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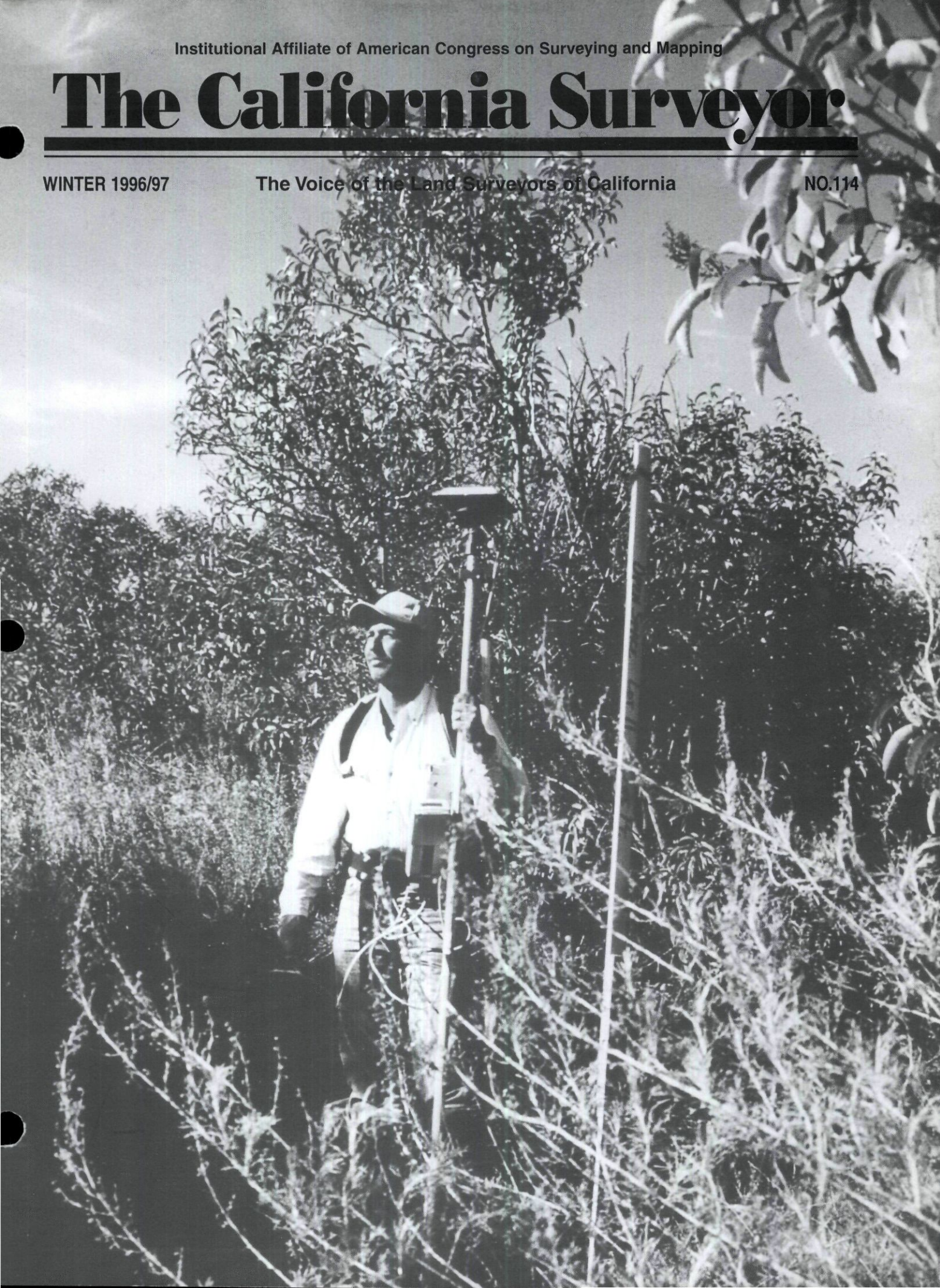
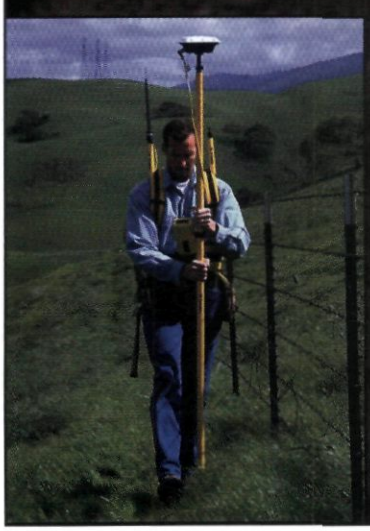
The California Surveyor

WINTER 1996/97 The Voice of the Land Surveyors of California NO.114





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The California Surveyor

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

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

PERSONNEL

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Membership in the California Land Surveyors Association, Inc. as a Sustaining Member is open to any individual, company, or corporation who, by their interest in the land surveying profession, is desirous of supporting the purposes and objectives of this Association. For information regarding Sustaining Membership, contact CLSA Central Office, P.O. Box 9098, Santa Rosa, CA 95405, (707) 578-6016, Fax (707) 578-4406.

EDITORIAL MATERIAL

All articles reports, letters, and contributions are accepted and will be considered for publication regardless of the author's affiliation with the California Land Surveyors Association, Inc. Contributions submitted on floppy diskette medium are encouraged. For compatibility, disks should be 5.25 or 3.5 inch, MSDOS (IBM compatible) format. We can accept ASCII text files or word processor files from the following programs: WordPerfect or Microsoft Word.

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DEADLINE DATES

Spring	January, 10, 1997	Summer	April 10, 1997
Fall	July 10, 1997	Winter	October 10, 1997

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

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Photo by: John R. Winn

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From the Editor

GIS, GPS, LSA and Widgets

By: Tom Mastin, PLS

Going against one of my ten axioms of life, this article may actually be about some issue that is of interest to surveyors. Before I start, our staff attorneys have asked that I place this disclaimer. The following opinion does not represent the opinions of the California Land Surveyors Association, The staff of the '"California Surveyor", the editor of the California Surveyor or any persons living or dead ...

I had a discussion with a respected fellow surveyor. The discussion concerned the GIS and GPS words. Worse than that, the Land Surveyors Act was also mentioned in the same discussion. The discussion went something like this: Me: "Are you going to eat those fries?"

Not Me:"I heard about a request for proposal that was being let to locate a series of widgit stations across the state. The work consisted of locating 1000 widgits to within 5 meters of relative position. The work was being done in order to ensure the Widgit spacing was sufficient for 100% radio-link coverage within the state. In addition, the access road to the widget stations were to be located within 5 meters to make sure the widgit repair trucks could get to the widgit stations. The information was then to be put into a GIS system operating ArcWidget 4.0"

Me: "Could you pass the Ketchup?"

Not Me: "The contract was issued to a company that specialized in creating GIS systems and did all the data collection work themselves. They had no licensed land surveyors on staff nor did they contract with any surveyors!!"

Me: "It doesn't look like you are going to have the other half of your sandwich"

Not Me: "The people issuing the contract was the state agency 'Department of Widget health and welfare'. So I called them to inform them that they were in violation of the Land Surveyors Act and that a land surveyor licensed by the State of California must perform the data collection. The guy I talked to kept thinking I had something to do with putting lawns in and could never figure out why landscapers had to do the work."

Me: "Grumpph !"

Not Me: "So I've written to the Board of Registration to tell them that they have to stop this work and any work done in the state that involves GPS and does not involve a licensed Land surveyor. I think as a profession we must protect the public from those using GPS who are not qualified. The Land Surveyors Act specifically states that the use of trigonometry to determine a position falls within the land surveyors province "

Me: "Miss can I get a double fudge sundae ?"

Not Me: "The board wrote me back and stated in a letter that they understood my concerns and are currently addressing the issue and the Land Surveying Technical Advisory Committee is in the middle of a 2 year study of how the issue of GPS and GIS can be addressed by a Blue Ribbon Committee and hope to have an answer before the turn of the century on who should be on the blue ribbon committee and if in fact they actually have to provide blue ribbons".

Me: "Hey I must have left my wallet at home, can you get the check ?"

Not Me: "Yeah sure - you %$##".

This conversation brought up three important issues. The first is obviously never hesitate to pay for my lunches. The other two are more complex. First when, if ever, does the Land Surveyors act regulate the control of GPS and GIS? The second, just as important, what is the practical regulation of GPS and GIS within the Land Surveyors Act?

Now like most land surveyors I am not smart enough to charge for what I am worth, but I am smart enough to understand and interpret the California Codes. However, I know better than to argue my case in front of a jury of my peers, as my peers tend to be quick with the rope. So I just want to throw out a few observations on the issue at hand in hopes to irritate someone enough to respond in writing to the California Surveyor.

Is the use of GPS for the collection of a data for GIS system regulated by the Land Surveyors Act? I don't see how. My recollection to the Land Surveyors Act, from when I was studying for the Land Surveyors test, it said something about we were licensed to protect the public welfare and property. If I recall some speakers I've heard over the years who are experts in legal matters (and of course, what land surveyor is not also an expert in legal matters); they always said something about the state licensing us because the general public could not be expected to determine our competence merely by

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mounted on a bipod is slanting quite sharply toward Maggies and the "surveyor" appears to be lining up a flagman by peering through the spindle of the compass. I used to work fot the U.S. General Land Office trying to make sense out of the fraudulent contract surveys of an earlier period. Your example of a surveyor must have been an old contract surveyor. He looks drunk which means he met the qualifications.

However, in the event that you have never encountered a real "Intrepid Surveyor" I enclose a copy of a page from the brochure of "Engineering Surveys Company". I think the picture is self explanatory.

I have been retired for over twenty years and the gap in equipment and methods is just too great for me to have any understanding or interest in the surveying of today. Thank you for sending me your magazine.

◆

John B. Duff

Advanced Technologies Corner

By: Michael R. McGee, PLS

GEOID 96

The National Geodetic Survey has an on going program to develop a national geoid model. This model computes the "Geoid Height" at a given location (latitude & longitude) which can be combined with ellipsoid height differences obtained by GPS to estimate orthometric elevations. The latest version "Geoid 96" was published in October. This model is expected to be quite an improvement over the former Geoid 93. Information and program copies can be obtained at the National Geodetic Survey Web Site on the Internet listed at the end of this article. The following information describing Geoid 96 was obtained from this site.

NGS Announces New Geoid96 Model

The GEOID96 model was computed on October 1, 1996 using over 1.8 million terrestrial and marine gravity values. The result is a gravimetric geoid height grid with a 2' X 2' spacing in latitude and longitude (2' x 4' in Alaska), referred to the Geodetic Reference System 1980 (GRS 80) normal ellipsoid in an International Terrestrial Reference System 1994 (ITRF94) frame. Then, by means of NAD 83 GPS ellipsoidal heights on NAVD 88 benchmark data, plus known relationships between NAD 83 and the ITRF94 reference frames, a conversion is applied to generate the final GEOID96 geoid model. This conversion causes the GEOID96 model to be biased relative to a geocentric ellipsoid; but, this bias is deliberate. The GEOID96 model was developed to support direct conversion between NAD 83 GPS ellipsoidal heights and NAVD 88 orthometric heights.

When comparing the GEOID96 model with GPS ellipsoidal heights in the NAD 83 reference frame and leveling in the NAVD 88 datum, it is seen that GEOID96 has roughly a 3-cm accuracy (one sigma) in the regions of GPS benchmark coverage. In those states (Arkansas, Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, North Dakota, South Dakota, and West Virginia) with sparse (150km+) GPS benchmark coverage, less point accuracy may be evident; but relative accuracy at about a 1 to 2 part-per-million level, or bet-

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ter, should still be obtained. For users with less stringent accuracy requirements, simple height conversions with GEOID96 in the conterminous United States can be sufficient. For users with more stringent accuracy requiements, please see the section entitled "Deriving Orthometric Heights From GPS", later in this document. Users should be aware that GPS ellipsoid height error, by itself, can be significantly greater than error in geoid height differences. As a rule, one can expect better results with GEOID96, relative to GEOID93, in any part of the United States.

The GEOID96 models in Alaska, Hawaii, Puerto Rico, and the Virgin Islands were NOT, computed by incorporating a conversion surface based on GPS benchmarks. This was due to a shortage of reliable NAD 83 GPS ellipsoidal heights on NAVD 88 benchmarks in these regions. The GEOID96 geoid models provided in these areas are relative to a geocentric, GRS80 ellipsoid; as were earlier GEOID93 and GEOID90 models. Due to poorer data coverage, error estimates for GEOID96 in these regions are larger. Long-wavelength errors may be as large as 4-5 parts-per-million in some areas.

Deriving Orthometric Heights From GPS

One key problem is deciding which orthometric height datum to use. NGVD 29 is not a sea-level datum, and the heights are not true orthometric heights. The datum of NAVD 88 is selected to maintain reasonable conformance with existing height datums, and its Helmert heights are good approximations of true orthometric heights. And, while differential ellipsoidal heights obtained from GPS are precise, they are often expressed in the NAD 83 datum, which is not exactly geocentric. In addition, GEOID96 rests upon an underlying EGM96 global geopotential model, and EGM96 does possess some error of commission.

Do not expect the difference of a GPS ellipsoidal height at a point and the associated GEOID96 height to exactly match the vertical datum you need. The results will be close when converting NAD 83 GPS ellipsoidal heights into NAVD 88 elevations; but, maybe not accurate enough for your requirement. However, one can combine the precision of differential carrier phase GPS with the precision of GEOID96 height differences, to approach that of leveling.

Include at least one existing benchmark in your GPS survey (preferably many benchmarks). The difference between the published elevation(s) and the height obtained from differencing your adopted GPS ellipsoidal height and the GEOID96 model, could be considered a "local orthometric height datum correction." If you are surveying an extensive area (100+ km), and you occupy a lot of benchmarks, then you might detect a trend in the corrections up to a one part-per-million level. This may be error in the GEOID96 model. Future Plans

A research effort is underway to improve geoid height estimates in the future, perhaps at the 1-cm accuracy level. One important direction is integrating gravity data with GPS and geodetic leveling measurements, and the study of error in GPS ellipsoid heights and in the NAVD88 vertical datum. It is likely that this research, in conjunction with the completion of the state upgrade GPS surveys, will yield a significant improvement to our geoid model in 1999.

For Products Available
From the National Geodetic Survey:
Web site: http://www.ngs.noaa.gov/GEOID/geoid.html
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National Geodetic Survey, NOAA, N/NGS12
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Silver Spring, MD 20910-3282
301-713-3242 fax: 301-713-4172

◆

Real-Time Construction Staking

By: D.K. Nasland, PLS and David Paul Johnson, PLS

Surveying has become a high-tech discipline. This is a radical change compared to the 1950s, when surveyors developed skills on the job. Today we commonly use global positioning systems (GPS) for control networks and monitoring. However, many surveyors are still skeptical about its use for construction staking. There is legitimate concern over the elevations developed by GPS receivers. We believe these can be managed with appropriate network design and project calibration.

Historically, surveying instruments have developed elevations referenced to the Geoid. When adjusted properly, the horizontal axis of a surveying instrument (level, etc.) is perpendicular to the pull of gravity, and therefore parallel to the surface of the Geoid. Heights above the Geoid are commonly known as orthometric heights or elevations. However, GPS receivers measure heights relative to a reference ellipsoid such as WGS-84, GRS-80, or Clarke's spheroid of 1866. Heights above an ellipsoid surface are known as ellipsoid heights, or GPS heights. When enough good bench marks and precise GPS heights are combined with an accurate Geoid model, GPS technology is capable of developing reliable project elevations.

A little over a year ago, our firm was considering buying GPS receivers. While doing research, cost and billing projections, we talked with as many current users as possible Real-time kinematic (RTK) equipment was just being released for the general surveying community, and one prominent GPS surveyor asked us why we would even want to use RTK. We went ahead, but it has taken our firm some time to develop faith in a tool in which you cannot see or feel any part of the element being measured.

Now we have completed a successful staking project, and we believe our experience will be useful to others With help from the Trimble Organization, Sunnyvale, Calif., we developed the following procedures for this staking project. We established a network of horizontally and vertically surveyed positions that accurately defined the site. We surveyed, using GPS, the same control points and developed a calibration to be used in RTK that defined the geoid (gravity model) for this specific site. We set the construction stakes and validated the work in progress.

This staking project was a 250 acre site in Ramona, California. The subdivision approval process consumed more than 4 years, and the final documents specified almost 200 acres as permanent open space. Due to terrain and environmental considerations, there are only 20 home sites. Construction staking included almost 4,000 meters of private access roads and more than 5,000 meters of boundaries marked open space. We also staked the 20 pad sites and their access roads.

Several characteristics made this project ideal for RTK staking. First is the topography; the high and thick brush on this site is typical of coastal sage prevalent in Southern California coastal mountain slopes. There are shrubs, trees and sages that intertwine with adjacent plants, making it impossible to walk through at times. This tangle can limit visibility to less than 3 meters.

Traditional survey methods using optical instruments and chaining or electronic total stations would have required many instrument setups, high rods and a lot of brush cutting for sight lines. Marking the open space alone would have involved a significant amount of site control with conventional surveying methods. RTK minimized the number of setups and visibility problems. We were required to mark the open space at each lot line and angle point no more than 90 meters apart. For practical purposes, we also had to

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Adverse Possession

Unsuccessful Adverse Possession Claimant May Not Receive Prescriptive Easement That Dispossesses Title Owner Of Use Of The Property.

Mehdizadeh v Mincer (1996) 46 CA 4th 1296, 54 CR2d 284

In 1967, Cruz installed a fence between his property and the adjacent lot. Later that year, the Weissmans purchased the adjacent lot. They assumed that the fence straddled the property line and reimbursed Cruz for half the cost of the fence on Cruz's request. In 1985, the Mincers purchased Cruz's property; they know from the plot maps that the fence was not placed on the legal boundary. In 1990, the Weissmans sold their property to Mehdizadeh. Later that year, the Mincers commissioned a survey which established that their property line extended ten feet beyond the fence. Mehdizadeh continued to maintain vegetation and a sprinkler system in the now-disputed property. The Mincers constructed a new fence on the boundary disclosed by the survey. During construction, the vegetation and sprinkler system were destroyed and Mehdizadeh sued for damages.

The trial court ordered the Mincers to pay Mehdizadeh &1500 to restore the property to its original condition and, pursuant to the agreed-boundary doctrine, gave fee title to Mehdizadeh, but enjoined him from using the land for anything other than landscaping and recreation; the Mincers retained an easement for light air, and privacy and were required to remove the new fence.

The court of appeal reversed, holding that the agreed-boundary doctrine applies only when, in order to prevent litigation, the parties resolve uncertainly about the true boundary by mutual agreement; there was no evidence that the original fence was built in order to resolve disagreement between owners about the true boundary line.

Furthermore, the trial court gave Mehdizadeh an interest that amounted to adverse possession under the guise of a prescriptive easement, because the Mincers were precluded from entering on or making any use of their land, while Mehdizadeh could enjoy use of the property, short of building on it. Mehdizadeh could not claim adverse possession because he had not paid taxes on the disputed property, a requisite element. The appellate court directed the trial court

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Preliminary Program

SUNDAY, MARCH 9, 1997

1:00 p.m. - 2:00 p.m.	Opening Ceremonies/Keynote Address - *Donald A. Wilson*
2:00 p.m. - 3:00 p.m.	Visit Exhibits
3:00 p.m. - 5:00 p.m.	Boundary Retracement Case Study - *Donald A. Wilson*

MONDAY, MARCH 10, 1997

7:30 a.m. - 8:00 a.m.	Coffee & Rolls with Exhibitors
8:00 a.m. - 9:30 a.m.	Legal Aspects of Research (Part 1) - *Donald A. Wilson*
9:30 a.m. - 10:30 a.m.	Visit Exhibits
10:30 a.m. - 12:00 p.m.	Legals Aspects of Research (Part 2) - *Donald A. Wilson*
12:00 p.m. - 1:30 p.m.	Joint Luncheon -A Light Hearted, Humorous, and Unexpected Talk - *Jeff Hendler*
1:30 p.m. - 2:00 p.m.	Visit Exhibits

Concurrent Sessions

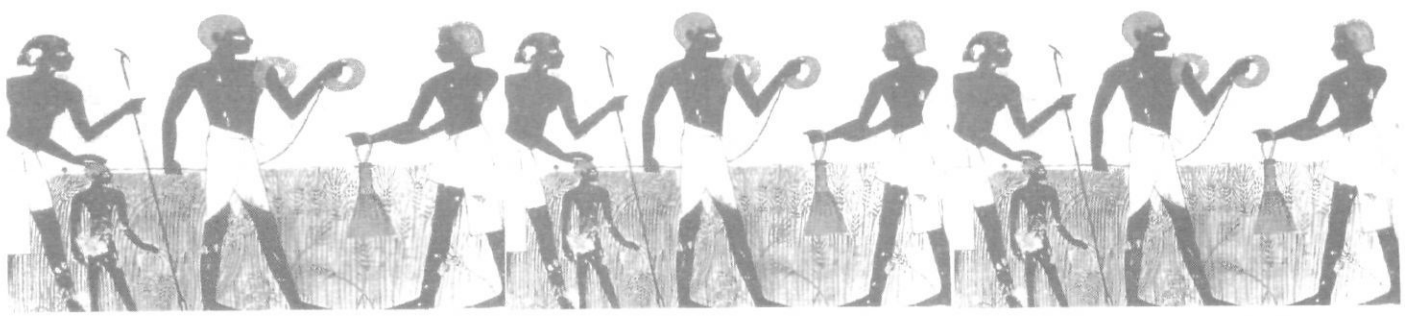
2:00 p.m. - 3:00 p.m.	Subsidence and Subsidence Monitoring (Part 1) - An Overview of Geoidal Modeling and GPS Derived Elevations - *David Paul Johnson & Edmund "Moe" Miller*
2:00 p.m. - 3:00 p.m.	Time Management - *Dr. John Kohl*

Concurrent Sessions

3:00 p.m. - 4:00 p.m.	Subsidence and Subsidence Monitoring (Part 2) - *Marti Ikehara and Alan Ramelli*
3:00 p.m. - 4:00 p.m.	How to Hire and Fire - *Dr. John Kohl*
3:00 p.m. - 4:00 p.m.	Customer Service and Goal Setting- *Jeff Hendler*
4:00 p.m. - 4:30 p.m.	Visit Exhibits

Concurrent Sessions

4:30 p.m. - 5:30 p.m.	Panel Presentation - The Clark County GIS Update Case Study - *Dave Edwards, Dave Gray and Brett Jefferson*
4:30 p.m. - 5:30 p.m.	Internet 101 - *Michael V. Ekedahl*
6:00 p.m. - 9:00 p.m.	***Exhibitor-Sponsored Cocktail Party & Education Foundation Scholarship Auction - Larry Tardie, Auctioneer***



TUESDAY, MARCH 11, 1997

7:30 a.m. - 8:30 a.m.	Coffee and rolls with Exhibitors

Concurrent Sessions

8:30 a.m. - 9:30 a.m.	GPS and the Surveyor - *Brett Jefferson and Mark Bardakjian*
8:30 a.m. - 9:30 a.m.	Four Laws of Motivation - *Daniel McAllister*
8:30 a.m. - 9:30 a.m.	Title Problems Caused by Past Legal Descriptions - *James R. Dorsey*

Concurrent Sessions

9:30 a.m. - 10:30 a.m.	GPS and GIS (Session 1) - *Jerry Wagner*
9:30 a.m. - 10:30 a.m.	Starting Up Your Own Business - Entreprenueralism - *Ed Joyce*
9:30 a.m. - 10:30 a.m.	Title Problems Caused by Past Legal Descriptions - *James R. Dorsey*
10:30 a.m. - 11:00 a.m.	Visit Exhibits

Concurrent Sessions

11:00 a.m. - 12:00 p.m.	GPS and GIS (Session 2) - *Fred Wong and Mary Tsui*
11:00 a.m. - 12:00 p.m.	Kick-Starting a Company in a Mid-Life Crisis: Differences and Strategies - *Ed Joyce*
12:00 p.m. - 2:00 p.m.	Joint Luncheon - Egyptology - *David Goodman*

Concurrent Sessions

2:00 p.m. - 3:00 p.m.	High Accuracy Surveying with GPS (Session 1) - *Dr. Richard Snay*
2:00 p.m. - 3:00 p.m.	Legal Aspects of Surveying - *Jerry Broadus*
3:00 p.m. - 3:30 p.m.	Visit Exhibits

Concurrent Sessions

3:30 p.m. - 5:00 p.m.	Mock Trial - *Jerry Broadus*
3:30 p.m. - 5:00 p.m.	High Accuracy Surveying with GPS (Session 2)- *Dr. Dennis Milbert*
5:00 p.m. - 5:30 p.m.	Closing Ceremonies and Grand Prize Drawing

WEDNESDAY, MARCH 12, 1997

8:00 a.m. - 5:00 p.m.	Tenures of Land Evaluation of Evidence, Admissibility of Evidence, and the Location of Boundary Ownership Lines -*Robert W. Dahl, BLM and Jerry Broadus*

THURSDAY, MARCH 13, 1997

8:00 a.m. - 12:00 p.m.	Subdivision of Sections; An Overview - *James D. Claflin, BLM*
1:00 p.m. - 5:00 p.m.	Controlling Intermediate Monuments and Junior/Senior Corners - *Ronald W. Scherler, BLM*

THE CURRICULUM ...

- Historical
- Master Title Plats
- Original surveys
- Retracement and Evidence
- Completion Surveys
- Restoration of Lost Corners by Proportionate Measurement
- Junior-Senior Relationships
- Subdivision of Sections
- Independent Resurveys
- Controlling Intermediate Monuments
- Hiatus and Overlaps
- Local Surveys
- Area Relationships
- Legal Descriptions
- Records Research
- Riparian Surveys (I,II,III)
- Mineral Surveys (I,II)
- Special Surveys
- Special Methods
- Geodesy
- Data Coordinates and Data Bases
- Coordinate Systems and Projections
- Photogrammetric and Cartographic Products
- Alaska Surveys
- Fraudulent Surveys
- Survey Protests and Appeals
- Interior Board of Land Appeals
- The Surveyor in Court

BLM WORKSHOP

Wednesday, March 12, 1997 & Thursday, March 13, 1997
8:00 a.m. - 5:00 p.m.

COURSE DESCRIPTION/LEARNING OBJECTIVE

Advanced Cadastral Survey (Part One of Six Parts) presented by the Bureau of Land Management. The Opportunity: Since 1980, the Bureau of Land Management has offered a course called Advanced Cadastral Survey designed for senior field surveyors of its own Cadastral Survey Staff, and for comparable employees of other Federal Agencies.

In response to the interest expressed in this course by private professional surveyors, and at the request of the Western Federation of Professional Surveyors, this course has been developed for experienced surveyors in the private sector. It is intended for individuals who hold valid state licenses to practice land surveying.

The Course: Advanced Cadastral Survey is an intensive course which covers the major aspects of cadastral surveys, with particular emphasis on the U.S. Public Land Survey System with supporting specialties. The majority of instructors will be BLM Cadastral Surveyors highly experienced in their area of instruction. Selected experts from other sources may be used as appropriate.

PROGRAM SPEAKERS

JAMES D. CLAFLIN

SUBDIVISION OF SECTIONS AN OVERVIEW

The Land Surveyor is employed as an expert to identify land which have passed into private ownership. This usually requires the subdivision of sections into aliquot parts. In this capacity the Land Surveyor is performing a function contemplated by Federal Law. This presentation, based on the 1973 Manual of Surveying Instructions, explores the subdivision of various types of sections with an emphasis on fractional sections and special situations.

JERRY BROADUS AND
ROBERT W. "BOB" DAHL

TENURES OF LAND EVALUATION OF EVIDENCE, ADMISSIBILITY OF EVIDENCE, ANDTHE LOCATION OF BOUNDARY OWNERSHIP LINES.

Through the perspectives of a Private Surveyor/Attorney, and a BLM Cadastral Surveyor, what is evidence, and how to document evidence is examined. The tangle of; previous surveys land ownership status, survey authorities, laws, policies, customs, overlapping jurisdictions and more, are carefully scrutinized. Review of actual boundary ownership line location cases on the Public Land Survey System, clarify and illustrate up-to-date interpretations, conflicts, and trends.

RONALD W. SCHERLER

CONTROLLING INTERMEDIATE MONUMENTS AND JUNIOR-SENIOR CORNERS

The first portion of this session will focus on the use of intermediate corners; meander corners, witness corner, line trees, witness points and closing corners to reestablish corners, such as 1/16th and 1/64 section corners. The second portion will look at junior-senior corners prior to 1973 and in accordance with section 5-35 of the 1973 Manual of Surveying Instructions.

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mark the open space often enough so that the next point in line could be seen.

The second reason we decided to use RTK at this site was because the site was large enough to realize the benefits of the method. Third, the area had been surveyed and controlled rigorously in 1990 using conventional methods, so we were able to control and validate the RTK work.

The site topography includes several meadows separated by steep brush-covered hills rising more than 50 meters above the meadows, some of which also have high sage. The meadows will contain the access roads and driveways to each building pad. The building pads are designed to take advantage of the views and are placed as high on the hillsides as practical.

Local mapping requirements determined that we should base our project on the North American Datum of 1983 (NAD83). We had an abundance of first- and second-order survey control monuments in the area, so fulfilling this requirement was not difficult. Twenty horizontal and vertical control points were previously established for use with an aerial photogrammetric mission. We positioned each point within a surveyed network that allowed some redundancy and used these for our current RTK GPS Survey.

First, we established a network that accurately defined the site. In general, the network can be an existing one or composed of newly established positions, but it should be readily accessible. The network should also nominally surround the working site. It should be designed, surveyed and adjusted with sound surveying practice.

Next, we surveyed, using GPS, the previously established control points. Then we resurveyed each position with RTK. We included enough redundancy to give satisfactory checks. We calibrated the survey to the published positions, set the construction stakes and made sufficient verifications to validate the work.

We checked into the previously established control network and restaked several construction stakes for quality control. In some cases, we changed the rod height and measured the point just set. We then compared the vertical element of the stake to the design value. Finally, if things did not look right, we found out why.

These procedures are fairly simple. Because RTK is fast, we actually spent very little time in the checking mode. Most positions are established in only a few seconds.

CHECKING OUT

In 1990, our firm located all property monuments still existing and surveyed them together with vertical benchmarks into the site network. The methods from 1990 used total stations for the horizontal network and automatic levels for the vertical element of the control. We constructed 20 additional horizontal and vertical control monuments to use as photo control for an aerial mapping program. The new aerial-control monuments happend to be properly spaced and sufficient in number to be used as the control for defining the geoid for our RTK project area.

In January 1996, we resurveyed each of the aerial-control points along with several first- or second-order geodetic

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control points with real-time GPS methods. This operation took a little more than a day. Our procedure was to set up a base receiver over one of the first-order stations and then occupy each of the aerial-control and geodetic points. After an initial tie was made at each point, we changed the antennae height by a set amount and reshot the same point. Each point took less than 2 or 3 min. including confirming satellite lock. Each occupation resulted in two observations of the same point. The varied terrain meant that we needed a dense radio network to traverse the project site without constantly moving radio repeaters. We rejected the option of a higher-powered radio due to the sharply changing terrain and used a low powered repeater layout that worked for us. RTK requires a radio link between each GPS receiver and the base GPS receiver. The base GPS receiver broadcasts its position along with satellite information and GPS time in data blocks. Roving receivers use the information in the data blocks to determine their position within about 1 cm in real time. If the receivers maintain radio link and satellite lock, horizontal and vertical positions can then be determined in seconds and used for construction staking purposes. There are two ways to make the necessary radio link. One can use a high-powered radio to transmit GPS RTK base station information over an entire job site. The other choice is to use several low-powered radio repeaters linked together in order to relay RTK information from the GPS base station to the roving GPS receiver(s). Generally speaking, each low-powered radio repeater will only cover a portion of a large job site because low-powered radios are somewhat limited to line-of-sight. On the other hand, high-powered radios are better able to cover a larger job site and are generally not as limited when it comes to line-of-sight operation. Because the low-powered radios have a shorter range, they do not require a federal radio license, however, because of the greater range, the high-power radios require federal licensing.

Production ranged from 1,200 to 2,200 meters per day of open-space layout. If we had used conventional surveying techniques, we estimate production would have been 500-1,200 meters, with much effort spent in clearing the line. We probably would have spent a lot of time assuring the line of sight between markers. Staking the pads and driveways was also rapid. The elevations returned by RTK were all within 2 cm of expected results.

We began the project with two Trimble 4000 SSE receivers. Trimble loaned us a new 4000 SSI so we could compare production. The difference was amazing. The SSI cut several minutes from the initialization time and also maintained satellite lock better, allowing the operator to work in thicker tree cover than before.

We had several nontechnical difficulties. There were many rattlesnakes, and a very heavy tick population, and we even discovered fresh mountain lion tracks. However, the crew took the proper precautions, wearing snake leggings and proper clothing as well as using repellent. We never saw the mountain lion, although there have been several attacks and one death within about 25 km of the site.

In the end, we staked this site as designed, and the results matched very closely with design expectations. We finished within our budget. No one was eaten by a mountain lion, developed Lyme disease or was bitten by a rattlesnake.

GPS DEMYSTIFIED

The GPS satellite network was initiated in 1978 by the Department of Defense and became a full constellation of 24 satellites in 1993. The satellites (the space segment) maintain closely monitored 12 hr orbits, approximately 20,000 km above Earth. They have radio receiver/transmitters that send updated satellite position information into individual satellites from Earth-based monitoring stations (the control segment) around the globe. The updated fixes are transmited to GPS receivers, (the user segment) and are used for general navigation as well as precise long-distance geodetic measurement.

While civilian GPS receivers used alone for navigation purposes are only accurate to about 100 meters in any direction, multiple GPS receivers capable of geodetic measurement, used concurrently, can resolve positions consistently to the centimeter level. Using a method known as *differential positioning*, *precise vector measurements* between simultaneous GPS-receiver observation points can be applied to a solidly anchored (published record) point of beginning. This process renders subsequent precise positions for all observations points of that specific GPS survey. The three-dimensional position coordinates can be mathematically transformed into standardized state plane coordinates or a local job coordinate grid.

***D.K. Nasland, PE, PLS**, is senior vice president of Nasland Engineering and a licensed land surveyor in Arizona, California and Nevada. D.K is a past president of the San Diego Chapter of CLSA.*

***David Paul Johnson, PLS** is a Trimble GPS salesman for Allen Instruments, the Founding chairman of the Southern California GPS Users Group, and a former seminar chairman for the Orange County Chapter of CLSA.*

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PRE-1893 MAPS - State Attorney General will decide?

By: Michael Stanton, PLS

For the past three years, I have been fighting the County of San Luis Obispo on the subject of legal lots and pre-1893 maps (also known to planners as "antiquated subdivisions"). This fight started in 1993, while applying for two certificates of compliance. I had a lot created by a rancho subdivision (pre-1893) and a metes and bounds parcel cut from it in the early 1900's. I was applying for two certificates, one for the deed cut from the rancho lot and one for the remainder. The planning department responded that the deed cut in the 1900's created a legal parcel, but the remainder was not a legal lot, because according to their in-house policy, an applicant must have a recorded metes and bounds description for the remainder. This response was not only irrational, it seemed downright contrary to law. I tried to explain to the planner (who had no experience in surveying or land title) that it is more valid to describe a remainder parcel by exclusion of the first deed out rather than by trying to write a metes and bounds for the remainder. After a six month battle and an investigation by the County Grand Jury, I got my two certificates.

Then, later that same year, our firm submitted an application for certificates on three lots created by a pre-1893 map. We got a response back stating that our request could not be granted because our parcels were created by a map filed prior to 1893 which pre-dates the first subdivision SMA in 1893, and that a chain of title would be required showing a separate conveyance of each parcel, before certificates could be granted. I was now getting upset, because I knew that just months earlier, other consultants had received certificates for lots within the same subdivision. I knew of no new law or change in the SMA which invalidated these pre-1893 maps. I then provided a letter from a County planner dated July 19, 1993, which read: "County Counsel has advised that the State Subdivision SMA states that a lot reflected on a recorded map constitutes a certificate of compliance. The Department will, however, issue a letter verifying that fact on legality if requested." After a few months of providing other evidence of certificates granted within the same subdivision, our certificates were granted.

The former County policy of acknowledging lots created by pre-1893 maps was consistent with Section 66451.10(a) of the SMA which states, ".... two or more units of land which have been created under the provisions of this division, or any prior law relating to the division of land or a local ordinance enacted pursuant thereto, or which were not subject to those provisions at the time of their creation, shall not be deemed merged by virtue of the fact that the contiguous parcels or units are held by the same owner..." To summarize, any map created prior to 1893 was not subject to the SMA; thus lots shown on such maps are legal parcels.

From the Constitution of California, Article XI (eleven), Section 7: "A county or city may make and enforce within its limits all... ordinances and regulations not in conflict with general laws." Thus, if a local ordinance conflicts with State law it is preempted by such law and is void. The California courts have concluded that the Subdivision SMA fully "occupies the field" as to subdivisions of property, so that any inconsistent local ordinance is deemed invalid.

In 1996, another case in San Luis Obispo County involved a request for seven certificates for seven parcels which were created on a pre-1893 map of the Town of El Moro in 1889. Staff originally claimed that the parcels were shown on a "survey

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map" that predated the adoption of the State Subdivision SMA. County staff now refers to any subdivision map filed prior to 1893 as a "survey map" instead of a "tract map." The property consisted of two non-contiguous blocks of land consisting of 3 lots and 4 lots. County Staff, with support from a County Supervisor and County Counsel, claimed that since there were no deeds conveying the properties separately, only two legal parcels existed and only two certificates of compliance could be granted.

An attorney and I spent the next six months providing various maps, deeds and case law to support our position. At each hearing, hundreds of pages of evidence were submitted, and at every hearing County Counsel needed more time to review our documents. Our most conclusive evidence was a Superior Court case which ruled that the blocks and lots shown on the (pre-1893) map were separate legal parcels for purposes of valuation of property to be condemned by the County. After five hearings, thousands of pages of evidence provided to County Counsel and hundreds of hours of our time, County Staff reversed and recommended for approval of the appeal to grant seven certificates of compliance.

I was excited at first, until I read the Staff report. Nowhere in this document did the County acknowledge the validity of the pre-1893 map of the Town of El Moro. To quote directly from the staff report, "Although the first deed separating this property occurred in 1970 when the property was deeded out from the Estate, it was ordered by the Probate Court. After further legal analysis it was determined that the deeding of the property pursuant to an order of the Probate court which described seven parcels by reference in its action did create the seven parcels later conveyed in the Executrix's deed." Later, the same report reads, "Since creation of these seven parcels in 1970 by deed was pursuant to an order of distribution of the Probate court, the seven parcels were legally created in compliance with the Subdivision SMA."

So what we had was an application approved for the wrong reasons! The individual parcels were created on the subdivision map of 1899 and not by the Probate court. The County conveniently rolled over when they realized that we were going to pursue this item to resolution in court.

In reality, these "in-house" policies act as a merger ordinance disguised in the Certificate of Compliance process. The apparent goal of this illegal policy is to merge thousands of contiguous lots which are held by common owners.

There is little case law on the subject of pre- 1893 maps. In Morehart v. County of Santa Barbara (1994) 7 C4th 725, the court sidestepped the issue since County staff had previously issued Certificates of Compliance for blocks within the 1888 map of the Town of Naples.

The case of John Taft Corp. v. Advisory Agency (1984) 161 CA3d 749, decided whether lots shown on a United

Continued on page 21

States Government Survey Map were legal parcels for SMA purposes. The court found that U.S.Survey maps do not "establish subdivisions" for purposes of the Act, but were intended to provide a common method of property description. There was no local agency control over these maps, and since they were not recorded in the local county recorder's office, they did not provide constructive notice to subsequent owners. The court decided that lots shown on U.S. Survey Maps were not legal lots under the SMA.

The SMA, by definition deals with "sale, lease or financing" of real property. Yet local agencies around the State continue to confuse "sale lease or financing" with "development." The issue of being able to develop a lot should not be tied to lot legality. If lots created on a pre-1893 map are 25 feet wide by 75 feet deep on a 1:1 slope with no water, sewer, utilities or access, then the lot may be a legal parcel without the owner necessarily having the right to build.

Andy Gustafson, formerly of the Ventura County Counsel's office, believes that pre-1929 maps do not create legal lots because the SMA requires map approval pursuant to a law "regulating design and improvement of subdivisions" and no such law existed prior to 1929. I have a hard time buying into this argument since "design and improvement" was not much of an issue in the 1850's when travel by foot and horseback was the norm. Should the subdividers of the 1850's be blamed for not anticipating the advent of the automobile? By this reasoning, subdivisions of today could be invalidated a hundred years from now because we did not anticipate some sort of rapid transit system of the future.

Section 66499.35 of the SMA defines "Official Maps" and lots shown on these maps constitute legal parcels. However, I am not aware of any County which honors these "Official Maps" as a basis for legal parcels. If a map is titled "Official Map" and if that map is certified as being such, and it is signed by the Board of Supervisors, why isn't it an official map in the eyes of the local agency?

REQUEST FOR ATTORNEY GENERAL'S OPINION

Tom Vaughan, PLS and I had been dealing with these issues in our County and felt that an Attorney General's Opinion would benefit our profession. A letter was sent from the Central Coast Chapter of CLSA to Tom Bordonaro, Assemblyman- 33rd district from Paso Robles, requesting the opinion in August of 1996. In November, I received a phone call from the Attorney General's Office saying that they would decide on this matter.

The text of the request is as follows: *Can a local agency (city or county) impose a local policy of invalidating or merging parcels originally created on pre-1893 maps (pre dating in the local agency's opinion the first predecessor statute of the Subdivision SMA on May 8, 1893), unless conveyed separately by deed, in violation of Government Code Section 66499.35 (d) which states "A re-*

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corded final map, parcel map, official map, or an approved certificate of exception shall constitute a certificate of compliance with respect to the parcels of real property described therein?"

Also, does the extant map titled, "Official Map of the County of San Luis Obispo," prepared after 1850, signed by the Board of Supervisors constitute an "official map" for purposes as stated in Government Code Section 66499.35 (d)?

It appears that many counties in the State have imposed their own "in-house " policy regarding pre-1983 maps. In most cases, if the applicant has an attorney and can afford to fight long enough, the local agency will roll over eventually. I don't think that there is any County Counsel in the state that wants to go to trial on this matter and risk losing a case that establishes a precedent for the rest of the State.

There are estimates that California has up to a million "antiquated" but legal lots held by 400,000 owners, created by deed, subdivision map or by deed and record of survey, that were filed before the "original predecessor to the SMA in 1893." Local governments around the State may need to make concessions with regard to lots that do not meet today's stringent zoning requirements. To do otherwise not only goes against the due process procedural requirements of the Subdivision SMA, but also denies economically beneficial use of property.

The battles over legal parcel status are occurring in almost all coastal counties in the State. Some agencies have already implemented local "antiquated subdivision ordinances" in conflict with State law.

We need an Attorney General's opinion on this issue to prevent costly litigation for thousands of landowners throughout the State. Anyone who would like to provide materials to assist in this decision can mail them with a cover letter to Dorothy Calegari at the Central Office.

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1997 Complete Package (as above) including PE & PLS Act with Board Rules and Subdivision Map Act on disk	$36.00	$54.00		
1997 Refill Package including PLS Roster, PE & PLS Act with Board Rules, and Subdivision Map Act	$20.00	$30.00		
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PE Act & PLS Act with Board Rules - 1997 publication (51/2 x 8 1/2)	$6.50	$12.00		
Subdivision Map Act - 1997 publication (51/2 x 81/2)	$6.50	$12.00		
Audiotape - Subdivision Map Act - by Robert Merritt, Esq.	$10.00	$15.00		
1997 Celestial Observation Handbook and Ephemeris (Sokkia) - with HP-41, HP-42 and HP-48 Programs	$4.50	$6.00		
California Coordinate Projection Tables - NAD '83 by Ira Alexander, C.E. PLS and Robert J. Alexander, PE	$8.00	$12.00		
Right of Entry Cards (*minimum order is two*)	2/ $3.00	2/ $6.00		
Corner Record Forms - FORM PWA-102 (8/88) (*minimum order is 25*)	$10.00 (25)	$15.00 (25)		
Land Surveying Brochure (minimum order is 50)	$15.00 (50)	$30.00 (50)		
Standard Contract Forms - Agreement for Professional Services	$6.00 /pad of 25	$12.00 / pad of 25		
Land Surveying for the Land Owner and Real Estate Professional by Daniel E. Beardslee, P.L.S.	$8.00	$12.00		
Easements and Related Land Use Law In California - 2nd Edition by Donald E. Bender, J.D.,L.S.	$20.00	$30.00		
COMPUTER SOFTWARE				
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Product News

Nikon Releases New AL-22 Electronic Level with Fast, Accurate REadings and an Atractive Price

Melville, NY-September 14, 1996 — The new, attractively priced AL-22 Electronic Level from Nikon delivers fast, accurate results with minimal effort, allowing the user to become a one-person leveling crew. The advanced speed of the AL-22 rotating laser provides high-quality performance over a 725-foot (220 meter) operating diameter, and its 360-degree automatic level reference permits instantaneous grade checks throughout the job site.

Nikon Inquiry Response Center
28 Brandywine Drive
Deer Park, NY 11729

Trimble Introduces Real-Time Decimeter Level DGPS Receivers

SUNNYVALE, CA, October 2, 1996 — Trimble (NASDAQ:TRMB) introduced today the 4000RSi Reference Surveyor and 4000DSi. Differential Surveyor, the latest 4000 Series DGPS receivers providing high performance and real-time positioning accuracy to the decimeter level for the marine survey market. These receivers incorporate Trimble's latest GPS advancements, including Super-trak technology and EVEREST Multipath Rejection Technology. The 4000RSi and 4000DSi are ideal for dynamic positioning and navigation applications such as hydrographic surveying, dredging and vessel tracking.

Trimble Introduces Pathfinder Office Software for GPS Data Processing

SUNNYVALE, CA, October 2, 1996 — Trimble (NASDAQ:TRMB) today announced Pathfinder OfficeÖ software, a powerful new software system for managing and processing GPS data. The software is Microsoft« WindowsÖ based and incorporates a wide variety of features designed to greatly increase the efficiency of GPS/GIS data collection.

For an interactive look at company news and products, visit Trimble's site on the World Wide Web at http://www.trimble.com.

Carl Zeiss and TDS Launch New Onboard Software For RecElta 13C/14C Total Stations In U.S.

TDS (Tripod Data Systems), Corvallis, OR, and Carl Zeiss, Inc., Thornwood, NY, have developed a U.S. version of the TDS Surveying software for the Zeiss RecElta 13C/14C DOS Total Stations. TDS users can now have onboard convenience without compromise when choosing a field instrument.

Zeiss Rec Elta 13C/14C Total Stations With New Onboard TDS Software

Here's Some Important Information About CLSA

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

Representation

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

Education Opportunities

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

Business and Professional Services

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

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Continued from page 12

to quiet title to the disputed property in favor of the Mincers, holding that when a claimant cannot satisfy the requirements for adverse possession, the claimant may not receive a prescriptive easement that extends so far that it becomes the equivalent of a fee interest and dispossesses the record title owners of part of their property.

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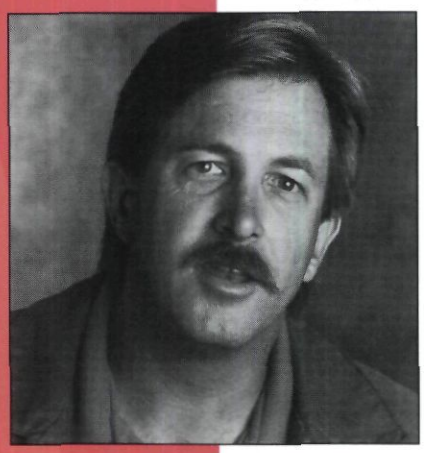
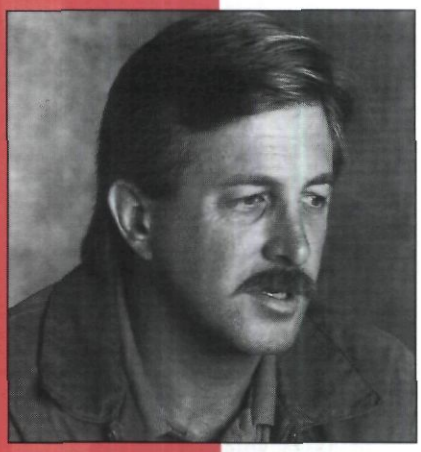
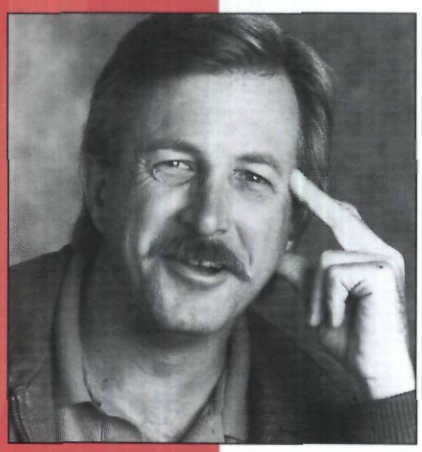
We Surveyed Our GPS Customers...







"We switched from Trimble to Leica GPS. The price was right. The learning curve on the dual-frequency equipment and the Windows-based software is a lot shorter. Cabling and laptop downloading are lightning fast. And Leica's local support is always there. Nothing else we compared came close."

Bruce Hunsaker
Hunsaker & Associates
Riverside, California

...and They Told Us We Were Right on the Mark.

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