standards, data collection procedures, etc. A Cooperative Agreement between Caltrans and NGS was developed and executed to establish the respective responsibilities, funding and other required project requirements. Caltrans provided the primary funding for basically all work associated with the establishment of the HPGN including NGS participation. One very significant result of Caltrans negotiations with NGS was their agreement to assign a resident Geodetic Advisor for the State of California. This was invaluable to all, particularly to those involved in the HPGN project, but also for anyone involved in geodetic positioning and surveying. NGS assigned Don D'Onofrio to this position in mid-1990. Caltrans funded about one-half of the funding for the Advisor position. The Advisor position has been continuously funded since that time.

Input for the network was also solicited from Caltrans District survey personnel, interested county survey staffs and other local agencies. After consultation with members of the profession, it was decided that the primary network design requirement would be approximately 40-mile spacing along transportation corridors. This was intended to meet initial basic needs, match terrestrial accuracies, and meet reasonable productivity levels. If a more dense spacing might be needed in some areas, this could be addressed later, as funds became available. This initial network layout would provide approximately 150 new monumented stations. NGS required a tie to an existing National Geodetic Reference System (NGRS) station in each one degree of latitude by one degree of longitude segment throughout the

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state. This would ensure that there was a sufficient tie between the newly established stations and the remainder of the existing horizontal network in California. The ultimate goal was the overall adjustment of the existing network into the newly defined GPS-derived HPGN. The result was an overall network of 245 stations (238 of which were in California).

The network included the following stations:

- New stations: 148
- Existing National Geodetic Reference System (NGRS) stations: 28
- NGRS Network Tie stations: 39
- National Crustal Motion Network stations: 18
- Tidal Bench Marks: 5
- Ties to the Oregon High Accuracy Reference Network (HARN): 6
- Ties to Arizona: Very Long Baseline Interferometry (VLBI) site: 1 (This site is also labeled a National Crustal Motion Network – NCMN – site.)

Note: The terms High Precision Geodetic Network (HPGN) and High Accuracy Reference Network (HARN) were used for state-wide networks somewhat interchangeably until NGS settled on using HARN for all state-wide networks. Caltrans had by then developed its plans using "HPGN" and decided to keep their terminology.

One unique requirement of the agreement between Caltrans and NGS was that NGS requested an independent HPGN adjustment be performed by a third party outside NGS. This was due to the complications of crustal motions that had occurred in California and due to the ongoing crustal motions during the two month survey itself. Caltrans initiated a separate contract with the University of California, San Diego to perform this adjustment.

Field Operation Planning and Execution

Caltrans was responsible for laying out the network and installing specified high-quality stable monuments according to NGS specifications. District survey personnel would install the monumentation and assist with data collection. Most of the monument installation was accomplished about 1990. The NGS Geodetic Advisor also assisted in station site selection and the selection of additional ties to the existing NGRS network. Most new stations consisted of highly stable NGS Class B driven rods. In addition, it should be noted that the data collection, field observations, scheduling, etc. were coordinated by the Geodetic Advisor.

With the completion of station selection and the monumentation of new stations the project data collection was scheduled to begin, and did, on April 5, 1991. Project observations started in southern California with a major densification of San Diego County geodetic control. This portion of the network is described in a companion article by Steve Martin who was then employed by San Diego County and is now the Survey Supervisor for the East Bay Municipal Utility District (EBMUD), headquartered in Oakland. After the three-day occupation of the HPGN stations in San Diego County, Caltrans and NGS observers began moving northward through the state. The observation schedule called for one six-hour session (the San Diego County observations called for seven hour sessions) to be observed daily for five days per week. By 1991 the satellite constellation was such that all observations were obtained during the daytime. Caltrans provided six observers and NGS provided five. Caltrans districts provided personnel throughout the project as the observations moved northward through their districts. District 7 in Los Angeles provided two observers who observed throughout most of the project.

Computations Provided by NGS

NGS provided computational expertise. The baseline computations were performed by the NGS computing personnel in an office provided by Caltrans at its District 11 Kearny Mesa Surveys office. The computational office remained there until about half way through the project when it moved to Sacramento at the Caltrans Transportation Lab, where the NGS Geodetic Advisor had his office, for the remainder of the project. Observation data were forwarded to the computational office via overnight mail. These were early days for transferring digital data and each day's data was downloaded by the observer onto pre-formatted 3 1/2-inch diskettes. Two independent sets of data were downloaded from the receiver and the second set retained by the observer until the original set was delivered and verified. In only a few instances was this second data set required due to corrupted diskettes.

About three weeks into the project, the observers asked for a meeting to discuss the observation schedule. The active HPGN participants met in Ventura to discuss issues and options related to the schedule. It became apparent that the time to make long drives between stations was the basic issue, because many were in excess of 100 miles. The predetermined work schedule and sending data on a daily basis via the local post office hours was creating extra long days and/or missed mailing deadlines. This culminated in excessively long five-day weeks. The meeting participants agreed that Caltrans and NGS would each add one extra observer to the schedule and shorten the observing week to four days. This provided a minor extension to the overall project schedule (55 observer days per week with eleven observers over five days versus 52 observer days with thirteen observers over four days). The other main decision in the observation schedule was to allow re-observations to be scheduled after the completion of the original network. By the time observation data was received and processed, the observers had moved too far to recall them for individual baseline re-observations.

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Project Equipment

Primarily two types of GPS equipment were used during the project, Trimble and Ashtech. Some of the equipment was borrowed from other agencies. For one period several Ashtech receivers were borrowed from the Los Angeles Department of Water and Power office located near Bishop. The receivers had older eproms (programmable chips) that might prove problematic when incorporated with receivers with a later version of the eprom. Ashtech was contacted and they agreed to replace the eproms on an emergency basis if we could get the receivers to them. A Caltrans surveyor made the trip to Ashtech headquarters in Sunnyvale and Ashtech personnel made the replacements while he waited. The observation schedule was not affected. The final observations for the original project were obtained on June 11, 1991. Re-observations were completed on August 13, 1991. Most re-observations were for single baselines and were scattered throughout the state. In most instances this necessitated sending a team of two or three observers to distant areas throughout the state. This was a somewhat minor but more time-consuming task.

Observation Details and Results

As mentioned above, there were a total of 245 stations in the project. A total of 570 station occupations were completed during 65 observing days. This was accomplished by 23 total observers, 15 from Caltrans and 8 from NGS. There were 23 GPS receivers used during the project. The final NGS adjustment for the project was accomplished in May, 1992. As noted above, NGS requested that a separate adjustment be performed by an independent third party. This adjustment was accomplished by Dr. Yehuda Bock of Scripps Institution of Oceanography at UC San Diego under contract from Caltrans. Dr. Bock and his staff had extensive knowledge of California's unique crustal motions, GPS technology and related adjustment processes. This proved to be a valuable rationale as there was a minor disagreement in one area of the state between the NGS and Scripps adjustments. The UC San Diego adjustment was proven correct in this area. It was incorporated into the NGS adjustment prior to publication.

Network Adjustment

The HPGN adjustment was a three-step process. Coordinates were obtained for those Very Long Baseline Interferometry (VLBI) stations which were to be used as project constraints. (NGS policy was to constrain statewide networks to VLBI for accuracy and consistency throughout the country.) The VLBI stations were occupied by equipment that received radio signals emanating from sources such as quasars. In California some of these VLBI sites are permanently mounted large radio telescopes. In other cases the site was occupied by mobile equipment. At the permanent sites a relationship was determined to a nearby survey mark established for this purpose. Then either this mark or the actual mark occupied by the mobile VLBI van was occupied during the HPGN observation phase. These stations were part of the NGS National Crustal Motion Network (NCMN). There were about ten such sites in California that were part of the NCMN.

The existing NSRS HPGN stations were then constrained to these VLBI/NCMN coordinates. Then HPGN coordinates were determined for the entire HPGN network (including those newly established stations). The final results were published by NGS in July 1992. A comparison was made between the newly derived HPGN coordinates and the published coordinates of the NGRS stations included in the project. The shifts ranged from 0.00 meter to 1.3 meters. The average shift was 0.27 meter. The differences can be attributed to a couple of factors. One is the ongoing crustal motions in California which can vary from zero to as much as five centimeters per year across the state. Another is the inconsistencies in the 18,000 station NGRS network in California due to older and primarily terrestrial observation techniques which ultimately necessitated the need for the HPGN.

NGS publishes coordinates that are referred to the NAD83 datum. These published coordinates include an epoch date which is the effective date of a project's observations. The HPGN epoch date is the decimal year equivalent for May 8, 1991 or 1991.35. May 8 was the mid-point of

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the primary HPGN observation period. Some questions were raised about the effect of crustal motion during the course of the project. Since the primary network observations took place in slightly more than two months the worst case scenario for motion would be less than one centimeter which would be masked by the noise level of the overall results.

The Subsequent Twenty Years

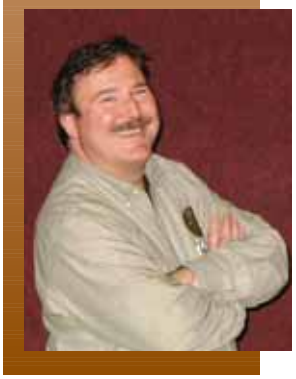
Since the completion of the 1991 HPGN project there have been significant crustal motions in California. These motions take two general forms: secular and episodic. Secular motion is the normal movement caused by plate tectonics. California consists of two basic plates: the North American and the Pacific. Secular motion can reach five centimeters annually in the west central portion of the state. This accounts for about a one meter shift since the 1991 HPGN. Since these shifts occur over somewhat large areas they have little effect on projects encompassing about 40 kilometers or less. Secular motions can be effectively ignored for work within such areas.

Episodic motions, those caused by earthquakes, can be another matter entirely. In these cases regional coordinate changes can be significant and instantaneous. After each of the major earthquakes since 1991 Caltrans has taken a major role in re-observing HPGN stations affected by the earthquake extending the survey out to a region deemed unaffected by the earthquake. In the case of the 1994 Northridge earthquake, USGS made the observations. Each of these projects was accompanied by a new epoch date.

Network Densification

It was clear that the spacing of HPGN stations was not sufficiently close enough for Caltrans ongoing projects, nor to meet many of the requirements of other State and local agencies and private firms. Thus, within a short time after completing the basic HPGN network, Caltrans originated the HPGN-Densification (HPGN-D) project. This densified the original network of GPS control throughout the state to about 15 kilometers. The overall HPGN (Order B) and HPGN-D (First Order) networks consisted of about 1100 stations.

Today there is an increasing number of Continuous (CGPS) stations in California operated by public and private agencies. These “active” CGPS control stations reduce the need for a large number of passive GPS-suitable control stations. However, there is a whole generation of GPS surveyors who have gained an appreciation for the California HPGN and continue to depend on it. While some CGPS stations are part of special scientific investigations, e.g., the Plate Boundary Observatory project, they might have a limited life. Those 1100 passive monuments tied to the California HPGN will serve at least another generation of geodetic surveyors and possibly for many decades to come. ■



By: Steven J. Martin, PLS

Steve Martin *is currently the Survey Supervisor for the East Bay Municipal Utility District (EBMUD), headquartered in Oakland, CA. Prior to accepting the position at EBMUD, Mr. Martin was employed by the County of San Diego in increasingly responsible roles spanning 17 1/2 years. He started his Survey career in 1988 while employed by the City of San Diego as the 4th man on a Survey crew, a position called "Engineer Trainee". He has been licensed since 1996 and a CLSA member since 1990.*

A Reflection on the San Diego County High Precision Geodetic Network

and the Start of the Statewide HPGN Survey

20 years ago, surveyors from Municipal, County, State, Federal agencies and academia worked cooperatively to establish a High Precision Geodetic Network (HPGN) over San Diego County. This cooperative effort was on a scale which likely has not been seen since. Additional mutually beneficial joint geodetic projects were undertaken over the following decade. Some of the relationships developed would go on to foster the creation of the California Spatial Reference Center (CSRC.) A look back at this landmark survey is warranted in this 20th anniversary year of the HPGN survey.

San Diego County's goal to establish a high accuracy uniform horizontal and vertical datum to support a GIS and "future" widespread use of GPS was initially a Countywide effort only; however the developing CALTRANS efforts offered a unique opportunity to partner on HPGN's, both countywide and statewide. Practically both were surveyed at the same time. The San Diego County HPGN is a 34 station, simultaneously observed, "B" order geodetic network. This was unique in that 34 survey crews, if you will, with 34 dual-frequency geodetic grade GPS receivers were all up and running at the same time over stations spread throughout the 43,000 square miles of San Diego County. Keep in mind GPS use in the survey industry in 1990 was still fairly new and 34 dual frequency receivers fielded in one campaign was unheard of at the time.

The Statewide HPGN, described in a separate article by Don D'Onofrio and Bob Nelson, consisted of 254 stations across all of California, only 11 of which were in San Diego County. It could be said that San Diego County established a densification network simultaneously with the HPGN survey, however unique among densification surveys, the San Diego County network was at the same accuracy level as the statewide HPGN.

The County's efforts to establish a HPGN began in late 1989 with a committee established with the following mission statement: "The purpose of establishing and maintaining a GPS network in San Diego is to provide a uniform horizontal and vertical datum to be used in support of the Regional Urban Information System (RUIS); in the assessment and management of Infrastructure, Demographics and Environmental policies; and in the anticipation of future widespread use of GPS by public and private industry."

The City of San Diego and CALTRANS District 11 Surveyors joined the committee and inquiries were made to

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Dan Harrison, longtime County ROS map checker monitors a Trimble 4000 SST receiver during one of the 7 hour sessions

NGS about obtaining a State Advisor. In January of 1990, Yehuda Bock and Duncan Agnew, scientists at Scripps Institution of Oceanography joined and recommended that "A" order accuracy be strived for to support crustal motion studies. In May of 1990, Bob Nelson and John Fundus of CALTRANS Headquarters joined and presented their plans for a statewide network. In November of 1990, Don D'Onofrio, newly appointed California State Geodetic Advisor, attended the committee meeting along with Gilbert Mitchell of NGS. In February of 1991, County Surveyor Chuck Moore spread the word about the upcoming survey at meetings, conventions and sent a letter to industry inviting their participation.

Quite a lot of planning and preparation was still required before the target San Diego County HPGN survey date of April 5, 6 & 7 1991. Detailed instructions were written for the many Surveyors, some of whom would be running a GPS receiver for the first time. Training meetings were held. Discussions of minutia such as do we measure the HI in millimeters to the bottom of the punch mark in the disk or to the top surface of the disk (a couple of millimeters difference)? Forms were made up to get a rubbing of the disk stamping and UHF radios were allocated to each operator for emergency communications (no cell phones back then).

The County of San Diego Department of Public Works (DPW) was an active and energetic organization when I joined as a newly minted LSIT in February of 1990. Land

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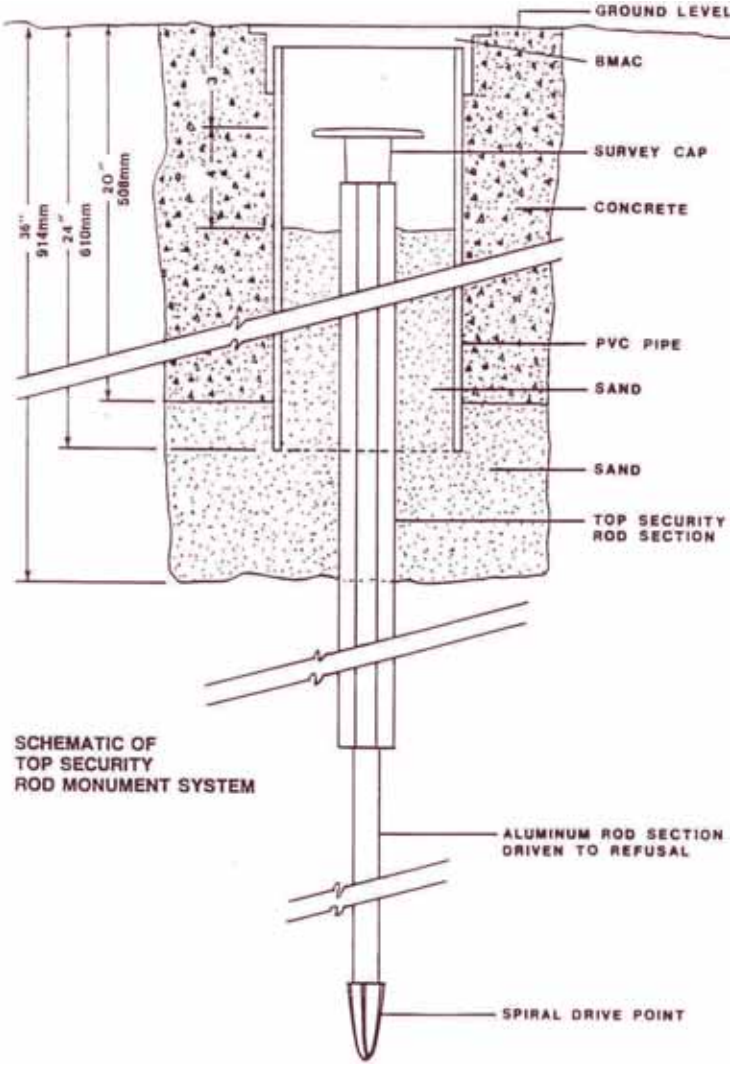
Development was still in the boom of the late 1980's and the TRANSNET initiative, a half cent sales tax increase for transportation projects, brought a flood of projects into DPW, under which was the Field Survey unit that I was hired into. The planning for a county wide geodetic network only added to the energy and workload. As a part of the network preparations, DPW requested proposals from GPS manufacturers for the purchase of GPS receivers for use on the HPGN survey and public works projects. The proposal from Ashtech Inc. of Sunnyvale, California was accepted and we acquired 5 LD-XII dual-frequency GPS receivers. I volunteered to work on the crew first selected to learn the use of this new technology and was selected to attend training at Ashtech's facility along with Party Chief Norman Peet. The late, great, Ellis Veach taught the course in Sunnyvale and he would later come down to San Diego to assist during the HPGN survey.



SCHEMATIC OF TOP SECURITY ROD MONUMENT SYSTEM


Then Party Chiefs Norman Peet (County of SD) and Ron Dodds (City of SD) auger to intall a Bernsten rod type monument in the Eastern San Diego County desert

Party Chiefs' Norman Peet (San Diego County) and Tim Dickey (CALTRANS) had many years experience with geodetic control networks and were tasked in late 1990 with selecting sites for the proposed network stations. The committee, after consultations with NGS, had decided on the Bernsten rod-driven-to-refusal type monument or a disk set in bedrock. Tim Dickey was responsible for building the 6 new stations that would become part of the State HPGN and reconnoitering the 5 existing network tie stations. Norman Peet worked collaboratively with personnel from various agencies on most of the rest of what was planned

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to be a 30 station network. I worked on Norman's crew at the time and I have to say that the amount of cooperation between the crews and other agency personnel was exceptional.

Because the survey was going to mix different types of GPS receivers, Ashtech and Trimble, an experiment was set up to test the mixing of data from the two proprietary receivers. Four marks were set in a nearby field, then Norman Peet and I traversed around the quadrilateral and ran levels between the marks. Next, two Trimble 4000 SST and two Ashtech LD-XII receivers were set up for four hours or so for the experiment. The data was processed in the Geodesy lab at Scripps Institution of Oceanography (SIO). Some weeks went by and we received a phone call from Dr. Bock indicating that we had to have miss-measured the antenna heights by a couple of centimeters. We considered that, and indicated that not only had we measured the HI in 3 places around the ground plane using the precise graduated millimeter rod before *and* after each session, we had measured with a decimal foot tape as a independent check. Furthermore, we had leveled to each mark *and* leveled to the top of each tribrach insert, so our response was that there was no way we miss-measured an antenna height. The reply we received back was something along the lines of "it must be the deflection of the vertical then", which did not sound right to me at the time because of the flat terrain and short, 100' +/-, distances, but nobody could come up with a good answer for the discrepancy. With what we now know about antenna phase center variations and antenna calibration models, it is highly likely the cause of a couple of centimeter discrepancy.

As the start date of the survey approached, the outreach efforts of Chuck Moore, Yehuda Bock and others gained momentum. Additional resources were identified and the network was expanded to 34 stations. One side note: 1990 was a drought year and it had been very dry in San Diego County that winter, which made for good weather to install monuments. However, March of 1991 ended up being what was termed "Miracle March" for the much needed snow and rainfall that fell all month long. While this was good for the semi-arid County, the snowpack in the mountains left a few of the recently built stations on mountaintops inaccessible. Several stations were built at lower elevations in the last few weeks to replace these, mostly in bedrock (less time and labor), including the station in Rancho Cuyamaca State Park that Dan Harrison is manning in the photograph at the beginning of the article.

Stations in the San Diego County HPGN are spaced approximately every 20 kilometers throughout the County,

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A Trimble 4000 SST GPS receiver borrowed from MIT at station SDGPS 15, a station set to replace the mark on Volcan Mountain which was inaccessible due to snow.

which is really too close together to achieve "A" order relative accuracy (1:10,000,000 over 20km is smaller than the expected setup error), however every effort was made to achieve the highest accuracy possible. Not only were all 34 stations observed simultaneously, the observations were repeated on 3 days, meteorological observations were observed at most stations several times during the sessions and plumb-bobs were used to verify optical plummet tribrachs. The schedule for operations was set for Friday, Saturday and Sunday, April 5, 6, & 7, 1991 to minimize impacts on existing projects and deadlines. Miraculously, the rain stopped as this start date approached.

With all of the careful planning and preparation, the actual field operations went off relatively trouble free. Of course, there were some issues, such as:

◆ Two of the NGS operators who were assigned existing NAD83 network stations on mountaintops were late getting started on the first day after having to slog thru the snow to get to their respective stations.

◆ One of the County of Orange surveyors was delayed due to a helicopter crash on the freeway near his assigned station.

◆ One of the borrowed Trimble receivers was set to log to an external data collector, so no data was collected for that station on Friday. A call to Trimble on Saturday morning corrected the problem.

◆ The crew at a station by the Old Point Loma Lighthouse, found themselves answering questions from 10,000 tourists and 200 2nd graders.

◆ On Saturday and Sunday, the County Party Chief occupying a station in a desert campground east of Borrego Springs found himself surrounded by participants in what is the annual Peg Leg Liars Contest. When he told them he was making measurements to satellites, they did not really believe him and thought it an elaborate setup for a contest entry.

Mike Binge at station Junction Azimuth mark near the Tecate border crossing during the 1991 San Diego-HPGN survey.

Once all of the data was downloaded and backed-up to multiple 3.5" diskettes (I still have memories of formatting hundreds of diskettes for hours on end…the County IT department saved 6 cents apiece purchasing unformatted diskettes), the data was then delivered to Yehuda Bock's group at Scripps Institution of Oceanography (SIO) for processing. Dr. Bock is one of the developers for the GAMIT software (GPS at MIT) along with scientists at the Massachusetts Institute of Technology. The GAMIT software is a true multiple baseline processor in that instead of looking at one base and rover GPS receiver pair at a time to determine a vector or baseline, GAMIT looks at all receivers and double difference combinations available to determine unknown station coordinate parameters in one least-squares solution. With 34 simultaneous data sets, that makes for a lot of double difference combinations and requires a fair amount of computational power.

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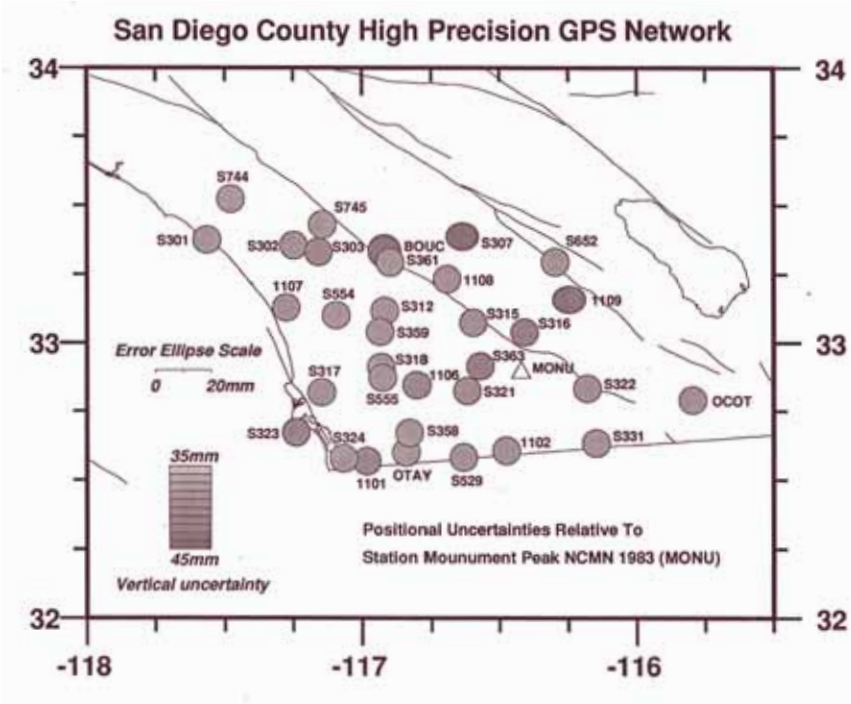
Shimone Wdowinski, Jian Zhang and Peng Fang in SIO's IGPP basement geodesy lab

I was detailed to work with Dr. Bock's group on the processing and spent weeks converting the data to the RINEX format and manually fixing cycle slips (full automation of the data "cleaning" process was still in the works). The GAMIT software ran on the HP Apollo or Sun UNIX workstations in the geodesy lab down in the basement of Institute of the



Poster by Peng Feng for the 1991 Fall American Geophysical Union (AGU) meeting

Geophysics and Planetary Physics (IGPP) building at SIO. Once I got each day's dataset ready for processing, I would initiate the process in the afternoon and let it run all night… only to come in the next day and find that someone else at SIO had killed my process so their project would run on the shared network resource. Eventually, I had three good daily solutions. We had planned on running a grand solution, where all three days worth of data would be processed simultaneously to estimate stations coordinate parameters, i.e. processing and adjustment all in a single step. Because of the size of the data set, computational power and the shared resources, we decided to use the daily solutions for "Bluebooking" and submission to the NGS database.

In my summary for the processing and adjustment at SIO, I noted that vertical uncertainties were on the order of 3cm or 6 times worse than the horizontal uncertainties, and that GPS vertical uncertainties are expected to be 3 times worse than horizontal uncertainties. Again, with what we now know about antenna phase center models, the discrepancy I noted then is explainable. Once the project was submitted to NGS, it took several months for the California State HPGN to be adjusted. There were some discussions between NGS and Dr. Bock's group at SIO, who were contracted to parallel process and verify the State HPGN, regarding how to handle the crustal motion that occurred during the 5 months it took to survey the state HPGN. Eventually it was decided to use the mid-point of the survey, 1991.35 in decimal year format, to reduce all of the data. Once the two organizations had agreement on how to handle the adjustment of the Statewide network, results were published in 1992 along with the San Diego HPGN results. Readjustment of existing stations in the NGS database followed many months later.

The publishing of this High Precision Geodetic Network in San Diego County ushered in a new era in the survey industry. It can be said that the proliferation of GPS survey methods in the years to follow was enabled by the existence of an accurate geodetic network to base the work upon. Many cities within San Diego County subsequently established their own City-wide 1st order control networks and enacted parcel coordinate-tie ordinances to facilitate GIS databases. It was also a new era for inter-agency cooperation. The County Survey Unit assisted CALTRANS District 11 with a project to improve the Geoid model in San Diego County in 1992 and again with some cross County 1st order trig-leveling in 1995. All participants cooperated once again in 1998 for a resurvey of select HPGN points for a readjustment and unification of the various statewide HPGN's by NGS (by then, NGS favored the term HARN – High Accuracy Reference Network). The California Spatial Reference Center (CSRC) was founded at Scripps Institution of Oceanography in 1999 as NGS's partner in California. A 1999 densification survey with cooperative efforts from CALTRANS, the City of San Diego, and several private survey firms fielded 47 dual frequency receivers and was processed by CSRC (see ROS 16810). It really was a decade of change for surveying in California. Establishing partnerships enabled projects that may have been too big for one agency alone.

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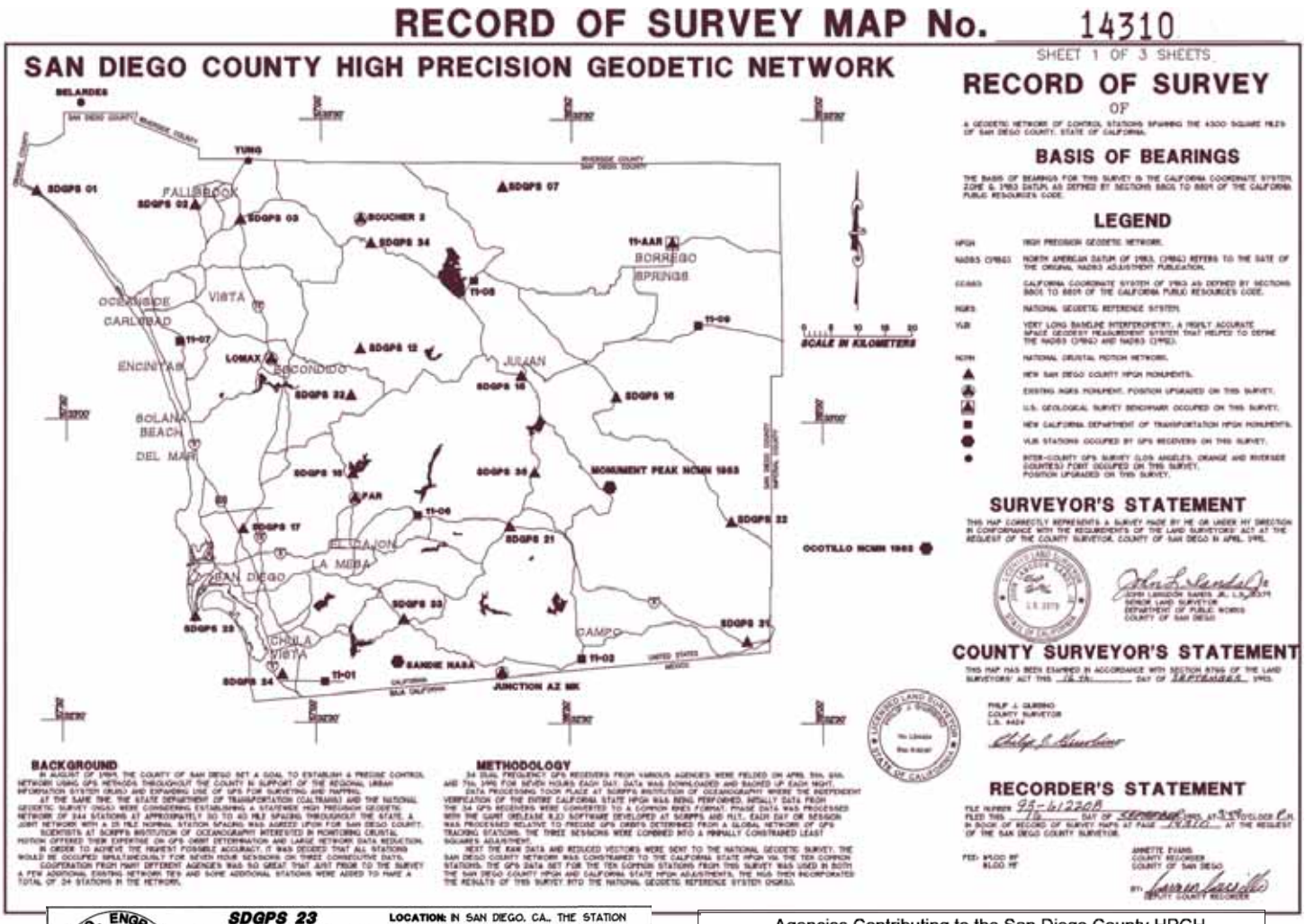

RECORD OF SURVEY MAP No. 14310

SAN DIEGO COUNTY HIGH PRECISION GEODETIC NETWORK

SHEET 1 OF 3 SHEETS

RECORD OF SURVEY

OF

BASIS OF BEARINGS

LEGEND

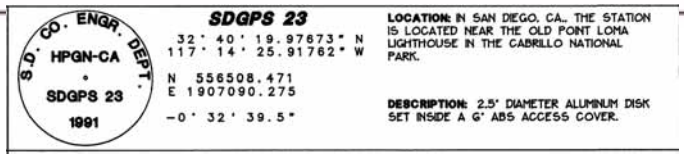
SURVEYOR'S STATEMENT

COUNTY SURVEYOR'S STATEMENT

RECORDER'S STATEMENT

BACKGROUND

METHODOLOGY


S.D. CO. ENGR. DEPT.
HPGN-CA
SDGPS 23
1991

SDGPS 23

32° 40' 19.97673" N
117° 14' 25.91762" W

N 556508.471
E 1907090.275
-0° 32' 39.5"

LOCATION: IN SAN DIEGO, CA., THE STATION IS LOCATED NEAR THE OLD POINT LOMA LIGHTHOUSE IN THE CABRILLO NATIONAL PARK.

DESCRIPTION: 2.5" DIAMETER ALUMINUM DISK SET INSIDE A 6" ABS ACCESS COVER.

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Agency	Personnel	GPS Receivers
County of San Diego	20	5 Ashtech LD-XII
Scripps Institution of Oceanography	2	6 Trimble 4000 SST 1 Ashtech MD-XII
National Geodetic Survey	8	7 Trimble 4000 SST
California Dept. of Transportation	12	--
City of San Diego	3	--
County of Orange	4	4 Ashtech LD-XII
Ashtech Inc.	1	2 Ashtech MD-XII
Massachusetts Institute of Technology	--	4 Trimble 4000 SST
California Institute of Technology	--	2 Trimble 4000 SST
U.S. Geological Survey	--	3 Ashtech LD-XII

The San Diego County HPGN survey was one of the highlights in my career and a landmark survey for California. I hope that by reflecting on how change occurred 20 years ago, we will gain perspective and insight on how to manage the change occurring in our profession today.

Author's footnote: To give credit where it is due; the idea for a retrospective article came from a former co-worker of mine at the County of San Diego, Mike Binge, who writes a column for POB magazine. I spoke with Mike at the CLSA/NALS conference in March and he mentioned his idea for a column. As I dug out my old photos for Mike, I thought that a retrospective was a really good idea and suggested the idea to the California Surveyor.

Reference: "County of San Diego's GPS-A-THON" B. Cooper, POB magazine circa 1992. ■

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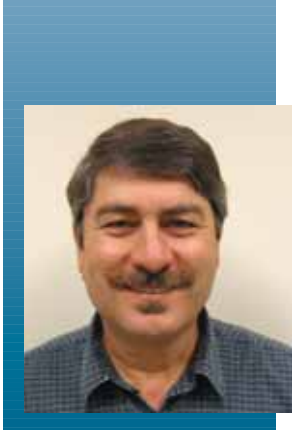

By: Frank Romano, PLS

Frank Romano, Jr. *obtained his CA license in 1990 and NV license in 1991. He is owner/operator of Frank Romano Surveying and has recorded over 100 Record of Surveys since 1993. He is currently employed by Caltrans, District 12, Irvine, CA, and is a former Adjunct Professor, Survey Program, Santiago Canyon College, Orange, CA.*

Simultaneous or Sequential Conveyance?
One surveyor's quest for the answer

In the fall of 2007 I acquired a job wherein a five-acre desert parcel had been split by separate deeds in 1965. This survey brought up the question of "simultaneous vs. sequential conveyance." Can two parcels be created simultaneously by two separate deeds? More specifically, were the two parcels that I was tasked to survey created simultaneously by two separate deeds? What follows is an account of my quest for the answer.

Anyone who has surveyed for any length of time, especially in the desert, has come across deeds that look like they were written by a lawyer, realtor, or property owner, without the slightest understanding of the excess/deficiency nature of the Public Lands Survey System. Such was the case as I began to investigate the title history of my two parcels. The description of the two creating deeds in question clearly overlapped each other (see Fig. 1.) I was then tasked with determining which deed created the senior parcel. The created deed for Parcel "A" was found to be recorded in Book 6378, Page 214. The creating deed for Parcel "B" was recorded in Book 6378, Page 215. Problem solved! Page 214 comes before Page 215, therefore, Parcel "A" is senior to Parcel "B".

Wait a minute! Not so fast. What's this? Both deeds were executed on the same day by the same Grantor and recorded on the same day at the same time. Was it the owner's intent to convey them simultaneously? The deed for Parcel "A" was recorded on April 26, 1965 at 10:27AM. The deed for Parcel "B" was also recorded on April 26, 1965 at 10:27AM. The exact same date and time. Simultaneous conveyance? Now I began to have second thoughts. So I did what any self respecting surveyor would do, I reached over and pulled Brown's *Boundary Control and Legal Principles 4th Ed.* off of the shelf and turned to the section on *Locating Simultaneously Created Boundaries* in which he defines *"A simultaneously created boundary results when several parcels of land are created in the same 'legal instant' by the same person, persons, or agency and by the same instrument."*[1] *emphasis added.*

Same legal instant? Check!
Same person? Check!
Same instrument? Negative!

Now I realize that his book is a book of legal principles based on court cases: State and Federal, some in California, and some in other parts of our country. So I looked for the references that he bases this statement on especially the "*by the same instrument.*" To my surprise there are none. I searched and found none in any

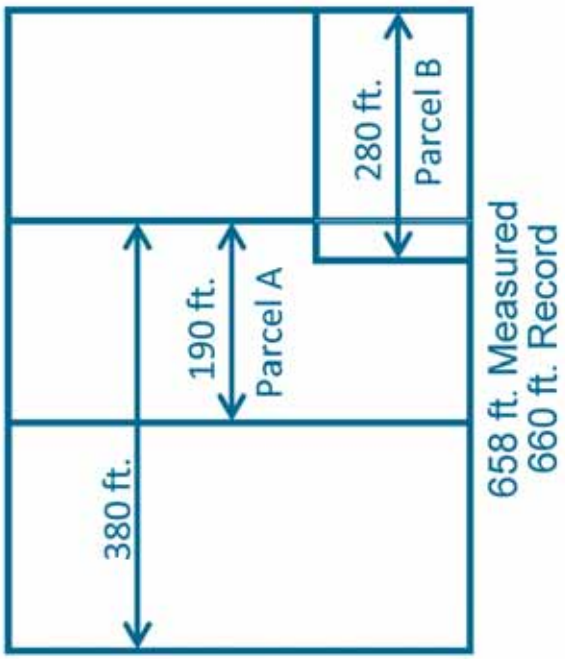

Fig. 1

of the many reference books in my library. It was then that I decided to solicit the aid of others.

My first step was to post the problem on the California Land Surveyors Association (CLSA) Forum, a blog for surveyors hosted by CLSA on their website: *www.californiasurveyors.org*. I explained the problem and requested justification and references for any opinions expressed. I received several responses. One of

Continued on next page

Continued from previous page

the responses reasoned that *"the deed with the lower page number came first, unless the two deeds were recorded as the same instrument."* and referenced Brown.[1] Another reasoned, *"Our state is a 'recording state'" meaning that higher credibility/status is given to the first recorded document. In this case, the first document to record achieved the vaulted status of a recorded deed PRIOR to the very next one on the page.*" The remaining responses agreed with the two stated above.

Which took me to my next step, what does California law have to say about recording documents and specifically the *order of recording*? California Government Code Section 27320 states:

When any instrument authorized by law to be recorded is deposited in the recorder's office for record, the recorder shall endorse upon it in the order in which it is deposited, the year, month, day, hour, and minute of its reception, and the amount of fees for recording. The recorder shall record it without delay, together with the acknowledgements, proofs, certificates, and prior recording data written upon or annexed to it, with the plats, surveys, schedules, and other papers thereto annexed, and shall note on the record its identification number, and the name of the person at whose request it is recorded. Efforts shall be made to assign identification numbers sequentially, but an assignment of a nonsequential number may be made if not in violation of express recording instructions regarding a group of concurrently recorded instruments and if, in the discretion of the county recorder, such assignment best serves the interest of expeditious recording.

A reading of the above section of Code would indicate that the recording order is *"…the year, month, day, hour, and minute of its reception…"* and that the page numbering is *"…its identification number…"* and is used for index/retrieval purposes. The code specifically provides for *"…concurrently recorded instruments…"* as the same transaction.

Now for my final step, what about case law? Are there any court cases that would address this issue? With a little assistance from a friend and colleague, Tod Coleman, I was directed to the following case: Soman Properties v. Rikuo Corp. (1994)[2]. Although this case was not specifically about the order of recording documents, that question was a side issue. It was used to make the point that two documents were recorded at the same *"exact time"*[2] and that the consecutive sequencing of the assigned numbers indicated that the documents *"…were filed as part of the same transaction."*[2] The case showed that the Court decided: 1) the "*year, month, day, hour and minute"*[2] determined that the documents were filed at the same *"exact time"*[2]; and 2) the assigned sequential indexing determined that they were part of the same transaction; Both consistent with CA Gov. Code Section 27320.

In light of said California Code and the Court's interpretation, it would seem that Brown's statement, *"A simultaneously created boundary results when several parcels of land are created in the same 'legal instant' by the same person, persons, or agency and by the same instrument."*[1] should be revised for California to read *"A simultaneously created boundary results when several parcels of land are created in the same 'legal instant' by the same person, persons, or agency and by the same transaction."* Emphasis added.

It was finally time to hang my hat. For the reasons stated in the following note, I accepted them as a simultaneous conveyance and placed the note on my map.

> "BOOK 6378, PAGES 214 AND 215 O.R. WERE BOTH EXECUTED ON THE SAME DAY AND RECORDED ON THE SAME YEAR, MONTH, DAY, HOUR AND MINUTE. IT IS MY OPINION THAT THIS SHOWS THE GRANTOR'S INTENT TO CONVEY BOTH PROPERTIES AT THE SAME MOMENT IN TIME AND THAT THE TWO DEEDS WERE CONCURRENTLY RECORDED CREATING A SIMULTANEOUS CONVEYANCE OF THE TWO PARCELS. MY UNDERSTANDING OF CALIFORNIA GOVERNMENT CODE SECTION 27320 IS THAT TIME OF RECORDING, NOT THE INDEXING (OR PAGE NUMBERING), DETERMINES THE ORDER AND PRECEDENCE OF RECORDED DOCUMENTS."[3]

The map was accepted by the County Surveyor and recorded.

You, on the other hand, may have a different opinion. If so, I would love to hear it. So pick up that pen and write to the editor. Do it now! And don't forget to include your reasoning and references. I look forward to hearing from you!

> *"For having lived long, I have experienced many instances of being obliged, by better information or fuller consideration, to change opinions, even on important subjects, which I once thought right but found to be otherwise."* Benjamin Franklin

References:

1. "Boundary Control and Legal Principles" 4th Ed.; Brown, Robillard, and Wilson
2. Soman Properties v. Rikuo Corp. (1994) 24 Cal. App.4th 471, 29 Cal.Rptr.2d 427
3. Record of Survey 07-244, R.S.B. 133/90, San Bernardino County, CA ■

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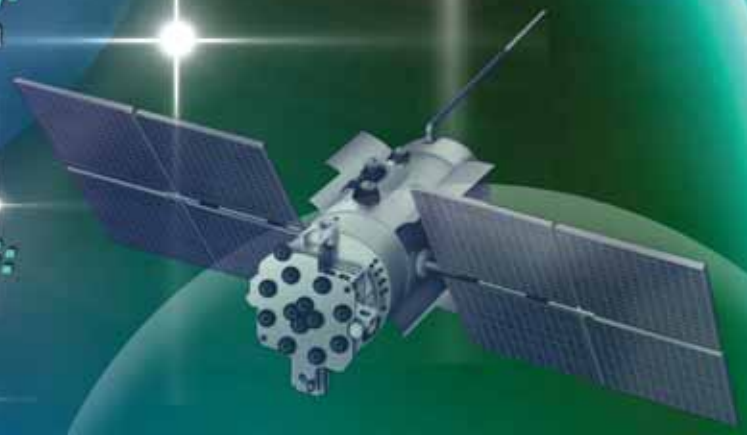

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Postcards

Photo taken in Rhodope Mountains in Bulgaria near Alamovci Village, Zlatograd.

The coordinates are: 41°23'34.40" N, 24°59'47.30" E. Submitted by Stoinan Stoinanov, True North, Ltd., Plovdiv, Bulgaria.

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The More Things Change...

Quotes from the near and distant past that prove the point: the more things change, the more they remain the same.

By: David E. Woolley, PLS

***Dave,** is the CLSA Orange County Chapter Legislative Chairman, Chapter Representative, State PPC Member, and owner of D. Woolley & Associates, Tustin, CA*

The following quote was taken from "Notice Afforded by Record of Survey Maps in California" by Neil J. Cummins, Jr., California Surveyor (1978), Issue 50:

What is a Record of Survey?

"It should be noted that a Record of Survey does not affect the record title to property – its function is limited to a full presentation of the facts as the surveyor finds them. Normally, the surveyor will advocate a position for the lines surveyed and disclose conflicting evidence found by note on the map; however, in extreme cases, the surveyor may not adopt any position for the lines in question and will limit his findings to a presentation of the evidence found. Where strongly conflicting evidence is found, the county surveyor will often place a note on the map drawing attention to the fact pursuant to California Business and Professions Code, Section 8768. A Record of Survey's effect is on the location of the real property, as opposed to title. In the case of the Record of Survey showing an alternative position of lines, the filing of the Record of Survey is merely a disclosure of the problem, even though the surveyor may have shown a solution which in his opinion is correct."

"The effect on the marketability of the record title, however, may be pronounced. Normally the effect of a Record of Survey showing conflicting positions is most harmful for the purchaser of the land for development, who must properly establish the exterior boundaries of his property in order to subdivide the interior. Also such a survey is potentially harmful to an occupier of land who constructs improvements within the area of conflict without a notice of the survey."

Does a Record of Survey afford constructive notice?

"A Record of Survey is not necessarily made at the request of a person having any interest in the property surveyed and, even if made at the request of such an owner, may also show evidence affecting other property not owned. This Record of Survey does not normally appear in the chain of title, even though, following examination by the County Surveyor, it must be filed with the County Recorder (unless it fails to comply with Business and Professions Code, 8762.5, in that is an authorized division of land)."

"If a Record of Survey (which is a public record) is not in the chain of title it does not operate as a constructive notice to a purchaser. The current standard coverage title insurance policy in California restricts its coverage to items shown by public records and defines "public records" as those records imparting constructive notice. Such a policy therefore does not protect against loss resulting from the effect of a Record of Survey not in the chain of title."

Can a title company be held liable for failure to disclose a Record of Survey?

"California courts began to recognize the tort liability of abstractors in J. H. Trisdale v. Shasta Co. Title Co permitting an action in negligence for faulty preparation of a title report. Most recently, Jarchow v. Transamerica Title Insurance Co. allowed recovery for emotional distress caused by the title company's failure to defend and clearly stated that a title insurer who prepares preliminary title reports in connection with the issuance of a title policy assumes a duty more rigorous than that assumed in the issuance of a title report. Jarchow uses the term public records in connection with the abstractor's liability without limiting reference to constructive notice; Jarchow's standard is that of Contini "the abstractor must report all matters which could affect his client's interests and which are readily discoverable from those public records ordinarily examined when a reasonably diligent title search is made"."

"Therefore, a title company can be held liable for failing to show a Record of Survey on a preliminary title report on the basis that it breached the standard of care owed as an abstractor. The title company will breach that standard of care if it owed a duty to discover the existence of the Record of Survey."

Conclusion

"Regardless of the constructive notice afforded by the filing of the Record of Survey, it appears that the title company issuing a preliminary report within an area affected by the Record of Survey will be liable to any third party relying on the report for adverse effects resulting from failure to disclose the Record of Survey unless the title company can show it was unreasonable to expect the title company to discover the Record of Survey."

Continued on next page

Continued from previous page

The More Things Change...

Commentary by David E. Woolley, PLS

There are several landmark cases which forever changed the practice of land surveying in California. One such case is Stearns v Title Insurance and Trust Company (4th App. Dist. 1971) 18 Cal. App. 3d 162, 95 Cal. Rptr. 682 ("Stearns").

Background:

The Stearns case centered on a marketable title claim that Plaintiff Stearns ("Plaintiff") asserted against his title insurer Defendant Title Insurance and Trust Company ("Defendant") seeking damages from an alleged monetary loss due to a trespass claim (observed encroachments) and Defendant's failure to defend Plaintiff in an underlying action between Plaintiff and his neighbor.

In Stearns, Plaintiff's claims were based on discrepancies contained in three properly filed surveys, resulting in a dispute involving Plaintiff and a neighbor claiming encroachment and ultimately a dispute regarding the interpretation of Plaintiff's title insurance policy. Historically and today, title insurance policies are based upon information available in "public records". The Court noted that Plaintiff had prior knowledge of the disputed boundary seven years before seeking title insurance, and subsequently when seeking the title insurance policy from Defendant, Plaintiff did not ask for the survey exception to be removed. Additionally, Plaintiff did not make Defendant (title insurer) aware of any underlying disputes when Plaintiff obtained title insurance on his property. Without all of the details and 45 years after the fact, it appears Mr. Stearns may have set his moral compass next to a magnet while taking a reading.

Land surveyors, who are familiar with the title insurance survey exception, recognize the following phrase in the Conditions and Stipulations of the "Exclusions" section of a title insurance policy:

"Discrepancies, conflicts in boundary lines, shortages in area, encroachment, or any other facts which a correct survey would disclose, and which are not shown by the public records".

Title insurers and lenders understand any one of the above mentioned items are extremely costly to resolve. It is easy to understand a lender's requirement that an ALTA/ACSM land title survey be conducted as well as the requirement of removing the "survey exception" from the title insurance policy as a condition of the funding. Few land surveys carry more liability than the liabilities associated with performing a land title survey.

Considerations:

Several notable rules were set forth in the Stearns case. The most notable being the following quote:

"[the] mere fact that instrument has been recorded does not give constructive notice thereof unless there is some statute authorizing or permitting such an instrument to be placed of record at the same time making the effect of such recording constructive notice [citation]. Private records of survey such as [surveyors' names] …are recorded, however pursuant to Business and Professions Code § 8762 et. seq. These sections contain no provisions that such recordation shall impart constructive notice. The term "public records" is, in turn, unambiguously defined as those records which impart constructive notice."

Stearns v Title Insurance and Trust Company, supra, 18 Cal. App. 3d at 169.

According to the Stearns ruling, the title insurance company is not liable for the information shown on a Record of Survey (i.e. discrepancies, conflicts in boundary lines, shortages in area, encroachments, etc.) because, although the Record of Survey is filed and available to the public, this information is not a public record. A review of the case history indicates Stearns is still current and accurate despite the conclusions of Neil J. Cummins, Jr. as stated above.

This public record definition, as stated in Stearns, begs the question: Is it possible to make a Record of Survey a public record as defined by Stearns? The answer is yes. A properly qualified and executed boundary line agreement results in a public record. Although the State of California does not recognize boundary line agreements moving a title line (when the title line location can be determined on the ground by a land surveyor because such situations are exclusively reserved for lot line adjustments pursuant to the Government Code), filing a quitclaim of interest for either side of the established line would (by reference) enter the Record of Survey into the public record. This solution, however, carries great liability and risk for the land surveyor. For example, suppose two adjoining real property owners quitclaim interest either side of a line which is later determined to have been incorrectly established and shown on a Record of Survey? This circumstance could result in a bona fide marketable title claim (against the land surveyor) a basis for rescission and/or monetary restitution for the value of both properties due to the negligence of the land surveyor.

In a related hypothetical, suppose that, in the event of an encroachment onto an adjoining parcel of land, a responsible land surveyor (working with an attorney) prepares a license or maintenance agreement or prepares a renewable/temporary easement that refers to an accompanying Record of Survey? This would result in a public record. I specifically distinguish a temporary easement as a remedy for an encroachment, as an easement diminishes the value of a property and encroachments are often temporary in nature. Depending on the circumstances, a client resolving an encroachment problem may be better served by a fee title adjustment rather than an easement. The solutions contained in this paragraph typically involve less liability for the land surveyor in the event of a survey mistake.

Conclusion:

The decision on which of these approaches to take will vary (based on circumstances associated with the properties and owners) and, as with boundary determinations, the land surveyor with the most complete research and defensible approach will typically prevail.

The fact the title insurance companies do not recognize Records of Survey as public records has no bearing on the land surveyor's obligations to file a Record of Survey documenting discrepancies, conflicts in boundary lines, shortages in area and/or encroachments. Failure to file the Record of Survey is likely to be deemed negligence per se and/or provable common law negligence by the land surveyor. When existing encroachments are observed and not noted on a Record of Survey, there is a valid presumption by public that no such encroachment exists on the property. If existing encroachments are not shown on the Record of Survey, a host of other legal claims may be raised against the land surveyor including constructive fraud, negligent misrepresentation, collusion (with the property owner) and so on. ■

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

RISK MANAGEMENT FOR LAND SURVEYORS

Uninsurable Professional Liability Coverage Requests
Watch out for this stuff

We're in complicated and confusing legal territory now. Your client may ask you to provide protections that aren't insurable.

This article will explore three uninsurable requests you may receive from a client.

While coverage is similar from company to company, there are no standard policies so you will have to carefully read your policy, and when in doubt, contact your insurance company or broker.

What is Professional Liability Insurance?

Professional Liability basic coverage provides payment on your behalf for damages resulting from your negligence in providing professional service. It's your errors and omissions, malpractice, mistakes that ultimately result in property damage or bodily injury that affects your client. Of course there are exclusions, modification, limitations. Again, it is important to read your policy carefully.

Uninsurable Request #1: Naming Your Client as Additional Insured

Your client may request that you name them as additional insured on your policy. This may be done with a General Liability policy but may not be done with a Professional Liability Policy. If your client was named as additional insured on your Professional Liability policy, they would, in fact, be insuring themselves for professional services which they don't provide.

If you have a General Liability policy you may provide additional insured status to a client which, in essence, shares your insurance.

Uninsurable Request #2: Contractual Liability Coverage

You can't give it away! It is more complex than additional insured and equally important to understand.

Contractual liability coverage can be provided under a General Liability policy but is excluded under a Professional Liability policy - except for that which would be covered under tort or common law.

Here's a contractual liability exclusion from a Markel policy that reads "any claim based upon or arising out of the assumption of liability in any contract or agreement including but not limited to hold harmless and indemnity clauses, warranties, guarantees, certifications or penalty clauses; provided, however, this exclusion shall not apply to liability that the insured would have in the absence of the contract or agreement."

The Chartis contractual liability exclusion says, "the liability of others assumed by any Insured under any contract or agreement unless such liability arises as a result of a Breach of Professional Duty by the Insured in performance of Professional Services and would have existed absent such contract."

So, you can indemnify your client as much as you want, but your Professional Liability policy won't cover them like a General Liability policy. This is because Professional Liability policies are only covering your professional services that would be covered, absent a contract, under tort or common law.

Uninsurable Request #3: Indemnity Agreement Provisions

Often, a client will request a broad form indemnity agreement which includes indemnification for everything - including the client's negligence. This will not be insured under your Professional Liability policy.

A limited indemnity agreement, which may be insured under your Professional Liability policy, covers you only for your damages to the client caused by your negligence in performing or furnishing professional service.

What You Should Do

Be cautious! Insurance issue can be a complicated maze, Read your policy carefully and when necessary, ask for legal advice or assistance from your insurance company.

If you decide to sign-off on requests for things that are uninsurable - remember you are on your own and if something happens, the damages will come out of your own pocket. ■

Here's Some Important Information About CLSA

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

Representation

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

Educational Opportunities

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

Business and Professional Services

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

JOIN CLSA TODAY!

■ **CORPORATE MEMBER** *$159.00 + Entrance Fee. Shall have a valid CA Professional Land Surveyor or Photogrammetric license.

■ **CE CORPORATE MEMBER** *$159.00 + Entrance Fee. Any California registered Civil Engineer who is authorized to practice land surveying pursuant to Article 3, Section 8731 of the PLS Act and must be actively practicing land surveying and show sufficient proof thereof. CE Corporate membership must be approved by the Board of Directors.

■ **AFFILIATE MEMBER** *$79.50 + Entrance Fee. Any person who, in their profession or vocation, relies upon the fundamentals of land surveying.

■ **ASSOCIATE MEMBER GRADE** *$79.50 + Entrance Fee. Any person who holds a valid certificate as a Land Surveyor-in-Training.

■ **OUT-OF-STATE CORPORATE MEMBER GRADE** *$79.50 + Entrance Fee. Any person who resides in a state other than CA, who is a member of the other state's Association, and meets the requirements of Corporate Member.

■ **STUDENT MEMBER GRADE** *$15.90. A student in a college or university actively pursuing a surveying education.

■ **SUSTAINING MEMBER GRADE** *Annual Dues $318.00 + Entrance Fee. Any individual, company or corporation who, by their interest in the land surveying profession, is desirous of supporting the purposes and objectives of this corporation.

1. Member Grade Applying for _____ Date _____
2. Name (Full) _____
   FIRST MI LAST
3. Mailing Address _____ _____
   STREET COUNTY
   _____
   CITY STATE ZIP
4. Mailing Address is: ☐ Business ☐ Residence 5. Bus. Phone _____
6. Res. Phone_____ 7. Fax _____ 8. E-mail _____
9. Name of Firm, Agency or College _____
10. California License Number PLS# _____ LSIT# _____ RCE#_____ EIT# _____
11. Have you previously been a member of the State Association? ☐ Yes ☐ No Year _____
12. Signature of Applicant _____

Mail your completed application to:

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P.O. Box 9098
Santa Rosa, CA 95405

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

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

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

☐ Visa Credit Card # _____ Exp. Date _____

☐ Master Card Authorized Signature: _____

By: Robert Reese, PLS and Tom Mastin, PLS

Robert Reese *lives and works in San Luis Obispo, California. He is the owner of REESE Water and Land Surveying Services, a single person land surveying business providing land surveying and hydrographic services to a wide array of clients. He has been an active member of CLSA for over 25 years.*

Tom Mastin *has been involved in surveying since 1972, becoming licensed in the State of California in 1980. His background has been in most aspects of private practice surveying. From time to time he has been active in both local and state CLSA. As a follower of George Bernard Shaw's belief that "He who can, does. He who cannot, teaches", Mr. Mastin has long been involved with the education of surveyors, from organizing LS & LSIT review classes, to teaching surveying at a local community college, to his current career as a lecturer at Cal Poly State University, San Luis Obispo, teaching surveying, photogrammetry and remote sensing classes.*

Positioning Using GPS and CORS Part 3

In this Part 3 we discuss how to import RINEX data from CORS into your own processing software. But first we have some comments regarding Part 2, in which we discussed how to process your GPS data with CORS data using on-line services (Part 2 was published in California Surveyor Issue #166).

After some questions and comments from various individuals, it has been brought to our attention that there were some clarifications needed for the Part 2 article. The following Erratum 1 is for clarification and Erratum 2 pertains to an omission.

Erratum 1 - In Part 2, METHOD C, STEP 5: The article states "Using a program like NGS' Horizontal Time Dependent Position (HTDP) will convert an ITRF2005 position to a NAD83 epoch of your choosing. It also provides you a link to a map showing you the CGPS stations used for the solution." Note that HTDP does NOT provide the link; it is SCOUT that does this.

Erratum 2 - In Part 2, COMPARING SOLUTIONS USING ON-LINE PROCESSING: The table of coordinates for comparison of solutions preceding the NOTES section was inadvertently omitted.

The missing table of data is as follows:

PROCESS	Latitude(1)	Accuracy(m)(2)	Longitude(1)	Accuracy(m)(2)	Ellipsoidal HT(m)	Accuracy(m)(2)
OPUS	35 18 10.66234	0.045	120 39 41.50075	0.033	64.347	0.075
$OPUS_{HTDP}$	35 18 10.66302(3)		120 39 41.50068(3)		64.353(3)	
CSRS-PPP	35 18 10.6641	0.012	120 39 41.4999	0.045	4.310	0.065
SCOUT	35 18 10.66356	0.013	120 39 41.50102	0.041	64.342	0.057

Table notes:

(1) Latitude and Longitude values are shown to the precision returned by the service.

(2) Accuracy for OPUS is indicating Peak to Peak Values, accuracies for the other two solutions is standard deviation.

(3) CSRS-PPP and SCOUT datum was ITRF05 and epoch 2010.632. OPUS datum was ITRF00, epoch 2010.632.Using NGS's HTDP to convert the OPUS ITRF 00 value to ITRF05, epoch 2010.632 provides results of Latitude = 35 18 10.66302; Longitude = 120 39 41.50068 and Ell. Ht. = 64.353 m.

We apologize for any confusion we may have caused. This process can be complicated enough, even without our finely-honed ability to confuse.

Positioning Using GPS and CORS, Part 3 - DO IT YOURSELF PROCESSING

Part I of this series of articles gave an overview of the acronym-rich GPS reference station environment, including CORS (Continuously Operating Reference Station administered by National Geodetic Survey) and CGPS (non-NGS Continuous GPS stations). These generically are referred to as CGPSS (Continuous GPS Stations).

In Part II, the use of some on-line services that process your data with CORS data was discussed. Often it is easier to add CGPSS observation data in RINEX format to your own processing software, making the CGPSS an integral part to your overall solution. The CGPSS can be used as a base station for all your other measurements, allowing you to perform a rapid static survey with only one rover.

There are several considerations in using CGPSS data, mainly: site selection, download sites, data compression, antenna models, and navigation data. When you are adding the CGPSS data, there are a number of options on how to download the data. The data is always in Receiver INdependentEXchange (RINEX) format and may be compressed. There are three general compression methods: standard ZIP compression, GNU compression and the Hatanaka compression which is a high compression technique specific to RINEX data. The GNU compression can usually be expanded with a standard unzipping program. The Hatanaka compression is sometimes also compressed with a ZIP program, requiring two unzipping processes. At the end of this article there is a discussion about expanding Hatanaka files. This article will discuss using the NGS website, which will provide NGS sanctioned CORS only, and also using CSRC website, which provides access to non-NGS CGPS sites.

USING NGS CORS

Under the main NGS webpage, there is a CORS link, or you can go straight to the CORS page at http://www.ngs.noaa.gov/CORS/

STEP 1 - Determine the CORS you want to use

a. Clicking on the map on the CORS page will bring up an interactive map. The map currently works better with Firefox or Chrome web browser than it will with Internet Explorer. If you enter in a city on the location dialog box (not the SiteID box) and click on the "GO" button the map will zoom to the city, list all NGS CORS within 250 KM, and put pushpins of their locations on the map. You may want to zoom the map out to see all the NGS CORS.

b. Move the cursor to the pushpins and they will show you the name.

c. Click on the name on the list and it will zoom to that station.

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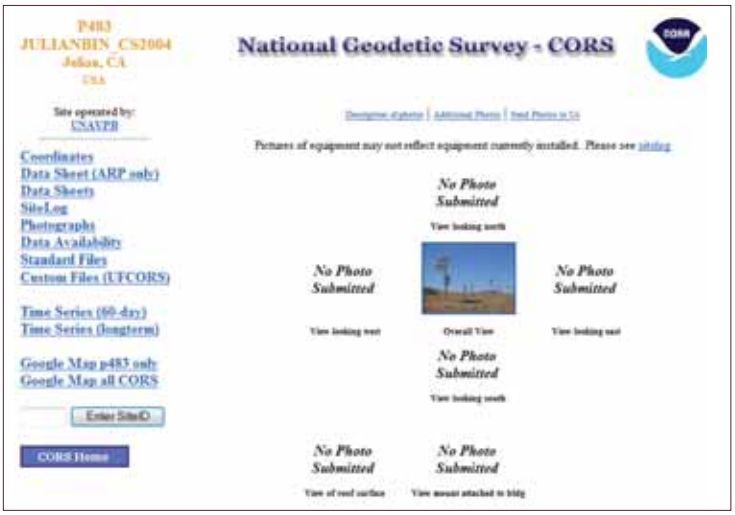


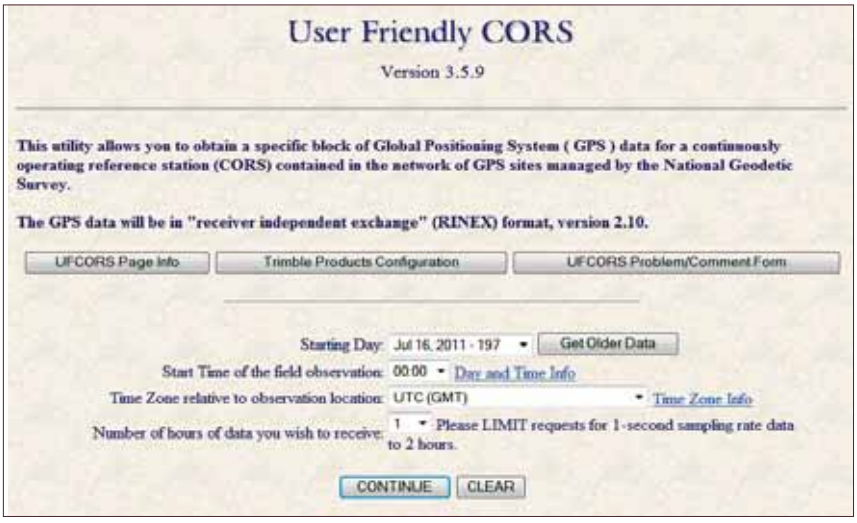
STEP 2 - Get Coordinates for your stations of interest (SOI)

a. If you are in the map view, click on the station name in the list or the pushpin on the map.

b. On the balloon that appears over the site click on "Get Site Info".

c. On the left side of the Site Info page click on "Coordinates". The coordinate sheet will come up. You should use the Antenna Reference Point (ARP) values. There are coordinates on the ITRF2000 datum and the NAD_83_CORS96 datum. The EPOCH being used will be listed. You will need to copy and paste these coordinates into your processing software for site position control.

Note: Looking on the list on Figure1, you will see that you can also get the Data Sheet (ARP Only) which will also have the coordinates in NAD83 (CORS) and State Plane Values. You may want to download this for project information used in reporting, etc. The SiteLog will show you the receiver and antenna for the site. The antenna information is usually embedded in the RINEX file, but you should verify the antenna type.



STEP 3 Method A– Download RINEX using UFCORS

a. To access User Friendly CORS (UFCORS) do one of the following.

1. From the Site Info page from the Map, just click the "Custom Files (UFCORS)" link on the left, - OR -

2. From the main NGS web page http://www.ngs.noaa.gov/ select "UFCORS" on the left – OR -

3. From the CORS web page http://www.ngs.noaa.gov/CORS/ select "Data Products" and on that page under "Methods of obtaining NGS CORS data, 1. Customized", select "User Friendly CORS (UFCORS)". Once you are on the User Friendly CORSweb page,

b. Day Selection: Select the "Starting Day" for your survey. The number to the right is the ordinal day. That number is usually embedded in your data file names.

c. Time Selection: Enter the Start time in your time zone, which should include a period of time prior to when you began collecting data.

d. Enter your time zone. Note that daylight saving time zone changes are available, so you will have to know that.

e. Determine how many hours of data you need. This should cover the full time span during which you collected data. These files are not huge so make sure you get enough hours of data.

f. Click "Continue" to get to the second input page.

At the top of the next web page:

g. Select the site for which you want information.

h. Select the data time interval. This should match the time interval for your data collection. The default "As is" should be fine, but you can set it to match your sample rate.

i. You can also download the coordinate files, meteorological files, the data sheet and if necessary the orbit information in SP3 format which is an ASCII file with the orbit information.

j. Finally you can select the compression type.

k. Click on "SUBMIT". A dialog box asking where you want to save the zip file will come up.

l. Save the data to the appropriate folder. Once you have saved that data file, you can select the next CORS you need from the pull-down list, then click submit.

Note: The zip file you just saved contains the site observation information file, a navigation information file, and other files.

STEP 3 Method B – Directly copy from the NGS FTP site

a. Go to the main CORS page on the NGS Website http://www.ngs.noaa.gov/CORS/

b. Select "Data Products" from the left side.

c. Under "Methods of Obtaining NGS CORS Date, 3. FTP", click on the "Silver Spring" Anonymous ftp site ftp://www.ngs.noaa.gov/cors/ . (You can click on the Alternate site if you just can't help yourself.)

d. Click on the "rinex/" folder, then the folder for year of your survey, then the folder for ordinal day.

e. First find the global broadcast orbit file (navigation file) "brdc[ddd]0.[yy]n.gz", Where dddde notes the ordinal day and yyde notes the year.

Continued on next page

f. Right click on this navigation file and save to the appropriate folder on your computer.

Note: If the precise orbits are available, you may download them from this same folder. These files will start with "igu" for the ultra-rapid orbit (every 6 hours); "igr" for the rapid orbit (18 hours); "igs" for the final orbits (14-16 days).

g. For the RINEX observation files, find the NGS CORS you are interested in and click on the station name to open the folder.

Note: In these folders there two compression type files: ".[yy]d.Z" files are Hatanaka double compression; "[yy]o.gz" files are GNU zip compression, where yy is the year. It is easier to download and expand the GNU zipped file although it is roughly twice the size of the Hatanaka compression. See the end of this article for how to expand the Hatanaka compression.

USING CALIFORNIA SPATIAL REFERENCE CENTER (CSRC) FOR CGPS STATIONSIN CALIFORNIA

The CSRC site can be found at http://csrc.ucsd.edu/. Ultimately, in order to download the RINEX data for a particular site on a particular day, you will have to know the site name and the ordinal day. CSRC has a utility called "Convert Date" accessed by their "VIEW PORTAL RESOURCES...Utilities" button. Some of the proprietary data files use the ordinal day in their file name.

STEP 1 – Determine the CORS you want to use

a. Use the CSRC interactive map. From the Main CSRC page click on the "Via MAP BROWSER" button. Often Windows Internet Explorer requires a redraw (F5) to bring up the map. Zoom in on the project area and note all the sites that might be of interest to you. The refresh rate on the map tends to be slow, so be patient.

It is up to you how many sites you want to incorporate into your static processing.

STEP 2 – Copy directly from the CSRC FTP Site

The actual ftp website can be accessed directly at ftp://garner.ucsd.edu/pub/. From the CSRC's main menu

a. click on "VIEW PORTAL RESOURCES" button.

b. On the Data Portal page, under "RINEX Data" header, click "Data Browser"

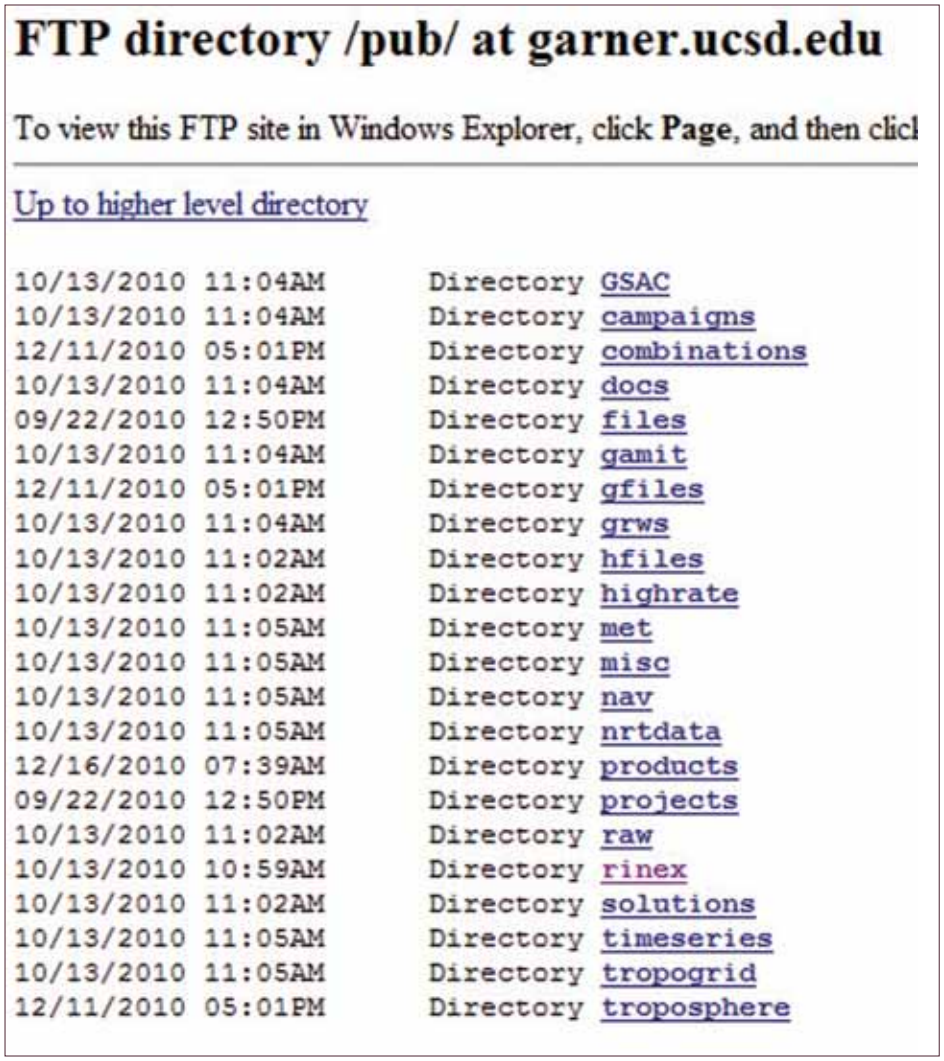
c. At the top of the Data Browser page, click "Direct FTP Access"

Note: There are several alternate methods to get the data you need from the CSRC ftp server. The method above is direct and allows you to navigate to the folders containing an entire day's observations for one particular site.

STEP 3 – Extract the RINEX Data from the FTP Site

a. Once at the FTP site, click on the "rinex/" folder, then the YEAR folder, then the ORDINAL DAY folder, then the file for the site you selected.

*Note: The file format for the RINEX data at a particular site, on a particular day, in a particular year is [nnnn][ddd]0.[yy]d.Z, where nnnn is the four character site code, ddd is the three digit ordinal day and yy is the two digit year. CSRC makes available two kinds of files on its server for 60 days: the file listed above, and a "....[yy]o.Z" file, both for the same site. The "...[yy]**d**.Z" file is a Hatanaka double compression file, while the "...[yy]**o**.Z" file is a standard zip compression. It is easier to download the standard zipped file although it is roughly 3 times larger than the Hatanaka compression. See the end of this article for how to deal with the Hatanaka compression. After 60 days, only the Hatanaka compressed file is available.*



FTP directory /pub/ at garner.ucsd.edu

To view this FTP site in Windows Explorer, click Page, and then click

Up to higher level directory

10/13/2010 11:04AM	Directory	GSAC
10/13/2010 11:04AM	Directory	campaigns
12/11/2010 05:01PM	Directory	combinations
10/13/2010 11:04AM	Directory	docs
09/22/2010 12:50PM	Directory	files
10/13/2010 11:04AM	Directory	gamit
12/11/2010 05:01PM	Directory	gfiles
10/13/2010 11:04AM	Directory	grws
10/13/2010 11:02AM	Directory	hfiles
10/13/2010 11:02AM	Directory	highrate
10/13/2010 11:05AM	Directory	met
10/13/2010 11:05AM	Directory	misc
10/13/2010 11:05AM	Directory	nav
10/13/2010 11:05AM	Directory	nrtdata
12/16/2010 07:39AM	Directory	products
09/22/2010 12:50PM	Directory	projects
10/13/2010 11:02AM	Directory	raw
10/13/2010 10:59AM	Directory	rinex
10/13/2010 11:02AM	Directory	solutions
10/13/2010 11:05AM	Directory	timeseries
10/13/2010 11:05AM	Directory	tropogrid
12/11/2010 05:01PM	Directory	troposphere

b. Download the compressed RINEX file for your site.

c. From the same folder, download the generic navigation file named "auto[ddd]0.[yy]n.Z", where ddd is the ordinal day and yy is the year.

Continued on page 41

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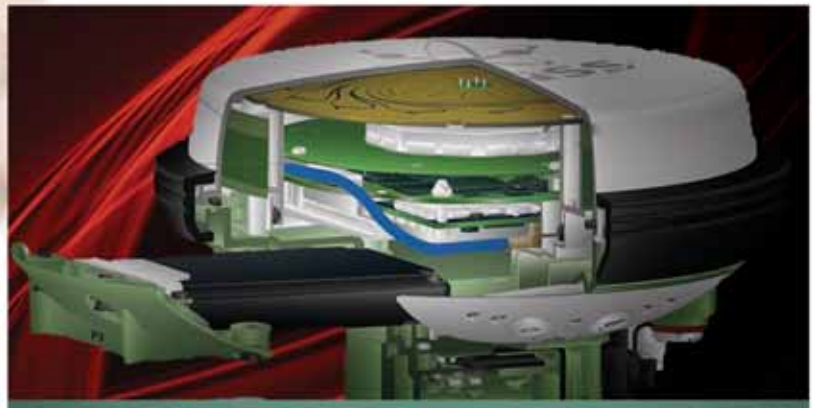

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Leica Geosystems

By: William R. Hofferber Jr, PLS - President

Two Organizations, an Ideal Partnership

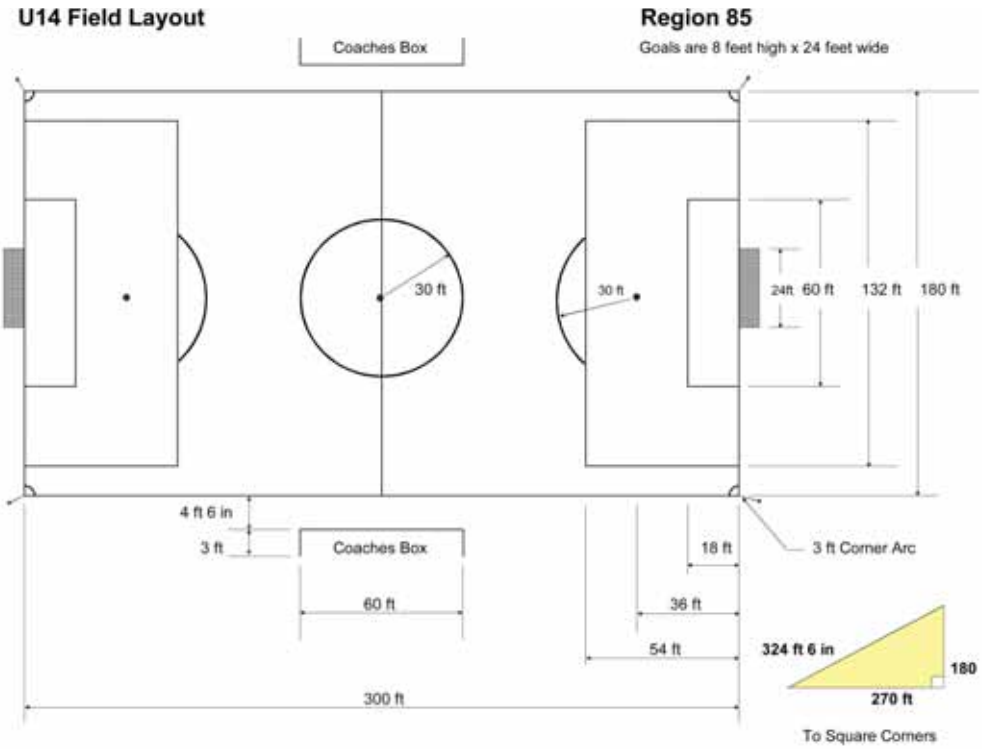
Rarely is there an opportunity to partner with another organization where both have an equal, but somewhat different benefit. An opportunity of this nature did take place for the California Land Surveyors Association (CLSA) and the American Youth Soccer Organization (AYSO). On the surface it may not seem like a good paring, but these two organizations are in fact very similar, with AYSO being founded in 1964 and CLSA being founded in 1966 and both are non-profit organizations relying almost solely on volunteers.

AYSO is a national organization with a mission to develop and deliver quality youth soccer programs which promote fun, in a family environment. AYSO is mostly run at local levels by teams of volunteers. These AYSO volunteers indicated that soccer field layout has always been a time consuming and challenging task; tasks that the Professional Land Surveyor members of CLSA were pleased to perform.

To have fields ready to go for the fall season, AYSO Region 85 needs 22 fields laid out at 14 different locations with these fields ranging in size depending on the age groups of the players. On April 23, 2011 CLSA members Tim Smith, Pete Wiseman, Dee Smith, myself and three surveying students, met with AYSO Region 85 volunteers Jim Bothwell and Michele Horwich to lay out 2 of their soccer fields. They were quite excited to see just how a land surveyor would go about performing this task which usually takes them approximately 3 hours to accomplish.

The first field we surveyed was at Serrano Intermediate School in Lake Forest, CA. After setting up the total station and providing a hands-on demonstration of how the total station worked, we had the requested 11 points for the field set in about 40 minutes. To say the least, Jim and Michele were somewhat wowed! After surveying this field we drove about 1 mile to a second location, Olivewood Elementary School, to lay out another field of the same size. The surveying of this field took us about 25 minutes to complete.

Afterwards, I was able to spend some time speaking with Jim and Michele about how important it is for land surveyors to gain some positive exposure through outreach. We thought this would be an excellent opportunity to showcase the land surveying profession to the soccer playing youth, and their parents.



Since completing the original survey of soccer fields for Region 85, CLSA members from Orange County, Los Angeles and Riverside/San Bernardino Chapters have participated in layout approximately 50 fields for AYSO. I would like to thank the 30 volunteers who joined in these efforts!

AYSO was appreciative of our efforts and allowed CLSA an opportunity to further our goal of creating public awareness for the land surveying profession by providing us booth space at their opening/photo day event. On September 10th, Jay Seymour and Mark Danielson, represented CLSA at the opening day/photo day ceremonies

Continued on next page

Continued from previous page

in Rancho Palos Verdes and distributed information packets to any, and all, interested players, parents, and coaches. The following day Dee Smith, Josh Tatman, and I did the same at El Toro Community Park for the Lake Forest Region 85 group. I personally found it very rewarding to show off some of the survey equipment, and spend some time explaining to parents and players about what it is that we do as land surveyors and how we helped out their regional field directors by using our tools and skills.

I am very excited about the opportunities that lie ahead for CLSA to capitalize on this partnership with AYSO and the statewide outreach and exposure it should have on our profession. I encourage CLSA members to be proactive in this outreach by contacting your local AYSO and offering assistance. ■

Continued from page 38

Positioning Using GPS and CORS Part 3

STEP 4 – Use the data in your processing software

With either file format, you will have to expand the downloaded files. If you downloaded the GNU compressed files, you can use your normal unzipping routine. See the end of this article for how to deal with the Hatanaka compression. Place the RINEX observation file and the navigation file in the folder where your processing software can retrieve it. Usually your processing software can directly read RINEX files, however you may need to rename the navigation file so that the first 4 characters of the name match the first 4 characters of the RINEX observation file. Also, you will need to be sure of the CORS antenna model and any offsets as discussed in Part II, and incorporate those data into your processing software.

FILE COMPRESSION TYPES: WORKING WITH HATANAKA FILES

If you download an observation file that ends in a "d.Z" or "d.gz", this indicates it was originally compressed using Hatanaka compression technique.

a. First do a standard or GNU expansion of the "...d.Z" file, using a standard unzipping tool. This will give you a file that ends with "...[yy]d" where yy indicates the year. The preceding file name characters remain the same.

b. Then you will need to use a special utility program to uncompress the resulting Hatanaka file. To download the "crx2rnx.exe" utility program from the GSI website,

1. Go toftp://terras.gsi.go.jp/software/.

2. Click on the "RNXCMP_4.0.4/" folder, or the current version(by now you are an ftp expert).

3. Download the "RNXCMP_4.0.4_Windows.tar" file, which itself is a compressed file containing a number of programs, one of them being "crx2rnx.exe".

4. Extract the "crx2rnx.exe" and place it in the folder with the observation files to be extracted. The newest version of "crx2rnx.exe"allows for drag and drop extraction, which means you can select your compressed observation files and drag them to the crx2rnx program.

c. Finally, you should have an uncompressed observation file which will have the extension "...yyO".

d. After all this compression, avoid the bends: take your time coming to the surface.

Good luck and remember it is easier than this article makes it sound. ■

Q&A SMA Expert

By: Michael P. Durkee, ESQ

Michael P. Durkee, *a partner in the Walnut Creek office of Allen Matkins, represents developers, public agencies and interest groups in all aspects of land use law. Mike is the principal author of Map Act Navigator (1997-2011), and co-author of Ballot Box Navigator (Solano Press 2003), and Land-Use Initiatives and Referenda in California (Solano Press 1990, 1991).*

415.273.7455 mdurkee@allenmatkins.com

Mike wishes to thank Tom Tunny, Senior Counsel at Allen Matkins, for his contribution to this article.

Question

Do you know whether the Legislature has taken any action recently to extend the life of tentative maps and if so, what the details of the extension are?

Discussion

Yes, in fact, the Legislature did recently approve another extension of the life of certain tentative maps.

This past July 15th, Governor Brown signed into law AB 208 (Fuentes), which extends for two years the life of those tentative and vesting tentative maps that were still alive on July 15, 2011 (the date the new law took effect) and that would have otherwise expired before January 1, 2014.

AB 208 builds upon two earlier legislative extensions given during this prolonged economic downturn: (1) the 24-month extension granted by AB 333 (Fuentes) in 2009; and (2) the 12-month extension granted by SB 1185 (Lowenthal) in 2008. With nearly 2,500 approved tentative maps representing nearly 330,000 housing units in California, this measure is significant.

AB 208 creates new Government Code section 66452.23, which recognizes that this extension is available in addition to all of the other extensions (or "stays") already recognized by the Subdivision Map Act (i.e., Sections 66452.6, 66452.11, 66452.13, 66452.21, 66452.22, and 66463.5). So, for example, even if a tentative map qualifies for the new 24-month extension granted by AB 208, this would not preclude the subdivider from employing the phased final map extensions provided under Government Code section 66452.6(a)(1) and/or any applicable litigation stays pursuant to Government Code section 66452.6(c).

When calculating whether a tentative map would otherwise expire before January 1, 2014 and thereby be eligible for AB 208's two-year extension, one must include any discretionary extension granted by a city or county pursuant to Government Code sections 66452.6(e) or 66463.5(c) on or before July 15, 2011, and any extensions effectuated through the filing of one or more multiple final maps pursuant to Government Code section 66452.6(a) on or before July 15, 2011. One is not required to count any time that the map's life is stayed by litigation or a development moratorium pursuant to Government Code sections 66452.6 or 66463.5.

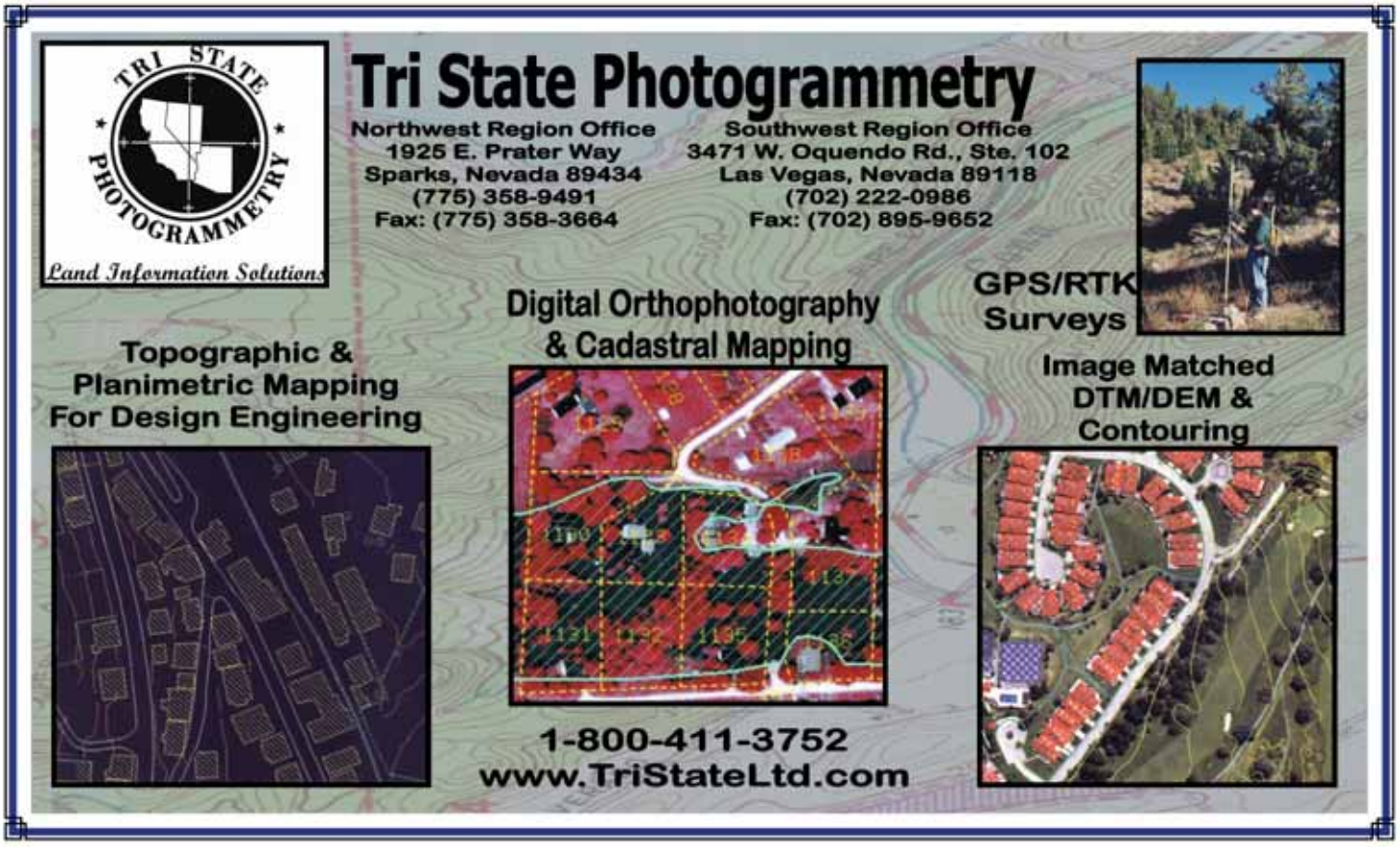
Like AB 333, AB 208 includes provisions that change the "one bite of the apple" rules set forth in Government Code section 65961 in two ways. First, it shortens from five to three years the period of time after the recordation of the final map during which new conditions cannot be imposed on a project. Second, AB 208 provides that for any tentative or parcel map subject to AB 208's two-year extension, Section 65961 does not prohibit a local agency "from levying a fee or imposing a condition that requires the payment of a fee … upon the issuance of a building permit, including, but not limited to, a fee defined in Section 66000" [the Mitigation Fee Act]. (Gov. Code § 65961(f).) Thus, a local agency may attempt to impose fees or fee-based conditions during building permit issuance. The "legality" of such local agency efforts would depend on the facts of each case. ■

NCEES Honors Patrick Tami for Service

Patrick Tami, PLS, has been awarded the NCEES Distinguished Service Award for his dedicated service to the engineering and surveying professions. NCEES recognized the 2011 award winners at its annual meeting, held August 24–27 in Providence, Rhode Island. Pat Tami has been a member of the California Board for Professional Engineers, Land Surveyors, and Geologists since 2006 and is a former board chair and vice chair. During his tenure on the California board, Pat has played an active role in outreach, giving presentations on licensure and the surveying profession.

In addition to being a Past President of CLSA, Pat has been an active member of NCEES, serving on its board of directors as Western Zone Vice President from 2008 to 2010. His contributions to the work of NCEES committees and task forces include chairing the Committee on Uniform Procedures and Legislative Guidelines. He has also assisted with the development of the NCEES Fundamentals of Surveying and Principles and Practice of Surveying exams, serving on the exam development and standard setting committees for surveying.

Congratulations Pat!



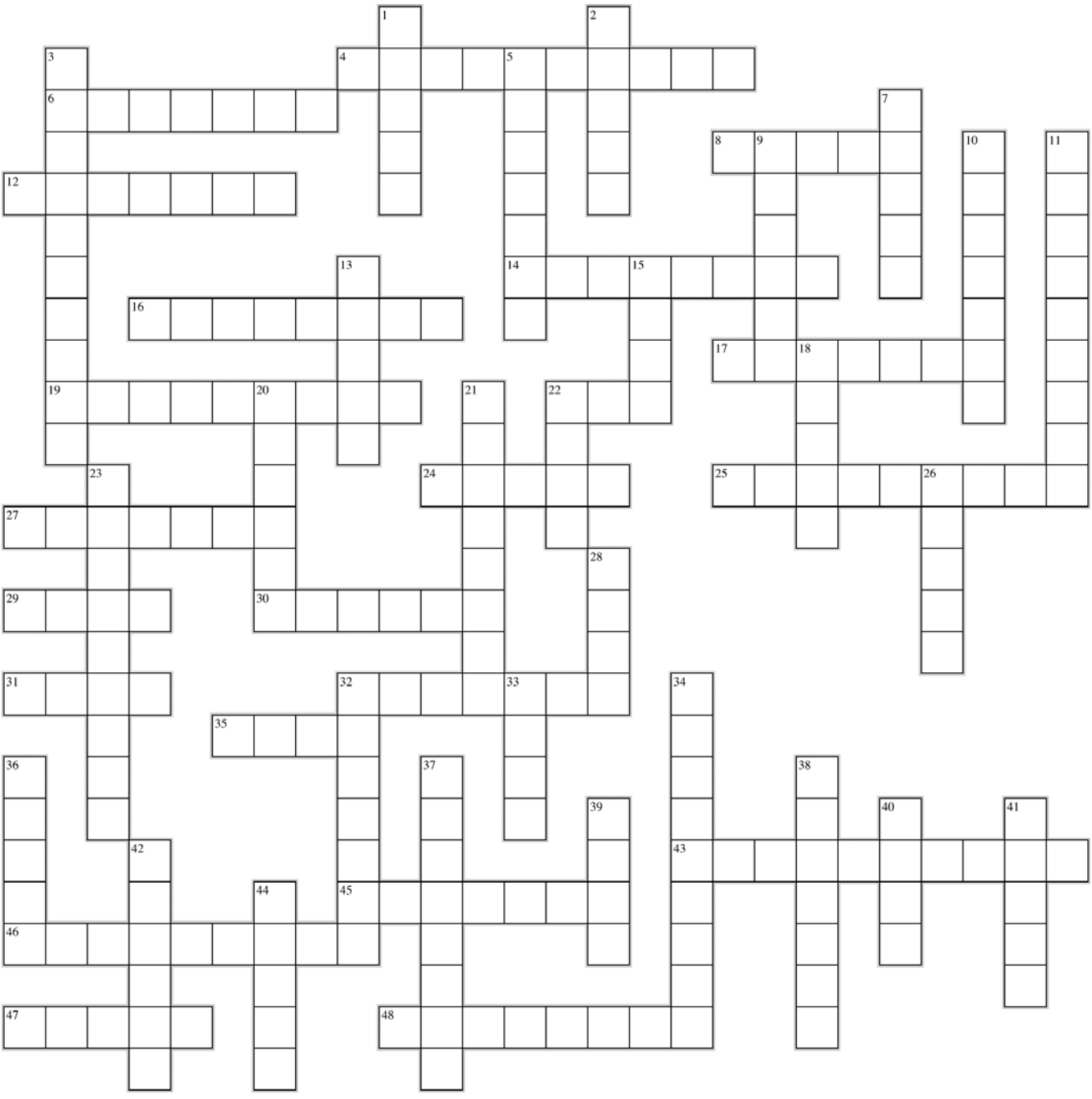
Crossword Puzzle

By: Ian Wilson, PLS

Ian Wilson, PLS *is the Director of Survey for Cardno WRG, Inc. in Roseville, CA. He started surveying in 1988 in Southern California and is now enjoying life in Northern California. Ian enjoys hearing from fellow members about the crossword puzzle and is always looking for clue ideas and input. He is licensed in California and Nevada and has specialized in boundary, topographic and Land Title surveys. His expert witness practice in boundary and easement issues is growing. Ian has been a member of CLSA since 1988.*

CLSA Crossword Puzzle #20

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



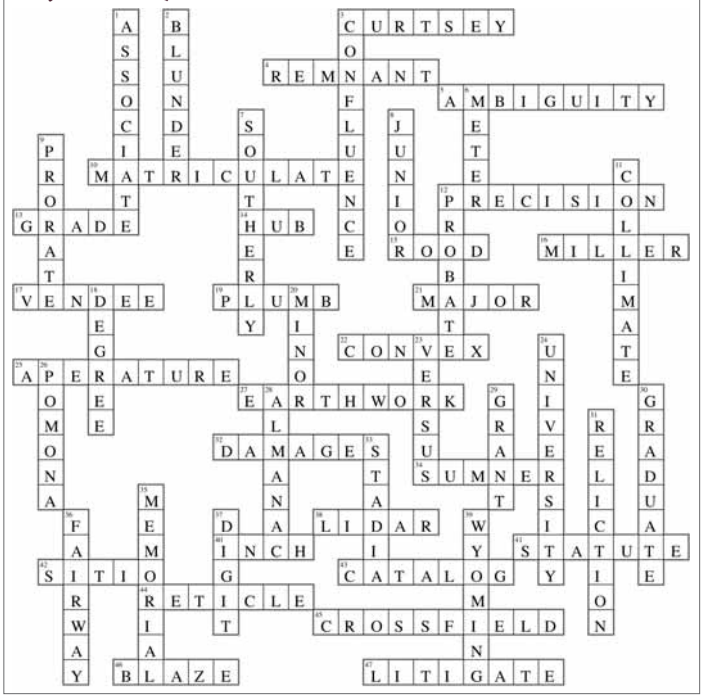
Across

4. JOINING OF TWO STREAMS
6. GIVE UP, AS A RIGHT-OF-WAY
8. GRANT FOR A PERIOD
12. STREAM CHANNEL
14. ALONG A STREAM
16. DEGREE OF CONFORMITY TO A STANDARD
17. 2.471 ACRES IN EUROPE
19. GAIN BY RECEDING?
22. TEN CHAINS
24. CHAINING PIN
25. STONE MARKING A BOUNDARY
27. FORTY POLES
29. DIRECTOR OF SCRIPPS ORBIT AND PERMANENT ARRAY CENTER
30. WAY OUT
31. CLSA'S SANTA HOME
32. OBJECT OF A GRANT
35. NORTHERN PERCH?
43. LAND SET ASIDE FOR PUBLIC USE
45. SQUARE MILE
46. DEGREE OF STREAM WANDER
47. GPS DATA FORMAT
48. REAL PROPERTY RESTRICTION

Down

1. V-SHAPED CUT, AS IN A STONE
2. EMBANKMENT
3. STUDY OF SUBAQUEOUS GEOMORPHOLOGY
5. NOT MERCATOR
7. 39.37 INCHES IN CALIFORNIA
9. INTEREST IN LAND
10. ANCIENT LAND INFORMATION SYSTEM STILL IN USE
11. RENDER PARALLEL
13. OLD SURVEYING STAFF
15. MINE ENTRANCE
18. ARC CONECTOR
20. SMALLER THAN A PENNINSULA
21. LONG TIME SAN DIEGO COUNTY ROS MAP CHECKER
22. LANDFILL PROBLEM
23. DEGREE OF REFINEMENT IN A MEASUREMENT
26. MAPPING ANGLE
28. HIATUS
32. SCIENCE OF GETTING THE EARTH IN SHAPE?
33. PRESIDENT WHO LATER SERVED AS CHIEF JUSTICE
34. WRITTEN DECLARATION OF FACTS
36. SLOPE AT FOOT OF CLIFF
37. NOT LAMBERT
38. FROM ANOTHER SOURCE
39. 7.92 INCHES
40. SIZE OF "MANDRILLA WOOD"
41. WIDOW'S ESTATE
42. STEEP SIDED LAVA FLOW
44. SHANKAR'S INSTRUMENT

Key to CLSA puzzle #19 (Surveyor Issue # 166)



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Top Captions for issue #166 Cartoon

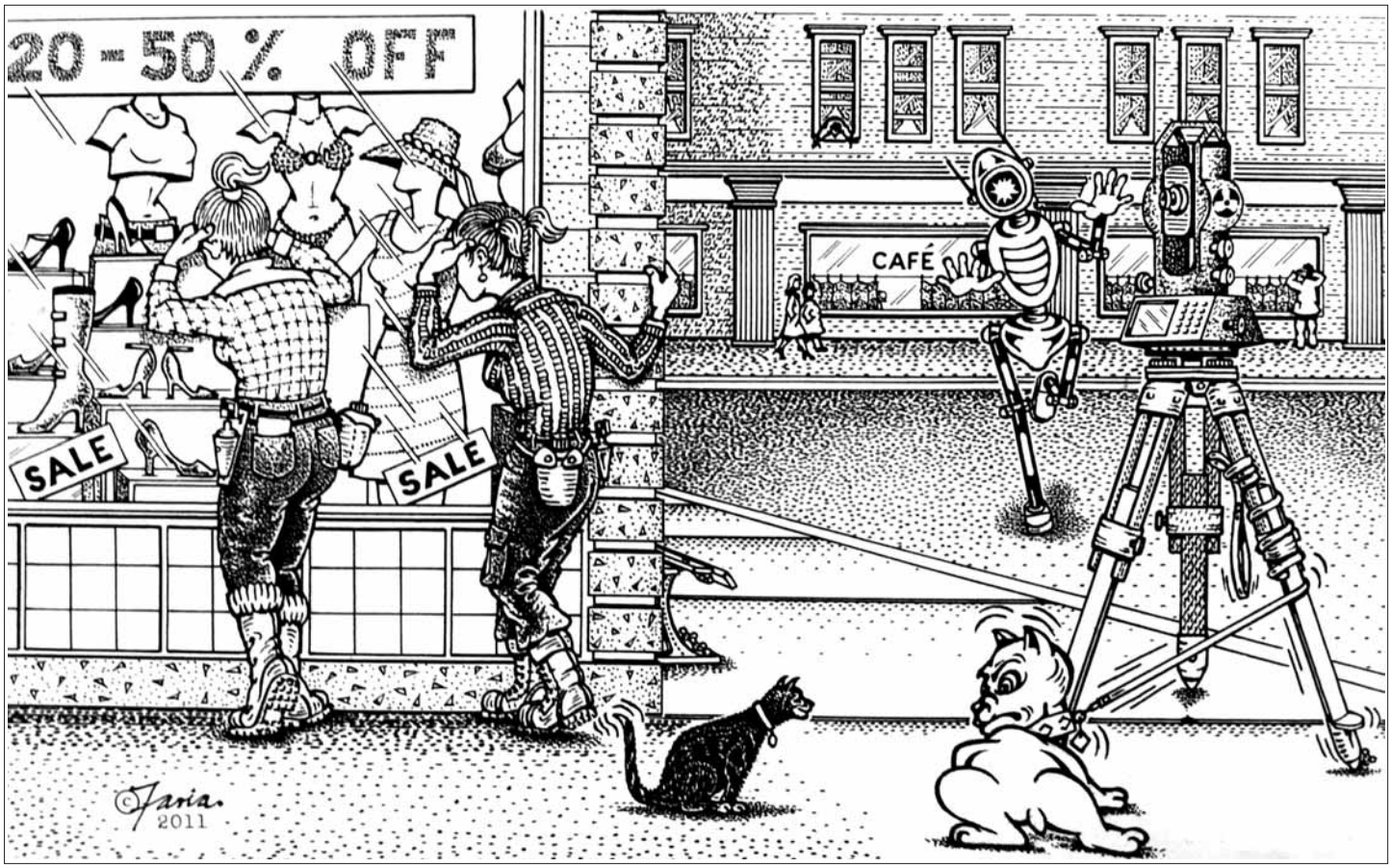
This has been the worst day ever! Woke up late, rodman called in sick, totalstation/case fell out of truck on on-ramp (forgot to close side cabinet), battery dead (hooked to truck battery), somebody stole my backsight, got bit by some sort of an alien bug, and now I can't get robotic lock through all of these darn trees. What else can possibly happen??
Erik T. Howard, PLS

I knew that monument would be a great human lure
Mark Sidler, PLS

Work slow? Employ your "staff" and "cash in" on some berries.
Phil Danskin, PLS

Plumb that rod before I eat you!
Ronald Garton, PLS

These trees itch; I wish I had a back scratcher.
Ken McTaggart, PLS



Submit your caption for the cartoon above to clsa@californiasurveyors.org by November 1st.
Our favorite captions will be published in the next issue of the California Surveyor.

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