California Land Surveyors Association 1966

California Surveyor

Issue #185

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CALIFORNIA SURVEYOR

Issue #185

COLUMNS

FEATURES

The *California Surveyor* is a bi-annual 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 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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Central Office

2520 Venture Oaks Way, Suite 150
Sacramento, CA 95833
916-239-4083 • 916-924-7323 fax
clsa@californiasurveyors.org
www.californiasurveyors.org

California Surveyor Editor

Landon Blake
lblake@hawkins-eng.com

California Surveyor Designer

John Berkowitz
john@caladmanagement.com

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Editorial Material

All articles, reports, letters, and other 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 e-mailed to Landon Blake at *lblake@hawkins-eng.com.*

Material Deadline Dates

Spring: March 1
Fall: September 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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PRESIDENT'S MESSAGE

Ian Wilson
CLSA 2017 President

This is my first "message" as President of the California Land Surveyors Association. And, I admit to being more than a little intimidated by that. CLSA has featured prominently during my career in land surveying. From the first meeting I attended 29 years ago to the San Francisco Chapter Meeting I attended last week, CLSA has offered me opportunities for learning, mentorship, both ways, now, comradery and professional sharing.

Our responsibility as an organization, at the state level, 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....*" Our membership is open to all involved in the practice of land surveying, whether licensed or not; employed in the private sector or public sector; business owners or employees. Everyone is welcome. Everyone brings valuable contributions and assets.

Lately, we have experienced a polarization among our members. The effect of that is that some of our members have left the organization. We need to heal that rift and get back to the business our organization was formed to do 51 years ago.

In a "family" as large as ours, with people so vastly diversified, over a state as large and varied as ours, it is only natural that we have differences of opinion. Frankly, those differences are our strongest asset. Those differences allow us to ensure that we have all points of view brought to the table during discussions, at Chapter level as well as at the Board Meetings. It is those diverse views that help us to come to the best decision for the Association. Democracy works. It gets hijacked from time to time, but it always returns, because democracy works.

Democracy works because, in the long run and with honorable people, the decisions taken even out to being the best decisions for the group. Some will not like the decision taken. Some will gloat over being on the "right side." That is natural, but we need to work to make sure that it doesn't polarize the group.

We have come through some very difficult times over the past few years. We have made significant changes in the way we do business. Some of the changes have been good; some have not. Only by pulling together and working together can we strengthen CLSA and get on with realizing our goals over the next 50 years.

Nothing stays the same. Everything changes. Change is neither good nor bad. It is a fact of life. Regardless of whether you like the change or dislike the change, join with the rest or your colleagues and peers at CLSA to ensure that our voice IS the voice of land surveying in California and that our voice is clear and strong.

Those of you who have not renewed your membership this year, for whatever reason, we need your voice. Please come back.

Those of you in the public sector who left many years ago. Consider returning. We really could use your input from the public sector viewpoint.

Those of you who have never been members, jump in. We need your efforts. There are more than 4,000 licensed surveyors in California and many, many more people who are LSITs. We need your voice to add to ours.

Those of you who have been members for many years, seek out colleagues who have not. Invite them to a Chapter Meeting. Encourage membership.

To everyone, get involved. Attend Chapter Meetings. Join the discussion. Bring your point of view. Get on a committee that strikes your passion. Voice your opinion. That's how CLSA will last another 50 years. With your strength. An elephant can crush a single straw. Stand thousands of them on end and they can easily support the elephant.

Thank you all for your support! I am humbled to be your President.

Ian Wilson, PLS
CLSA President 2017

EDITOR'S MESSAGE

Landon Blake
***California Surveyor* Editor**

Welcome to the Spring 2017 Issue (Issue #185) of *California Surveyor* Magazine!

This issue starts with a legislation report and a summary of our **51st Annual Conference.** We then have five contributed articles.

The first details a volunteer expedition to **Mount Boardman**, where the volunteer team reset the corner common to four California Counties.

The second describes surveys of **Mission Beach** in Southern California.

Chris Martin offers the perspective of a young professional in his article, and thinks about **how to properly ask questions of your surveying mentors.**

Steve Shambeck describes his journey from **land surveyor to photographer** in his article.

Ken Wilson finishes our list of contributed articles with a description of the **unseen tasks** many land surveyors perform as part of their work. He uses his survey in the rugged California Coastal Range as the setting for this article.

We also continue a couple of topics from our last issue. We conclude our review of the case decided in **IBLA 99-363.** In this second article reviewing the IBLA decision, we look at the BLM's consideration of private survey maps, their method of double proportioning, and their treatment of bona fide rights.

Our last article revisits the topic of **error adjustment**, and considers four steps that can be used to analyze errors after a survey is completed.

I hope you enjoy reading this issue of our magazine. Please reach out to me if you would like to contribute an article for our fall issue.

I want to thank John Berkowitz for his patient help putting together the magazine. I also want to thank Warren Smith, Mike Pallamary, Chris Martin, Steve Shambeck and Ken Wilson for the contribution of their articles to this issue.

LEGISLATIVE REPORT

Ralph Simoni
CLSA Legislative Advocate

Adoption of Transportation Funding Proposal

Before discussing the bills of interest to CLSA members, it is important to mention the major **transportation funding proposal** adopted by the legislature on April 6. The legislation provides for $5.2 billion annual revenue from a combination of sources (supplemental registration fees, gas tax increase, diesel fuel tax increase, etc.) for a 10 year $52 billion program to enhance California's transportation. In addition to significant state and local road and highway improvement, the bill proposes transportation congestion alleviation with a diverse range of public transit enhancements. In addition, the transportation funding proposal contains accountability provisions that are claimed to ensure that the revenue enhancements are spent for the sole purpose of improving transportation.

The transportation funding proposal was a top priority for Gov. Brown and the Democratic legislative leadership. From a political perspective, the bill required a 2/3rds vote of both the Assembly and Senate because it proposed an increase in taxes to generate the annual revenue. Although the Democrats hold a super majority in both houses of the legislature, the 2/3rds vote threshold was not guaranteed because many Democratic legislators are skeptical of tax increases imposed on their constituents. However, good old-fashioned politics was used to cajole many reluctant Democrats and a sole Republican to vote in favor of the transportation proposal by earmarking funds for specific projects in their districts. From Gov. Brown's perspective, this is a major "legacy" victory that will hopefully improve California transportation over the ensuing decades.

In addition to the promised public benefits, the $52 billion 10 year program should also benefit the land surveying profession by providing funds for many projects that will require survey activity. In addition, there could be more funding from the federal government to implement the Trump Administration promise of $1 trillion in infrastructure funding projects that would extend beyond mere road and transit projects to utility lines, water conveyance, airports, etc. The combination of state and federal funding should provide a strong job market for CLSA members for many years to come.

Bills of Interest to CLSA Members

The deadline for introducing bills for consideration during the 2017 legislative session was Friday, February 17. Starting with the Monday of that week, there were approximately 1200 Assembly Bills introduced and approximately 550 Senate Bills introduced and the cumulative total for the entire session exceeded 2550 new items of legislation for the session.

The CLSA Legislative Committee met on March 4 to review and take positions on the 48 bills that affected CLSA members and the practice of land surveying. Of these, CLSA took seven positions on bills and requested additional information on several more bills that were ambiguous. The CLSA positions are communicated to the authors and legislative committee staff through written correspondence, and if the position is "support" or "oppose" includes testimony at committee hearings. It should be noted that the legislative process is dynamic and bills are frequently amended. Therefore, the attached CLSA positions only apply to the bill versions reviewed by the CLSA Legislative Committee at the March 4 meeting.

The CLSA positions on these bills are as follows:

Assembly Bill 278 ***(Steinorth)***: provides a limited exemption to the California Environmental Quality Act (CEQA) for certain narrowly defined transportation projects.

The bill provides a common sense exemption for projects that "consist of the inspection, repair, rehabilitation, replacement, or removal of existing transportation infrastructure ... if the project is located within an existing right-of-way ... and it does not add additional motor vehicle lanes, except for auxiliary lanes." Additionally, the bill provides for necessary checks and balances that will ensure that these projects do not adversely impact the environment.

Position: Favor

Status: failed passage in the Committee on Natural Resources

continued on page 7

Assembly Bill 1005
(Calderon): requires of the Department of Consumer Affairs (DCA) to conduct an occupational analysis of professional and vocational licenses subject to examination to determine whether there is a need for examinations to be offered in languages other than English.

Although the CLSA Legislative Committee took a "not favor" position, the CLSA Board took a position of "oppose" because it felt that the scope of the bill should not apply to the land surveying profession which requires English proficiency in such tasks as writing descriptions of lot line adjustments, corner records, describing the location of easements, and records of survey that are recorded and relied upon by third parties.

Position: Oppose

Status: referred to Committee on Business and Professions

Assembly Bill 1635
(Quirk-Silva): requires all state agencies, departments, boards, and commissions to establish and achieve an annual goal of 25% small business participation in state procurement's and contracts.

Although not opposed to the concept of small business participation as many land surveying firms qualify as a "small business," this standard would be applied to all projects, regardless of size, and in many large infrastructure projects it may be extremely difficult to fulfill the 25% small business participation threshold, as well as give small businesses an undo advantage.

Position: Not Favor

Status: referred to the Committee on Accountability and Administrative Review

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Senate Bill 2
(Atkins): establishes the Building Homes and Jobs Fund to support the development, acquisition, rehabilitation, and preservation of affordable housing to be funded by a $75 surcharge on recording certain real estate instruments.

Although CLSA supports the concept of creating more affordable housing, the $75 recording surcharge is an inappropriate source of funding as recording statutes are intended to create an orderly process of property ownership for the benefit of both property owners and the general public. The surcharge would apply to a variety of different documents recorded by land surveyors such as lot line adjustments, parcel and subdivision maps, easements, etc.

Position: Oppose

Status: on the Senate Appropriations Committee Suspense File

Senate Bill 436
(Allen): establishes the California STEM (science, technology, engineering, and mathematics) Professional Teaching Pathway Act of 2017.

Because land surveying requires an underlying knowledge of the principles of technology, mathematics, and engineering, an educational emphasis on these principles would assist in the recruitment, training and retention of qualified professionals needed to educate students, some of whom could become future land surveyors.

Position: Favor

Status: Senate Appropriations Committee

Senate Bill 640
(Hertzberg): imposes a tax on various services, including land surveying services.

The CLSA Legislative Committee believes it would be unwise public policy to apply a service tax on land surveying services that would have broad ramifications for all sectors of the California economy because of unique services of a land surveyor are necessary to facilitate and maintain both vital California infrastructure and provide homes, offices, and stores for Californians. Additionally, public infrastructure projects and private projects would become more expensive and many services performed by land surveyors provide a public benefit beyond the actual survey service performed – the general public benefits from more precise property boundaries.

Position: Oppose

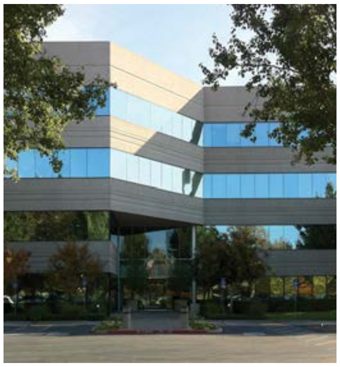
Status: referred to the Committee on Governance and Finance

Senate Resolution 24
(Hill): recognizes the week of March 19 through March 25 2017 As National Surveyors Week.

Position: Support

Status: Adopted

Subsequent CLSA Legislative Columns will provide updates on the progress of the bills and any amendments.



CENTRAL OFFICE REPORT

Kim Oreno
CLSA Executive Director

Greetings!

2017 got off to a busy start with Annual Conference planning. You can read the conference wrap up article on page 10. We hope that if you were able to join us this year, you enjoyed yourself and if you weren't able to attend this year, please consider joining us for the 2018 Annual Conference which will be held from March 23-27, 2018 at the Hyatt Regency in Downtown Sacramento. The CLSA Conference Committee has already begun work on lining up another fantastic event. We hope to see you there!

CLSA's committees have been very busy so far this year. The CLSA Legislative Committee has met twice to review and take positions on bills that affect land surveying in California. The CLSA Policies & Procedures Committee has been hard at work editing the Professional Services Agreement that is for sale in the CLSA Store. Look for the new, updated version which will be available after attorney review. CLSA's Monument Conservation, Membership and Education Committees have also met this year, ensuring that CLSA's goals *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* are a top priority.

CLSA's Workshop Committee Chair, Rich Maher, has put together an informative series of webinars, one taking place every month for the rest of the year:

- The August 30th webinar topic is **Good Neighbor Fence Act of 2013 (AB 1404).**
- The September 13th webinar topic is **NGS State Coordinator/Regional Advisor Update.**
- The October 25th webinar topic is **The Railroad Taper or Transition Curve.**
- The November 8th webinar topic is **Elevation Certificates: Surveyor's Notes.**
- The final webinar of the year will take place on December 6th and will cover **3D Subdivisions.**

These webinars will be recorded and uploaded to the website. These along with past webinars are available for free to all CLSA members. Those who aren't members of CLSA can purchase these recordings through the CLSA Store.

An exciting change has taken place on the CLSA website calendar. In addition to all CLSA events, we are now posting industry events of organizations from all over the state. If you would like to include an event on the CLSA calendar, please send an e-mail to *clsa@californiasurveyors.org*. Thank you to CLSA's Public Awareness Committee for reviewing and gathering these postings.

2017 has indeed been a busy year. Many more administrative and creative tasks were accomplished than the ones noted above. CLSA Headquarters strives to provide outstanding service to CLSA Officers, Board Members, Committee Chairs, Liaisons and Members. We are fortunate to have the time, effort and guidance of the CLSA Executive Committee and Board of Directors.

We welcome your thoughts; please send any feedback by e-mail to *clsa@californiasurveyors.org*.

On March 20, 2017, Senate Resolution No. 24 was passed by the California State Legislature. Senate Resolution No. 24 recognized the week of March 19-March 25, 2017 as National Surveyors Week.

From left to right: Senator Bill Monning, BPELSG Board Member Steve Wilson, CLSA President Ian Wilson, Vice President of the American Council of Engineering Companies California Ralph Guida, BPELSG Executive Officer Ric Moore, Senator Jerry Hill, Senator Anthony Cannella, Senator John Moorlach

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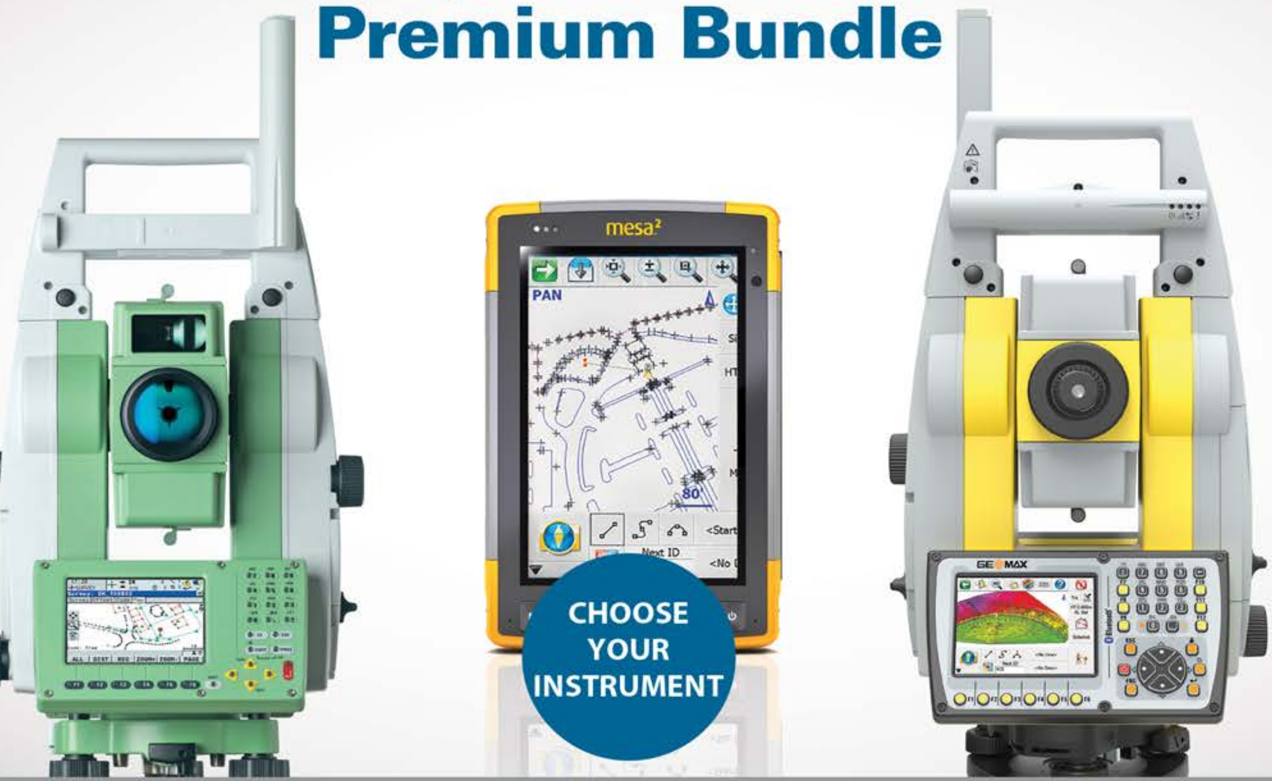

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WELCOME

51st Annual Conference

Thank you to the over 350 participants who came together for CLSA's 2017 Annual Conference at the Wyndham Anaheim Garden Grove. Conference goers enjoyed an expansive continuing education program, a sold-out exhibit hall, the ever-popular CLSA Education Foundation Live Auction and Party, a golf tournament at Anaheim Hills Golf Course and bowling tournament at Fountain Bowl.

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The conference curriculum began with a full day of pre-conference workshops featuring Jeff Lucas discussing "*What Went Wrong? A Study in Surveyor Errors and Omissions"* and Ryan Hunsicker reviewing "*GIS for Surveyors*." Sunday's opening ceremonies and general session featured a presentation on the future of surveying from Chris Trevillian from Trimble Inc. Following opening ceremonies, attendees chose from over 40 breakout sessions, from Sunday to Tuesday, featuring topics that encompassed the wide diversity of surveying practice issues in California.

The 2017 CLSA Conference was fortunate to welcome the support and expertise of nearly 30 companies in a sold-out conference exhibit hall, featuring the latest tools and resources available to California's professional surveyors. The conference also welcomed the backing of 16 generous sponsors. CLSA's 51st Annual Conference could not have materialized without the collaboration of these terrific businesses and chapters.

The CLSA Education Foundation again played a significant role in the conference. The Foundation's silent auction offered a vast array of donated items for attendees to bid on, and Monday night's annual banquet featured a live auction and presentation of scholarships to students. The 2017 Conference was a tremendous success for the Education Foundation, raising over $19,000 in scholarship revenue for surveying students here in California.

Thank you to the 21 students who worked so hard to make sure that conference events ran smoothly and congratulations to CLSA Conference Committee Chair, Bill Hofferber and the entire committee including Sayana Domingues, Michael LaFontaine, Rob McMillan, Joe Padilla, Aaron Smith, Diane Wells and CLSA President, Ian Wilson for a job well done delivering a successful event.

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Attendee Testimonials

“ The bowling tournament was “great fun, my first time attending, really enjoyed getting to know some students and surveyors I had not met previously.” ”

“ Jeff Lucas is “always lively and informative. Impossible to fall asleep when Jeff speaks.” ”

“ “Evan Page did a great job and I will attend his seminars again in the future.” ”

“ The Joint Professional Practices Committee roundtable provided “good information, effective presentation style. I was impressed how well they handled the various chapters and how each was able to build on the previous presentation.” ”

“ David Roth’s Successful Expert Witness session was a “good presentation for those who haven’t really been an expert witness.” ”

“ Bill Beardslee’s session on Survey Cost Analysis was “excellent, well worthwhile.” ”

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Rich Brown accepting the award on behalf of Central Valley Chapter for Chapter Newsletter of the Year 2016, Immediate Past President Roger Hanlin, President Ian Wilson, Rich Maher accepting awards for Member of the Year 2016 and Chapter of the Year 2016 for Orange County, Greg St. John accepting the award on behalf of the East Bay Chapter for Chapter Website of the Year 2016.

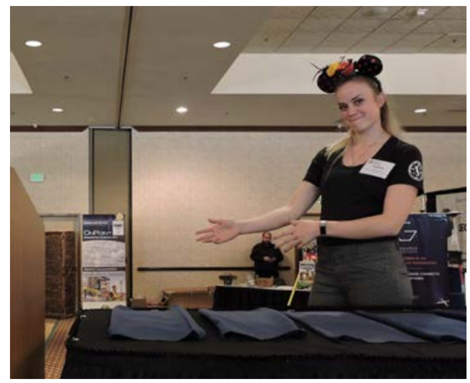
Attendee Testimonials

Chris Trevillian's session on The Future of Surveying from a Trimble Perspective provided "very interesting, futuristic information."

Evidence, Truth and Levels of Proof was "well done, tons of knowledge and, while somewhat provocative, was in line with future expectations for the surveying profession."

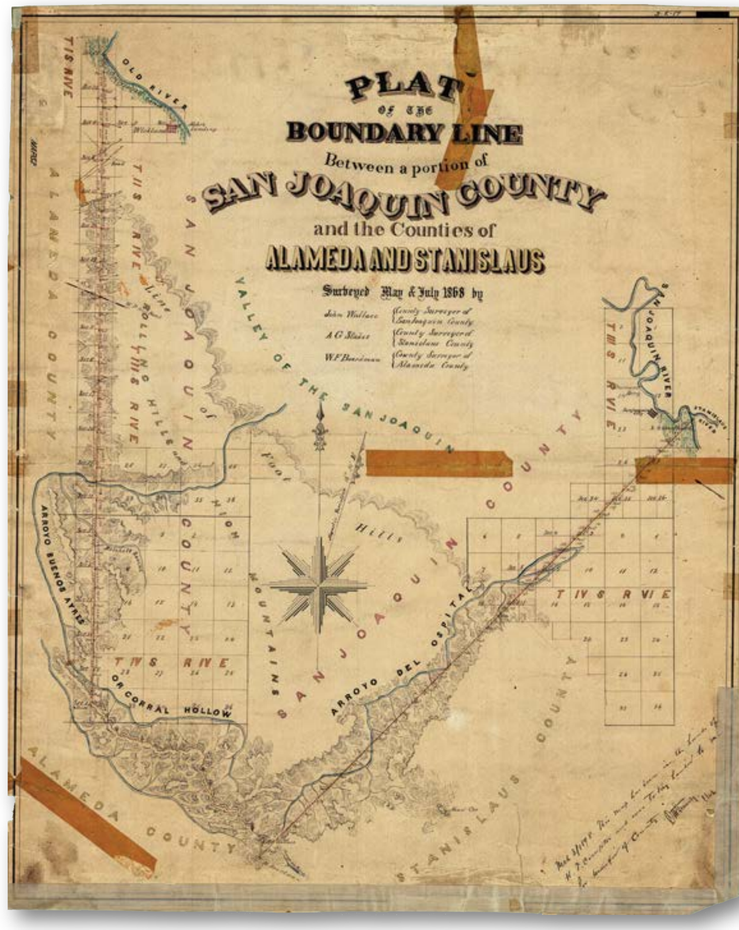
"The CLSA Staff was amazing!"

"The opportunity to interact and network with other licensed professionals, up and coming technicians, and students are the added bonus of conference attendance."



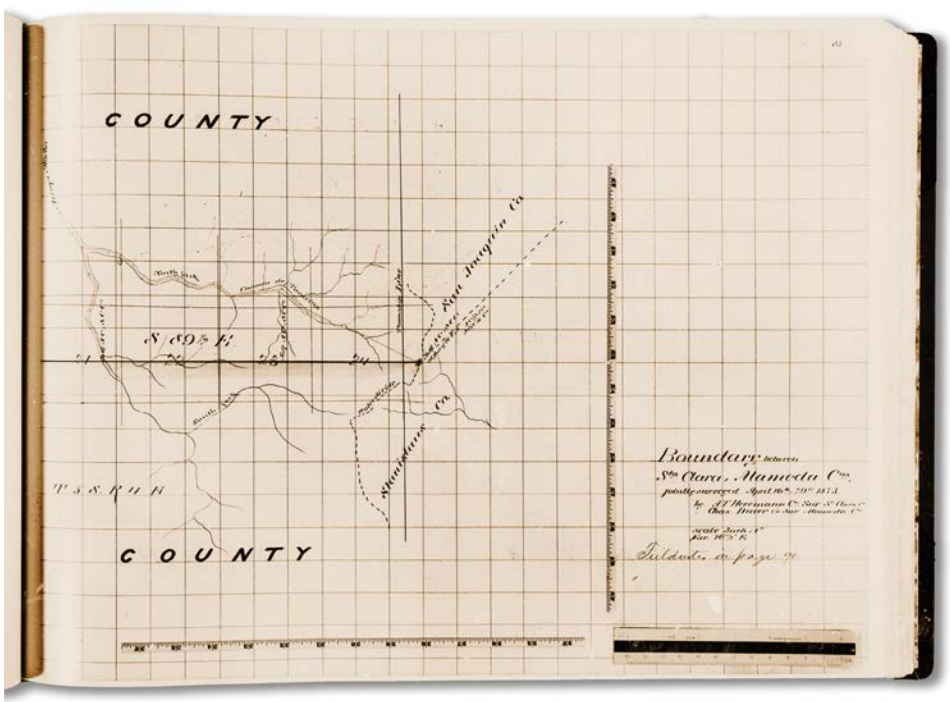
Mount Boardman Expedition 2016

By Warren Smith
San Joaquin County Public Works



Four Counties – Alameda, Santa Clara, San Joaquin, and Stanislaus – converge at a single point on Mount Boardman. The first field survey was performed in 1857 to establish this corner (see field notes). This was followed in 1867 by a joint three-County survey (see map). The Alameda County Surveyor was W.F. Boardman, the San Joaquin County Surveyor was John Wallace (a former GLO Deputy U.S. Surveyor), and the Stanislaus County Surveyor was A.G. Stakes.

This survey began at the corner common to Contra Costa, Alameda, and San Joaquin Counties on an island in Old River, and proceeded south to the ridge line of the coastal range pursuant to the statutory description of the Counties. It then followed the ridge line to a high point, previously established. From there, the survey between Stanislaus and San Joaquin Counties progressed in a straight line to the confluence of the Stanislaus and San Joaquin Rivers.



A subsequent resurvey in 1931 by Stanislaus County perpetuated the Oak tree at the corner location by setting four iron pipes at roughly 20' offsets. In 1970, a resurvey of the Alameda-San Joaquin County line by Curtis Brown found the iron pipes and established state plane coordinates on them. All four Counties are in Zone 3 of the California Coordinate System, and the Brown survey utilized CCS27 values.

In order to determine CCS83 SPCs, a joint venture was proposed between the four County Surveyors to occupy the four iron pipes with GPS receivers and calculate coordinates for the center of the Oak tree. On November 18, the crews met at the gate to the N3 Cattle Company's ranch, and were escorted to the location by ranch foreman Ken Chaulet via a seven mile drive over fire roads.

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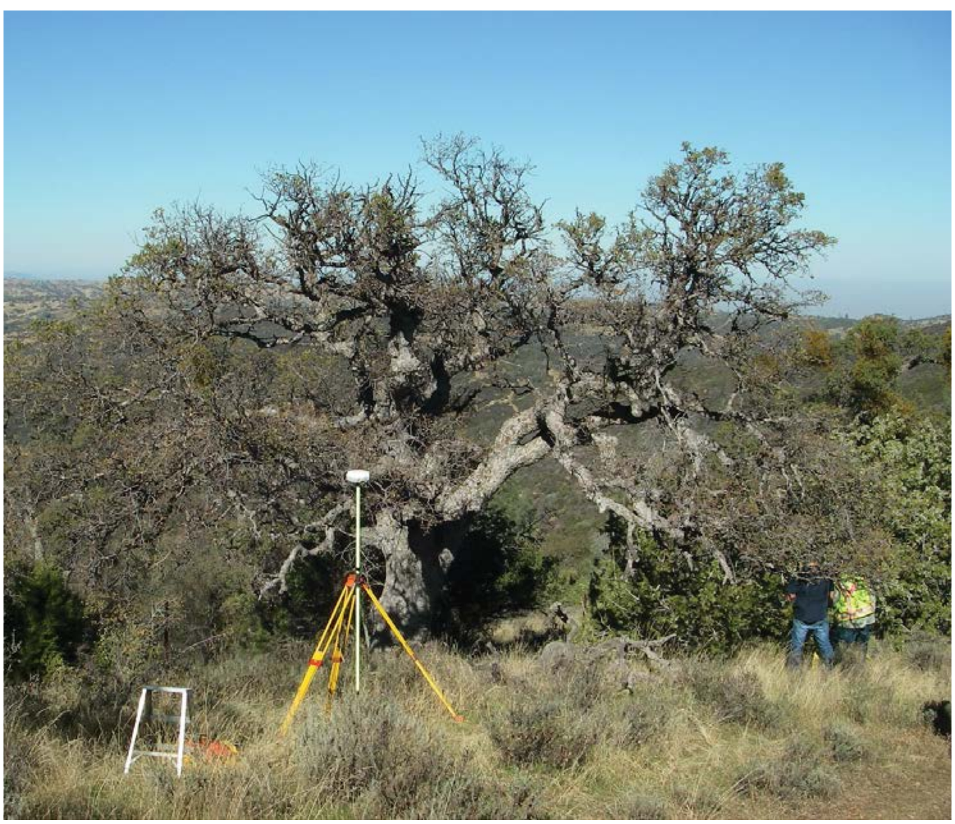
Present for the expedition were Warren Smith, San Joaquin County Surveyor; Michael Rubner, Alameda County Surveyor; Bill Slepnikoff, Santa Clara County Surveyor; Gwen Gee, retired Santa Clara County Surveyor; Chris Wilson, Deputy Santa Clara County Surveyor; Larry Fontana, Assistant Stanislaus County Surveyor; Chad Johnson, Deputy Stanislaus County Surveyor; and Mike Quartaroli, longtime local land surveyor.

Three receivers (Trimble R8, Leica 500, and iGage X90) collected static data for 30 minutes on each pipe. The post-processed coordinates were derived, and the center of the Oak tree was determined to be:

N 1 999 379.80
E 6 279 635.00

Orthometric height: 3488 ft. (est.)



These values have been inserted into each County's GIS basemap for purposes of commonality.

One of the iron pipes was missing its cap, so a brass washer was affixed with LS 4450 and LS 4842 stamped on it. A Corner Record was filed in each of the four Counties.

A lower peak is named Mount Wallace, and currently has a CORS station situated on it.

As it turns out, the summit is southerly of the corner by about 250 feet. The 1857 survey was run from the east edge of the San Francisco Bay due east until it reached the ridgeline of the coastal mountains. The White Oak tree is currently in a state of distress from drought conditions.

The weather was clear and dry – the following day was rainy, which would have precluded access. The next site visit is likely to be by an unmanned aerial vehicle. At the ridgeline, discussion and amazement was had about the rigors and stamina of the first survey crews in running line up and down canyon walls through manzanita, scrub brush, and rattlesnakes.

The site visit was the culmination of a nearly ten year effort, begun by Santa Clara County Surveyor Gwen Gee.

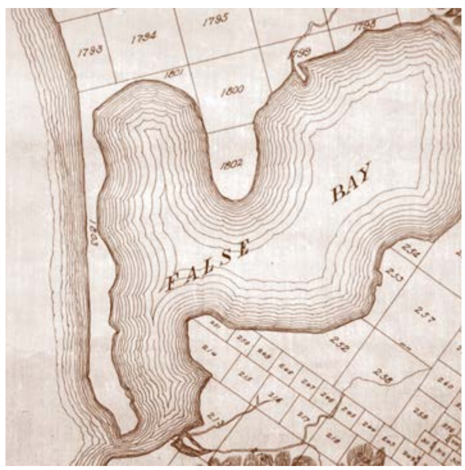
The Survey of Mission Beach

By Mike Pallamary
Pallamary & Associates

Poole's map showing the "worthless sand pit"

When Henry Fitch prepared his map, which served as the basis for the granting of the pueblo lands by the United States Lands Commission, he depicted this strip of land as the *Falsa Punta* or false point. For many years, the new pueblo lot remained undeveloped, even through the land boom of the late 1880's. The peninsula remained nothing more than a right of way for a streetcar line that ran from New San Diego to La Jolla. In 1914, as San Diego entered another land boom, the remaining City pueblo lots were mapped for development. Working for a syndicate headed by sugar magnate John Spreckels and his partner, a real estate man named George L. Barney, the Union Title and Trust Company hired Engineer David Loebenstein to prepare a subdivision map of the land.

Loebenstein was born in the Hawaiian Islands on March 22, 1881. He came to California as a young man and attended preparatory schools. He studied surveying and civil engineering. He returned to his native islands and entered the employ of the Hilo Railroad working under his father, a noted Civil Engineer. He was later engaged in surveying and construction work for the government in various public works projects. He was then assigned to the United States navy and army as an assistant on the Midway Islands under Lieutenant W. R. Cushman. Returning to Hilo, he became involved in the construction of the Hilo breakwater, where he was responsible for many of the initial surveys.



Poscoe's map showing Pueblo lot no. 1803

Upon his return to California, Loebenstein secured a position as an Assistant Engineer for the Southern Pacific Railroad on the Tucson division in Arizona. As the project neared completion, he prepared to return to Hawaii. His plans were soon interrupted when an old friend, John B. Osborn, convinced him to stay in California. His friend had arrived in San Diego in 1907. In a prominent biography of important San Diegans, Osborn was memorialized as a man who needed:

> "No introduction to the people of San Diego, for he is numbered among the greatest of the many forces which helped to upbuild this city. A man of broad education, extensive knowledge and considerable wealth, he has made himself a prominent factor in the community through the quiet, yet forceful influence he exerts in behalf of public progress, through his generous support of measures for the public good and by timely assistance which he renders when material aid is needed."

Osborn also served as president of the city council, and he was largely responsible for the problematic installation of a water system for the city *second to none in the United States.* He helped his close friend, David Loebenstein, set up a successful practice involving the relocation of boundaries of land and the making of subdivisions and mineral surveys. He surveyed the one thousand-acre tract known as Lakeside Farms, a two thousand acre tract at Lakeside for the San Diego Eucalyptus Company, the two hundred and fifteen acre Lemon Grove Park, and many other subdivisions throughout the county. He was reportedly *well qualified by professional skill and ability, both practical and scientific, for the important work entrusted to him.* Due to his fortuitous political connections, one of the most important projects entrusted to Loebenstein was the survey and mapping of the Mission Beach subdivision.

In early sales brochures for the subdivision, it is noted that the tent city concept, which had proven so successful for Spreckels in Coronado, influenced his decision to develop the peninsula. Upon inspection, one observes a remarkable similarity

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John D. Spreckels

with the Silver Strand, south of Coronado. Initially conceived by Spreckels as a summer resort, the land had been looked over by early developers. When the project was envisioned, the automobile was still considered a novelty and the north end of the beach was intended to become an owner-occupied Tent City. The original sales brochure stated that the project was distinctive and original ... the lots are sold to you, and are of ample size for the purpose intended. Each owner is supposed to supply a tent storage house on the rear of the lot, used, if desired, as a private garage while he is at the Beach, and at the other times for storage of tent and furnishings."

Loebenstein laid the subdivision out into 249 blocks containing, on the average, 20 lots each. The map recorded on December 14, 1914, as County Recorder's Map No. 1651. The total number of lots within each of the 249 blocks did not exceed 26, as all of the lots were uniquely identified sequentially by the letters of the alphabet, "A" through "Z." The perimeter of the subdivision was bounded by beaches, public roads and walkways, thus limiting the number of private parcels fronting on the bay and ocean. The streets were set back far enough to ensure the city's residents adequate access to the ocean and bay. In later years, the city did not improve the coastal walkway to its full width.

According to the late Norman Glover, a Professional Land Surveyor and a contemporary of Loebenstein, the Mission Bay Engineer was an ardent stamp collector. Glover notes, "All he was trying to do was collect enough stamps so he could sell them and buy himself a yacht. Which he did. And then he went for a trip around the world in it. And that was the last I ever heard of him."

Before developing Mission Beach, Spreckels obtained the rights to a 35-foot wide railroad right of way running the full length of the peninsula. To assure full usage of his trolley line, the streets of Mission Beach were limited to a maximum width of 16 feet while the walkways, known as *courts*, are no more than 10 feet in width. The narrow passageways naturally discouraged vehicular traffic and, when combined with the unusually small lots, Spreckels was assured of maximum usage of his trolley line. To further obviate vehicular activities, Spreckels had the streetcar right of way constructed nearly two feet above the existing road grade, virtually eliminating automobile access across the peninsula.

Despite his efforts, the area developed slowly, due in large part to the onslaught of World War I. By 1916, losses in other business ventures forced Spreckels to sell a large block of land in North Mission Beach to J. M. Asher. Asher eventually became known as the *Father of Mission Beach.* Six years later, Spreckels announced plans for the Mission Beach Amusement Center. Under Spreckels's plan, the project was to include a roller coaster, the Mission Beach Plunge, a dance casino, auditorium, and hotel. As had been done with other parks around the country, the project was to serve as an attraction for buyers of the lots.

In pursuit of his project, Spreckels's Mission Beach Company petitioned the Superior Court to exclude *certain lands* from the subdivided tract because there had "developed a demand for the establishment and installation on the location herein sought to be excluded of a city suburban recreation center where can be erected and maintained such features of outdoor recreation, bathing, swimming, boating, auditorium, seashore amusements, and other educational facilities with adequate transportation and other public utility services." The location was the center of the subdivision, while the *adequate transportation* was Spreckels's trolley line. In response to the petition, the court agreed and Loebenstein prepared a new map depicting the resubdivision. The new plan, numbered 1809 by the county recorder, eliminated 363 lots in addition to the original beach core. On July 4, 1925, the Giant Dipper roller coaster opened a few weeks after the rest of the park. The coaster was the city's fourth. The first had been built in Coronado in 1894, the second was built in 1912 at the Wonderland Amusement Center in Ocean Beach, and the third was at the Panama-California

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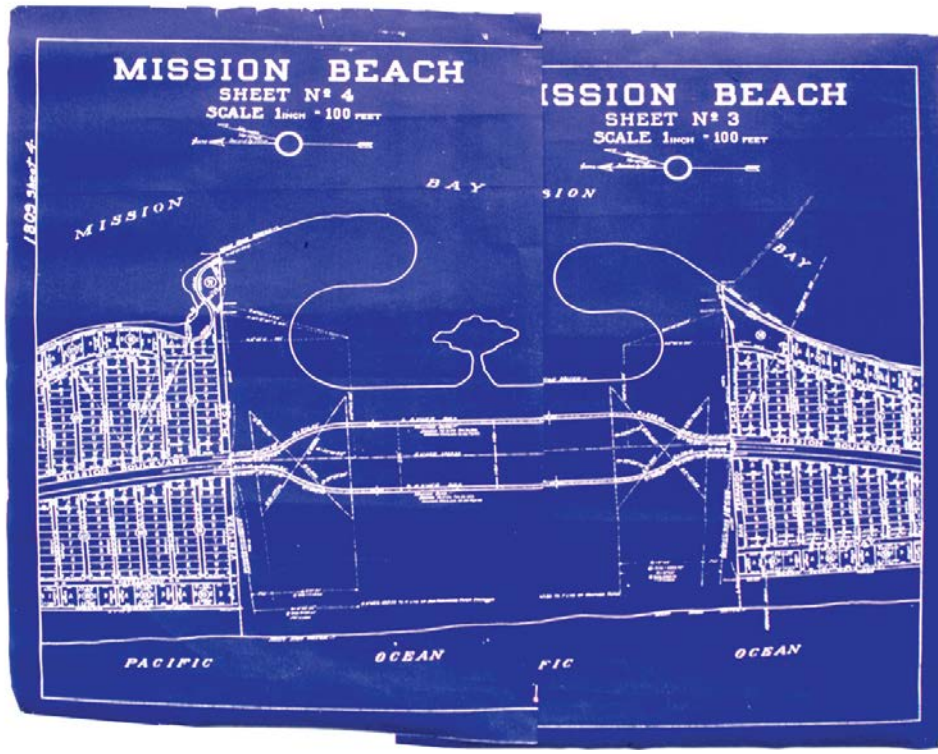
The tent city at Coronado, cir. 1908

The Survey of Mission Beach – *continued from page 18*

Exposition in Balboa Park in 1915 and 1916. The coaster was erected in the areas identified on the original map as the *Prado*, the *Esplanade*, and the *Plaza*.

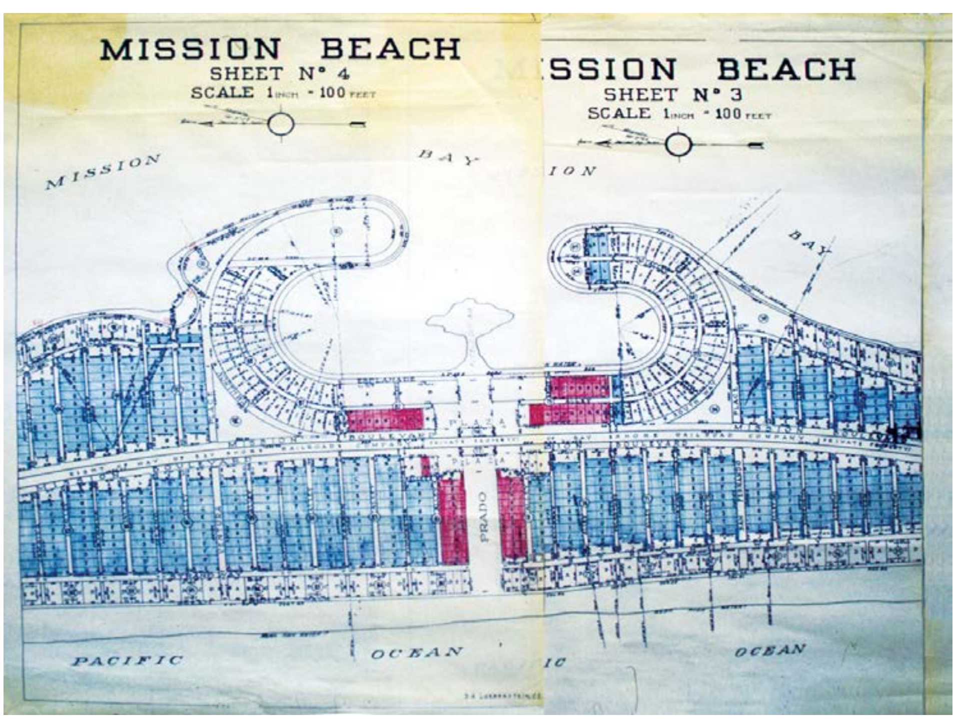
Ironically, when Mission Beach was originally promoted, this area was gloriously depicted in the sales brochures and advertisements in a fashion reminiscent of early developers. This large expanse of land, located between San Fernando Place and Ventura Place, included both the largest and smallest lots within the original subdivision. Sixty years later, this area became the source of a major political controversy when the city allowed private developers to improve the area as Belmont Park.

In the ten-year period between the filing of the original map and the amended map, numerous lots were sold. Because the sales occurred before the amended map was filed, they were legally described as lots of subdivision map no. 1651. After 1924, when the amended map was filed, subsequent lots were described by reference to subdivision map no. 1809. The lots sold earlier were still conveyed by reference to map number 1651, while those later resold were expressed in terms of both maps no. 1651 and 1809.



Subdivision map no. 1809

This dual description raises questions as to which map dictates the location and description of the lots bought and sold during this ten-year period. Fortunately, both maps were the work of Loebenstein, with the second being a revised tracing of the original map. The completed map indicates that Loebenstein purportedly set two-inch square redwood markers at the block corners and curve points of the roadways. Theoretically, these markers would agree with the dimensions as shown on the recorded map.



Subdivision map no. 1651

According to the late Surveyor Curtis M. Brown, co-author of *The History of San Diego Land Surveying Experiences*, David A. Loebenstein "had a poor reputation among those of his vintage; [Engineer] William Rumsey commented to me that Loebenstein rarely set monuments in his filed subdivisions. I could not prove this contention, nor did I have the opportunity to do so."

As would be revealed in later years, many of the dimensions and information shown on both Loebenstein maps were in error. The largest documented blunder is located in one lot and is 30 feet in size. Brown documented the conflict in his classic textbook, *Boundary Control and Legal Principles*. Over the years, other discrepancies surfaced, generally occurring in and around curved portions of the beach. In 1988, Eilleen Forrester, a student

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at Fresno State University, prepared a collegiate thesis on the layout of Mission Beach. Using sophisticated computer technology, Ms. Forrester isolated many errors in the map. Discrepancies averaging between five and ten feet were typically encountered. Her methodology is the one used by the county's more sophisticated and knowledgeable Surveyors.

One prime example of these errors can be found in the northern portion of the beach between Yarmouth and Windemere Court where a ten-foot error exists. In preparing the map, Loebenstein had apparently neglected to consider the width of the alley that ran along the eastern edge of the two blocks. The problem was made more confusing because of Lowenstein's omission of an alpha-identifier to describe one of the affected lots. The Mission Beach Company resolved the problem by adjusting the boundary lines of the two blocks and closing the segment of the alley containing the ten feet needed to restore the lots to their intended widths.

Following the remapping, an upturn in the local economy lured investors back to the beach. Lots ranged in price from $400 to $1,500. As development picked up steam in the 1930's, the City Engineer went about the rigorous task of *tie pointing* the Mission Beach tract to establish permanent survey markers to be used in surveying public streets and private lots. The work consisted of burying large concrete monuments at alternating block corners. Additionally, the City Engineer supervised the setting of lead plugs in the surface of the concrete sidewalks to mark out the subdivision. Because of the proximity to the ocean, any markers that may have been set by Loebenstein were rapidly decaying and their perpetuation was of the utmost importance.

Mission Beach continued to develop in a leisurely fashion until the war placed a demand on affordable housing. Consequently, the improvements that did occur eventually came to typify the beach community. In the 1960's, as the surfing craze swept the West Coast and the counter culture population moved into the area, unique problems began to surface. The carefree lifestyle of the beach crowd was reflected in a *San Diego Union* article that reported on a series of encroachments, including the extension of structures into alleys and onto the public beach. A series of complaints were filed with the City Manager's office and in response to the growing problem, Assistant City Manager Walter Hahn reported, "We are planning a program that will provide for removal of the encroachments in a systematic manner." The city council instructed the City Engineer to conduct a detailed engineering study to determine how many property owners were building into the public rights-of-way.

City survey crews, under the direction of the City Engineer, went about the task of setting new *tie points* in an attempt to straighten out the street and block lines in Mission Beach. The tie point system, usually accurate and well conducted, involved City Surveyors conducting a field survey and upon completion, marking the results of their surveys by drilling holes in the concrete sidewalks and filling them with lead plugs centered with small brass tacks. The completed survey was then recorded on *tie point sheets* and placed on file with the city. When the city went about creating the new tie points, City Surveyors rejected most of the city's 1930 survey markers in favor of those that conformed to the City Engineer's recalculated positions of the original baselines. As word spread of the decision to realign the subdivision map, local Surveyors were outraged and many lodged complaints with the City Engineer. He steadfastly continued with the project, much to the dismay of the surveying community. In doing so, the reworked lines meant that fifty years worth of property surveys, both public and private, were being placed in conflict with the new city work.

The whole affair took a more troubling twist when the city monumented its survey by installing large *well monuments* on the new baselines, thus influencing Surveyors, Engineers, and City Surveyors who were inclined to use the markers. Unfortunately, because the city changed the baselines without properly documenting their work, confusion and uncertainty remain. The city's tie point records, on file with the City Engineer and distributed to private Surveyors and citizens, do not reflect the effects of the newer work. As a result, most of the newer survey work disagrees with the original work performed over the fifty-year period leading up to the city resurvey.

Despite the protestations, when the city completed the survey, city officials notified the property owners of the results of the new survey. The owners were then given a reasonable length of time to remove the encroachments. In addition, the city neglected to consider the accuracy of the data they were using, in the process introducing more errors. Some of the problems created by the city resurvey are

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Original city engineer survey monument

1964 city engineer well monument

documented on subdivision map number 5568. Surveyor E. Lyle McAllister related the problems he encountered, noting on the 1964 survey map:

> "(The) Alignment hereon of Devon Court was determined prior to City's setting of control monuments in the general area. Consequently, the center line of Devon Court lies 0.45 ft. south of the position thereof as determined by said control monuments, and is controlling for this map only ... (the) bearings and dimensions determined by calculation hereon, inasmuch as original lot contained substantial error of closure, and Maps 1651 and 1809 are unreliable."

In resetting the baselines, the new markers were set at a new offset line. Whereas the original 1930 markers were set at a three-foot offset to the right-of-way line, the new well monuments were set at a five-foot offset. In spite of the importance of the new work, the City Engineer did not refile the tie point sheets. Private Surveyors, unaware of the changes, used the intimidating 1964 five-foot markers believing them to be the three-foot markers as was shown on the city tie points. Consequently, new homes and expensive condominium projects were laid out and built two feet into the Mission Boulevard right of way.

In 2000, the City Council commissioned a survey of Mission Bay Park in connection with questions surrounding the location of the park's boundary lines. The City Attorney, the County Grand Jury, and the City Council all reviewed the new survey, based upon the 1930 survey markers, and certified it as being correct.

Years earlier, in 1971, the beach received more unwanted attention following complaints about *hippies* moving into the area. County Health Director Dr. J. B. Askew investigated the matter and concluded that the community was a "bag of worms." His controversial comments included a statement that the "young people in the area are making the resort peninsula a breeding ground of communicable disease." As a result, the city found itself compelled to review the area for more zoning and setback violations. Two years later, the *San Diego Union* reported that *Some Mission Beach residents may be in for a big surprise soon* when it published an article describing a problem between the City Engineer's office and property owners along Ocean Front Walk. In response to efforts to update existing engineering records, the City Engineer reported on extensive encroachments from private property owners on to the publicly dedicated walkway.

City Engineer James Casey reported that *it has been years since the city has checked the extent of encroachment along Ocean Front Walk*. City officials claimed that the public right of way was 12 feet wide, while the community plan described a 15-foot right of way. A 1926 improvement plan on file

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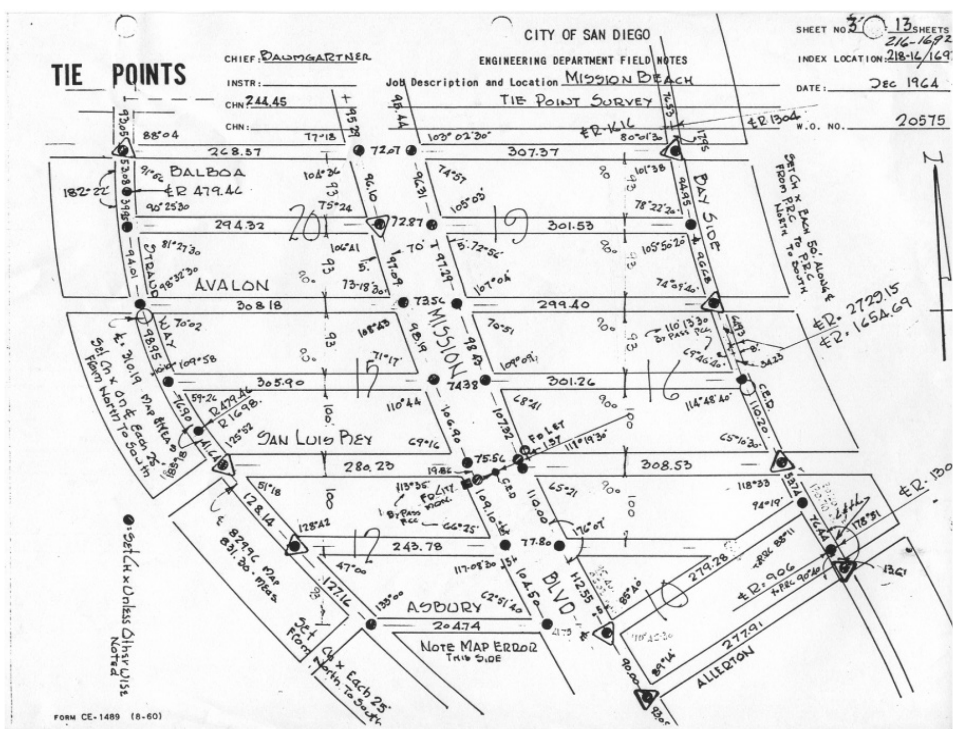

1964 city engineering department field notes

The Survey of Mission Beach – *continued from page 21*

for a portion of the boardwalk displayed the walkway also as 12 feet wide. Other city records showed the right of way as being 27 feet wide (12 plus 15). In any event, city officials stated it was known there were numerous encroachments in the right of way.

The problem was exacerbated by the fact that, because the boardwalk was a publicly dedicated walkway, everyone had rights to the area. Deputy City Attorney Hal Valderhaug stated that if any damage was done to any of the numerous improvements within the right-of-way, the person causing the damages might be liable for damages to the owner. *Trespass*, stated Valderhaug, was another matter. *If the police were called and the police knew it was public right of way they would tell the private owner it was his private matter and that we can't do anything from a criminal trespass standpoint,* Valderhaug said when asked about the right of property owners to eject people from the right of way. *They can put up a "no trespassing" sign but it's just not enforceable,* he said. *Technically it is public right of way, open to the public. Legally the city could probably grant encroachment permits to all those people; it's just if they don't have them they don't have any legal rights.* In the past, unless the encroachment created a public nuisance or stood in the path of a planned city project such as a street widening, it received little notice from the city.

When questioned as to the problem, Ron Lockhead, another Engineer with the city, said, "Thirty years ago we weren't worried about those kind of things." The city admitted that the issuance of the city encroachment permits was somewhat a matter of tradition. However, when it comes to permanent fixtures and improvements, property owners are required to get permits, said Lockhead.

Following the city's 1965 resurvey, officials began keeping records based on the location of city properties. "It wasn't until about that time that the city did much about the encroachments into rights of way," said Lockhead. To identify the extent of the problem, the city commissioned an aerial mapping firm to identify the properties in violation. When hearing of the new survey, the *San Diego Union* asked.

> "Does the forthcoming survey of encroachments in the beach area signal a new hard-nosed approach by the city? Is it perhaps, a prelude to city crews moving in with wrecking bars and jackhammers to rip out the illegal improvements?"

Casey responded by stating: "the cure may be greater than the ill" from the standpoint of asking someone to tear down a wall that may be encroaching into the public right of way by a half a foot. In a memorandum to Mayor Pete Wilson, Deputy City Manager John Fowler added, "The fact that the adjacent property owner has fenced a portion of the right of way does not give the property owner prescriptive rights to the use of that area." After considerable discussion, the city arrived at two possible options with respect to removal of the encroachments. The first was to require the owners to remove the encroachments at their own expense. The second was to have the city remove them and initiate action to recover costs from the property owner. The predictable wave of protest influenced city officials to reconsider the matter. As for the Ocean Front Walk encroachments, Fowler said, "It is suggested that nothing be done immediately. This would allow the encroachments to remain in place until a specific project utilizing the right of way is determined and a construction schedule is established."

It was not long before the issue resurfaced again, much to the dismay of local residents. In 1984, the City's Transportation and Land Use Committee rejected recommendations from members of the city planning department who raised the issue again. They urged the city to force property owners to seek *encroachment removal agreements* for the improvements. One resident predicted that there would be

Mission Beach was gutted to create Belmont Park

Development is tight in Mission Beach

The Survey of Mission Beach – *continued from page 23*

By 2002, the boardwalk was widened

a *world war* if the recommendation was heeded. The TLU committee voted 5-0 to instruct city lawyers to draft a new ordinance, defining *encroachment* and setting out an abatement process that would relieve the property owners from the threat of *heavy-handed treatment from the city.*

The city again restated the fourteen-year-old decision that until a project was identified, it would not proceed with reclaiming the land. The planning staff pointed out that unless the city stopped the expansion of the encroachments, it risked losing any future right to the public land. This recommendation conflicted with prevailing law that protects the city's rights in the same fashion that the federal government's are protected. A local group, the Mission Beach Open Space Committee called for the *speedy removal* of Ocean Front walk encroachments, although no one from that organization appeared before the committee.

Overturning their previous decision, the city proposed that the property owners sign agreements affirming the city's right to demand removal of any encroachments on 30 days' notice. If the agreements were signed, the city promised to waive normal permit fees. If not, the city reserved the right to remove the encroachments immediately and charge all costs to the property owners. Again, the property owners defended their self-perceived rights to continue their use of the land. After heated testimony, the city officials sided with them. Within three years, the city conducted a zoning-enforcement sweep throughout the community based upon the citations found in the 1978 plan. In response, the Mission Beach Town Council filed a protest with the city's Public Services and Safety Committee. Resident Brian Wagner said, "It's the little things that they're driving people crazy about," adding that residents with questions or complaints about citations found the city non-responsive.

Other residents expressed concern with the city's enforcement of a law that banned the parking of vehicles in yards and on setbacks. Still other property owners were upset that their long-standing buildings conflicted with the revised Precise Plan and its new building setback lines. Because of a tendency by most property owners to accept official city reports and surveys, residents did not challenge the city's newest reports. And in most cases, the city's determination of setback violations was based upon their erroneous baselines.

In the years to follow, the city stepped up its efforts in response to acquire the ocean frontage for enhanced access to the beach. Following implementation of a development plan and the requisite findings of *public necessity,* the city adopted a resolution approving the widening project. Concurrently, the council instructed the city attorney to proceed with the widening of 1.6 miles of the Boardwalk, north of the roller coaster. The first section of the project, 750 feet in length, was pegged at a cost of $150,000.

In April 1999, the property owners unsuccessfully challenged the city's environmental report for the boardwalk widening. One month later, the city attorney filed misdemeanor criminal charges against eleven of the property owners for refusing to remove walls, patios, and other encroachments in the city's claimed right-of-way. In response, an attorney representing ten of the property owners entered innocent pleas in the Superior Court while another 25 owners faced criminal charges unless they agreed to tear down the walls and other obstructions.

When the Coastal Commission heard the matter in August, a group of homeowners pleaded to the commissioners that they needed the extra walls to provide an extra buffer to protect their homes from storm waves. Despite the entreaties, the commission voted unanimously to proceed with the widening and, a couple of weeks later, the matter went to court. A Superior Court jury found 19 property owners guilty of misdemeanor charges of encroaching onto the popular walkway. Under the terms of the findings, the owners faced six months in jail and a $1,000 fine if they failed to move the encroachments. In January 2000, the city began removing the offending improvements to make way for the boardwalk widening.

Taking the Next Step

By Chris Martin, *KSN*

Introduction

"Great Googliy Moogily, they did it, wife! They gave me my license! Let's pay the fee before they change their minds."

After weeks of waiting I received the news. Yes, I said "weeks." Please don't send e-mails about how in your day you had to wait months, and walk uphill both ways in the snow carrying a chain and plumb bob to get to your results from a mailbox. It was a big moment for us. I went to college for 5 years (it was supposed to be 4 years but I had a little too much fun), worked to get my responsible charge for an additional 5 five years, and studied countless hours. I finally achieved the goal I set out to do. The wife and I were ready to make the "medium bucks" as our local county surveyor would say.

That was two years ago. What's changed for me in those two years? Well I'm a bit fatter now, I was prescribed glasses from my optometrist, and I have a better understanding of how little I knew about the profession at the point in time I received my license. As I sit here thinking about the old me, I realize that I wouldn't have an understanding about how much I didn't know if it weren't for the mentors I have around me. I also realize not everyone is as lucky as I am to have the same type of mentorship as I have.

Well, I'm here for support. To help others facing the situation I was in two years ago I've decided to write a series of articles. The intent of these articles is to share the lessons I've learned regarding technical skills, professional etiquette, observations, life lessons, maybe a couple of my favorite recipes, and week 12 fantasy football picks. I'd like my articles to teach some lessons I have had to learn the hard way, and raise discussion points between potential mentors and newly licensed professionals.

Many people here may read these articles, scoff, and say what a ninnyhammer (someone bet me I wouldn't use "ninnyhammer" in an article; I just won a taco truck burrito). If you feel this way kindly flip over to Dave Wooley's article so you can have more substance in your life. This article isn't for you. If you read my articles and think to yourself, *who can I discuss this with?* Please read on and share. If I can provide insight to at least one person and possibly prevent them from learning the hard way, then I've accomplished what a came to do. Enjoy!

The single biggest realization in my career came early on. I was working on a project for a mentor of mine and asking questions regarding the process of completing the project. Not one or two questions on the project, but a ridiculous amount. "Hey, Mr. Blank, how do I turn my computer on? Hey, Mr. Blank, when is lunch? Hey, Mr. Blank, what rhymes with orange?" To say I annoyed the so-called Mr. Blank was probably an understatement.

I went and had lunch with Mr. Blank and he told me the single most important thing of my career. "Chris, why do you think this company likes me as an employee?" I replied with, "Your boyish good looks and devilish charm?" Mr. Blank said," Well those things help, but I was really going to say when they hand me a project they know it's going to get done." My expression probably was likened to a googly-eyed teenager saying, "Well, Duuuhhhhhh!" He followed it up with, "On my own ... with no help," and then stared at me. I proceeded to melt away like the bad guy in *Raiders of the Lost Ark*.

That last part isn't true, but I did reflect on this conversation. I had an epiphany after that lunch. The obvious concept of doing things without guidance had not occurred to me at this point. This is what my employer had envisioned when they hired me. This is how I take my career to the next level.

I spent some time thinking of what may constitute a valuable employee. Someone who is efficient, makes few mistakes, and provides the least amount of interruption throughout the day. To comply with this mold I broke down my faults into two groups.

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My inability to ask questions properly and efficiently, and reviewing my work thoroughly. I provided myself the following guidelines for improvement in these areas:

The Art of Asking Questions

Asking questions became a habit for everything I was tasked with. It was so bad that asking my employer was my first option before taking it upon myself to find an answer. This constantly interrupted my supervisor's train of thought and my own. Before asking questions consider the following:

1) **Did you look first?** Often times when the question of, "Where is x located?" popped up I had not looked myself. It seemed to be in the same spot every time. Strange how that works.

2) **Can you Google it?** Do that first. Often times you will find answers to small questions with a quick search of the pop up browser.

3) **Is there a small decision to be made regarding the project?** Attempt to make it and take a note of it. When the responsible charge surveyor reviews your work inform him of those decisions. You can always correct them later on. (Please note that not all surveyors like this step. Some are more comfortable with questions being asked as the project progresses. Feel out who you are working with on this project before doing this.)

4) **Can you continue on with the project without asking the question?** I would write my questions down and continue on with the project as long as possible. I would then ask all my questions once a day to minimize interruptions.

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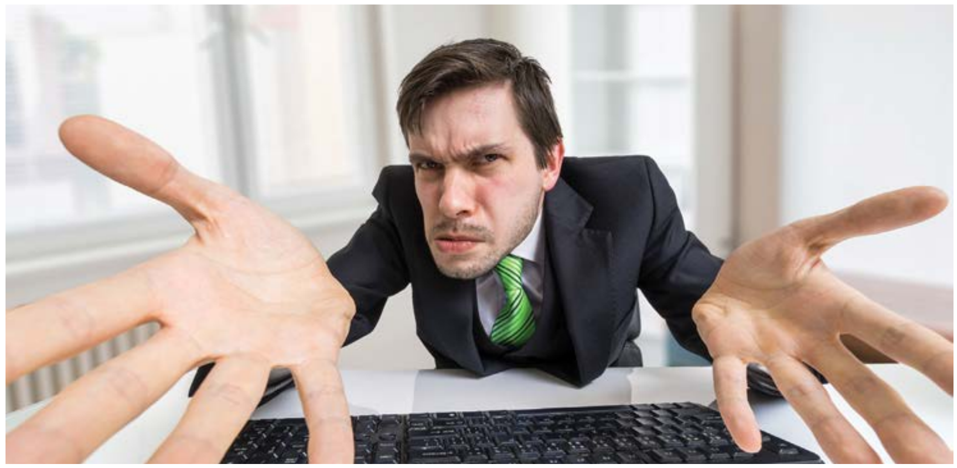

Taking the Next Step – *continued from page 25*

5) **Have you completed similar projects in the past?** Oftentimes questions will come up with formatting a project deliverable to the surveyor in charge's liking. Reviewing previous projects that are similar and copy and pasting material will answer many of these questions.

When the time comes for you to finally ask the questions take one last step before you knock on that office door. Come up with a solution first! Now I'm sure you are reading this and saying, "Well gee Chris, the whole point of me asking is so I can get a solution. If I knew the answer I wouldn't be asking." Then you probably are mocking me, "Look at me, I'm Chris, and I ask questions I know the answer to. I'm a fancy boy."

The truth is it doesn't have to be the correct solution. That's right I said it, it's okay to be wrong. There are actual benefits to this approach. The first being you will progressively develop your problem solving skills to match real world situations. There will come a point in time where your supervisor is not around. These skills will help you learn the tricks and alternate sources to come up with solutions for your coworkers, clients, and other people you may mentor someday. The second benefit is you will come across to your supervisor like you have shown some real thought on this issue. Like you're not trying to walk in and ask for the easy way out. Believe me, sometimes the image could use a little boost.

Review Your Work

This guideline is something I need to stress. Early in my career I would depend on the project surveyor to find all my mistakes. This is not a good way to operate. What I didn't understand was he had on and off days too. He may have been bitten by his neighbor's dog on the way in, slipped on a banana peel in the parking lot, or realized he picked up fat free milk at the store instead of 2%. Whatever the travesty is, he or she may not be focused on the task at hand. This leaves room for errors to slip through the cracks.

I ended up making a game of my effort. I challenged the person in responsible charge to find something wrong with my work. I'd try and finish my project to the point where they could deliver it without comment. I often lost, but every once in a while I reluctantly received work back with no revisions. This also made my manager review my work a little harder. It's hard to hand back something without at least one comment. You feel like you didn't do your job.

So hey, maybe you do all this and your perfect in every way and I'm just a big ol' dummy. Well humble yourself. Ask your supervisor to have a teachable moment with you like mine did. Take the criticism in stride and better yourself in the areas described. Even if you don't agree with them. Don't tell yourself there is no room for improvement.

From Surveyor to Photographer

By Steve Shambeck
PLS Photography

It's my dad's fault really. He got me started in bike riding, motorcycles, surveying and photography and a general love of most any activity outdoors. I'm not sure if it's in the DNA or if I just admired how he succeeded in most everything he set out to do. So when I told my dad, George Shambeck, PLS 3419, back in 2006 that I was transitioning out of my surveying career and starting a photography business, I was not surprised that he gave me nothing but support and good wishes.

The reasons many of us got into surveying are actually similar in photography if you think about it. I get to be outdoors a lot. Every job is a little different and I get to go to some very interesting locations. There is always something unexpected that challenges my technical and business skills. Surveyors are always trying to decide when to purchase that new GPS equipment just as I am always tempted to buy the latest camera model. Surveyors are faced with software that always begs to be upgraded and the photographer is teased with a new version of Photoshop all too often. The biggest difference between the two is the reward system. In surveying I received a pretty good paycheck. Unless a photographer is shooting a lot of weddings (not my bag), or doing consistent corporate work, it can be a stretch to pay the bills. That being said, I can count on one hand the number of times a survey client said "Wow, this ALTA is awesome! I can't wait to have you make me another one." Yet my photography clients are a constant source of ego inflating encouragement and often ask when I can come back and shoot some more. Perhaps I just wasn't that good at ALTA's.

I am a freelance photographer which allows me to shoot what I like most of the time. I have purposely chosen not to specialize in any one aspect of photography for fear of burning out too soon. One of my favorite things to shoot has been sports. I have been blessed to have been hired to shoot everything from the X Games, to Supercross, to the biggest international Rugby tournament in North America. But my interest in photography doesn't stop with sports. I also work with real estate agents, marketing firms, and do a lot of portrait work for those who want something a little edgier than your typical portrait photographer will offer. The most rewarding things I get to do with my camera involve my faith. I am blessed to lead a group of photographers at my church and have been able to use my skill in the missions field as well. In the past couple of years, I have been on assignments in Cambodia, Myanmar, central Mexico and India twice! During my Mexico assignment, I got to shoot from an ultralite aircraft and from inside a federal prison. Mrs. Shambeck was not too pleased with those activities.

My dad never forced me to follow in his footsteps, but I'm glad I did. He encouraged me to be the best I could be at whatever I wanted to do. He led by example and I am thankful for that. That being said, while he is probably a better surveyor than I ever was, I hope I am at least as good of a photographer.

Thanks dad.

The Invisible World of the Land Surveyor

By Ken Wilson
Wilson Land Surveys, Inc.

In our profession as surveyors, much of our work is done invisibly. We retrace lines of title that cannot be seen or felt. We process coordinates that are arbitrarily established and useful only to ourselves. We measure with invisible beams of light and collect data with wavelengths from satellites high in the sky, invisible to the naked eye. No wonder people have trouble figuring out what we do! But there are a few things that we do that are highly visible. Two of these are our maps and our monuments. Our job is to answer the question of WHERE? Yes occasionally we answer the question of WHAT (what we found, what we shot, etc.) and HOW (how we measured and how we got there). But the question of WHERE is the one we are paid to answer. WHEN we did it only matters if we miss the deadline and WHO or WHY doesn't usually matter.

Our maps are a record and also a way to communicate our work. However, the important part is to make sure that our map represents what really exists and the relationship between its parts, that is the distances and directions portray accurately what is in the real world. The better a person is at measuring, note keeping, organization and data processing, the more closely the map will coincide with reality. Now with the advent of computer aided drafting, anyone with the ability to learn the program can draw lines on the screen, label them and present it as a precise rendition of what he surveyed.

As in all professions there are differing degrees of professionalism, ability and quality among surveyors. I want to illustrate something that happened to me that highlights the fact that our work is highly invisible and that less than professional work can appear to be quite good from first glance. With the aid of computer graphics anyone can produce quality work that makes other efforts look like they were done by a three year old in a sandbox. How could this be?

In discussing this topic we need to recognize the fact that whenever we establish a boundary, our opinion is now subject to the review of other surveyors who will be coming along behind us. If they agree with our methods, measurements and reasoning they will state that they found our monument and have accepted it as correct. On the other hand, if the retracing surveyor feels that we have somehow placed the monument in a mistaken location due to one or more reasons then we are going to see a statement that the monument and its location has been rejected as being in the wrong place. While the intent of the retracing surveyor is not to denigrate the actions of the previous surveyor, it is inherent in our work that this decision be made with each and every monument we find in the field.

With that being said, I did a boundary survey in a quite rugged area of the Central Coast of California along the ridge of the Coast Range above Lake Nacimiento. The land there is intensely scenic with steep rocky outcrops, dense underbrush, mighty oaks and views of the Pacific that defy the imagination. One early morning, upon arriving at the top of the divide between the Salinas Valley and the ocean, the fog was moving rapidly up and over the ridge. From a vantage point several miles to the east the fog bank appeared to be bread dough slowly kneading its way over the mountains. Well, we were in this fog bank, which was a living breathing, moving thing. It must have been traveling at 15-20 miles per hour. Within the fog was the powerful aroma of a type of sage that was sweet smelling and yet pungent at the same time. Either you liked it or you hated it but you weren't getting away from it because the air was thick with its scent.

Anyway, it was on this ridge that I and my assistants worked for several years searching out 120-130 year old government corners using my semi-automatic total station (before GPS was cheap). We were careful to measure our lines using the techniques that I had learned from my previous employer and ones that we had developed on our own. I was confident that our work was of good quality both in the accuracy of the measurements and the decisions I was making with regard to the monuments we found and accepted. However, because the original monuments can become quite obscured over time or even may vanish altogether, there are times when a fresh look at a location has merit.

Here is an example how we may think we have the right answer for a corner position, but after a subsequent review of

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The Invisible World of Land Surveyors – *continued from page 29*

the evidence we come up with a different decision:

During a part of this survey I was retracing a section corner that was on a north facing slope with many trees, plenty of brush and quite a few rock outcrops. The location was about 300 feet above a deep canyon. I did not necessarily need to establish this corner but I wanted it to verify the quarter corners to the east and south. There were three live oak bearing trees listed in the original field notes. I thought that I had found one of them so I tied it out. It fit reasonably well with the two quarter corners. Ten years later, I surveyed the section to the northwest of this section corner, so I needed to make sure of this corner. I decided to return to the area to double check my first decision. Upon returning, this time with a little more care and wisdom, I found another tree with an odd vertical line about twelve inches long near the base of the tree. So even though I had never seen a bearing tree with a scar like this I pretended that this was the bearing tree for the appropriate direction that the scar was facing and used the tape and compass to determine approximately where the original corner might have been. Then I began looking for the other trees from this position. Amazingly, I found two other live oaks that had a similar faint vertical scar and they were facing the correct way. Upon measuring their location, I determined that these were indeed the original bearing trees! The catch was that I had walked by and examined all of these trees ten years before but had not noticed anything unusual about them. I had not noticed the faint vertical scars they all shared and so I dismissed them as not being the bearing trees.

To borrow a statement from another surveyor named Doug Morin – surveying is like solving a murder mystery. You need to keep second guessing yourself and never give up gathering evidence. Hopefully, the additional evidence will verify that the work I did previously was correct. Sometimes, however, it can change my entire way of thinking.

So, on this particular survey, I did the calcs, set the corners and then filed the record of survey. Now, other surveyors can use it to retrace my work and decide if they think it represents the reality of both measurement and corner acceptance. And so along came another surveyor who was working on some parcels to the north of my project. He completed his first survey and filed a map showing his work. His next project was to retrace some of the corners I had previously identified and measured to. Naturally, I was interested in what he might find and what corners he would accept. I chatted with him on the phone a little bit and even met him once in the field and observed him working with his sons. I didn't think too much about it until I got a copy of his first map. I needed to do some more work in some of the same areas that he surveyed and our work began to overlap. So, using his map as a guide I began looking for the corners that he had found that I would need to use for my project.

I recovered several corners and as is my custom, treated each one objectively. I never accept any section or quarter corner just because someone else did. I check the monument itself for consistency with the record and the bearing trees for size, scar direction, type and overall authenticity. I check the measurements to the corners, any and all accessories, topo calls to nearby streams and ridges and distances and bearings to adjacent corners within a mile or more. Putting all of the puzzle pieces together I then in my mind determine how likely this corner is to be in the original location. I do this even for monuments set by the County Surveyor. I also ask myself these questions:

When was the corner retraced and re-established and by whom? What is the reputation of the surveyor who retraced it?

In retracing the work of this surveyor, I remembered that he was quite new in the area and I recalled that he had only filed four Records of Surveys in the County. I speculated whether this job might be a bit more than he would have wanted. High up in the forest I arrived at a monument shown on his map as a found rock mound and I immediately noticed that the rocks did not have any moss or lichen on them. In fact, upon questioning the surveyor later, he told me that he had "built" the rock

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The Invisible World of Land Surveyors – *continued from page 30*

mound around a "stone" that he had found that fit the dimensions of the original. I suggested to him that a good practice would be to leave the evidence as you find it (setting a pipe or rebar next to it would be acceptable) and that normally surveyors do not embellish the old rock mounds they find. He shrugged it off like it was nothing. Also, I asked him if he had ventured a little further to the south of this location and if he noticed anything unusual? He said no and asked what I was talking about. I let him know that approximately 150 feet south from this point was a magnificent rock formation that included an incredible vertical drop (it took a rock several seconds to hit the ground). If the original surveyors had trekked in that location, surely they would have had to offset their line from this precipice. By my reckoning the location of the line should have been at least 100 feet east of this corner which would have then missed the cliff altogether. When searching in this easterly location I found a rock which agreed with the original and a mound just above this rock. I later accepted it as the correct location of the corner.

Another problem I had with the work of this surveyor was that I did not agree with his measurements. On his map he would list a measurement between two found monuments but my measurements were up to 50 feet different than what he had shown on his map. It really made me wonder. I checked myself before finishing the job and by means of closures of traverses and angle checks to distant control points, I felt that my work was reasonably accurate and of good quality.

There were a few other disagreements I had with this surveyor but for the most part I accepted nearly all of the corners he had found or used with the exception of two or three. Now comes the fun part. After accepting the corners, a surveyor needs to process his measurements, organize his data, perform his calculations and then return to set the actual corners of the parcel he is surveying. I did not measure any of the corners that the surveyor set but I did get an idea of what he might be up to when I examined his last record of survey. The first map he prepared did not show any of the corners that I had retraced. But his last map was a partial retracement of work that I had done to the south. On his map he showed his found monuments with the accompanying bearings and distances. On face value, the measurements he showed were very consistent with the original GLO bearings and distances. What struck me though was that my monuments that I had either prorated and set or had found were shown as being way out in left field. His map made my work look like a third grade crayon sketch while his looked like the Mona Lisa. After a minute of feeling a little beat up I remembered that the proof of any map is how close it agrees with reality. I was confident and even looked forward to the time when another surveyor would venture into the area and retrace our work. It would be very illuminating to see what he would come up with and whether he would accept my work, the other surveyor's or perhaps something else.

That is what makes this job so fascinating and sometimes frustrating. Validation is often slow or nonexistent. But how refreshing it is when someone shows some of your corners on a map and it says "Accepted as true corner." This is the courtroom of reality, where other surveyors of competent stature and ability come to examine your invisible lines and your arbitrary coordinate system, your organization skills and decision making ability. When one of your peers decides that they agree with you and build on what you have done, this is, in my opinion, far better than trying to educate attorneys, judges and juries who know little about angles, distance meters, GPS or COGO. Most of our validation comes from the surveyors who come after us and find our evidence. Will they agree with it or will they show it to be in error? Hopefully, they can accept our work and our monuments because they agree with the measurements and decisions we made. As this process repeats itself, over the years a reputation is developed wherein other surveyors can say about one of their predecessors, "they did good work." This legacy exists among surveyors that have left us but whose work remains in the form of tagged monuments bearing their number. It gets to the point where when we find a monument with a certain number we immediately conjure up an idea of how reputable the corner might be just because of the one who is responsible for it.

CLSA 2017 Photo of the Year

Rich Maher

Rich Maher, PLS of KDM Meridian surveying the bluffs of Solano Beach for erosion monitoring.

A Review of IBLA 99-363 — (part 2)

By Landon Blake, *Redefined Horizons*

In this article, we conclude our review of the decision in IBLA 99-363. In this case three landowners (referred to in this article as "Simpson") appeal a dependent resurvey of a Colorado township containing their land.

In the first article, we considered the IBLA's decision on three types of evidence in this case related to the contested section corner:

1) Physical evidence.

2) Topographic features.

3) Oral evidence.

In this second article, we will consider the IBLA's decision in this case as it relates to:

1) Private survey maps as evidence of PLSS corner location.

2) The proper use of the double proportion method of corner restoration.

3) Bonafide rights of land owners in BLM Dependent Resurveys.

You can read the first article for a timeline of events related to the dispute decided in this IBLA decision. Let's next consider the key facts related to the three issues we are going to discuss in this article.

Key Facts

Private Survey Maps

- The 1920 Summerhalter Survey showed a sandstone with notches, but didn't note the dimensions of the monument or include any information that would establish the location of the monument. All bearings and distances shown on the Summerhalter Survey were taken from a single found monument, with no reference to the original GLO plat or field notes.

- The 1931 Colorado Highway Department Survey Map didn't show what evidence was used to establish the unmarked sandstone as the section corner. It also didn't contain bearings and distances that could be used to calculate the location of the section corner.

- The 1958 Colorado Highway Department Survey Map showed the disputed section corner in a different location than the unmarked sandstone.

- The 1978 Johnson Survey....

- The 1981 Goff Engineering Survey used the unmarked sandstone as the record monument for the disputed section corner. The map had no explanation for the acceptance of the unmarked sandstone and no reference to the original GLO survey field notes or topographic calls.

- The 1985 Cliff Schmid Survey used the unmarked sandstone as the basis for some measurements, but didn't accept the sandstone as the section corner monument. Schmid believed the proper location of the section corner as about 100 feet south of the unmarked sandstone.

- Simpson claims there was a survey by Sorenson that tied to the unmarked sandstone, but it was never presented in evidence.

Proper Use of the Double Proportion Method of Corner Restoration

- The original survey showed the east line of Section 30 as 80.00 chains long and the east line of Section 31.00 as 80.00 chains long.

- The double proportion performed by BLM in the dependent resurvey stretched over 8 sections in the east-west direction. It proportioned a total of 219.74 feet in the east-west direction. The double proportion stretched over 4 sections

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in the north-south direction. It proportioned a shortage of 869.88 feet in the north-south direction.

- The double proportion performed by BLM in the dependent resurvey placed the location of the section corner common to Sections 29, 30, 31 and 32 south and a bit west of the unmarked sandstone.

- As part of the double portion performed by the BLM in the dependent resurvey some land owners gained land and others lost a little land. The loss of area for the Simpson parcel(s) was larger than most other land owners in the double proportion.

Bonafide Rights of Land Owners In Dependent Resurveys

- Simpson relied on the 1981 Goff Engineering Survey to occupy his lands.

- The Forest Service had set boundary signs that fit better with the location of the unmarked sandstone than with the corner position established by double proportion.

Legal Questions

The IBLA decision discusses these legal questions:

1) Did the BLM properly consider the evidence of the private surveys before it determined the section corner common to Sections 29, 30, 31 and 32 was lost?

2) Did the BLM properly apply the double-proportionate method to calculate the position of the section corner common to Sections 29, 30, 31 and 32?

3) Did the BLM improperly ignore Simpson's bonafide rights to the area he had occupied?

The IBLA Decision

Let's see what the IBLA had to say about the three legal questions in its decision.

Question #1: *Did the BLM properly consider the evidence of the private surveys before it determined the section corner common to Sections 29, 30, 31 and 32 was lost?*

Yes.

The IBLA found the BLM did properly consider the evidence of the private surveys. Its finding was based on the following facts in evidence:

1) BLM had obtained copies of the private surveys as part of the dependent resurvey.

2) BLM had examined the private surveys for evidence related to the disputed section corner.

3) BLM had properly concluded the evidence on the private surveys related to the disputed section corner wasn't enough to establish it as a found or obliterated corner instead of a lost corner.

In its decision the IBLA agreed with the BLM that the private surveys didn't contain the information required to establish the unmarked sandstone as the section corner. This was despite the fact that some of these private surveys showed the sandstone and accepted it as the section corner location. It said, for example, that:

"Without explanation or reference to the 1882 survey field notes and topographical data, the Delzell Survey utilized an unmarked sandstone (the Stone) as the record monument for the section corner."

It also said:

"BLM found these surveys to be inconclusive as to the location of the section corner, as the surveys either were inconsistent in their location of the section corner or lacked sufficient information regarding distances or bearings which could have been used to reconstruct the location of the section corner."

Question #2: *Did the BLM properly apply the double-proportionate method to calculate the position of the section corner common to Sections 29, 30, 31 and 32?*

Yes.

Simpson claimed that the original GLO surveyors never surveyed the east line of Section 31. Simpson claimed the original GLO surveyors had set the corner using a bearing and distance from the west section corner common to Sections 30 and 31. With this claim, it appears Simpson was attempting to place all the shortage on the east side of Section 30 entirely into

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Don't Use a Questionable Corner Monument

The IBLA makes it clear in this case, that if an alleged corner monument is rejected as the original monument, the rejected monument can't then be used to object to a proportioning method or to make a claim of bonafide rights. In this case, the unmarked sandstone monument couldn't be used to show the BLM's proportioning during the dependent resurvey was grossly in error, because the unmarked sandstone wasn't legally established as the original corner monument. In addition, the private landowners in this case couldn't claim bonafide rights in their disputed parcel boundaries based on reliance upon the sandstone monument, because the IBLA found the corner monument wasn't good evidence of the original surveys.

the length of the east side of Section 31. Simpson thus asserted the BLM had to take this error into account in its double-proportion calculations. However, Simpson provided no evidence of this fraud on the part of the original GLO surveyors, and the IBLA disagreed with Simpson's claim. The IBLA found no modification of the standard double-proportion method was needed, because no fraud had taken place in the original survey.

Simpson then claimed the double-proportion was faulty because it unjustly penalized the Simpson parcel when compared to the other parcels. Simpson's claim of injustice was based on the fact that the Simpson parcel lost more area as a result of the corner restoration by double-proportion than any of the other impacted parcels.

Again, the IBLA disagreed with Simpson. It found the double-proportion was properly applied, and that the loss of area to Simpson's parcel was proportionate to the size and configuration of his parcel. Commenting on this application of the double-proportion, the IBLA said:

"Delzell complains that the double proportionate measurement method used by BLM to reestablish the lost section corner failed to treat all entities equally. The crux of this argument is that, as a result of the resurvey, Delzell lost more acreage than other private landowners... Delzell mistakenly equates equal treatment with equal result. The double proportionate measurement method is a purely mathematical process which applies equally to affected landowners... Here, as the record shows, every landowner in the subject area had the same measurement method applied to his or her lands. BLM prepared a description of impacts showing that all areas, including lands owned by FS, received a proportionate share of impact. While the outcome of this measurement was different depending on the parcel, the disparate outcome does not mean that the underlying treatment of the landowners was unequal."

Question #3: *Did the BLM improperly ignore Simpson's bonafide rights to the area he had occupied?*

No.

Simpson claimed it had bonafide rights to the area it claimed before the dependent resurvey because it had properly relied on the 1981 Goff Engineering Survey, and thus the unmarked sandstone monument that Goff had accepted as the corner.

The IBLA found this reliance on the Goff Survey was insufficient to establish bonafide rights that would need to be protected in the dependent resurvey. It said of a dependent resurvey:

"It is, by definition, a restoration of the original conditions of the official survey, and therefore need not validate a landowner's title that is not based on patents grounded on the original survey ... the Survey Manual makes clear that private survey boundaries may be affected by a dependent resurvey.... Further, this Board has warned that "one who relies on other than an official survey that has been duly accepted and approved by the Secretary of the Interior does so at his peril."

Because there was a very weak link (or no link at all) between the unmarked sandstone and the monument set in the original survey, the IBLA found that Simpson couldn't prove a good faith effort to rely on evidence from the original surveys when locating his land.

Lessons

What are some lessons we learn from the legal issues we discussed in this second part of our review of this case? There are several lessons, but I will pick out only a few:

If you are going to rely on private surveys to establish a corner monument as the original corner monument, those maps should contain adequate details on the character of the monument marking the corner.

If you are going to use a private survey to establish a corner monument as the original corner monument, those maps should contain adequate bearing and distance ties to allow the corner to be related to other corner monument or physical features.

The results of corner restoration through proportionate methods do not require that each parcel impacted by the parcel lose or gain an equal area of land. The proportionate method is legally presumed to treat each parcel equally if it is executed in the manner defined by survey manual in place at the time of the dependent resurvey.

Reliance on a monument of questionable character accepted as a PLSS corner on private surveys doesn't give a land owner an adequate claim of bonafide rights.

Where The Private Surveys Fell Short

A number of private surveys were presented into evidence by the landowners in this case. Most of these surveys were reviewed by the BLM, and found to be poor evidence of the original corner location. The IBLA later upheld this conclusion of the BLM. Why did the IBLA find these private surveys falling short of the standard for good evidence? Each survey had its own errors, but a reading of the IBLA decision reveals these common shortcomings in the way the private surveys depicted the corner in questions:

1) The maps showed the disputed corner, but didn't provide sufficient bearing and distance ties to other corners or physical features that could be used to locate the disputed corner.

2) The maps accepted a stone as the corner monument, but didn't include details on the character of the stone monument or why it was accepted as the corner location.

3) The surveys made little or no attempt to relate the unmarked stone monument to features of the original GLO field notes or plat.

Survey Error Adjustment with Java and Groovy

(Part 2)

By Landon Blake,
Redefined Horizons

This article is the second in our series of articles that discusses survey error adjustment methods. It attempts to explain the concepts of error adjustment in a non-traditional way. It does this with examples and computer code rather than complicated math.

In the last article of the series, we covered these topics:

1) The definition of the terms "precision," "accuracy," and "granularity" as they relate to survey measurements.

2) The need to compare multiple sets of measurements to assess measurement quality.

3) The nine elements of a survey measurement error analysis and adjustment system.

In this second article of the series, we will discuss the following topics:

1) The 4 steps (related to error management) you should take when identifying the quality of survey measurements.

2) A short explanation of error type, magnitude, and sign.

3) The differences between potential errors, likely errors, estimated errors, and the actual errors in a survey.

4) The 4 techniques you can use to identify errors in your survey.

Basic Steps of Error Analysis After Survey Completion

After a survey is complete, what basic steps can you take to analyze the errors in your measurements? We are going to outline a 4-step process you can use to analyze errors on survey completion in most scenarios. Here are the four (4) steps:

1) Determine the type of possible errors in your survey.

2) Estimate the likely magnitude for the possible errors in your survey.

3) Analyze your measurement data to calculate actual measurement errors. Compare these to your estimated errors.

4) If the actual errors exceed the estimated errors, look for blunders and the accumulation of systematic errors.

Let's cover each of these steps in more detail.

STEP #1: Determine the possible errors in your survey.

The first step in analyzing the errors in your survey is to determine the type of errors that could have occurred in the survey measurements. In this step, you are focused on the **type of the errors**, not the magnitude of the errors. Your goal in this step is to have a short list of the potential errors in your survey. You need to think about the following factors when you create the list:

1) The type of survey being performed.

2) The type of instruments being used.

3) The methods used to execute the survey.

Let's consider a couple of examples. In the first example we will look at a level run in a vertical control survey. In the second example we will look at the layout of building corners as part of a construction survey.

Example #1: Level Run In a Vertical Control Survey

In our first example we've got a level loop completed as part of a vertical control survey. The level run starts at benchmark 32C, which has a known elevation, and runs through new benchmarks 102, 103, 104, and 105. The loop checks into benchmark 33C, then runs through new benchmarks 106 and 107 and ends at Benchmark 34D. The level run was completed with an automatic level (manual read) and a philly rod. Single readings were taken on the rod for each backsight and foresight. New benchmarks 104 and 105 were shot with intermediate foresights.

What type of errors could be present in our survey, given the type of survey, instrument used, and methods of execution? These errors would include:

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1) Problems with the existing benchmark elevations. (These problems could result from errors in the original survey that established the elevations, or because the physical benchmarks have been disturbed or displaced.)
2) Unbalanced distances between the instrument, backsight point and foresight point.
3) Misleveled instrument when rod readings were taken.
4) Misleveled rod when rod readings were taken.
5) A rod with missing sections or sections that have slipped from the correct position.
6) Busted rod readings. (These busted readings could result from heat shimmer, the distance to the rod from the level, number swapping with the reading is recorded, or a mistake when noting the location of the level cross hair on the rod bars.)
7) Slightly incorrect rod readings. (These incorrect readings could result from heat shimmer, the location of shadows on the rod, the distance to the rod from the level or other factors that make the rod difficult to read through the scope of the level.)

Example #2: Level Run In a Vertical Control Survey

In our second example we've got a total station survey to layout the corners of a building. The building corners were laid out from two instrument points using a common backsight point and a common check point. Corners 2052 to 2056 were laid out from Control Point 10. Corners 2056 to 2060 were laid out from Control Point 13. Control Point 13 was the common backsight point, and Control Point 17 was the common check point. Each building corner was marked with a single angle and distance. The building corners were laid out radially, not on line. A check shot was taken on the check point at the beginning and end of each occupation. Additionally, Corners 2055, 2056 were checked from Control Point 13 after being set from Control Point 10.

What type of errors could be present in our survey, given the type of survey, instrument used, and methods of execution? These errors would include:

1) Problems with the existing control point coordinates. (These problems could result from errors in the original survey that established the coordinates, or because the physical control point monuments have been disturbed or displaced.)
2) Misleveled instrument when angles and distances were measured.
3) Misleveled rod when angles and distances were measured.
4) Miscalibrated electronic distance meter on the total station.
5) Miscalibrated angular circles and measurement systems on the total station.
6) Imperfections in the electronic distance meter and angular circles.
7) Site conditions that impact the angle and distance measurements of the total station (fog, dust, heat or cold).
8) Improper prism constant setting in the total station/data collector.
9) Improper scale factor for distances in the total station/data collector.

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Maximum Accumulation of Random Errors or Blunder?

Random errors almost never accumulate to the maximum. The more observations in a chain, the less likely it is that this maximum accumulation will occur. If you are seeing error values that approach the amount that would occur in the maximum accumulation or random errors, you almost certainly have a blunder, and not just random errors that failed to cancel each other.

Kid's Corner

Kathy Nitayangkul:

I took my little cutie out for a day with mom. Ethan is 9 years old and loves joining me in the field.

Ethan Pugh

STEP #2: Estimate the likely magnitude for each type of error in your survey.

The second step in analyzing the errors in your survey is to determine the type of errors that could have occurred in the survey measurements. In this step, you are focused on the **magnitude of the errors**, not the type of the errors. When estimating the magnitude of the errors in your survey, you need to consider the size of the error, the number of times it can occur, the mathematical sign of the error, and any ripple effects. (See the sidebar for more on the elements of error magnitude.)

When estimating the error of magnitude, I focus my efforts on attempting to quantify random errors or systematic errors that don't accumulate. These types of errors can be ignored or adjusted in the survey. Their largest estimated values will set the bar we use to identify blunders or systematic errors that accumulate. Estimating the magnitude of blunders or systematic errors that accumulate can be more difficult, and is usually only helpful when we are trying to figure out what type of blunder we've made.

Let's see if we can come up with reasonable error values for our two previous survey examples.

Example #1: Level Run In a Vertical Control Survey

Here are estimates of two random error types in our level survey. The estimates include the likely size of the error, the mathematical sign of the error, and accumulation type of the error, and ripple effect.

Type of Error: Unbalanced backsight and foresight distances.

Size of Error: 0.005 to 0.040 US Survey Feet

Mathematical Sign: Positive or Negative (Sign depends on type of sight and the direction of tilt in the level plane of the instrument. The sign of these errors will tend to be randomly distributed between positive and negative signs.)

Accumulation: These errors may accumulate, but are just as likely to cancel. They will only accumulate if backsights are consistently shorter (or longer) than foresights.

Ripple Effects: If not canceled by an error of the same magnitude, this error will ripple through the entire level run or level loop.

Type of Error: Slightly Incorrect Rod Readings

Size of Error: 0.005 to 0.015 US Survey Feet

Mathematical Sign: Positive or Negative (The sign of these errors will tend to be randomly distributed between positive and negative signs. Even if the instrument man consistently reads the rod high and low, the signs will be opposite [and cancelling] on the backsight reading and foresight reading.)

Accumulation: These errors may accumulate, but are just as likely to cancel. Any accumulation of these errors will be random.

Ripple Effects: These errors will have little or no ripple effects.

Let's determine a total estimated error for our example level run. To keep things simple, let's just determine the likely size of the random errors, the number of occurrences, the likely total error if the individual errors cancel each other, and the total error if the individual errors accumulate.

For our calculations in the table, we need to remember that we have 6 level set-ups

continued on page 38

Magnitude – The Size, Number of Occurrences, Mathematical Sign, and Ripple Effect of Your Errors

When you consider the magnitude of errors in any survey, you need to think about four factors for each error type. These factors are the size of each possible error type, the number of occurrences of a possible error type, the mathematical sign of a possible error type, and any ripple effects of an error type. Let's return to our level loop as an example, and consider just one error type that can occur in differential leveling – an out-of-plumb level rod.

What is the possible size of the error caused by an out-of-plumb level rod? This depends in part on how far out of plumb the level rod is ... but it often helps in error adjustment to think about the typical case. Let's assume we've got a diligent rod man who is plumbing the level rod without a hand level bubble. It seems safe to consider the typical size of our error for an slightly out of plumb rod to be 0.02 or 0.03 feet. We could confirm this with some testing that incorporated a deliberately out of plumb rod.

How many times could this error occur in our differential leveling survey? There could be one possible occurrence each time a rod reading is taken during the survey. However, we need to remember we only want to count the occurrences of rod readings on a turn point if we are looking at the errors impacting the closure on a closed level loop. (We wouldn't count the rod readings on intermediate foresights.)

What are the mathematical sign of these errors? The sign could be positive or negative depending on the type of reading (backsight or foresight). There should be an even number of positive errors and negative errors, which means these errors will typically cancel and not accumulate.

Does this type of error have any ripple effects? Yes. Their error in a misleveled rod will impact all subsequent elevations calculated as part of the differential level loop or level run.

in our loop, 6 backsights, and 6 regular foresights.

In a perfect world, we know that our random errors will exactly cancel, and our total error in the level run would be 0.000 US Survey Feet. In practice, we know this doesn't happen. Most level runs have at least a small amount of closure error, and the longer a level run is the more error it will have. As a result, we will assume in our calculations that 1 out of 8 random errors will accumulate instead of cancel.

Error Type	Size Estimate (Average)	Number of Occurences	Likely Total Error	Maximum Total Error
Unequal backsight and foresight distances	0.01	6	0.008	0.060
Slightly misleveled instrument	0.015	6	0.011	0.090
Slightly misleveled rod	0.005	12	0.020	0.120
Slightly incorrect rod reading	0.005	12	0.015	0.060
Totals			0.041	0.330

STEP #3: Analyze your measurement data to calculate actual measurement errors. Compare these to your estimated errors.

The third step in our process is to calculate the actual measurement errors from our survey and compare these to our estimated errors. There are three ways to calculate the actual amount of errors in our survey:

1) Compare your measured values to more accurate existing values, or values you will "assume" contain no error.

2) Use mathematical closures or geometric rules.

3) Use average or best fit values.

Once your actual error values are complete, you compare them to your estimated values and ask this important question:

Do my actual error values match my estimated accumulation of random errors?

If the actual error values are larger than the estimates, you need to:

1) Take a hard look at your random error estimates.

2) Look for blunders.

3) Look for the accumulation of systematic errors.

Example #1: Level Run In a Vertical Control Survey

What does the table from Step #3 in our example survey show us?

If we've properly estimated our errors, we would expect to find we misclose on the elevation for Benchmark 34D by around 0.04 US Survey Feet. Any misclosure that is smaller than this means our random errors are cancelling each other at a rate that is smaller than 1 in 8, or that we didn't do a good job estimating the size of our random errors. We also can see that any misclosure error of 0.33 US Survey Feet or more must be a blunder or accumulation of systematic error.

STEP #4: If your estimated errors are much larger than your estimated errors, look for blunders or systematic error accumulation.

The fourth step in our process is to look for blunders or systematic error accumulation. This is only necessary if our actual errors exceed our estimated errors.

When you look for blunders, you may need to go back and reconsider the type of errors in your survey. Which of these errors are the result of blunders or systematic error accumulation, and what would the likely size of these errors be?

If the cause of a blunder isn't obvious from the data, in can be dangerous to guess. A better choice is to repeat observations in part of the survey to determine and fix the blunder.

Example #1: Level Run In a Vertical Control Survey

Let's return to the example of the level run from our vertical control survey. What would we do if our calculated closure on Benchmark 34D was 1.06 US Survey Feet?

This is well above our threshold of 0.33 US Survey Feet. That means we need to start looking for a blunder or the accumulation of systematic error. Most surveyors with experience in differential leveling will immediately recognize that our misclosure amount is likely made up of a random error accumulation and a blunder. The 0.06 feet in the 1.06 feet misclosure is likely the random error from our level loop, and is close to our 0.04 estimate of the likely accumulation of random error. The 1.00 foot in the 1.06 feet misclosure is a blunder that likely resulted from misreading the whole foot number on a backsight or foresight. We need to track down the incorrect rod reading to fix the blunder. Given the design of our level run, this will be difficult to do. We can likely determine if the busted reading occurred between Benchmark 32C and Benchmark 33C or Benchmark 33C and Benchmark 34D based on our measured elevation for Benchmark 33C. If we had executed a run from Benchmark 34D back to Benchmark 32C (forming a loop) and had tied the same temporary benchmarks, we could isolate the backsight/foresight pair with the busted reading.

Preventing & Managing Errors In Surveying

In this article we aren't talking about the actions a land surveyor takes to prevent errors in a survey. That means, in this article, we aren't talking about:

1) Survey planning.

2) Error budgets in surveys.

3) Field crew training for error reduction.

4) Selection of survey methods as part of error management.

5) The role of equipment maintenance as part of error management.

I hope to talk about preventing errors in surveys in a future article.

— MEMBER PHOTOS —

Carol Knox visits the Greenwich Meridian

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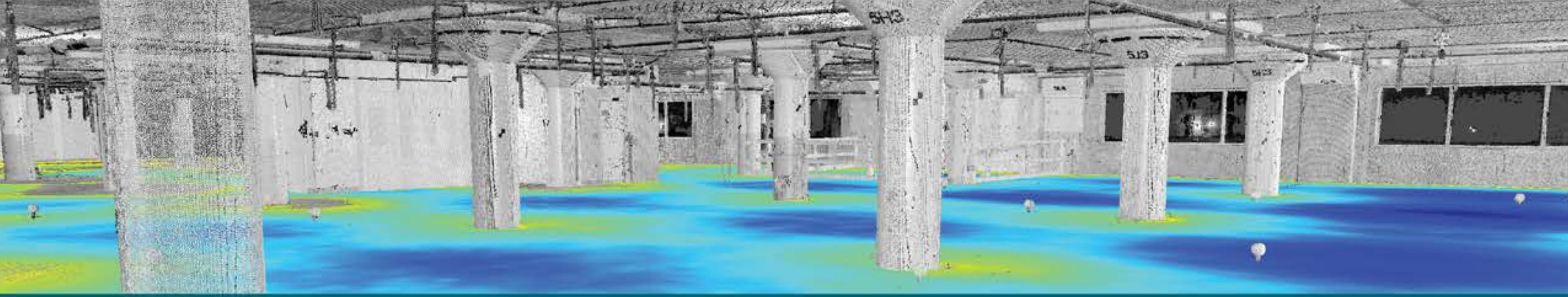

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