CALIFORNIA SURVEYOR

ISSUE #183
SUMMER 2016

A FUTURE WORTHY OF OUR PAST

50th Anniversary Conference Wrap-Up

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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.*

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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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COLUMNS

FEATURES

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

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

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

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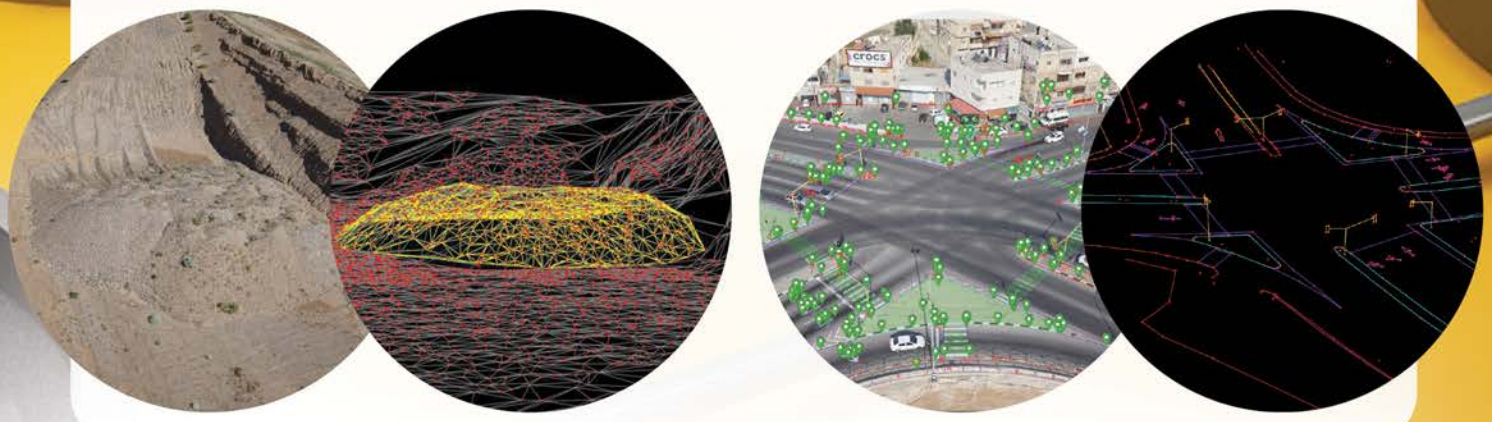

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PRESIDENT'S MESSAGE

Roger K. Hanlin, PLS
CLSA 2016 President

This year the California Land Surveyors Association is celebrating its 50-year anniversary and I am honored to serve as President for this special year. I am even more pleased to write this President's message following a great 2016 conference in Sonoma County, the birthplace of CLSA.

The conference was well represented with members from all across the state attending workshops and special sessions with a variety of topics hosted by national speakers, attorneys, college instructors, CLSA members and representatives from state and federal agencies. The theme of our conference was paraphrased from President Ronald Reagan's second inaugural address "A Future Worthy of Our Past" to honor the accomplishments of all those who gave their time, talent and energy to make CLSA all that it is today. That inaugural address spoke of a new beginning, restored confidence and the tradition of progress.

In many ways CLSA, at 50 years old, should be reminded how this year can embrace the spirit of a new beginning and build upon our past accomplishments to restore confidence in our membership and continue the tradition as we progress into the next fifty years.

CLSA has been shaped and guided by a half a century of hard work from many dedicated individuals who strived to organize, manage and motivate professional colleagues who joined together in an effort to enhance the profession of land surveying. I had the privilege to meet and speak with a few of our founding members and original signers of our Articles of Incorporation during the conference at the Trentadue Winery Gala in Healdsburg, California. The founding members in attendance were Robert (Bob) Curtis, Joseph Scherf and Earl Ray Cross. The signers of the original Articles of Incorporation in attendance were Paul Lamoreaux, Jr. (Current Director) and Larry Cloney.

Every one of those original members gave heartfelt testimonials with passion and reflection of the ideals that motivated them and fellow founders to create an association to promote the profession of land surveying. Bob Curtis stated "Back then it was a lot of hard work and we fought many battles." Briefly pausing for a moment, I responded "After 50 years, it's still a lot of hard work and we're still fighting many battles." I thanked those gentlemen on behalf of all CLSA members for creating an association that continues to promote and influence the profession of land surveying nationally, across the state and in our communities.

As I reflect on the comments of our founders, I am reminded of the reason I became a member of CLSA thirty years

continued on page 4

ago. It was the desire to keep informed with current practice standards, legislation, new technologies and pursue continuing education. I wanted to be a part of an association of dedicated professionals who joined together for a common purpose to share ideas, set goals and take action that raise the level of expectation in ourselves and our profession. It was a new beginning in my career.

We must all remember why we joined CLSA and why we need to spread the word to non-members how CLSA provides the opportunity to fulfill higher career expectations which results in higher career performance. We must emphasize how CLSA provides a place to keep informed of current standards and for ideas and suggestions to rise from the local chapter level to state level for development and action through the many committees and liaisons currently working daily for the benefit of our membership.

CLSA is also a place to develop leadership skills that make a difference and influence others. Those who choose to volunteer their time and effort to lead will be rewarded with the personal satisfaction that they had a part of something that, in some way, changed the surveying profession for the better. This gives CLSA purpose and serves the land surveying profession and ultimately the public.

Since becoming an officer in CLSA, I have been mindful of the sense of responsibility to the membership not only to perpetuate the original ideals from 1966 but to keep an open mind to new ideas and suggestions. We should do this with professional respect, adhering to the right rules of conduct and civility during debate befitting a professional association. This allows a positive atmosphere of sharing ideas, healthy discussion and effective group decision making for the benefit of CLSA members and the land surveying profession.

We should embrace the spirit of a new beginning with every new member, chapter, student chapter, liaison, committee member, committee chair, officer, executive director, management company and editor who bring their inspiration, passion and perspective with their new beginning in the pursuit of knowledge, ideas, goals and action. In turn, they will encourage others to get involved in pursuit of higher expectations for themselves and their profession. Embracing this spirit of new beginning restores confidence and keeps CLSA vibrant and vital to the membership, profession and ultimately the public as we continue our tradition to progress into the future.

EDITOR'S MESSAGE

Landon Blake
California Surveyor Editor

I'm very pleased to introduce the Summer 2016 issue of the *California Surveyor Magazine*. Before I provide you with a brief overview of the articles in this issue, let me thank a few of the hard working volunteers and team members that helped bring this article together. Jeff Burgess, Anne Hoppe, Ron Nelms, Dave Wooley, Ken Wilson, Rudy Misland and Daniel Katz all contributed content to this issue. I appreciate their patience as I learned the ropes as editor. Jeff Burgess and John Berkowitz at CAMS also helped assemble the magazine and prod me along when other work got in the way. David Kendall and Dave Wooley helped with article editing, and Pat Tami provided photos.

Here is a brief overview of the articles in this issue:

Jeff Burgess provides a wrap-up of our annual CLSA Conference. Anne Hoppe helps us understand the (at times) tricky rules related to public dedications on old subdivision maps by looking at five court cases that deal with the related legal issues. Dave Wooley explains how a land surveyor can be held liable to a party with which he doesn't have a direct contractual relationship. Ron Nelms offers a true story about using right-of-entry when a land owner is determined to destroy property corner monuments. Ken Wilson takes a look at fences and how they play a role in boundary determination. Student Rudy Misland offers an implied caution for users of RTN with his comparison of RTN and RTK precisions. Daniel Katz wraps up this issue with a discussion of using unmanned aerial vehicles in your land surveying business.

I'm pleased to let you know the article by Dave Wooley in this issue is the first in a new regular column about the business of land surveying that will be written by members of the Orange County Chapter. I've met a lot of great land surveyors and civil engineers that weren't very good business men and women. Perhaps this regular column can offer advice on how we can all make improvements to the way we run our businesses.

We are already getting content lined up for the Fall 2016 issue, including the introduction of two more regular columns. The first of those new columns will review IBLA decisions related to land surveys, and the second will gradually walk through the concept of measurement error adjustment with the help of open source code in the Java programming language and Groovy scripting language.

I've also put together a simple set of article submittal guidelines. Please shoot me an e-mail if you'd like a copy, or if you have any other feedback on this issue of our association's magazine. I invite article contributions on a variety of topics! (We need to hear from a more diverse set of voices from within our profession and from within related professions.)

Let me conclude my again thanking everyone that helped me edit and produce this issue of *California Surveyor Magazine*. I deeply appreciate their assistance.

Roger Hanlin receives the California Senate Resolution recognizing National Surveyors Week.

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CENTRAL OFFICE REPORT

Jeff Burgess
CLSA Executive Director

As previously announced to the membership, the Executive Committee of the CLSA selected California Advocates, Inc. Association Management Services division (CAMS) as the incoming association management firm. CAMS currently provides a broad range of management services to a diverse variety of state and regional association clients. For CLSA, California Advocates, Inc. uniquely combines a solution based legislative and regulatory advocacy program led by longtime CLSA lobbyist Ralph Simoni, with a full-service association management firm providing an array of services including complete management services, financial planning, and conference execution.

CAMS has hired Jeff Burgess as Senior Account Executive to serve as CLSA's Executive Director. The Board of Directors has affirmed CAMS' contract and approved the appointment of the Executive Director. Jeff has a successful history in communications and management in the engineering, construction and non-profit sectors. Most pertinent to his new role, Jeff previously served as Membership Director at the Consulting Engineers and Land Surveyors of California (CELSOC – now known as ACEC California). Jeff also previously held senior management positions at a solar photovoltaic association, an engineering outsourcing firm and was most recently Director of Operations and Membership for the Northern California Golf Association in Pebble Beach.

CLSA has been actively representing California's professional surveyors, particularly in the State Capitol. Among the issues that have risen recently:

A CLSA-led effort neutralized potential revisions of the Professional Land Surveyors Act ("PLSA") during the current Legislative Session. Amending California's Business and Professions Code § 8726 is a delicate and sensitive endeavor because it embodies the "core principles" of the surveying profession in the state. CLSA believes that, rather than just amending Section 8726, a more holistic approach is necessary including conducting educational outreach programs to affected stakeholders (e.g., contractors). This education outreach will help to foster compliance with Section 8726 and will promote a strong working relationship with the Board of Professional Engineers, Licensed Land Surveyors and Geologists ("BPELSG") so that there are disciplinary consequences for noncompliance. These components will ensure that more parties are aware of land surveying's defined scope of practice and the consequences for violating this scope. CLSA is committed to continue working with a broad coalition of partners to update and modernize the PLSA to address compliance issues related to emerging technology.

CLSA rallied to support the American Council of Engineering Companies (ACEC) sponsored Senate Bill 885, which prohibits contracts that require state licensed design professionals, including engineers, land surveyors, architects, and landscape architects, to defend claims made against other persons or entities involved in construction projects. Design professionals will pay their proportional share of defense costs. However, when insurance coverage is not available, it is unfair to obligate them to defend lawsuits against other persons or entities.

Jeff Burgess, CLSA Executive Director

CLSA's Legislative Committee made numerous comments regarding the Board for Professional Engineers, Land Surveyors and Geologists (BPELSG) rulemaking proposal to amend Section 464 of Title 16 of the California Code of Regulations relating to updating language regarding the Corner Record.

CLSA is an active participant in the Department of Industrial Relations (DIR) Technical Advisory Committee reviewing Title 8, Construction Safety Orders, to consider potential health and safety concerns associated with working alone during field surveying operations.

In addition to all of the legislative and regulatory affairs CLSA is overseeing, the Central Office has successfully transitioned all of the day-to-day activities to CAMS. The Central Office is proud to serve CLSA members and is available to answer any questions or provide assistance.


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A FUTURE WORTHY OF OUR PAST

CLSA 50th Anniversary Conference Wrap-Up

Thank you to the nearly 450 participants who came together to celebrate 50 years of CLSA at the 2016 Annual Conference in Sonoma – the birthplace of CLSA! Coincidently, the 2016 Conference also provided the opportunity to commemorate 125 years of professional surveying licensure in the U.S., with California being the first state to license in 1891. Conference goers enjoyed an expansive continuing education program, a sold-out exhibit hall, the ever-popular CLSA Education Foundation Auction and Party and – capping the event – a festive 50th Anniversary Gala at beautiful Trentadue Vineyards in Geyersville.

The conference curriculum began with one-and-a-half days of pre-conference workshops featuring nationally renowned presenters Dr. Jan Van Sickle and Gary Kent. Concurrent with the workshops and held throughout the conference, 30-40 attendees participated in the LS review track developed to assist those preparing for the exam. Sunday's opening ceremonies and general session featured a presentation on the future of surveying from Chris Bradshaw, Senior Vice President at Autodesk. Following opening ceremonies, attendees chose from over 40 breakout sessions, from Sunday to Wednesday, featuring topics that encompassed the wide diversity of surveying practice issues in California.

The 2016 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 13 generous sponsors. CLSA's 50th Anniversary Conference could not have materialized without the collaboration of these terrific businesses.

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

continued on page 10

Cocktail Reception and Live Scholarship Auction again featured "Lightning" – CLSA's favorite auctioneer – keeping attendee's entertained as he coaxed donations from the crowd. The 2016 Conference was a tremendous success for the Education Foundation, raising $16,574 in scholarship revenue for surveying students here in California.

Unique to the CLSA Annual Conference was the 50th Anniversary Gala, held on the stunning grounds of Trentadue Vineyards in Geyersville. Conference attendees were

thrilled to celebrate the presence of three CLSA Charter Members and two additional members that signed CLSA's original Articles of Incorporation. After a terrific meal featuring Trentadue's award-winning wines, many attendees shared stories of CLSA comradery and tales of surveying in the Golden State – all a fitting tribute to CLSA's 50th Anniversary!

The 2016 CLSA Conference featured all of the terrific elements of the annual gatherings of the past, along with singular events to celebrate the association's 50th anniversary. Congratulations to CLSA Conference Committee Chair, Aaron Smith, and the entire committee for a job well done delivering an event that exemplified the conferences theme: **A Future Worthy of our Past!**

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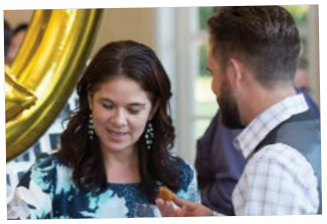






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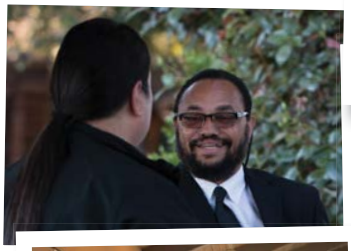



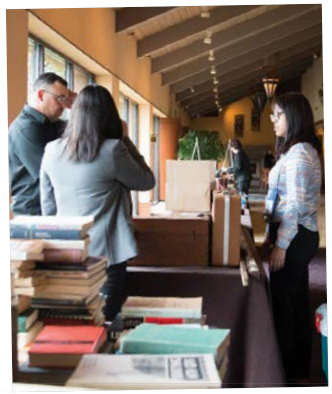






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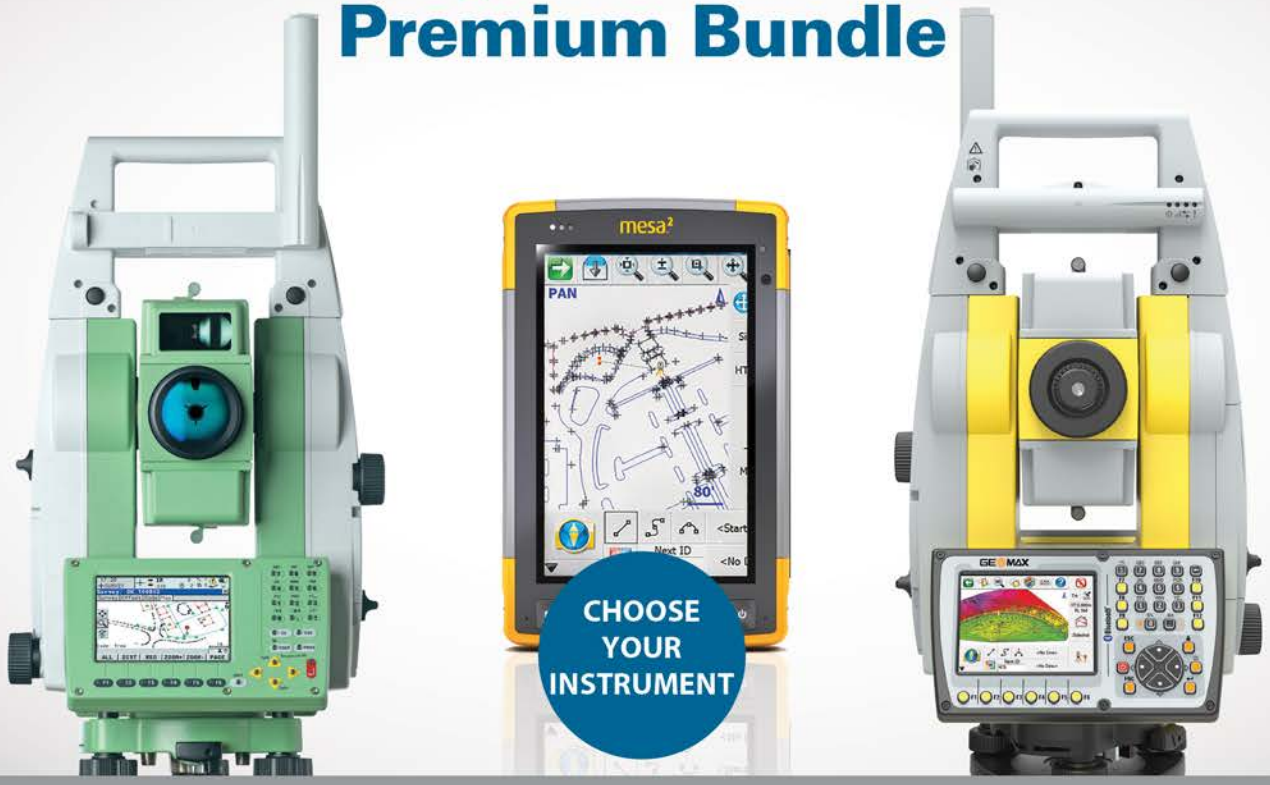

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EARLY CALIFORNIA – Act and Intents of Dedication

By Anne Hoppe

The Early Land Rush

California's earliest settlers arrived engaged in rampant land speculation. Much land was acquired and subdivided with hopes by the owners of making a fortune on the smaller lots. Some entrepreneurs sold their mapped parcels, some did not; some filed their maps with the County, some did not. The courts have interpreted their acts and conduct as evidence of their intentions. We will discuss the actions and intentions of subdividers to dedicate land for public use such as streets prior to 1901. There was not a specific statute related to the dedication of public road right-of-way before 1901, thus the actions and intentions of the subdividers in these situations are paramount.

Dedication of Streets by Map – Then and Now

Early maps riddle the California landscape. During the fledgling years of the state, it was common practice to record maps with the County Recorder. The Political Code of 1850 § 4234 prescribed the duties of the recorder to keep "all the books, records, maps and papers deposited in his office." In addition, §3658 required the Board of Supervisors to provide maps to the assessor "... showing the private lands owned or claimed in the county, and if surveyed under authority of the United States, the divisions and subdivisions of the survey; if held under Spanish grants, the exterior boundaries of such grants and the number of acres claimed. Maps of cities and villages, or school districts, may in a like manner be provided...."(Durkee 2012, 115).

Today, streets are offered for dedication as shown on a map and must be accepted, or rejected, by the government body. (A dedication may also be offered without a map. It may be explicit via the map or by a separate instrument. The dedication can also be implicit as determined by the acts of the parties.) The statute that eventually required the recording of a subdivision map was enacted 9 March 1893, as Chapter 80 of the 1893 Statutes (Act of 1893). The Act of 1893 simply required that developers record their maps for the purpose of sale of lots shown thereon (1893 Cal Stats, c LXXX). It was not required by statute to formalize a road right-of-way dedication until the 1901 Act (1901 Cal Stats, c CXXIV). The 1901 Act required the map be presented to the government body for acceptance of the streets on behalf of the public for their use. In general, an "offer" and an "acceptance" was required for a dedication to be complete. Courts have subsequently determined the acts of offer and acceptance are not always required to be formal. (For example: When the public begins to actually use a road, formal acceptance by the agency may not be required for "acceptance." In addition, actions of a public agency related to the road, such as maintenance of road improvements, may constitute acceptance.)

This article reviews cases which established principles of "*intent and conduct*" required to effectuate dedications or roads and street to public use occurring before 1901. The case narratives have been condensed, however the pertinent facts remain intact. (The maps used in this article are for illustrative purposes only and were not derived from case records. The intent is to assist you in picturing the scenario to understand the cases.)

The Sale of a Lot Shown Adjacent to a Public Street Is an Act of Dedication

Kittle v. Pfeiffer [22 Cal 485 (1863)]

Legal Principles:

> *The sale of a lot shown adjacent to a public street is an act of dedication.*

continued on page 14

The sale of a parcel described as adjacent to a public street is an act of dedication. (A controlling call to the "side" of the road or street right-of-way instead of the "centerline" doesn't change the application of this principle.)

In 1854, Pfeiffer quitclaimed to the City of San Francisco 'Belle Air Place' and 'Pfeiffer Street' to be kept forever as public highways. The deeds were recorded. Subsequently, in October 1855, Pfeiffer mortgaged to Kittle Lot 1494 ($10,000). The legal description was by a metes and bounds calling distances to Belle Air Place and Pfeiffer Street. In 1857, Kittle obtained a decree against Pfeiffer foreclosing the mortgage and the premises were finally conveyed to Kittle by a Sheriff's deed. Kittle continued to possess said lot. The lot included a building erected by Pfeiffer. Pfeiffer commenced the building of another structure within the confines of Belle Air Place and Pfeiffer Street. Pfeiffer also threatened to enclose and completely obstruct the streets. (*Kittle* p.3)

Records indicate that neither the City of San Francisco nor the public ever actually accepted the streets. From these facts the trial court initially found that the streets never existed. The principal question of the case was 'what acts are necessary to constitute a dedication of land to public use.' (*Kittle*, p.3) Many prior cases were used by the Supreme Court to establish that the doctrine of dedication is applicable to streets, parks, cemeteries, alleys, squares and landings. Such a dedication may be without any grant or conveyance and if there is a grant, a dedication is valid even if there is no designated grantee ("the public" is the implicit grantee). Therefore, the Supreme Court held, a sale of a lot according to a map, on which streets, alleys, squares, landings or parks are marked out, is a dedication to public use. Furthermore, a sale of a lot described as bounding on a street is of itself a dedication without any further action. Whether the lot is bounded by the center of the street or the sideline, the dedication is the same (*Kittle*, p.4).

Based upon principle the court determined that the deed to the City and the mortgage to Kittle were a dedication to public use. Pfeiffer insisted that the mortgage descriptions included distances to the sidelines of the streets; therefore did not include the streets. The court further found that the principle of law is that where a line is described running to a certain object, the object holds. The street is the object. Furthermore, the deeds to the City did not pass title to the soil, but only a dedication to public use (*Kittle*, p.5).

The Laying Out of a Tract of Land Into Lots Adjacent to Streets and Selling the Lots Without Limitation is an Act of Dedication

Stone v. Brooks [35 Cal 489 (1868)]

Legal Principles:

The laying out of a tract of land into lots adjacent to streets and selling the lots without limitation is an act of dedication.

There is a presumption that lots sold adjacent to public streets have a greater value, and that a public street dedication (and not a private street) will be assumed when there is a lack of contrary evidence.

This case is to recover the cost of improving Perry Street by assessing the lots fronting on the street. It is to be determined that the City of San Francisco Board of Supervisors had jurisdiction of Perry Street and was authorized to make improvements. Stone insists that the street is public and the City had jurisdiction while Brooks insists that Perry Street is a private street and not subject to the jurisdiction of the Board of Supervisors (*Stone*, p.3).

In 1861, there were three lots (100 vara each) – 76, 77 and 78. The three lots fronted on the southerly line of Harrison Street, and were laid out east to west. Third Street bounded lot 78 on the west and Second Street bounded Lot 76 on the east. Perry Street was laid out by an unknown entity through the approximate east- west center of Lot 78. Houses were built upon the street frontage with access from the west via Third Street. Mrs. Masterson owned Lot 77 and mapped it in 1861. She also extended Perry Street to the west line of Lot 76 through the west-east center of Lot 77 as shown on her plat, thus creating a cul-de-sac, not a thoroughfare. The lots on her plat were numbered one to thirty-three and they fronted upon Perry Street. Masterson sold the lots of her subdivision at public auction as represented on her map. Brooks purchased ten lots at the auction of which five fronted upon Perry Street. Others purchased lots across from Brooks on Perry Street. (Stone may have been one of these. It is not clear in the case.)

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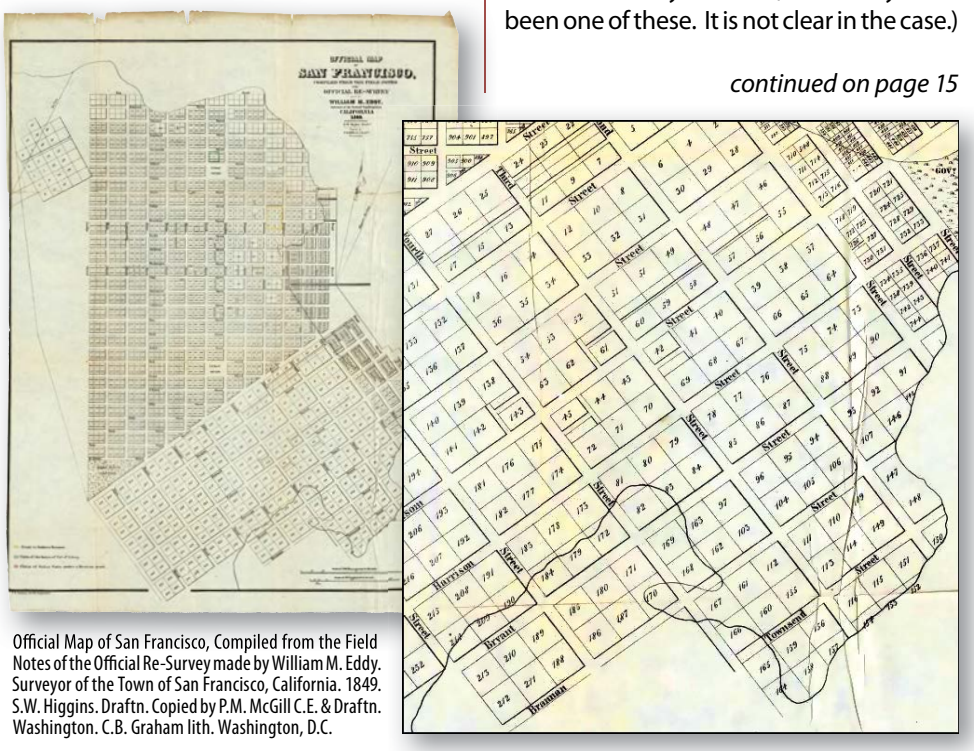

Official Map of San Francisco, Compiled from the Field Notes of the Official Re-Survey made by William M. Eddy. Surveyor of the Town of San Francisco, California. 1849. S.W. Higgins. Draftn. Copied by P.M. McGill C.E. & Draftn. Washington. C.B. Graham lith. Washington, D.C.

All new owners built homes upon their lots with access only available from Perry Street. Masterson sold the remainder of her lots in a private sale and the descriptions included Perry Street. Though shown on Masterson's map, Perry Street was never officially conveyed to the City (*Stone*, p.4).

In 1862, an Act relating specifically to the City of San Francisco, provided that all the original streets and all other streets, alleys, places, lanes and courts were dedicated to public use and declared to be open public streets. This empowered the City to improve the public right of ways. The Act created the law that the government body must accept a street, but the court did not deem this as a requirement as it would destroy the common law doctrine of dedication. Unless the street was dedicated to public use, the city had no obligation to keep the street in a safe condition. In this case, Perry Street was subject to grading to benefit the public safety (*Stone*, p.4).

The facts are that Mrs. Masterson conveyed lots with the presumption to achieve the greatest profit. A lot fronting on a public street was considered more valuable than a lot fronting on a private street, since there are fewer restrictions. There was no evidence in the conveyances that indicated any limitations to the sales. In addition, the lots were represented as bounded by Perry Street and to access the lots, which were a subdivision of Lot 77, one had to pass through Lot 78 including Mrs. Masterson. If Perry Street were a private street, she would not have had the right to pass through Lot 78; therefore it was necessary for Perry Street to be a public street for Masterson to convey her platted lots (*Stone*, p.5).

Numerous cases assume and recognize that a dedication is made by the owner and such action precedes any act of the public in order to make a public thoroughfare. The act of opening the street and making improvements was an act by the City, accepting and perfecting the dedication. The question in this case is whether Masterson dedicated the street via her conveyances as to authorize the Board of Supervisors to improve the street. The court found that there is no difference in dedication by a party whether they laid out a town or a new subdivision within a platted town. The act of laying out lots bounded by streets without any limitations is in itself an offer of dedication. (*Stone*, p.6). The fact that Perry Street was a cul-de-sac versus a thoroughfare did not change the presumption that the lots were sold to the greatest profit ... a public street.

Subsequent Remapping of Land Shown as a Street on a Record Map Was Revocation of the Unaccepted Offer of Dedication

Hayward v. Manzar, et al [70 Cal 476 (1886)]

Legal Principles:

> *The subsequent remapping of land shown as a Street on a previously filed subdivision map was a revocation of the unaccepted offer of dedication.*

In 1854 Castro claimed to own Rancho San Lorenzo under a Mexican land grant. He caused a map to be made and a town laid out named San Lorenzo, later to be renamed Hayward. He filed the map with the recorder of Alameda County. In 1856, Castro caused a second map to be made and recorded. He materially changed the layout of the first map by increasing the size of the blocks. Both maps depicted Castro Street, however the 1856 map depicted it further to the southwest than depicted on the 1854 map (*Hayward*, p.2).

Castro Street, as shown on the 1856 map ran in a northwesterly direction through town and intersected the county road, leading from San Leandro to Mission of San Jose, south of a line on the 1854 map marked Pierce Street. South of the intersection, Castro Street was opened and used as a public road. North of the intersection, Castro Street was not opened and used by the public (*Hayward*, p.2).

Later in 1856, Castro conveyed to Hayward a portion of Rancho San Lorenzo, lying north of Pierce Street and east of the county road. The conveyance included Castro Street as shown on the 1856 map and the county road was the recognized boundary. Hayward fenced his land and planted another row of trees in addition to the row that Castro had already planted along the boundary. Additionally, a

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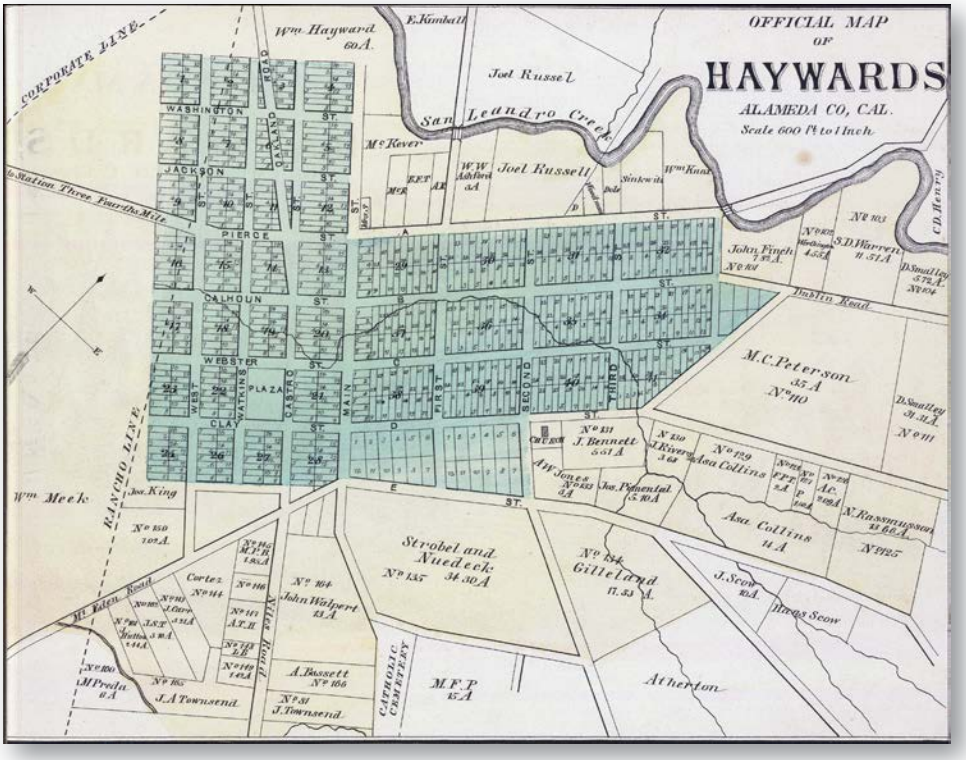

Official map of Haywards, Alameda Co., Cal. (Published by Thompson & West, Oakland, Cala., 1878)

few more conveyances were made in accordance with the 1856 map (*Hayward*, p.2). In 1858 and 1859, Castro mortgaged the balance of his rancho, including the town site. The mortgages were foreclosed upon and Atherton obtained possession. In 1862, Atherton filed a new map of the town, showing Castro Street as being cut off at the intersection with the county road. Therefore Castro Street no longer was depicted as extending onto Hayward's land. Atherton made many conveyances with reference to his map (*Hayward*, p.3).

In 1876, the town of Hayward was incorporated. The board of trustees, thence accepted the dedication of Castro Street as filed by Castro in 1856. The marshal tore down Hayward's fence, dug up his trees and opened the road for public use (*Hayward*, p.3). Hayward brought an action to recover damages alleging that the town representatives were trespassing upon his property. To determine if there was trespassing, it needed to be determined if Castro Street had been dedicated to the public. The court made a judgment based on the following facts:

1) The public did not use Castro Street, as it was intended on Castro's map.
2) By preference, the public used the county road.
3) Hayward, for approximately twenty years, had exclusive possession of his land, including the alleged street.
4) Neither the public, nor the county had at any time accepted or used the land as a public street.
5) Four years prior to the county's actions, Hayward fenced his property with a substantial picket fence.
6) Two rows of trees were planted on the property, one row by Castro and one by Hayward.
7) Hayward had filled and graded the land (*Hayward*, p.2).

It was determined that the proceedings taken by the town of Hayward to remove the trees and fence were not authorized, since their claim to the street was invalid in such that the street had never been dedicated, used or accepted as a street. Castro Street was remapped with Atherton's map of 1862, prior to the incorporation of Hayward.

The Sale of Lots In a Subdivision Is an Act of Dedication For the Town Square Shown On the Subdivision Map

San Leandro v. Le Breton [72 Cal 170 (1887)]

Legal Principles:

> *The sale of lots in a subdivision is an act of dedication for the town square shown on the subdivision map.*

In 1854 Estudillo owned the six thousand acre Rancho San Leandro, situated in Alameda County. The Estudillo's proposed a town site for two hundred of the six thousand acres. They hired a survey of lots, blocks and streets and caused a map to be made. All of the streets were named; lots and blocks were numbered, except for one block, which was not numbered or divided into lots, and it was depicted as Court Square on the map. Estudillo Street, Ward Street, Davis Street and Martinez Street bound Court Square. The map was recorded with the county recorder and certified as a plat of the town in 1855. The map was exhibited to purchasers and all deeds were made referring to the map (*San Leandro*, p.2).

The town was incorporated and made a body politic in March 1872. The Board of Trustees caused a new survey and plat to be made. It was an exact duplicate of the 1855 map and was adopted and approved by resolution and ordinance in December 1872. Between 1855 and 1857, the Estudillo's sold more than eight blocks and thirteen lots. One of the blocks was opposite Court Square and the public square was represented to the buyer (*San Leandro*, p.2).

Court Square was open and used as a public square for 8-9 years subsequent to the map recording in 1855. Either in 1862, 1863 or 1864 one of the defendants enclosed the square along with their adjacent block on which they resided and erected a barn on the block depicted as Court Square. In addition they planted a portion of the enclosed area. This caused the complaint (*San Leandro*, p.2).

The court found "That the town proprietors in making the map and plat of the town, as

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Map of San Leandro, Alameda Co., Cal. (Published by Thompson & West, Oakland, Cala., 1878)

stated, and in placing the same as public record of the county in the office of the recorder, it operated as a declaration on their part to dedicate the place named 'Court Square' to the purposes of an open, public town square for the use of the inhabitants of the town and the public. That in immediately following up the making and filing of the said map and plat by sales and conveyances by them of lots and blocks in the town to bona fide purchasers, in accordance with such map and plat, such dedication became absolute and irrevocable" (*San Leandro*, p.3).

Then it was further argued that the subdivider never intended that the square be dedicated. The intention was for San Leandro to be adopted as the county seat and Court Square to be the courthouse location. However, in December 1854, the subdivider executed a deed for four acres in favor of the County of Alameda for the exclusive use of a courthouse and other required ancillary buildings. In August 1856, another deed was executed in favor of the county for block nineteen according to the subject plat and the site was selected for the courthouse and jail by the board of supervisors (*San Leandro*, p.4).

The court further found "That neither at the time of the making of said survey and plat by the proprietors, to wit, some time previous to the twenty-ninth day of December, 1854, or at the time said plat was filed as aforesaid, or at any time, did said proprietors intend that said place, named on the plat 'Court Square,' should be used for the erection of county buildings, or be used in any manner for county purposes; but, on the contrary, it was the intention of said owners and proprietors, in laying out said town as aforesaid, that this place, so left by them open and vacant, and by the name 'Court Square,' should forever be and remain an open, public square for the use of the town and the inhabitants thereof and the public" (*San Leandro*, p.4).

A Plat Showing Streets Is a Mere Offer of Dedication; An Act of Acceptance Is Required

People v, Reed [81 Cal 70 (1889)]

Legal Principles:

> *A plat showing streets is a mere offer of dedication. An act of acceptance by the public agency is require.*

This case was against Reed, a subdivider, to declare Divine Street a public street, and to remove his buildings from the 'street.' In 1862, Reed owned in fee some land in the City of San Jose. He had his lands surveyed and mapped by the city surveyor, Healey. In addition to his land, adjacent land was included to be subdivided and mapped into streets, blocks and lots. Divine Street was laid down for a distance of 1050 feet and 60 feet wide and it was within the area that Reed owned. One block, between blocks six and seven and San Pedro Street and Market Street, of Divine Street is the subject of this case (*Reed*, p.1).

Reed made approximately twenty-five copies of his map and distributed it to interested people. The map was not recorded, and upon distribution, he gave instructions that the map should not be recorded because there were lands included in the map which belonged to others. He was unable to obtain their consent for the mapping and the subdivision. A portion of the specific land was blocks six and seven. The remaining extent of Divine Street was thrown open to public use in conformity with the map and has been used and maintained. With the consent of Reed, interested owners, the mayor, and common council of the City of Jose, the streets within Reed's map, except the subject area, were acknowledged as public streets (*Reed*, p.2).

Reed made various conveyances with reference to the map. Some were made with reference to lots and blocks but most were metes and bounds descriptions ignoring the streets. Many of the conveyances were of land he had no title to and some fronted on the street in controversy but not the specific length in dispute. Additionally, Reed conveyed all of block six and seven to his wife in 1867 using a metes and bounds

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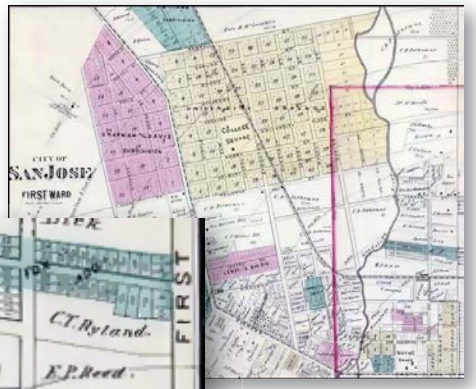
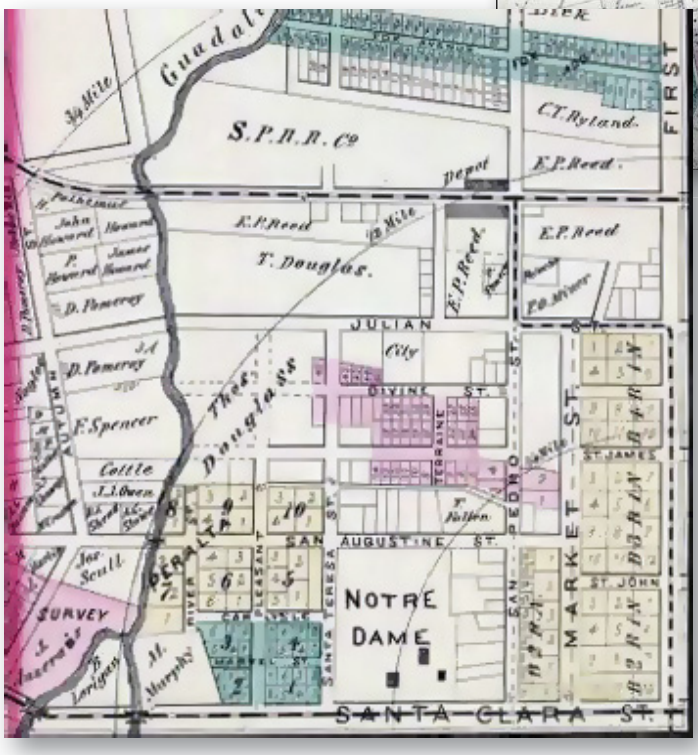


City of San Jose, first ward. (Thompson & West, San Francisco, Cala. 1876)



Acts and Intents of Dedication – *continued from page 17*

description including the portion of Divine Street in controversy that lies between the two blocks. The Reeds occupied the land with buildings and fences. The couple made more conveyances but none of them fronted on the subject street. The fee title remained in Mrs. Reed's name until her death and then willed to her husband (*Reed*, p.3).

Twenty-two years later, in 1884, the mayor and common council passed an ordinance declaring that the strip of land in controversy "be and the same is hereby dedicated and set apart to public use a public street forever" (*Reed*, pg.3). The commissioner was instructed to demand possession, remove all obstructions and open the street for public use. If possession was refused, the city attorney was instructed to commence proceedings to accomplish the same (*Reed*, p.3).

Initially, the court found that the street was dedicated for public use; however, Reed appealed the judgment and was granted a rehearing. It has been well decided by the courts, "In dedication, no particular formality is necessary. It is not affected by the statue of frauds. It may be made either with or without writing, by any act of the owner, such as throwing open his land to public travel, or platting it and selling lots bounded by streets designated in the plat, thereby indicating a clear intention to dedicate; or an acquiescence in the use of his land for a highway, or his declared assent to such use, will be sufficient; the dedication being proved in most, if not all, of the cases by matter in pais, and not by deed. The vital principle of the dedication is the intention to dedicate; and whenever this is unequivocally manifested, the dedication, so far as the owner of the soil is concerned, has been made." (*Reed*, p.4).

Reed disputed this, based on the following facts.

1) The map was never recorded.
2) The portion of the street in controversy was never opened as a street.
3) For many years the subject land was fenced and occupied by substantial buildings.
4) No lots were sold fronting on the subject length of street.
5) No individuals who purchased lots fronting on the other lengths of the street ever saw the map.
6) At the time of purchase, none of the above individuals had information about a street in the subject area.
7) The property was enclosed and permanently improved.
8) The city took no action for more than twenty years. (*Reed*, p.4).

The court determined that the making and filing of a map is only an offer of dedication and does not become effectual and irrevocable until the public accepts such dedication. Additionally, the making of the map and distributing it to purchasers does not constitute a dedication unless the map is filed with the county recorder. The judgment was in favor of Reed since there was not either a dedication or acceptance by the public (*Reed*, p.4).

Depiction of Streets Is a Mere Offer of Dedication

Phillips v. Day [82 Cal 24 (1889)]

Legal Principles:

> *The depiction of streets on a map is merely an offer of dedication. When land that includes road and street right-of-way is sold/purchased as a single unit, it can indicate an intention to revoke the offer of dedication.*

August 1887, Day and Phillips entered into a contract where Day was bound to sell to Phillips a tract of land known as 'John Fulkerson Place.' Upon several increments of fees paid, Phillips was furnished an abstract of title, and upon review by his attorney it was determined the title was not perfect. Phillips declined to fulfill his contract and sued Day to recover the fees that had been paid (*Phillips*, p.2).

The title of the land originated from a grantee of a Mexican land grant. Richard

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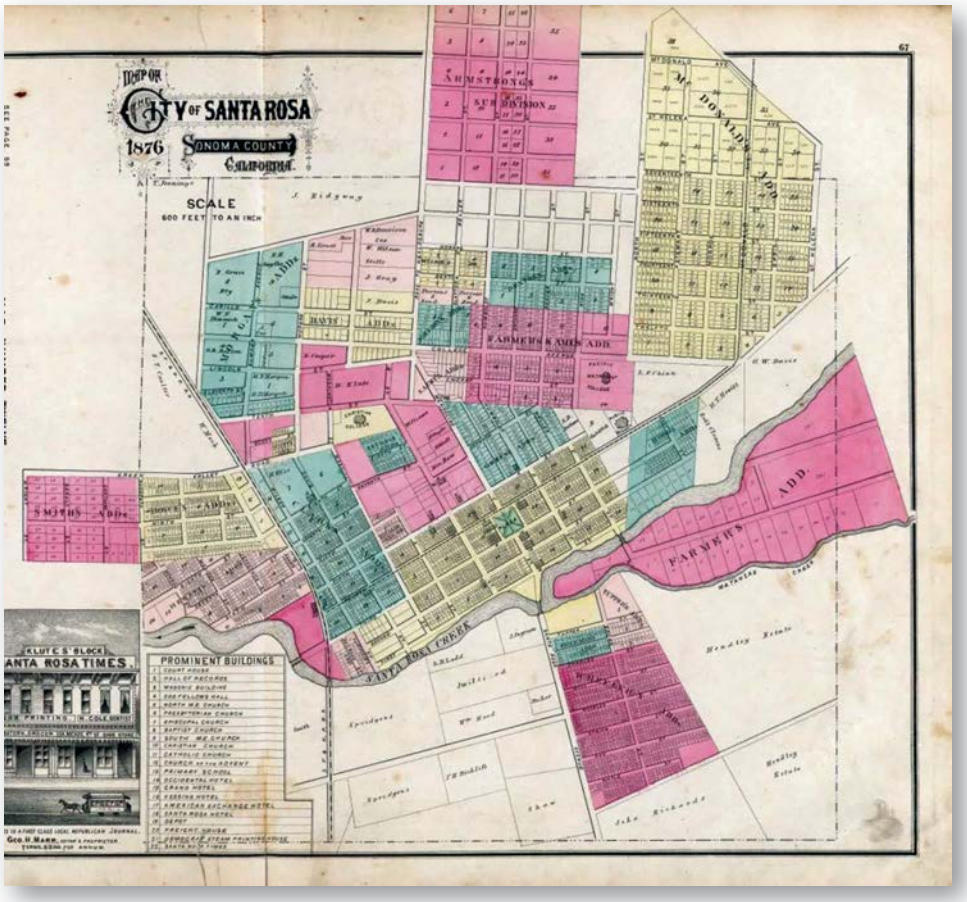

Map of The City of Santa Rosa, 1876, Sonoma County California. (with view of) Santa Rosa Times building.

Fulkerson acquired title from the unnamed grantee. Fulkerson fenced and cultivated the property for more than thirty years. Fulkerson conveyed the property to James Armstrong, who in turn laid out streets and lots upon the land, without ever removing the fence. One certain street was graded and graveled, and was enclosed within the fenced area. James Armstrong conveyed three lots, none of which were on the gravel street and later conveyed the balance of the tract to Walter Armstrong. Where the gravel street intersected the public highway, which traveled from Santa Rosa to Healdsburg, there was a gate along the fence line of Armstrong's property. The gate was kept closed. Walter Armstrong additionally conveyed a minimum of four lots, and they were all along the gravel street. After the conveyances, Walter Armstrong filed the 'Norwood' tract with the county recorder. The map showed lots, blocks and streets. That same day, Walter Armstrong conveyed the balance of the unsold tract back to Fulkerson. The conveyances from James Armstrong to Walter Armstrong and from Walter Armstrong to Fulkerson recognized the map. There is no mention of how many of the owners went into possession or used the street, but Fulkerson did testify that some of them did and they used the street to access their lots (*Phillips*, p.2).

Eventually all of the lots sold by Armstrong were reconveyed back to Richard or John Fulkerson, except a portion that was conveyed to Abshire. There was then no use by the public nor had there yet been acceptance by the public agency. Upon Richard Fulkerson receiving title, he reconveyed it all to John Fulkerson. The conveyance made no mention of the streets. John then conveyed a right of way over the south thirty feet of the gravel road and moved his fence to the centerline of the road. The north thirty feet of the road was then within the enclosed area which is in dispute, (*Phillips*, p.3).

Fulkerson conveyed a triangular piece of land to Day in August 1886. This was northerly of land already owned by Day. The conveyance used a metes and bounds description and there was no mention of streets or the 'Norwood' map. On the northerly portion of the tract was the gravel road that was within the fenced area. Furthermore, the parcel was bounded on the south by the road to Healdsburg, which had been previously conveyed by Fulkerson to another party. (*Phillips*, p.3).

The triangular piece of land is the contracted land from Day to Phillips. Phillips contends that the two streets are dedicated to the public and for that reason he is not bound to purchase the property, which is encumbered with the rights of ways. Once again the court is asked to consider what is necessary to constitute a dedication of land for public use when the land is mapped and the conveyance of lots reference the map. The court referred to People versus Reed, in which there was not an acceptance by the public body, and if there was ever an offer to dedicate, it was withdrawn with the sale of the property in a body, including the mapped streets (*Phillips*, p.3).

The acts and conduct of the owner evidences the intention of whether the street was offered for dedication and/or withdrawn therefrom. All of the purchases were made prior to the map being filed. All but two of the purchasers reconveyed their property back to Fulkerson, the original grantor. The property was always fenced and conveyed in that condition by Armstrong. The property was platted as a body including the areas alleged to be dedicated streets more than a year prior to the filing of the 'Norwood' map. One of the purchasers, who did not reconvey their property to Fulkerson, expressly waived their right to have the street fronting on their property kept open for public use. The other party who purchased some of the property did not purchase with reliance on the map, and is not fronting on the controversial streets. The court found "That thereafter, in 1879, R. Fulkerson conveyed all of the lands reconveyed to him as aforesaid, by metes and bounds, ignoring the designations of streets and lots, as marked upon said map, to J. Fulkerson, and he thereupon entered into the possession of the whole thereof under said deed, claiming title thereto, exclusive of other right; and more than five years prior to the date of the agreement between plaintiff and defendant, enclosed the premises in the pleadings described with a good and substantial fence, and the same has continued closed ever since" (*Phillips*, p.4).

Day had proved that there was a clear title to the land and there was no evidence that there was a dedication of streets. If there was a dedication, the purchasers could have enforced the dedication at any time but lost their rights by lapse of time. It was so ordered for Phillips to finalize the purchase and accept the conveyance (*Phillips*, p.5).

Conclusion

Without a specific statute, actions and intentions were the only evidence available prior of road right-of-way dedication and acceptance prior to 1901. After many maps, Chapter CXXIV, Section 3 of the 1901 statute was finally amended to read "The map or plat so made, acknowledged, and certified shall be presented to the governing body having control of the streets, roads, alleys and highways in the territory shown on the map or plat, and said governing body shall indorse thereon which streets, roads, alleys and highways, offered by said map or plat, they accept on behalf of the public and thereupon such streets, roads, alleys and highways only as have been thus accepted, shall be and become dedicated to public use. When so indorsed, and not before, said map or plat shall be recorded in the office of the county recorder of the county in which the city, town, addition or subdivision is situated, in a book kept for that purpose."

Black's Law Dictionary defines an express or implied dedication as "A dedication may be express, as where the intention to dedicate is expressly manifested by a deed or an explicit oral or written declaration of the owner, or some other explicit manifestation of his purposes to devote land to the public use. An implied dedication may be shown by some act or course of conduct on the part of the owner from which a reasonable inference of intent may be drawn, or which is inconsistent with any other theory than that he intended a dedication." The cases we explored clearly and logically depicted

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this for us and they are simply a stepping stone for further research relevant to your situation.

Additionally, many entities filled the gap with their own statutes. As stated in *Stone v. Brooks,* The Act of 1862 related to the City of San Francisco and the streets were hereafter dedicated. The City of San Diego has an 1898 ordinance which accepts all dedications and offers of dedications. Los Angeles County has a resolution from 1894. The County of San Diego has an order from the Board of Supervisors in 1909. It seems logical that other cities and counties may also have the same type of acceptances. It would need to be researched in your subject area. Without the official acceptances, *intention* and *conduct* were the basis of the courts' decisions. Thus, if you are surveying within a pre-1901 map, where lots have been sold adjoining the streets, the streets have been improved by the government entity and traveled by the public, logic is that you may be able to assume the street was dedicated and accepted by intention and conduct.

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Phillips v. Day 82 Cal 24 (1889); Cal LEXIS 795
People v. Reed 81 Cal 70 (1889); Cal LEXIS 986
San Leandro v. LeBreton, 72 Cal 170 (1887); Cal LEXIS 487
Stone v. Brooks 35 Cal 489 (1868); Cal LEXIS 118

Maps

All of the maps are from the David Rumsey Map Collection at *www.davidrumsey.com* with permission.

Editor's Note:

I appreciate Anne's thorough research of the relevant state and common law described in this article. She's done a great job summarizing the 6 court cases related to road dedications on subdivision maps filed prior to 1901 and has educated me about an aspect of real property that I knew little about.

Land Surveyor Liability to Third Parties (Even Without Privity of Contract)

By Dave Wooley

Editor's Introduction:

In this article the author examines the implications of three California court cases on the liability a land surveyor has to a person that depends on his/her work, even when the land surveyor doesn't have a direct contractual relationship with that person. The first case examined is Bily v. Arthur Young and Company. *In this case the California Supreme Court considered when a person outside a contractual relationship could depend on the accountant's work product. The second case examined is* Beacon Residential Community Association v. Skidmore. *In this case the California Supreme Court determined if an architect owed a duty of care to homeowners with which it didn't have a contractual relationship. The third case examined is* Biakanja v. Irving, *in which the California Supreme Court lays out several factors that need to be considered when considering the liability of a professional to a person with which they don't have a direct contractual relationship.*

This article discusses the concept of "privity," which is a legal relationship between two people or organizations. In the context of this article, the term privity is used to describe the legal relationship between a land surveyor and his/her client.

Introduction

In most instances, a breach of the standard of care by a surveyor is proven by the testimony of competent experts in the field of land surveying. *Miller v. Los Angeles Co. Flood Control District* (1973) 8 Cal. 3d 689, 701-703; *Huber, Hunt & Nichols, Inc. v. Moore* (1977) 67 Cal. App. 3d 278, 313. There is limited case law on a land surveyor's liability to third party plaintiffs – plaintiffs not in privity of contract with the land surveyor defendant. To best understand whether a land surveyor has any liability to an adjacent homeowner not under contract with the land surveyor (third party liability), we must review professions that perform similar functions.

Intended Beneficiary – The *Bily* Factors

In Bily v. Arthur Young & Company (1992) 3 Cal. 4th 370, the California Supreme Court adopted the intended beneficiary approach of § 552, Restatement of Torts 2nd. This Restatement reads as follows:

§ 552: Information Negligently Supplied for the Guidance of Others.

(1) One who, in the course of his business, profession, or employment, or in any other transaction in which he has a pecuniary interest, supplies false information for the guidance of others in their business transactions, is subject to the liability for pecuniary loss caused to them by their justifiable reliance upon the information, if he fails to exercise reasonable care or competence in obtaining or communicating the information.

(2) Except as stated in Subsection (3), the liability stated in Subsection (1) is limited to loss suffered:

(a) By the person or one of a limited group of persons for whose benefit and guidance he intended to supply the information or knows that the recipient intends to supply it; and

(b) Through reliance upon it in a transaction that he intends the information to influence or knows that the recipient so intends in a substantially similar transaction."

Liability Without Privity and Only Foreseeable Risk to Tangible Property – The *Beacon* Case

More recently, in *Beacon Residential Community Association v. Skidmore, Owings & Merrill, LLP* (2014) 59 Cal. 4th 568, a condominium owners association brought

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a construction design defect action against the developer, architectural firms and others, alleging that defects made the homes unsafe and uninhabitable for a significant portions of the year due to high temperatures. With regard to whether there was actionable negligence against the architects, the California Supreme Court pointed out that actionable negligence involves a legal duty to use due care, a breach of such legal duty, and the breach as the proximate or legal cause of the resulting injury. Id. at 574. Whether a duty of care exists in a particular case is a question of law to be resolved by the court. Id. The Court considered whether design professionals owe a duty of care to a homeowners association and its members in the absence of privity. Id.

a. The *Beacon* Case and the *Biakanja* Factors:

Beacon states that there is authority for the imposition of liability where there is no privity and where the only foreseeable risk is of damage to tangible property. Id. Beacon discusses *Biakanja v. Irving* (1958) 49 Cal. 2d 647, 650 where the California Supreme Court held that a notary public, who negligently drafted a will, was liable to the intended beneficiary of the will. Id. In *Biakanja,* the Court explained that the determination whether, in a specific case, the defendant will be held liable to a third party not in privity is a matter of policy and involves the balancing of several factors including:

1. The extent to which the transaction was intended to affect the plaintiff.
2. The foreseeability of harm to the plaintiff.
3. The degree of certainty that the plaintiff will be injured.
4. The closeness of the connection between the defendant's conduct and the injury suffered.
5. The moral blame attached to the defendants' conduct; and
6. The policy of preventing future harm.

Id. (citing *Biakanja v. Irving,* supra, 49 Cal. 2d at 650).

In *Beacon,* the Court found that the architect's work was intended to benefit the homeowners living in the units the architects designed and helped to construct, therefore it was foreseeable that the homeowners would be among the limited class of persons harmed by the negligently designed units, homeowners had suffered injury, so the design defects made their homes unsafe and uninhabitable, there was a close connection between the conduct of the architects (sole architects on the project) and the injury suffered, and significant moral blame attached to the conduct of the architects, who had a unique and well-compensated role in the condo development and were aware that future homeowners would rely on

their specialized expertise in designing safe and habitable homes. Id. Although *Beacon* references the California Right to Repair Act, California Civil Code § 895, the Court stated that:

> "We need not decide whether the Right to Repair Act is itself dispositive of the issue before us. Assuming defendants are correct that the existence of a common law duty of care is required to maintain a negligence action under the statute, such a duty exists under the facts here."

Id. at 578. See also James Acret and Annette Davis Perrochet, *Architects and Engineers* (4th ed. 2015) §1:19.

The Court noted the declining significance of privity, as in construction law, where privity was not required. Similarly, in *Hale v. Depaoli* (1948) 33 Cal. 2d 228, the Court said:

> "Under the existing status of the law, an architect who plans and supervises construction work, as an independent contractor, is under a duty to exercise ordinary care in the course thereof for the protection of any person who foreseeably and with reasonable certainty may be injured by his failure to do so, even though such injury may occur after his work may be accepted by the person engaging his services."

b. Application of *Biakanja* Factors to *Bily* and *Beacon* Cases.

In *Bily,* the Court held that an auditor generally owes no duty of care to its client investors. *Bily v. Arthur Young & Co.,* supra, 3 Cal. 4th at 377-379. Bily focused on three (3) central concerns in finding the important "public watchdog function" of auditors, but sought to set a reasonable limit on their potential liability for professional negligence given the vast range of foreseeable third party users of an audit report. Id. Using the *Biakanja* factors, Court in *Bily* focused on:

1. The complexity of the professional opinions rendered in the audit reports and the difficult and potentially tenuous causal relationships between the audit reports and the economic losses from investment and credit decisions, the auditor exposed to negligence claims from all foreseeable third parties faces potential liability far out of proportion to fault. Id. at 579.

2. *Bily* emphasized that, unlike ordinary consumers in product liability cases, the generally more sophisticated class of plaintiffs in auditor liability cases permits the effective use of contract rather than tort liability to control and adjust the relevant risks. Id. at 579.

3. *Bily* expressed skepticism that exposing auditors to third party negligence suits would improve the quality of their audits. Id. at 580.

One could argue that exposing surveyors to third party negligence suits would actually benefit the public – other homeowners. This is a public policy argument.

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Beacon differentiated itself from *Bily*. Specifically:

1. The closeness of the connection between defendants' conduct and plaintiff's injury;

2. The limited and wholly evident class of persons and transactions that defendants' conduct was intended to affect; and

3. The absence of private ordering options that would efficiently protect the homeowners from design defects and their resulting harms.

Id. at 581. See also *Philadelphia Indemnity Insurance Company v. Simplex Grinnell, L.P.* (9th Cir. 2015) 616 Fed. Appx. 870, 872 (stating that, as the *Beacon* court explained, California case law establishes that architects, engineers and other "design professionals" who act negligently in the exercise of their specialized services, may be liable when their negligence causes personal injury or property damage to owners and third parties).

In Beacon, the architect engaged in his work knowing that the finished product (condominium) would be sold and used as residences. Patrick J. O'Conner, Jr., *The American College of Construction Lawyers Journal* (January 2015) Vol. 9, No. 1. In this way, the architect's work on the condo project was intended to affect the plaintiff and the "end aim" of the transaction was to provide safe inhabitable condos for future homeowners – a specific, foreseeable, and well defined class. Id. *Beacon* also observed, it is more appropriate to impose a duty of care under circumstances where there is "no spectre of vast numbers of suits and limitless financial exposure." *Beacon Residential Community Association v. Skidmore, Owings & Merrill, LLP,* supra, 59 Cal. 4th at 584. See also *Apex Directional Drilling, LLC v. SHN Consulting Engineers & Geologists, Inc.* (N.D. Cal. 2015) 2015 WL 4749004.

Similarly, in the earlier surveyor case of *Kent v. Bartlett,* the California Court of Appeal, First District held that:

> "the absence of privity of contract between the parties did not preclude plaintiffs from seeking to recover for alleged negligent failure on the part of defendant to perform a survey in accordance with terms of the contract with plaintiffs' predecessor in title, even though defendant was not alleged to have guaranteed the accuracy of his survey, where defendant should have reasonably anticipated that surveyed plat would be used and relied upon by individuals other than the person ordering it. Further, issues of negligence and proximate cause were questions of fact, which precluded entry of a judgment based on plaintiffs' opening statement."

Kent v. Bartlett (1975) 49 Cal. App. 3d 724 [emphasis added].

Analysis of *Beacon, Bily,* and *Biakanja*

To prevail in a negligence action as a third party, not in privity of contract with a surveyor, a plaintiff should argue the *Biakanja* factors and use the analysis in *Beacon* to differentiate plaintiff's case from the analysis in the *Bily* case. This is a fact sensitive analysis where plaintiff should show how their case is similar to *Beacon* by analyzing plaintiff's facts in the same way as was done in *Beacon*.

Real injury (damages) and reliance upon the survey in question must be shown in the negligence analysis in order to prevail as a third party not in privity of contract with the land surveyor. Damages must be quantifiable. A retained and designated expert witness in a civil litigation case is almost required in order to quantify possible damages.

While it is an uphill battle, there is case law to support a third party negligence case against a land surveyor, or other design professional in certain situations where reliance and damages can be proven.

Editor's Note:

This article highlights an important concept of California law that impacts every land surveyor in private practice within our state. This is the concept of a duty of care to individuals or organizations that depend on his/her work, without a direct contractual relationship. This concept is based on the principle that a land surveyor will meet a minimum standard of care, or duty of care, no matter what the specific language of his/her scope-of-services/ contract states. This is a topic all surveyors in private practice should pay attention to, and one that deserves more discussion in our profession.

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RIGHT OF ENTRY – Reasonable Efforts to Notify With a Deceptive Land Owner

By Ron Nelms

The right to defend land and property against intruders is rightfully in the framework of our legal rights as Americans. It is an important factor related to freedom and order in society related to control in society and government. The law relates to social order as necessary to human privacy, safety and control. Trespass of real property often causes property owners to feel violated. This feeling of violation rouses natural human tendencies towards strong defensive action. The surveyor needs to understand this natural tendency and develop strategies that will consider this tendency in his or her work. This includes making an effort to provide reasonable notification to private property owners before entering their private property.

Right-of-Entry in Tricky Situations

This effort to provide reasonable notification for right of entry can be challenging if there is a misunderstanding of the surveyor's intentions or if you are dealing with a deceptive property owner. Evasion and delay by a private property owner may cause a surveyor to enter private property without providing the advance notice he or she would under normal circumstances. Surveyors are important guests, with specific assignments on private property. They are carrying out an important social and legal duty for clients and society. There is duty to society that may come into conflict with the perceptions of owners and surveyors. In these cases, the surveyor must exercise the right of entry for the good of all concerned, especially adjoining property owners who share the common boundary lines that will be established in the survey. A challenging right-of-entry situation arose during a survey for a client who was referred to us from a fellow surveyor, Larry Otter. (Larry is retired and lives in the Springville area east of Porterville, California, where he practiced land surveying.) The client had a ranch near Larry's home and wanted to install a fence on one of her property lines. During the course of our research for the boundary survey, we determined the north quarter corner of the section needed to be located. This Corner had been identified several times by other surveyors and had been marked by iron pipes. Unfortunately, each time a monument was set it was removed shortly afterwords.

Repeated Loss of Property Corner Monuments

The repeated loss of the monument marking this quarter corner raised concern in my mind that notification related to right-of-entry would only lead to my own monument for this property corner being removed. Therefore, I dispatched a survey field crew to search for this particular corner monument without the advance notice to the private property owner that I would normally provide. During their corner search they discovered the previously set corner monument had been removed again. During the course of searching, soil was disturbed but placed back properly in the usual manner of responsible surveyors. During their work, my field crew happened to slightly reorient a small section of a locked cattle gate while attempting to climb over it. With no tools with them, they decided that Rodney, the foreman, would return and fix it. It was to be an adequate repair of a small damaged area. It was not a

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major matter but deserved to be left in the condition in which it was found – or better.

Land Owner Response to Our Entry

That afternoon I received a call from a fellow who introduced himself as Dave, the gate owner, who launched into a string of colorful adjectives describing his intense displeasure about our "trespass and vandalism." For about 20 minutes Dave ranted about our entrance onto his property and made comments about damage like: "deep ... pits on the property," "... collapsing fences," and "... hanging gates." I was finally able to assure him if there were any damages we would make every attempt to rectify them.

I attempted to explain that we did not know his phone number and were unable to contact him about our work on the property. I explained the surveyor's right of entry, but he wasn't pleased. I also informed Dave that the existing corner monument had been destroyed, and that intentional destruction of a monument was a crime. This was followed with a long silence. I obtained Dave's phone number, and I told him next time I would let him know before we entered his property.

All the while he was expressing the severity and egregious acts of vandalism, my thoughts were that he may have confused our crew with intruding vandals. There was some evidence of vandalism expressed in his attitude and illusions, partly supported by the condition of the property. My party chief, Tim Smith, with over 35 years of experience and knows proper procedure for correcting damages or making any replacements in carrying out professional assignments. Professional standards are very important to us.

As soon as I finished my conversation with Dave, I was on the phone to my field crew. My field crew explained to me that the dirt from our holes was placed back properly and the issue with the gate was a minor repair. In fact, gate had been damaged by others and then repaired which was evidenced by small screws attempting to hold the piece in place – not as effectively

as original factory welding. The repair was poorly done, and obvious as an inadequate treatment of some damage.

An hour or so later, I received a call from another fellow named Don who was also irate and he too began a lengthy monologue expressing his opinion that we were trespassers and vandals. I informed him that Dave called me earlier about the matter. His response was "Who's Dave?" Now I was confused and I asked him if he called earlier to which he replied, "No!" Prodding Don further, while still being respectful, I explained to him that somebody had already called us on this and we were looking into it. He asked who called and I said I thought the name was: "Dave." "Oh! That's my son," Don replied. The two seemed to act separately, but with the same attitudes. I told Don we would contact him and Dave before we visited the next time.

A week or so later and ready to set the corner, we left a message on both Dave's and Don's phones letting them know of the day we would be there. We suggested that they call back if the date was not convenient for them. There was no call back from them.

Gaining Access to Reset the Corner Monument

The crew arrived and they found a newly installed locked gate about 300 feet before reaching the gate encountered on our first visit. At that point, it was decided we needed more time to re-evaluate the importance of setting this corner. We needed to consider our rights to access the property for our work and our contractual obligations to our client. The crew returned to the office without setting the corner. The Tulare County Surveyor indicated in a subsequent conversation that he strongly felt the north quarter corner needed to be marked by a monument as part of our survey.

The next step was to contact Rick Moore at the California Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG) to get his take on the situation. He suggested that we make a diligent attempt to contact the owner and give them the time and date we planned to be there. He went on to say that if we cut the chain like surveyors often do that would be damaging to the property owner. However, he was aware of several situations where after making a diligent effort to contact the property owner, a surveyor had cut a link in the chain, replaced the link with a new lock, and provided the key to the property owner. He didn't necessarily advocate for that approach, but at least the chain would still remain intact and serving the intended purpose without causing damage.

I left a message for the owner as directed and implied by Mr. Moore. The next call was to the Sherriff's Department to put that authority on the alert of our arrival. I then arrived on site with my field crew. We contacted Don at his home on the property. He agreed to walk with me to the north quarter corner location, which was now guarded by a dummy in a shack. Don agreed to allow the gate repair to proceed while we were finishing our survey work. The site indicated no evidence that the

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crew disturbed the soil or destroyed the fences. Don and I discussed that maybe he had exaggerated the property damage a bit. His real concern was 'trespass.'

Don and I discussed the surveyor's right of entry and the need to set a monument at the position. I went further to inform him that I felt it my duty to do so. He seemed to understand but then he explained that the real resistance was his son, Dave. Also, he was concerned the position of the monument would reveal that his easterly fence was ten feet east of the corner with possible trespass on the neighbor's property. After an hour of attempting to persuade him to unlock the gates but to no avail, I informed him that the monument would be set today and that if needed we would exercise our right to cut a link in the chain. We would then put our lock on it and give him a key.

He responded by telling me he would not let me cut the gate chain. I told Don that either he would unlock it or we would cut the link. After several more requests to have him unlock the gate, I gave my field crew the command to cut the link. Don immediately went back to the house to call the Sherriff.

When the deputy arrived, I handed him a copy of CLSA's "Right of Entry" brochure and informed him that I felt it my duty to set the monument. The officer informed Don that we had gone through the correct procedures and that he was going to permit us legally to complete the task. He then drove away leaving us to the befuddled Don and under the watchful eye of the female mannequin guard.

Ensuring Monument Survival

Knowing that previous monuments for this corner had been removed, we took preventive measures to assure that the position would be easier to locate for the next surveyor. We dug a hole two feet deep and drove a 2 inch diameter iron pipe to a position leaving the top flush with the bottom of the hole. Then we set a magnet on top of that pipe and placed another 2 inch diameter pipe on top of the magnet so that it left the top position about 3 inches below the surface. There would be no future 'stealing of this monument.' Only a surveyor could find it – and that easily. We also set accessories to the corner by scribing an "X" on top of the concrete footing to the west fence and another on the footing of the east fence. The corner location would be preserved.

Editor's Note:

I appreciate the issues related to our right-of-entry that Ron brings to light in this article. This includes the following questions:

1) *What is a "reasonable" effort to provide private land owners with notice of our entry on their property for our boundary survey?*

2) *When an adjoining landowner is destroying monuments or denying access to land because they disagree with the likely results of our survey, how does the "reasonable" effort to provide advance notice of our entry to private property change?*

3) *When a land owner denies access to our team members for their work on a boundary survey, what is the appropriate response?*

4) *How do we balance the respect for private property with our responsibility to thoroughly search for evidence of property corner location, and to monument corners established in our survey?*

5) *How can we protect our survey monuments when dealing with a hostile land owner?*

Ron has done a good job raising these questions with his article, and in providing a few of his own answers. I believe right-of-entry is an important privilege we enjoy, and I hope we will see more content in our magazine about these questions and about best practices for using right-of-entry.

Ronald J. Nelms, PLS President of Nelms Surveying; Inc. in Bakersfield, CA and licensed in California, Arizona and Nevada. He also serves as chair for the Monument Conservation Committee.

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Possession, Fence Lines, and Boundaries in California

By Ken Wilson

Do surveyors determine property lines?
When should a fence line be accepted as the property line?
Is proration always the last resort?

Surveyors Determine the Extent of Ownership of Real Property

According to the California PLS Act section 8726 (c) surveyors are licensed in the State of California to "locate, relocate, establish, re-establish or retrace any property line or boundary of any parcel of land, right-of-way, easement, or alignment of those lines or boundaries." This statement authorizes those who possess a valid California License as Land Surveyor to actually and physically place in the ground monuments and stakes which represent the opinion of the surveyor as to the boundary or property line of his client. Notice that the words "boundary" and "property line" are used as synonyms here. Therefore, licensed surveyors in California do not merely lay out lot lines or deed lines that may or may not represent the actual boundary. No, the lines we lay out are the actual boundary lines or property lines that are considered as the extent of the ownership. The grant deed is the principal document that provides a written description of the extent of the property that was intended to be conveyed.

Based on what is written in the deed as well as any other item of evidence that may apply (i.e. maps of record, extrinsic evidence, oaths, etc.) the surveyor determines by various means of research, examination, measurement and calculation the location of the lines conveyed in the deed. This is implied in the PLS act at Section 8726 (e) which states "By the use of the principles of land surveying determines the position for any monument or reference point which marks a property line boundary or corner, or sets, resets or replaces any such monument or reference point." Also note Section 8762 (b) where the law stipulates when a Record of Survey is required. There the PLS Act states "after making a field survey in conformity with the practice of land surveying, the licensed surveyor or licensed civil engineer shall file with the county surveyor ... a record of the survey relating to land boundaries or property lines, if the field survey discloses any of the following ... the points or lines set during the performance of a field survey of any parcel described in any deed. This statement places a direct link between the practice of land surveying and the location of property lines.

"The principles of land surveying" encompass a variety of important aspects including:

1. History of boundaries and limits of ownership and the laws relating to boundaries, their establishment and meaning.
2. Statutes of the State of California concerning boundaries.
3. Opinions of courts of Law.

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It is true that there have been many cases where a boundary dispute has been argued in a court of law and the decisions rendered have become part of the decision making process of land surveyors. My first employer would always tell us that we should perform our work as if a judge or jury was going to be examining it in court (and never erase in the field book). In the few cases in which I have been retained as an expert witness, none of which ever made it to the appeal process, I found that some of the local judges and attorneys in the County Courts were not well versed in applying the "principles of land surveying." I basically needed to educate the attorneys with what I knew about the issues involved and then hope that the judge would understand what was being discussed. However, as I stated, only a few of the surveys that I have been involved with ever went to court. Of the 937 recorded surveys I have been responsible for only 4 were actually disputed in court.

So in practicality, because landowners have been depending on and using the corner monuments and line stakes that surveyors set, we, the land surveyors, have for all intents and purposes become the final say on those boundary lines. It is not that each and every decision we have made would be the same that a court of law might determine. But because the courts most likely will never have the opportunity to examine our surveys, it becomes evident that the monuments we have set have, in effect, become the property line in the minds of the adjacent property owners.

No one can fully explain every principle of land surveying in one article or probably in even one book. However, using the information provided here and elsewhere it is hoped that a better understanding of the "principles of land surveying" will be gained and applied in our important work.

How can fences be used to determine boundaries?

When I began surveying, the use of fence lines to determine boundaries was one of the most difficult concepts to understand. How did my employer, a licensed surveyor, know when to use a fence line as a boundary? At first it was a real mystery to me but gradually the principles regarding fences has become more clear.

There is a good possibility that a fence corner is at or near the property corner. This may sound simple and it is. When we go out in the field to recover evidence of a boundary where do we often look first? We usually start at the fence corner (or at a point on the projection of a fence line). Of course, this does not mean we ignore other typical areas where monuments exist such as centerline intersections but fences are typically and most often erected by the landowner or developer and placed on the lot lines. In more rural lands, fence corners are usually built just inside the lot corners.

It is apparent that this practice has, in general, been followed for a long time by prudent landowners who made an effort to perpetuate the location of their property boundaries. In casual and formal interviews with landowners, they have most often stated that when they replaced their fences, they were replaced in the same location as the previous fence. In time, many of the actual corner monuments and accessories (in the case of GLO surveys) have deteriorated, been destroyed or otherwise been lost, leaving the fence corner to remain. In some cases, the fence corners and much of the fence lines have also been removed or destroyed leaving very little evidence at all. When we go out in the field we look for whatever evidence is left that may help us re-create the location of the corners of the property. In city surveys, curb lines may provide evidence of the location of street centerlines and in turn, lot lines. But how can we be certain that the fence lines or other evidence of occupation represents the lines shown in our deed or record map?

Here is where we need some common sense and the ability to evaluate conflicting information. Have we located any original monuments, replacements of the originals, or other artificial items that may be at the location of the original corners? Our ability to see the difference between these and to assign the proper weight to their quality should be added to the entire mixture. Even if the more certain monuments are

distant from our own subject property, they can be helpful in our evaluation. For example, in one survey, there was a map prepared in the 1920's wherein scribed stakes had been set to delineate the lot corners and angle points along the right of way. We found no original stakes at or near our subject property. However, from available recorded maps, other surveyors had found original stakes and perpetuated them with iron stakes and pins. Even though none of these were used to determine the boundary, they verified for us that original stakes had indeed been set by the original surveyor at those locations and greatly increased our belief that original stakes had also been set at the corners of our parcel and adjacent properties. Also, the dimensions returned by the retracement surveyors of those who found original stakes taught us something about the quality of the measurements of the original surveyor, which in this case, was in the neighborhood of 1:600 to 1:800. Using this information, we used as reference two separate Records of Surveys, each of which showed a fence corner accepted as an original lot corner at the right of way of the County Road. Even though these two fence corners were about 4000 feet apart, we determined that the distance difference between the

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record as calculated and the measured was about 6 feet. This was consistent with the expected quality that we had found with other found monuments as discussed earlier. Both fence corners were similar in age (old posts and wire, deteriorated but still functioning). The fence lines that terminated at the corners ran straight and on bearings consistent with the original map. The other angle points and opposing right of way locations were calculated from these two fence corners.

This simplified description of a retracement illustrates how fence corners can be used to ascertain the location of boundaries. Each fence corner must be evaluated and checked with other evidence before we decide to accept it as the original location of the lot corner. Additionally, even if we determine that the fence corner is at the location of the original corner, this does not mean that the fence line is also on the true line. Do we have solid evidence showing that the fence line follows the line actually run by the original surveyor? If not, we must usually resort to holding the fence corners and running a straight line between them, ignoring the fence in between. In many cases, the fence line very closely follows the straight line between the corners but depending on the terrain (level vs. hilly, brushy or tree covered) the direction of the fence line could deviate from this line.

Many landowners measured the location of their property lines themselves and erected fences near the location of the true corner. Generally speaking, we know that in sectionalized land, the only original corners set by the GLO were the section and quarter-section corners. Therefore, in most cases, the only fence corners that actually represent the missing corners are usually at the section or quarter corners since these corners were the only ones where actual monuments were set. Unless we can prove otherwise, fence corners found near interior corners (center of section and 1/16th corners) are often not at the mathematical location of the deed corners where aliquot parts are used in the description since they were never properly determined by typical section breakdown and subsequently set by a land surveyor. Therefore, the section breakdown should proceed according to the standard rules for the surveying of public lands according to the official plat and field notes.

Sometimes, the fence corners at section and quarter-section corners are missing and all we have are portions of fence lines. By locating the fences and intersecting them with each other, we may be able to use them to determine the original locations. Of course, if we were to find other evidence to the contrary (old iron pipe, roads, testimony) then this must also be evaluated.

When it comes to testimony, it is always helpful to talk to the landowners who have lived in the area for a long time. Some may be able to remember whether or not the previous landowners knew anything about surveying, monuments, fence lines, etc. By interviewing them we may be able to gain valuable information that we can use in our determination. It is not just a matter of them simply remembering the exact location of a corner stake. What light can they shed on the subject? Do they remember seeing or hearing of original monuments in general? Did their deceased relatives have knowledge of them? What was their method of determining the boundary of their property? Did they ever set fence lines at locations other than at the boundaries of the property or by stringing out a quarter mile of barbed wire as was a common practice?

Ranchers have been in the habit of erecting "drift" fences which are fences that are placed to keep livestock within a certain area. These fences may be along tops of ridges or more convenient locations. These "drift" fences should not be confused with fences placed on boundaries. Sometimes, a fence corner is near a corner but not actually at the corner. Perhaps the landowner knew the corner was in the area but not exactly its location. Many times, after searching near an old fence corner, original bearing trees and other accessories have been found nearby which establish the original monument location.

On the central coast of California, there were subdivisions done between 1880 and 1920 wherein the original scribed stakes have long been destroyed. However, solid, straight fence lines remain which when measured agree with the record locations of the lots. If we do find evidence of original monuments or their replacements, these should be accepted. However, in the absence of original monuments, old fence lines are often solid evidence of the original locations.

When performing surveys in more urban areas such as in the San Jose area there are some other principles regarding fences that come into play. In many city subdivisions developed in the 20th century, it was typical for the developer to erect fences along the property lines of the development and a typical property owner believes that their fences represent their property boundaries.

How Can Fences Be Used to Support Other Boundary Evidence?

An example of using fences to support a mathematical boundary is a survey of two adjacent subdivisions recorded in 1890 and 1891 near downtown San Jose. The original maps show distances but no bearings and no indication of original monuments (see image, below).

By holding old centerline monuments likely set by the City (and used by other surveys of record) we determined that the two long streets are not parallel to each other. This is

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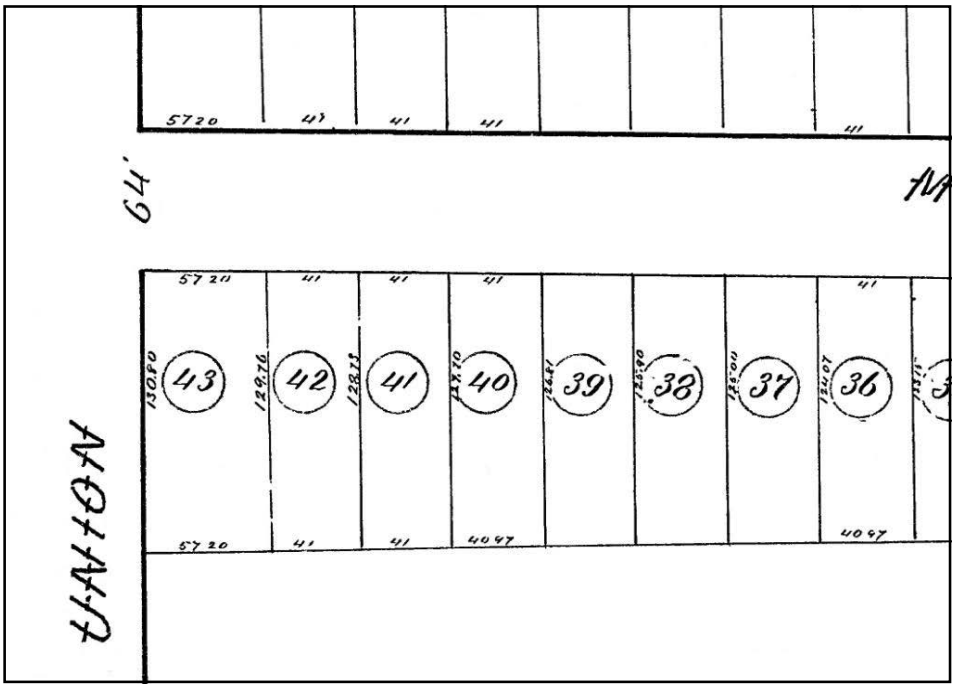
also evident from the original subdivision map where the distances of the lot lines along one of the streets gets smaller as you proceed down the block.

We performed our field survey and determined the lot lines from the centerline monuments and by proration along the lot lines. There have been a few Records of Surveys of lots within this block but no additional evidence better than the centerline monuments was shown. Since the original map did not have any bearings shown and also since distances control over bearings (a rule of surveying in the California Code of Civil Procedure Section 2077) the distances were used to prorate the lot lines. Record and measured distances matched each other extremely well. For example one line had a record distance of 1829.20' and a measured distance of 1829.40'. There was one notable exception where the record distance was 917.57' and the measured was 918.57'. Since this survey is being disputed, we determined that it would be helpful to locate many of the fences in the subdivision.

When we decided to locate the existing fences in this subdivision, the intent was not to use the centerline of the fences and create property lines from these. If this had been done, we would have had distances that would vary with the fences. Instead, we wanted to compare the location of these fences in relation to our prorated property lines. We found that these fence lines very closely matched our prorated locations (within inches in most locations). There is a generally accepted rule that proration is only to be used as a last resort. This example proves that this statement is not always true. While the general principle makes sense that original monuments control over prorated positions, it can also be stated that fence lines often do not control over appropriately determined mathematical positions. The decision to hold either fences or prorated locations is a decision that must be made by land surveyors. The result of the decision should be the locations that best fit the original.

Therefore, when little or no original monumentation is found, lines of possession including fences, curbs and buildings may often provide conclusive proof of the location of boundaries. Conversely, lines of possession can provide conclusive proof that the mathematically determined locations of our survey are in agreement with these lines of possession in the retracement area. There have been many times where we have painstakingly determined a boundary from all existent original monuments, deed calls, maps of record, etc. and then when we go out to set the final corners find that they land virtually on the old fences in the area. I assume that most of you have had the same experience. When this happens, even though it may be true that the contrary may someday be shown, my guess is that this survey is a success!



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"Fortified Base" King City, CA – by Ryder Kovach

Knowing how much cows like survey equipment I made this attempt to protect my base station. Surprisingly enough it was still standing at the end of the day.

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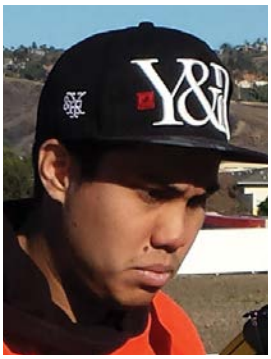
Evaluating the Position Repeatability of RTK and VRS Systems:

A Case Study on the Cal Poly Pomona Campus



By Rudy Misland

Introduction

The advancements made in Global Positioning System (GPS) technology have improved the accuracy and precision of positioning, in particular, the repeatability of positioning from Real-Time Kinematic (RTK) and Virtual Reference Station (VRS) systems. RTK and VRS positioning are important surveying techniques used today and their position repeatability is an important factor in determining the breadth of their adoption and the type of applications they are used for.

An Opportunity for Testing

Recently, I was offered the opportunity by Dr. Omar E. Mora, assistant professor at Cal Poly Pomona, and Travis Mensen, Project Manager at WestLAND Group to survey and compare the repeatability of RTK and VRS systems. Westland Group sponsored the necessary equipment to perform the experiment, while Omar and I tested both systems around the Cal Poly Pomona campus area. Our test site was located on South Campus Drive between Cal Poly Pomona's student village and the Agriscapes Pumpkin Field. The primary goal of the test was to evaluate the repeatability of the vertical component of both RTK and VRS systems.

Our Testing Procedure

The first step of the test procedure was to set two mag nails 100 feet apart as a baseline which we identified as 101, and 102, respectively. Next, we observed measurements using three different scenarios:

1. A single measurement taken every second to compute one observation.
2. Three measurements taken in five seconds to compute one observation.
3. Six measurements taken in ten seconds to compute one observation.

At the beginning of each scenario, we reinitialized (lost lock, subsequently gained lock) the system before recording any observations. For each session, we followed the following measurement pattern:

1. Initialized the receiver.
2. Measured the first half of observations needed at Point 101.
3. Reinitialized the receiver while moving towards 102.
4. Measured the first half of observations needed at Point 102.
5. Reinitialized the receiver and moved back to Point 101.
6. Measured the second half of observations needed at Point 101.
7. Reinitialized the receiver while moving towards 102.
8. Measured the second half of observations needed at Point 102.

The aforementioned procedure was repeated for all three scenarios and for both VRS and RTK systems tested.

Site Conditions of the Test Location

To assess the potential of both systems, we evaluated them in the best case scenario. Observations were performed in near perfect conditions, where the base station (for RTK positioning) and rover (for RTK and VRS positioning) were placed away from buildings and obstacles that may cause multi-path or an urban canyon setting. In our study, we used a Trimble R8 system and a Trimble TSC2 data collector. In addition, a 2.000 meter fixed height rod and a leveling rod bipod were used. The controller settings for the rover were set to have a PDOP mask of 4.0, elevation mask of 15 degrees, precision horizontal tolerance of 0.03 feet, and precision vertical tolerance

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of 0.04 feet. The controller settings for the base were set to have an elevation mask of 15 degrees and a logging interval of 1 second. The base station used for RTK positioning was placed approximately 150 feet away from 101 and 102.

The test data set was acquired on December 16th, 2015 and the data collection began with RTK positioning around 7:00 am and ended at about 4:00 pm with VRS positioning.

Test Results

Shown in **Figure 1** is the distribution of the vertical position for Scenario 1. The distribution demonstrates that RTK positioning has a similar trend in the data distribution for both points and both observation sessions for each point. However, this is not the case for VRS positioning, where there is a different trend shown for each observation session for each point.

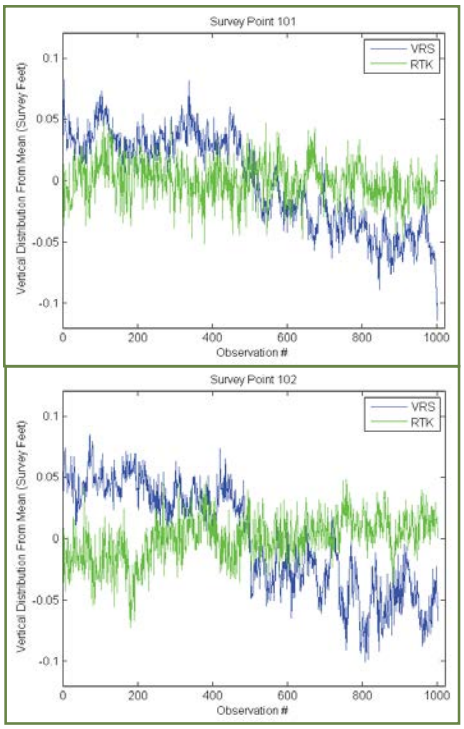

FIGURE 1: Verticle distribution from the mean shown for each observation. Green is RTK and blue is VRS positioning

Additionally, the ranges between observations are larger for VRS positioning than those seen in RTK positioning, including the standard deviations or 1 sigma (see **Table 1** and **Table 2**), which are twice as large for VRS in the vertical component when compared to the RTK system. In summary, the plots and tables provide a clear understanding of the repeatability performance of the two systems for the test performed. However, it is noted that the data is limited, and that various baseline lengths for RTK positioning were not tested. Therefore, in order to provide a complete comparison between the two systems we will be expanding the study to cover the Los Angeles County area, including the evaluation of other multiple VRS systems. The findings of the complete study will be published in a future article. Nevertheless, the initial findings provide us with some insight on what to expect from the two positioning system.

Precision Analysis of RTK Survey (1 Meas. in 1 sec.)						
	Point 101			Point 102		
	Northing	Easting	Elevation	Northing	Easting	Elevation
STD	0.01	0.01	0.02	0.01	0.01	0.02
Range	0.07	0.04	0.10	0.07	0.04	0.12
Units: Survey Feet						

Table 1: Statistics of RTK positions

Precision Analysis of VRS Survey (1 Meas. in 1 sec.)						
	Point 101			Point 102		
	Northing	Easting	Elevation	Northing	Easting	Elevation
STD	0.02	0.01	0.04	0.01	0.01	0.04
Range	0.09	0.06	0.20	0.08	0.07	0.19
Units: Survey Feet						

Table 2: Statistics of VRS positions

VRS Delays During Testing

VRS positioning, compared to RTK positioning on this particular day, required twice the amount of time to complete, since many of the observations did not meet the vertical and horizontal tolerance set, therefore, additional time was required to observe measurements that did meet the tolerances. In addition, we were unable to gain a fixed solution for some time (~30 minutes), which delayed our VRS test.

Conclusion

In this study, RTK and VRS techniques were evaluated to determine the repeatability performance of each system. We independently chose an area to perform our test by selecting an area that was a near ideal scenario. Subsequently, RTK and VRS positioning were performed at the chosen test site. Nonetheless, from the limited data acquired we may conclude that if performed under the best case scenario, RTK positioning will provide improved repeatability performance when compared to the VRS system tested.

The author wants to acknowledge the support of Rich Josenhans, Executive Vice-President from the WestLAND Group (located in Rancho Cucamonga, California) for his insight and feedback throughout this study. He also wants to thank Omar and Travis for their assistance with the project.

FIGURE 2: Rover system used for RTK and VRS data acquisition

Editor's Note:

Land surveyors should more frequently test the ACUTAL measurement capabilities of their equipment. Rudy has done a great job demonstrating how this can be done, and has produced intriguing results about the comparison of the vertical precision of RTK GNSS surveys and VRS GNSS surveys. I hope to see more of this testing in our profession moving forward, and I'm eager to share the results of such testing in future articles of our magazine.

What You Need to Know to Determine If UAVs Are Right For Your Survey Business

By Daniel Katz

Introduction

The explosion of Unmanned Aerial Vehicle (UAV or "drone") technology has led several industries to explore how this technology can provide value. While for many industries, UAVs have not yet lived up to their hype, more and more survey firms are discovering that they are uniquely positioned to capture real value from UAV technology today.

Though the land surveying industry writ large is realizing value from UAV technology, this does not mean that the opportunity is equal for every survey firm. In order to determine whether investing in UAV technology is right for a surveyor, it is crucial to understand both the real-world sources of and the real-world constraints on UAV-generated value.

Aerotas is focused on the real world of UAV operations. We help firms across industries set up and run their own UAV program, by equipping them with the right technology, training, and operational needs to immediately start profitably using UAVs in their operations. In our experience with land survey clients, we have learned the real world factors that determine whether a survey firm can realize value with a UAV program.

The Basic UAV Technology Stack

Most survey firms' UAV operations involve three pieces of technology: a UAV with a camera, autopilot software, and image processing software. There is a broad diversity of commercially-viable UAV technology available, from high-end hobby grade through military-grade, multi-rotor or fixed-wing. These UAVs range in operating capabilities, as well as in payloads they can carry — from different scales of cameras to laser scanners. Almost all have standard GNSS receivers, and some can carry RTK packages. A common package that Aerotas has found is feasible and profitable for the most surveyors includes a top-end consumer grade multirotor UAV with an integrated camera.

The Deliverables UAV Technology Can Produce

Most surveyors use a UAV to produce three valuable deliverables: a surface model, an ortho-rectified photograph, and individual photos and videos.

Surface Model

Using photogrammetry, the UAV software processes the images collected in a flight and produces a point cloud. Using the point cloud, surveyors can produce topographic maps, digital surface models, and models of buildings and structures. These can be pulled into 3D modeling software for line-work or engineering design. The processing software can also use this data to quickly and easily calculate volumes.

Orthophoto

The UAV package is also able to take the imagery generated in a flight and stitch together a high resolution ortho-rectified photograph. This orthophoto is useful for recording exactly how a site looked when it was surveyed, allowing for drawing or verification of line work and providing overall situational awareness.

Photo and Video

Finally, for some firms, simply being able to produce high-quality 4K photo and video can provide value. Firms use this capability for producing their own marketing materials, creating add-on deliverables for their clients, or being able to inspect and record key features of a job site.

How UAV Deliverables Translate to Real Value

While the added value of in-house marketing materials or client add-ons is self-evident, understanding how the 3D model and orthophoto deliverables can create value requires an additional layer of analysis. The value of these deliverables is predominantly in the savings they confer, rather than the new value they add.

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Reduced Man-Hours

The most direct way a UAV program can pay off is by reducing crew man-hours. Assume that completing a standard 10-acre survey job takes a conventional two-man crew one full day to create a topographic map with one-foot contours. Completing this same job with a UAV requires setting ground control points, executing the UAV flight, and processing the data. Setting ground control points (usually 5-10 total) on a 10-acre site takes around two hours. The flight, including safe operating procedures, takes 30 minutes. The processing to convert the UAV imagery into a 3D model takes about two hours of work, plus about two hours of computer processing time. This means that creating a standard topographic map of a 10-acre site goes from taking 16 man-hours to fewer than five.

Reduced Reliance On Contractors

A key opportunity for value is saving money that would otherwise be spent on contracting aerial contractors. Even when factoring in the additional man-hours to do the line work often included by aerial survey contractors, the total cost of completing aerial surveys in-house is significantly less than outsourcing. Furthermore, bringing this capability in-house reduces reliance on another firm's schedule, and dramatically reduces turnaround time.

Improved Situational Awareness and Verification

Regardless of the ultimate output, every operation with a UAV automatically collects high resolution site imagery. This means any existing data can be verified against the imagery behind it, providing certainty that the correct shot is being taken. When surveyors are drawing in the line-work on a UAV-generated map, they are drawing over the top of actual imagery of the site, allowing them to verify that the line is representing the correct feature. Furthermore, contextual and ancillary information about a surveyed site is readily available. This capability of UAV survey obviates the risk of providing erroneous information to clients or the cost of sending personnel back to a site to verify information.

Reduced crew risk

The course of their work often puts survey crews in potentially dangerous settings. Using a UAV to complete surveys in high-risk settings like roadways, cliffs, or unstable terrain reduces risk exposure.

The operational limits of UAVs

As capable as UAVs can be, they are not the right solution for every job. It is essential to understand the operational capabilities and limitations of the technology. There are four key variables to consider: accuracy, acreage, ground cover, and weather.

Accuracy

Common UAV systems are capable of reliably achieving accuracy between 0.1 and 0.2 feet when including Ground Control Points. Ground control points are a set of usually 5-10 known coordinates that can be identified from the air, and serve to anchor the digital model to the real world. Accuracy from operating UAVs without ground control points is limited by the GNSS receivers onboard the aircraft, which are usually accurate within a few feet.

This level of accuracy means that UAVs are most valuable for planning-grade surveys and producing standard one-foot contour topographic maps. There are systems capable of achieving higher accuracy via technologies such as aerial lidar and onboard RTK, which are considerably more expensive and complex.

Acreage

Common UAV systems work best for sites between 1 and 200 acres. A single 15 minute flight can cover up to 50 acres, with larger sites requiring only a quick battery change. Beyond about 200 acres, it is often more efficient to use traditional aerial surveying firms instead of UAVs. At the other end of the spectrum, one acre is usually the cut-off at which conventional terrestrial surveying is more efficient than using a UAV. There are UAVs that can easily cover greater acreage, however they are significantly more expensive and complicated.

Ground cover

Since most UAVs use photogrammetry to create their models, the UAV only measures what it can see, whether that be bare ground, grass, buildings, or trees. Hardscape and bare ground are easiest for the UAV to survey, while it is difficult to get valuable information from heavily covered areas. Sparse or irregular ground cover is viable as well, as the system automatically captures enough oblique imagery that it is possible to see underneath the occasional tree or shrub.

Weather

As with all aircraft, UAVs are subject to weather-based limitations. Most UAVs are reliable in up to 15mph winds; however, any moisture presents issues. Rain, snow, or dense fog all can interfere with the onboard electronics, reduce the ability of the camera to capture good data, and reduce safety by making it harder to see other aircraft or obstacles. Due to the types of batteries used, the aircraft should not be flown below freezing temperature. As with other limitations, there is specialized equipment that can operate in extreme conditions, but these are more expensive.

The Trajectory of U.S. Federal Regulation

The final and most dynamic topic to understand is commercial UAV regulation. Fully covering this topic could easily warrant

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a full book, so this section only addresses the most salient points of regulation. The key takeaway is as that the current FAA regulatory regime is overly burdensome to the point of making compliance unfeasible; however, the FAA will be implementing new rules starting in June, under which compliance will be viable for nearly all surveyors.

Regulation Today

To operate in perfect compliance today, the company must receive a special FAA-issued exemption called a 333 exemption (which takes about six months), and the operator must hold a pilot's license. In addition, flying anywhere near airports is generally prohibited, and getting special permission is difficult. Many companies currently operate UAVs without following these regulations, which has put pressure on the FAA to develop a new set of rules.

Regulatory Opening Coming June 2016

The FAA is on track to implement new commercial UAV rules in June, which are expected to do away with the exemption and license requirements. Instead, the new set of rules will require a written knowledge-based test, which will be proctored at local FAA offices. The FAA has also indicated that it intends to make operations near airports more flexible and straightforward.

Key Regulations That Will Remain After June

Two key restrictions that are likely to persist in the new rules are the requirement to maintain the aircraft in sight at all times, and to operate with a Pilot In Command. The line-of-sight rule places an effective limit on the size of plots that can be surveyed with UAVs: in clear weather most UAVs are only visible for about 1,200 linear feet, meaning that they can only cover about 125 acres while staying in sight from a central point.

The Pilot In Command requirement means that a UAV must have a dedicated operator with the ability to land the UAV in the case of emergency. In other words, a UAV operation without any human involvement will not be legal.

Conclusion

New technology always presents a mix of exciting opportunity and overwhelming challenge. However, land surveyors have always been some of the most capable professionals at realizing the value of new technologies. From GPS to robotic total stations, surveyors have proven their ability to rapidly scale new learning curves. This has also forced successful firms to be shrewd evaluators of the return on investment in new technology. UAVs are quite literally adding a new dimension of both opportunity and challenge. Making the right decision about whether UAVs are right for a given survey operation is a matter of knowing what to evaluate: how the technology works, what it can produce, how those deliverables translate to value, the limits of the technology, and the state of regulation.

We hope this article will serve as a simplified starting place for surveyors to identify whether using UAVs may present a profitable opportunity for their business. There is, however, a great deal of nuance in designing and implementing a UAV program that will maximize profit and minimize risks. Aerotas aims to make it as effortless as possible for our land survey clients to own and effectively use their own UAVs, by packaging together the right UAV technology with training, insurance, operations, regulatory compliance strategy, and continued support and service.

Daniel Katz is Co-Founder of Aerotas. He can be reached for more information at *daniel@aerotas.com.*

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