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The California Surveyor

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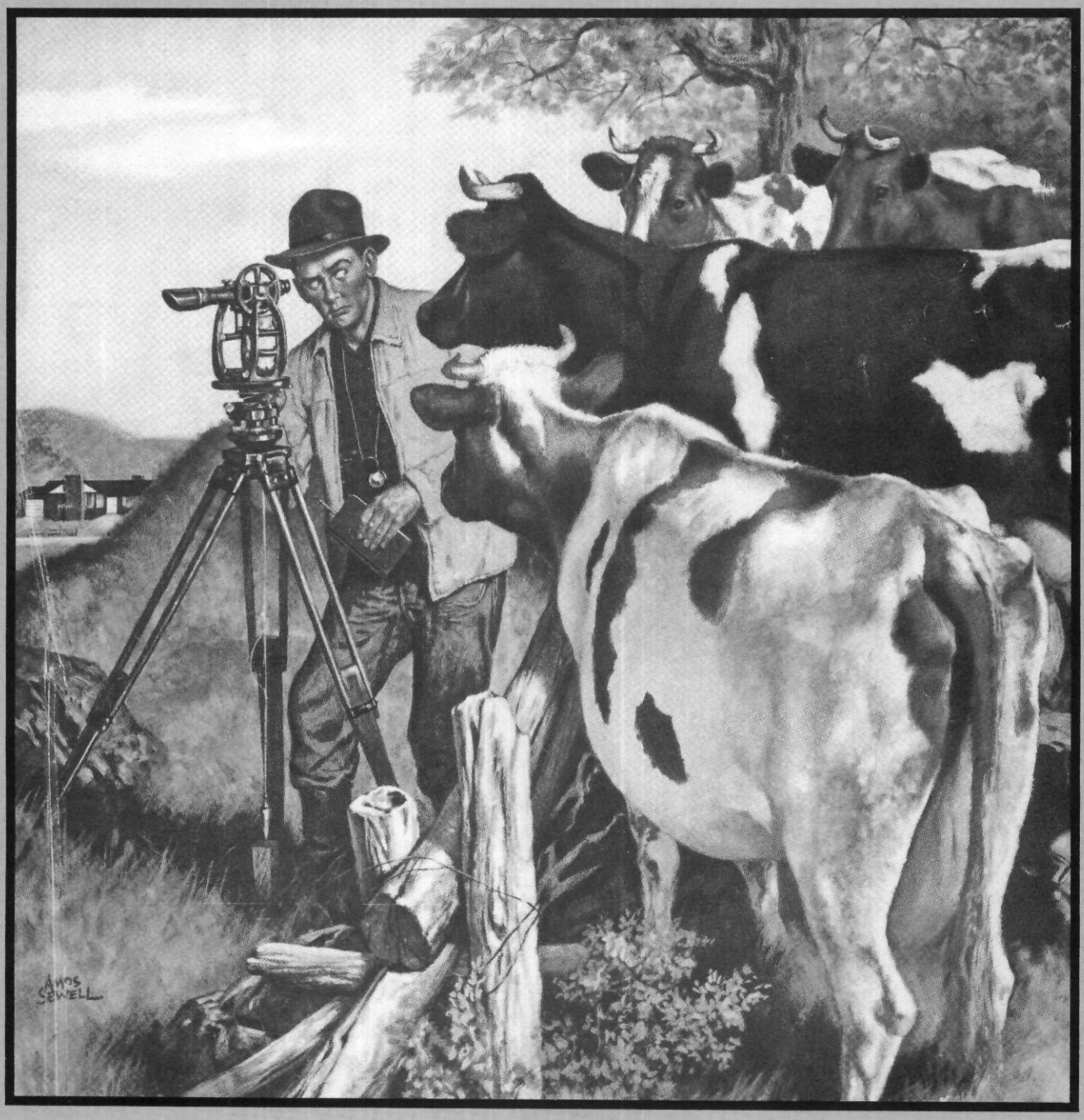

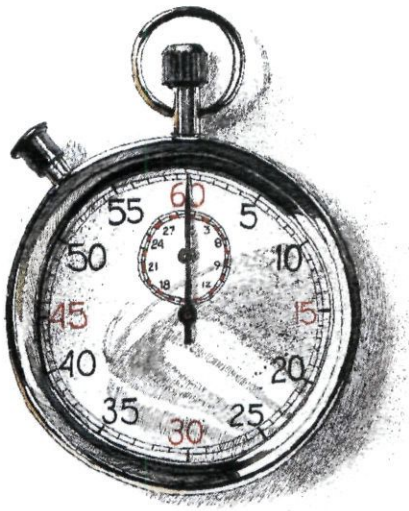

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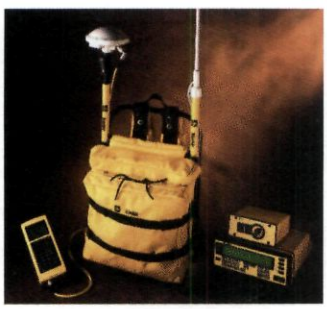

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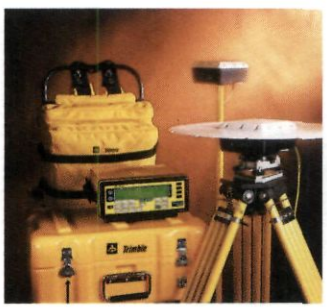

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The California Surveyor

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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
OWNER
California Land Surveyors Association, Inc.
CENTRAL OFFICE
P.O. Box 9098, Santa Rosa, CA 95405-9990
EDITOR
Tom B. Mastin, P.L.S.
ASSISTANT EDITORS
Michael McGee, P.L.S. • Linda Richardson, P.L.S.

ADVERTISING
Commercial advertising is accepted by *The California Surveyor*. Advertising rates and information can be obtained by contacting CLSA Central Office, P.O. Box 9098, Santa Rosa, CA 95405, (707) 578-6016, Fax (707) 578-4406. Circulation: 5,200.

SUSTAINING MEMBERSHIP
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 is 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, Microsoft Word.

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The California Surveyor

DEADLINE DATES

Fall	July 10, 1994	Spring	January 10, 1995
Winter	October 10, 1994	Summer	April 10, 1995

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

On the Cover:
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FROM THE EDITOR

Boundary Surveying — A Primer

By Tom Mastin, P.L.S.

THE TITLE MIGHT MAKE YOU THINK that this article should not be on the editorial page. If any of you finish it, you will see why it is appropriate in this venue. This article was written with the intent to entertain those surveyors who have gone through what I have gone through. It will irritate those who really hate to see professional articles written in this vein and just possibly enlighten those surveyors who are just starting this fine profession. Before I delve into the basics of boundary surveying as I see them, I should give you a little background on my "experience."

My surveying has been with small companies. Most of the surveying I have done has been boundary related surveying. I still do much of the field work, only slower. I started surveying over twenty years ago in a one man, one boy operation where I learned excellent field procedures. I also learned the theory of redundancy and some basics in boundary and public land surveys from that experience. I moved to other operations that allowed me to learn the intricacies of boundary surveys. Some consider me an old-timer, but they are usually too young to know better, and some still consider me a whippersnapper, but they are too old to know what's going on.

...all I had to do was be ever vigilant, do every survey like it was going to be argued in front of the Supreme Court and never, under any circumstances, never make a mistake.

After performing boundary surveys for several years, I have reached a point where not every boundary survey I work on gets me excited or is a mental challenge to me. I know that complacency is the first step to incompetency. So I realized that I have to get back to the basics in order to appreciate the work at hand.

I have always enjoyed listening to surveyors talk to surveyors at conferences, meetings, seminars, bars, restaurants, bathrooms, parking lots, lobbies and just about anywhere there were two surveyors. (You know the only way to quiet a surveyor — put them in front of an audience). When I was just starting I always heard surveyors talking about a survey done maybe twenty years ago raising its ugly head. The ugly head was usually a newer survey that disputed the location of one of the monuments, a dimension on the map that did not reflect the dimension in the field or, horror of all horrors, an original monument being found close but not close enough to the surveyor's own monument to that position. All the other surveyors who could relate to the time frame, would shake their heads in agreement. Being just a young pup back then I would think, "poor guy (it was usually a guy back then), I'll make sure I never fall into that trap." After all, we have calculators in the field that carry trig functions and if we need to we can rent machines that will measure distances up to a mile without a chain. I had read both of Curtis Browns' books at least twice, and even if I didn't understand what he meant I knew what he said. It was simple, all I had to do was be ever vigilant, do every survey like it was going to be argued in front of the Supreme Court and never, under any circumstances, never make a mistake. Cool — this surveying was going to be easy. Not only was it going to be easy, but what could be more fun than working outside, having constant mental challenges and have the delight of resolving conflicts between neighbors. It was going to almost be humanitarian work. Obviously, even then, I didn't understand the idea of fair compensation for the work performed, but that is another article.

I am not anywhere near having recorded surveys that are twenty years old, yet I am already having ugly heads pop up now and again. I, like every surveyor that does any amount of boundary surveys, am contacted concerning surveys that I did. Often by neighbors wanting to know why we set the iron pipe in their lawn or through their sprinkler pipe. I even get calls from realtors assuming that all the monuments I set come with a lifetime (that's my lifetime) guarantee to take any party interested in the property and show them each and every monument. I have also had people asking me to describe the surroundings of the monuments that I set over 10 years ago. I have found that I usually do better describing the surroundings when I was actually out there doing the field work. I also get those calls from other surveyors questioning my reasoning. At the time of the survey I was sure that all my decisions were made obvious on the record of survey and since I make no mistakes and perform every survey like it was the survey of the century, I have nothing to worry about. Well, usually the one they call on just might have been the one, and I am sure there was only one, where I had a slight lapse.

So over the years, I have come to understand some basics of boundary surveys that are not the same basics I thought I knew when I first started surveying. These are principles that I had heard of, but never appreciated until maybe it was too late.

Principle. A boundary survey stays with you as long as you live.

If a surveyor ever quotes this with sincerity, that surveyor is an old timer. Surveys are a surveyor's legacy. Some legacies are written about long after you are dead and will either make other surveyors in awe of you or laugh at you. Most often your surveys are just extra burdensome luggage that go away only by death or with the help of the federal witness protection program.

Principle. Once you put your name on that map you are taking responsibility for all the work done on that survey.

The only surveyor who has subordinates that make no mistakes are the surveyors that themselves make no mistakes. When someone wants an answer about a map they are going to look to the surveyor who signed the map. When someone finds a monument in the ground they are going to get a hold of the person whose number is on the monument. When someone calls to ask why a monument was set 2 feet from the original monument, they are going to ask the responsible surveyor.

Principle. You can never put too much information on a map.

The only exception to this that I have seen is where there is an attempt to obscure the fact that there was no good reason to do what was done. The Murphy's law that goes with this principle is "the monument in question is set at the corner that you had a good reason for establishing it the way you did, but you cannot recall what that reason was now."

Principle. The amount of research required is inversely proportional to the time and cost allotted.

This is almost one of those Murphy's laws except when it is happening there is nothing humorous about it. It relates to that Murphy's law that says the easier the survey appears to be the harder it is going to be. I have come to the realization that this is just a law of nature and there is no use in fighting the fact.

Principle. With age comes change.

I know that my opinions on boundary retracement have changed over the years. When I explain this to newer surveyors, I say it is because I have gained experience. That always sounds good. The changes are actually caused by experience, stress, need to conform, stubbornness, and all sorts of other factors that I have had to deal with. This principle obviously applies to all aspects of life, however, in surveying when it is mixed with the first principle, it can cause some serious soul searching and abuse of Rolaids.

Principle. There is no perfect boundary survey.

This principle is not based on the quaint notion that no one is perfect, but the fact that a court can make any reasonable decision about a boundary. Therefore when we show our interpretation of a boundary location, we can offer no assurances to our client on the validity of that survey. This is the case even when we are surveying a boundary to reflect a court decision on the location. Trust me. This is not a reason for setting monuments wherever it is easiest. This does not relieve a surveyor from making an educated judgement as to the location of the boundary. It is just often hard to explain to a client that those monuments are opinions and not facts. This is one of the three reasons why the public often ask "why can't any two surveyors measure the same?"

Every surveyor who has been surveying for a number of years have their own principles of boundary surveys. These are the ones that keep me up at nights, sometimes. The direct effect of these principles is that at any time a surveyor can have one of their surveys challenged. The side effects are that a surveyor can often see these challenges as a claim against their professionalism and competence and put up barriers to protect themselves. Surveyors take different actions to buffer themselves from these challenges. Substance abuse has been a longtime favorite. An air of superiority always puts the other side on the defensive. Memory lapse and lost records is also a favorite. Not returning phone calls works if the people never stop by the office. I've always liked the idea of moving to somewhere new every two years, leaving no forwarding address.

I have been taught by other surveyors actions and deeds that the best way to handle these problems is to face them with the healthy understanding that everyone goes through these trials and tribulations. That sounds good on paper, but is not easy to put into practice, day in and day out. There are times that the questions of uncertainty can so absorb your thought that it is difficult to function. This happens in surveying, it happens in relationships, it happens in life. Most of us are lucky enough to get back on track without too much damage. However, each time that happens I think we lose some of that innocence that we had in our early days of surveying.

These days when I see a surveyor who has spent their years performing boundary surveys I appreciate the effort and skills they have put into the profession just to survive and care not at all about a survey of theirs that might have gone sour.

So, what is the conclusion I have arrived at for my future in boundary surveys? I will put every item of importance on all my records of surveys, I will triple check every thing we did, I will figure in sufficient time to do all the necessary research and I will not worry about those that challenge my surveys. Oh, and I will write an article in ten years ridiculing my current principles. ⊕

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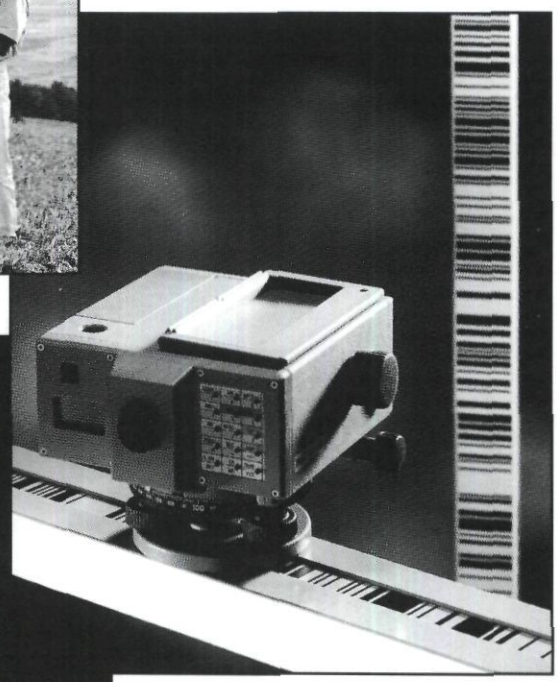

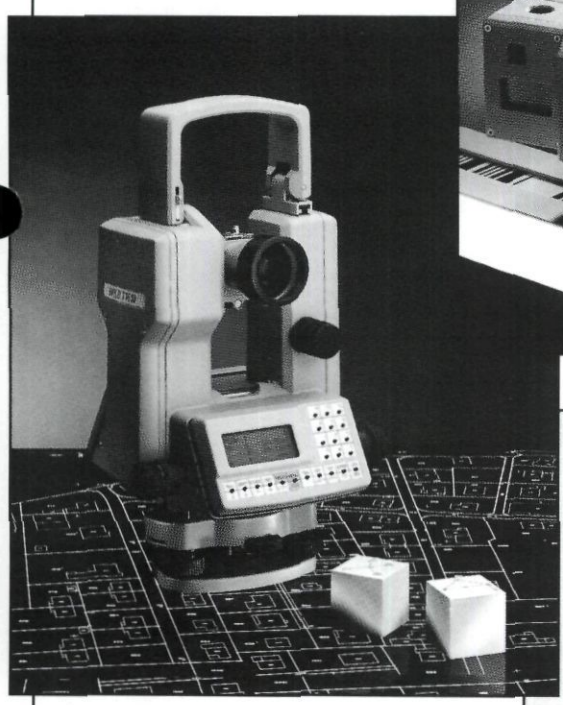

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LETTERS TO THE EDITOR

TRIG STAR, A PUBLIC AWARENESS OPPORTUNITY

The Central Coast Chapter of the California Land Surveyors Association recently sponsored the NSPS TRIG-STAR program at two of our local High Schools. It was eagerly received by both the students and teachers and the activity was given good coverage in the local newspaper. The program involves a surveyor explaining our profession's use of Trigonometry to the math class so that they can see how this theoretical principle is used in real life. For many of them, this is their first exposure to an actual Land Surveyor and lets them know that Professional Surveyors do not simply stand in the street and take pictures.

If your not familiar with the TRIG-STAR program it is formulated by the National Society of Professional Surveyors and given each year in High Schools throughout the nation. Problems demonstrating the application of trigonometry to every day survey problems are given to the instructor to assist in their class and a nationally prepared exam is administered by the teacher. The Central Coast Chapter gave each participating student a certificate of participation and a letter from NSPS was given each student for their school scholastic file. The winners were each given a plaque at our regular monthly dinner meeting and the event was covered by the local press.

Florida is in their third or fourth year with the TRIG-STAR program. During the 1992-93 school year they had 41 high schools participating. They then had three divisional competitions and a third to determine the best in the State. Florida awards each winner, a savings bond of increasing amounts as the competition became more selective. As the publicity and public awareness increases so do the number of schools wanting to participate in the TRIG-STAR program. Florida is expecting 90 schools this year.

As Surveyors we shouldn't let this marvelous opportunity to promote public awareness of our profession and the benefit to the educational process pass us by.

You can obtain an application and information package from the National Society of Professional Surveyors by writing or calling:

TRIG-STAR
5410 Grosvenor Lane
Bethesda, Maryland 20814
Telephone 301/493-0200

or contacting your CLSA Chapter Representative or Susan Jensen, NSPS Area 9 Director at 805/489-6647.

Randy Woodjack & Leonard Lenger, Chairs;
TRIG STAR Committee CLSA Central Coast

Central Coast Chapter President, Robert Reese presents award to San Luis Obispo High School TRIG-STAR winner Ismael Medrano as Trigonometry Teacher Janice Minyard looks on.

JAMES A. HAMBLIN SCHOLARSHIP WINNER

First I must apologize for the lack of expedience of my letter. This in no way demonstrates my lack of appreciation for receiving one of the five hundred dollar scholarships awarded by you at the Surveying Engineering Conference here in Fresno last month.

I feel very fortunate to have received the James A. Hamblin Scholarship and to have a future in an occupational field with the support and fellowship of the surveying community. I would like to take this opportunity to say Thank You for awarding me a scholarship specifically and for your support of the Surveying Engineering Program here at Fresno State generally.

Since I am paying my own way through college the money is greatly appreciated and will be used to pay for tuition, books and living expenses. Your thoughtfulness symbolizes the positive work environment I look forward to joining upon graduation in December of 1994.

L.A. Dibble

CLSA SCHOLARSHIP WINNER

I sincerely appreciate the extent to which your organization participates in distributing financial contributions to California State University Fresno Surveying Engineering Scholarship Foundation. It was generous enough to receive a $1000 check directly from your donations. I cannot express enough to what length this money will assist me. It is increasingly difficult to attend higher education facilities full time without having a part time job to bridge the financial gap. Thanks to you I am able to undertake 18 unit semesters without having to drop down in classes to entertain a part time job. This will most definitely allow me to graduate sooner. Once again, thank you and please keep up the great work.

Brian Dalager

IN MEMORY OF . . .

Edward W. Baca, PLS 3451, a Bay Area land surveyor, died March 15, 1994 in San Mateo, California of Atherosclerotic Cardiovascular Disease.

Ed was a past president of the Santa Clara-San Mateo County Chapter of the California Land Surveyors Association and a former member of the American Congress on Surveying and Mapping and the American Society of Photogrammetry. He also held a state teaching credential and taught land surveying at the community college level both in San Jose and San Mateo.

He was a California native raised in San Francisco and lived on the Peninsula for most of his career. He was a World War II veteran, having served in the Army Air Corps from April 1942 to November 1945. Ed also held a certificate for recognition of Outstanding Public Service, a President's award from the Delancey Street Foundation.

He had a long career in land surveying, having surveyed in Saudi Arabia, Afghanistan and Alaska. He worked for PGandE, the City and County of San Francisco, and a number of engineering and land surveying firms on the Peninsula prior to starting his own land surveying business in Redwood City.

Surviving is his wife, CeCe H. Baca.

Ed will be missed by his many friends. He was still practicing land surveying when he died at age 75.

Joddie C. Heavener, PLS 3778
Santa Clara-San Mateo Chapter President

GEOGRAPHIC INFORMATION UPDATE

February 8, 1994

The Geographic Information Task Force was established by Governor Wilson to recommend GIS policy, standards, and legislation to the Governor and Legislature for implementation. The Task Force completed and published its report in April, 1993.

This report recommended the formation of the California Geographic Information Coordinating Council (CGICC) to be responsible for recommendations to the Governor and Legislature. This Council would operate under the California State Office of Planning and Research (OPR). The Director of OPR reports directly to the Governor.

Since April of 1993, the following important events have taken place:

The Office of Planning and Research has suffered severe budget cuts and is not able to fund or participate in GIS.

The State of California, Teale Data Center, is attempting to salvage the concept of forming a CGICC and has held three meetings with former members of the GIS Task Force along with other interested parties.

Two meetings were held in Sacramento and one in San Diego to get input up and down the State. The facilitator of this effort and the contact for information is:

Randy Moory, GIS Manager
GIS Technology Center
Teale Data Center
P.O. Box 13436
Sacramento, CA 95813-4436
Telephone 916-263-1886.

This effort by the Teale Data Center focuses on:

Establishing a dues-paying association open to membership by all interested parties.

Three grades of membership are proposed:

1. Credentialed membership — two-year voting term, this grade has voting rights and would be made up of two members from the following: Federal, State, County, City, government agencies; higher education; professional societies and organizations; public utilities; private sector companies. Additionally, regional associations and special districts are being considered for voting membership by ballot amendment.
2. Associate membership — includes any interested individual with no voting rights.
3. Institutional membership — shall be available to any business entity; a not-for-profit professional or trade organization with at least fifty members; and to any government agency or institution of higher education. This membership has no voting rights.

Ballots were received to approve the by-laws and amendments in the mail on February 7, 1994. This is an extremely important movement. Surveyors and Engineers must protect their GIS needs and standards. It is up to us in the Professions to champion Surveying and Engineering interests in GIS technology that will become an important part of our everyday business and personal lives. If you have an interest in GIS, and someday everyone will, I urge you to get involved now.

John Canas, Orange County Surveyor ⊕

On "GOING METRIC"

By Fareed W. Nader

BIOGRAPHICAL SKETCH

Fareed Nader is a Professor of Surveying Engineering, and Coordinator of the Geomatics Center at The California State University. Nader teaches a wide variety of courses including geodetic surveying, geodesy, boundary control and legal principles, creative thinking, and futuristics. He is a Professional Land Surveyor licensed in California.

ABSTRACT

SURVEYORS SHOULD BE LEADERS in the United States' transition from the English measurement system to the metric system, but they appear to be doing nothing. Making unit conversions requires focused thought and subtle decisions. Concepts of soft and hard conversions are discussed, and three types of common conversion problems are illustrated with examples in surveying. A module is suggested for constructing a metric Public Land Survey System. Surveyors are urged to use their professional associations to get active in the transition to metrics.

INTRODUCTION

About one year ago, this author attempted to submit a building plan dimensioned in metrics to the local County building inspector. The technician at the inspection office very abruptly said, "It's not acceptable!" and refused to discuss the plan until all dimensions were shown in traditional English units. At the time, it seemed that the technician was ridiculously close-minded. Later, after some conversations with a constructor, I came to realize that the technician knew more than I did about the many ramifications of the units used on a construction plan.

That incident suggests a broader set of questions. Do surveyors know the many ramifications of the units they use in their work? Should surveyors make all measurements in metric units? Are surveyors prepared to work in metric units?

One's first response to these questions is, "Of course! We just flip the EDMI switch from feet to metres, and make any needed conversions with the U.S. Survey Foot; everybody knows 12 metre = 39.37 feet."

Unfortunately, not all areas of the country agree that the U.S. Survey Foot is the proper conversion to use. Some states are specifying the International Foot (1 foot = 0.3048 metre, exact) for conversions in State Plane Coordinates and other work. Many surveyors, and most of the public consider these concerns to be a waste of time, because they do not believe the United States is "going metric." The disbelievers recall the dashed expectations they had after the U.S. Congress passed the Metric Conversion Act of 1975, which advocated the use of the metric system, but did not mandate it and gave no deadline for its complete installation. The general public was angered by the whole process, and "going metric" went nowhere in the 1970s.

More recent actions by the federal government have made it necessary for surveyors to get serious about "going metric" again. Congress passed the Omnibus Trade and Competitiveness Act of 1988, which required all federal agencies to "use the metric system of measurement in its procurements, grants, and other business-related activities ..." Each federal agency was required to have a plan for "going metric" by October of 1992. (*Omnibus, 1988*) By Executive Order on July 25, 1991, President George Bush directed "all executive branch departments and agencies of the United States Government ... [to] use, to the extent economically feasible by September 30, 1992, ... the metric system of measurement ..." (*Bush, 1991*)

Surveyors will observe the effects of these federal actions most quickly because of the metric requirements developed by the General Services Administration (GSA) and the Federal Highway Administration (FHWA). GSA ordered that by October 1992, all their procurement orders would have to be in metric units, and that by January 1, 1994, all federal building construction plans and specifications must be metric. FHWA has ordered that by October 1, 1996, all government agencies receiving federal highway tax money must plan, specify, and construct using metric units. In response, many state highway departments, such as California's Caltrans, have already started assertive metric conversion programs for their employees and outside contractors.

What is not happening, is assertive action by surveyors and their professional associations to educate themselves and the public about "going metric." Most surveyors are passively (and perhaps smugly) sitting back, believing they can make simple conversions and thus be in the full metric stream. Unit conversions, however, require deeper thought and subtle but critical decisions to be made if surveyors are going to avoid liability, take a professional role, and reap the economic rewards of "going metric." This paper attempts to illustrate the need for making those subtle but critical decisions in converting from English units to metric.

BASIC CONCEPTS

One concept that has great importance for all surveyors, is that of "soft" and "hard" conversions to metric. A **soft** conversion is one in which an existing dimension (which is in non-metric units) is converted to metric units by multiplying the dimension by an exact conversion factor. For example:

1 Gunter's chain = 66.00 ft (12 m/39.37 ft) = 20.1168 metre correct to 4 decimal places. The correct decimal places could be carried out further, if needed.

A **hard conversion** is one in which the actual physical size of an object or line is changed so that the length in metric units is some convenient rounded off value that is easy to remember and work with. For example: 1 "metric chain" = 20.000 metre (exactly).

Confusion will arise because many people will incorrectly believe that saying "a Gunter's chain is about 20 metres" is the same thing as making a hard conversion. This type of conversion should be called an "approximate conversion," or perhaps a "rough conversion." The true hard conversion occurs when a new "metric chain" is created with exactly 20.000 metre between the 0 scribe mark and the 20 scribe mark on the chain.

Presently, the construction industry is using both soft and hard conversions of dimensions, and is anticipating to be totally metric; thus all specifications, drawings, construction, and inspection will be done solely in metric units without English units following in parentheses. Construction drawings will have *all* dimensions in millimetres (mm), and each sheet will have a note somewhere on it saying, "ALL DIMENSIONS ARE MILLIMETRES (mm) UNLESS OTHERWISE NOTED." Because of this note, the construction drawings will not show units trailing the numbers, and the numbers will not have decimal points. An example of a construction dimension is 2 402, which must be interpreted as 2,402 millimetres. Decimal points will not appear in dimensions unless, for some rare situation, precision greater than millimetres is needed. In the latter situation it would be shown as 2,402.5 without units. (*Metric Guide, 1993*)

The National Institute of Building Sciences (NIBS), the American Institute

of Architects (AIA), and the American Society of Testing Materials (ASTM) all recommend that units of centimetres not be used in specifications or on plans, because they force the use of decimals.

Converting Units and Rounding

The processes of first converting English unit dimensions to metric units and then rounding off require more attention than using significant figures and distinguishing between soft and hard conversions. Surveyors must be alert to recognize at least three types of conversion problems.

Type 1. Converting known dimensions between existing points.

In this situation expenditures have already been made to establish the points in space, so there are cost reasons, technical reasons, and possibly legal reasons why a straight-forward soft conversion would be most appropriate. There is no expectation of *moving* the points to create a cleaner metric dimension.

Example 1: Part of a legal description reads, "... thence 1,234.56 feet to an iron pipe ..."

Making a **soft** conversion of this dimension with the U.S. Survey Foot would result in the description reading, "...thence 376.295 metre to an iron pipe ..."

The metric dimension contains the same number of significant figures as the original, but shows slightly more precision. Rounding the number back to 376.30 metre would give the impression that measurement precision was less than actually occurred. Careful surveyors will suspect the technical validity of a field measurement to the nearest 1 mm anyway, so in this case it is best to show the conversion as 376.295 metre to indicate the precision used.

Legally, the "correct" end of the line is probably at the center of the iron pipe, so one might ask, "Why not just round off the number to something even less precise, like 376.3 m?" It is preferable to use 376.295 m, for the following reasons: (a) this lot dimension may need to be recognized and correlated with dimensions of adjoining lots and with graphics or computations in another record, (b) it tells a retracement surveyor what care was used to obtain the original dimension, and (c) it follows a long established procedure for significant figures.

Type 2. Converting dimensions in Code requirements.

Eventually government bodies will need to re-specify in metric all dimensions that are now part of the law, i.e., legislators will need to make hard conversions of any dimensions required by the law Code. Until that is accomplished, surveyors will need to use professional judgement to design and lay out land parcels in metric units, while still protecting the public health and safety.

Example 2: Zoning requirements in a California city specify a minimum width of 65 feet, a minimum depth of 100 feet, and a minimum area of 7,000 square feet for a single family house. What procedure and precision should a surveyor use to convert these values to metric?

A straight-forward **soft** conversions yields: 19.812 m width, 30.480 m depth, and 650.323 m^2 area.

Surveyors have no difficulty working with such numbers, but distrust and mistakes will occur when communicating these values to other engineers and constructors, material suppliers, and the general public. It would make sense to round off these dimensions to standard values more easily comprehended by non-experts. The question then becomes what procedure should be used so that all surveyors obtain the same results?

Until surveyors develop their own standard procedures, it may be most rational to utilize the method of **"Professional Rounding"** that has been adopted by the AIA and NIBS. This is the method surveyors will encounter when doing construction measurements on metric jobs. Its purpose is to force metric rounding into standard metric sizes that will be used for manufacturing construction materials and equipment.

Professional Rounding is based on a module of 100 mm, which is increased into "multimodules" for larger dimensions, and decreased into "submodules" for smaller dimensions. In decreasing order of preferred sizes (in mm) these are shown in Table 1 next to their foot equivalents and the "common" sizes they are replacing. (The common dimensions are shown to illustrate some of the standard lengths encountered at present in construction work and materials.)

TABLE 1.
NIBS Preferred Metric Values

NIBS preferred value (mm)	U.S.Survey Foot Equivalent (ft)	"Common" dimension (ft or inch)
6,000	19.685	20 ft.
3,000	9.843	10 ft.
1,200	3.937	4 ft.
600	1.968	2 ft.
300	0.984	1 ft.
100	0.328	4 inch
50	0.164	2 inch
25	0.082	1 inch
20	0.066	3/4 inch
10	0.033	3/8 inch

The largest of the NIBS multimodules is 6.000 m, which is much too small for converting the dimensions of the Example 2 zoning requirements. Using 19.800 m is a possibility since it is an integral multiple of the basic module (100 mm), and it is only 12 mm less than the exact soft conversion value. In this case, however, the dimension is much larger than typical construction materials, the metric length must be correlated with a length and an area, and a hard conversion to the nearest half metre makes much more sense. Therefore, the width is rounded up to 20 m, which increases the dimension only 0.9% above the soft conversion value. It is important to also note that rounding down would "offend" the Code requirement of the English unit minimum width dimension; rounding upward does not offend in this case.

A good argument could be made that a hard conversion value of 30 m should be used for the minimum depth dimension in this example. It is a round number that is only 1.6% smaller than the soft conversion value, it is the length of commonly available steel tapes graduated in metrics, and when combined with the rounded up value of 20 m for the width, it preserves the intent of an aesthetically pleasing rectangular shaped parcel. However, rounding down offends the Code, and *surveyors should not arbitrarily and independently modify a Code* which was developed from the input of planners, developers, surveyors, engineers, health officials, fire prevention people, politicians, and the public. Rounding up to the nearest half metre is a policy which maintains civic responsibility. So, for this example a minimum depth value of 30.5 m is selected, which deviates from the soft conversion value by only +0.07%.

Table 2 lists suggested interim values which surveyors can use for minimum width or depth while waiting for new Code values to be adopted by governing agencies. The column headed "Change" shows the percentages by which the Interim column deviates from the Soft Conversion column. The Change column shows that rounding the soft conversion values up to the nearest half metre will produce only minor increases in the shape of new lots.

TABLE 2.
Suggested Interim Values To Use For minimum Lot Dimensions In Current Code

Current Code lot minimum dimension (ft)	Soft conversion metric (m)	Interim rounded dimension (m)	Change %
50	15.240	15.5	+1.7
60	18.288	18.5	+1.2
65	19.812	20.0	+0.9
70	21.336	21.5	+0.8
80	24.384	24.5	+0.5
100	30.480	30.5	+0.07
200	60.960	61.0	+0.07
300	91.440	91.5	+0.07

The last conversion needed is for the minimum area, which was given as 7,000 square feet in this Example 2. The previous arguments apply for not offending the Code while waiting for the governing authorities to make the legal changes. Typical current minimum areas for single family house lots are given in Table 3, in the left column. The area should not be as difficult a criteria to achieve as is the minimum width or depth, since either or both of the latter must be modified in order to get the minimum area. That is, multiplying a minimum depth by its corresponding minimum width will not yield the minimum required area. Increasing one of the dimensions by only a few centimetres will increase the area by about 10 square metres. Nonetheless, the zoning requirements have an area criteria that must be achieved, and the conversion to metric must take these limits into consideration.

Surveyors should be involved when governing authorities debate what minimum metric areas to use. Until then a uniform interim standard can be achieved by first making a soft conversion from English units to metric units, and then rounding the soft metric values **up** to the nearest ten square metres. Suggested interim values for typical current Code areas are shown in the third column of Table 3.

TABLE 3.
Suggested Interim Values to Use For Minimum Lot Areas

Current minimum area (ft^2 or ac)	Soft conversion metric (m^2)	Interim rounded area (m^2)	Change (%)
7,000	650.32	660	+1.4
10,000	929.03	930	+0.1
15,000	1,393.55	1,400	+0.5
20,000	1,858.07	1,860	+0.1
2 acre	8,093.75	8,100	+0.08
3 acre	12,140.62	12,150	+0.08
5 acre	20,234.36	20,240	+0.03

Type 3. Converting dimensions in current design practice.

Many dimensions the surveyor uses are chosen, not because they are required by law, but because they are considered to be traditional or because they fit current design practice in a particular situation. The surveyor has more flexibility with converting these dimensions than with Type 2 conversions. Still, it is useful to adhere to Professional Rounding modules, if possible, while making a hard conversion, if the dimension is expected to be used on a constructed object.

Example 3: A suggested width for a bikepath in Fresno County is 8 feet. If a soft conversion is made, the width would be 2,438 mm, which is not a number designers easily work with. Other bikepaths in the County are as narrow as 6 feet and as wide as 10 feet, so the 8 feet dimension has a "design tolerance" of 2 feet. The latter is about 600 mm, which is one of the NIBS multimodules. Applying this design tolerance to the 2 438 mm width means the bikepath would be acceptable in the range of 1,838 mm to 3,038 mm. The largest acceptable multimodule would be 3,000 mm. The smallest acceptable multimodule would be two 1,200 mm modules, or 2,400 mm. Use 2,400 mm, since this is nearest the soft conversion value.

Why wasn't 2,500 mm selected? The main reasons are:

(a) the bikepath will be a constructed object, and its cost will be lower when constructors can use materials (e.g., expansion joint material) and equipment (e.g., paving machines) which are designed to work in NIBS multimodules, (b) there is a design tolerance below the 8 ft width as well as above it, so there is not an "offending direction" for the conversion — the smaller dimension of 2,400 mm is just as safe and requires less material for its construction than a value of 2,500 mm.

Continued on page 25

CLSA AWARDS

1993 Member of the Year

The Member of the Year Award was announced at the Annual CLSA Conference in March at Sparks, Nevada, and presented to **Michael McGee** at the Central Coast Chapter meeting in April.

Mr. McGee, who was President of CLSA in 1985, is deserving of this award based on his extensive contributions to the association and the surveying profession for 1993 and for his long career in surveying.

Mr. McGee is currently the Chair of the Advanced Technologies Committee. Under his leadership, the committee prepared and distributed NGS control data for California in a digital format. He coordinated the creation of the California Geodetic Control Committee, a statewide committee developing high production GPS standards.

Mr. McGee is the Assistant Editor to the *California Surveyor*. Additionally, he contributed many articles to the *California Surveyor* on advanced technologies and boundary issues. All of Mr. McGee's articles have been well written and informative. The *California Surveyor* has received many letters in praise of Mr. McGee's articles, many of which have been reprinted in other surveying magazines.

Mr. McGee has been very active in the Central Coast Chapter. He has presented two programs to the chapter at their monthly meetings. The topics have ranged from adjustment theories in boundary retracements to the understanding of datums and reference systems. He has helped organize a GPS seminar, sponsored jointly with Cal Poly — San Luis Obispo. He has also represented the chapter by giving presentations to the local ASCE chapter.

For all your efforts and professionalism, Congratulations Michael!

Elan and Michael McGee are stunned at the presentation of the Member of the Year Award to Michael during the April meeting of the Central Coast Chapter.

Distinguished Service Award

The Distinguished Service Award was presented to **Susan Jensen** at the Annual CLSA Conference in March at Sparks, Nevada.

Ms. Jensen earned the Distinguished Service Award for her activities over the years on behalf of the profession, CLSA, and surveyors nationwide. Ms. Jensen services include:

Central Coast Chapter President in 1990; Vice President in 1989; and Chapter Representative in 1984, 1991, and 1992. She chaired the Chapter Membership Committee in 1984 and more than doubled the Chapter Membership. She organized numerous workshops for the Chapter that financially benefited the Chapter and professionally benefited the local surveyors.

Ms. Jensen was the State Treasurer in 1985; the Secretary in 1986; President-Elect in 1987; and President of the State association in 1988, as well as Immediate Past President in 1989.

Ms. Jensen's other contributions to the State organization include being ACSM/NSPS Governor in 1988 (alt), 1989, 1990, 1991, and 1992; Awards Committee Chair in 1990 and 1991; Liaison with the Board of Registration in 1988 and 1989 (alt); Conference Committee Member; Planning Committee Chair in 1987; WFPS Representative in 1988 (alt), 1989, 1990, 1991, 1992, and 1993; Membership Committee Chair in 1985; initiated the auction at the annual conference to generate scholarship funds; helped create the non-profit foundation for surveying scholarships; as well as serving as a member on numerous Association committees.

This is far from a complete list of the contributions that Ms. Jensen has made on behalf of the profession, but it does express the commitment and dedication that Susan has shown for CLSA and the surveying profession.

Congratulations Susan! ⊕

Susan Jensen and her entourage at the installation of Officers for NSPS. Susan was installed as Area 9 Director of NSPS.

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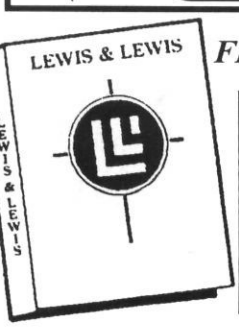

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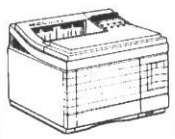

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SALES & RENTALS

THE OWNERSHIP OF SURVEYS AND WHAT CONSTITUTES A SURVEY AND MAP

By William G. Raymond C.E.
circa 1896

[Editor's Note: I want to thank Hal Davis for sending this article for publication. As you can see even 100 years ago they were asking the question "Why don't surveyors ever agree?"]

THERE SEEMS TO BE a difference of opinion among surveyors as to how much of the information obtained, and how much of the work done in making a survey shall be furnished to the individual for whom the survey is made. Many surveyors keep what are called "private notes." All men doing business as surveyors keep notes of all surveys in a convenient form for ready reference. The extent to which these notes are private has not been rightly comprehended by all surveyors, and hence has resulted the difference of opinion mentioned.

This article is an attempt to present a side of this question that has not heretofore been fully considered. An endeavor has also been made to point out to the young surveyor a line of action expedient for him to follow, which will at the same time be found advantageous to the community in which he works.

In this discussion the question arises at once, "What constitutes a survey?" and the answer obviously depends on the object of the survey. This discussion will be confined to land surveys; that is, to surveys made for the purpose (1) of subdividing a large tract of land into smaller parcels to be sold; (2) of determining the boundary of a tract the description of which is known; (3) of determining the description when the boundaries are known.

The principle to be enunciated applies to any other survey as well, be it railroad, canal, bridge, or topographical survey. Indeed, it is well understood in all such surveys, but seems to be ignored by many engineers having to do with land surveys.

A survey is the operation of finding the contour, dimensions, position, or *other particulars* of any part of the earth's surface, ... tract of land, etc., and *representing the same on paper.*

In making a survey it is necessary to set certain points, called monuments or corners, and to determine a description of these points. These items therefore become a part of the survey. Then a map must be drawn. This map, to be a faithful representation of the ground and the work done, should, together with the notes, show all of the items mentioned.

The object of establishing monuments or corners and describing them is twofold: (1) to mark on the ground the boundaries of the tract, and (2) to secure definite information as to its location with reference to other points or tracts, so that from this information the land may at a future time be found. For a complete survey, therefore, the corners must be fixed, information that will preserve their location must be obtained, and the facts must be delineated on a map with accompanying notes.

To whom belongs this survey? It would appear to be evident that it belongs to the individual who pays to have it made. It is not readily seen in what way the survey, or any part of it, becomes the sole property of the surveyor. He may keep a copy of his notes to facilitate his future work; but he has not the shadow of a claim to a single note, the time for taking which has been paid for by his employer. If his charge for his work is on a time basis, there can be no question as to the correctness of the above statements. If he contracts to do the work for a definite sum for the entire job, he may take as much time as he likes, and may keep as many private notes as he desires; but he is bound in honor to return to his employer the complete survey; and, if

he does so, the private notes would thereafter be of no great assistance to him in securing further employment, particularly when it is remembered that men of repute do not bid against each other for professional work. His reputation for accuracy and honesty will be a far more potent factor in securing employment than any set of private notes fairly obtained.

It is true that a great many surveyors hold a different opinion, and purposely return their maps and notes in such condition, that, while they may serve the purpose for which they are primarily made, they do not tell the whole story, nor enough to make it easy for another surveyor to relocate the tract surveyed. When this is done, the person ordering the survey does not receive what he pays for. Something is withheld. It seems to need no argument to show that this is radically wrong.

But there is another reason for condemning this practice. The correct and permanent location of all public land lines, as streets, alleys, etc., as well as the permanent location of party lines between private owners, is a matter of the gravest importance, and no information that will at all serve to fix such lines in their correct positions for all time, should be withheld from the owner who pays for the survey, be it private citizen, municipality, county, or state.

The records of monuments and street lines made by a city engineer are no more his private property than are the records in the offices of the clerk, auditor, or treasurer, the property of the individuals who held office at the time the records were made. The correctness of the position assumed has been indicated by court decisions.

A great deal of laxity is shown in the conduct of offices of city engineers and county surveyors. The methods of regulating the pay of these officers has doubtless had much to do with this. It is frequently the case that the surveyor receives no salary, but is allowed to collect certain specified fees for work performed, and this gives color to his claim that his work is private and belongs to him. That this is not true concerning the public work he does is evident from what has preceded. That the records of work done for private citizens are not the property of the public needs no demonstration; but such work belongs to those citizens for whom it was done.

A different policy should be pursued with regard to these offices. In every case such an office should be a salaried one, with such salaried assistants as may be necessary. Certain fees should be prescribed for performing the various kinds of work that the surveyor may be called upon to do within the limits of the territory of the political division whose servant he is. These fees should cover all work connected with public construction and public or private land lines, and should be returned to the public treasury.

Their amount may be regulated, from time to time, so that they shall aggregate a sum sufficient to pay the expenses of the office. They should, of course, not cover work of a private character not having to do with land lines. But the entire public is interested in the permanency of land lines, and all

records concerning them made by a public official should become public property. The permanency of land lines is too important a matter to be subject to avaricious and jealous rivalry; and all the surveyors in a given district should cooperate to preserve, in their correct places, all lines within the district.

To this end, the returns of every surveyor made to the owner should be thoroughly complete. Maps made for filing as public records should be so finished as to enable any surveyor to relocate the land without the least uncertainty as to the correctness of his work. That this is done in very few instances is well known to every surveyor who has had occasion to examine public records for data for surveys which he has been called upon to make.

Because of the fact that in most cases neither owners nor attorneys have been fully posted as to what constitutes a complete description, sufficient for relocation, and because surveyors have been willing to let matters stand as they were, great carelessness has arisen in the practice of making and filing maps for record.

While in some states good laws exist prescribing what shall appear on a map before it will be received as a public record, in more states there is nothing whatever to guide either owner, surveyor, attorney, or recorder in the matter. In the county records in such states, anything that is made up of lines and figures and labeled "this is a map," is considered sufficient basis for a correct description and location of the property it purports to represent — no matter whether it is drawn by hand, photo-lithographed, or simply printed with "rule" and type. The records are full of auctioneers' circulars, manufactured in a printing office from information coming from nobody knows where, filed at the request of the auctioneer's clerk, with no name of owner or other interested party attached, except as the name of the auctioneer appears in the accompanying advertisement. Further than this, these maps are frequently purposely distorted to create a favorable impression of the property to be sold. Wide streets are shown where only narrow ones exist, streets appear opened for the full width where they have been opened for but half their width, subdivisions are indicated as rectangles that really may not be even parallelograms, etc. Such maps as these frequently form the only basis for the description and location of the property they are supposed to represent. Such misrepresentations are bad, *very* bad for those who buy; but is the information given by these circulars much worse than that furnished by many of the maps made by surveyors and filed at the request of the owners?

On these plots, of "additions," we find lines indicating the boundaries of blocks and lots, all of which blocks and lots are numbered; the names of streets appear in neat letters; a few dimensions, possibly all linear dimensions, will be given; the streets or blocks may be delicately tinted, and the whole set off with a fine border and title. As an exhibition of the draughtsman's skill, these maps are perhaps valuable. As a source of information as to the location of the lines they purport to show, they are worth little more than the auctioneer's circular. Perhaps they have a few more figures, and the presumption may be a little stronger that the figures are correct.

Examine one of these maps closely. There will be found no evidence that a monument has been set in the field; not an angle is recorded, though the lines may cross at all sorts of angles; and dimensions are given that do not agree among themselves, so that the angles can not be calculated. There will be found no name signed except, possibly, that of the surveyor, who thus advertises what we shall charitably call his stupidity.

Frequently no monuments are set except small stakes at the corners of the blocks; but even the fact that such stakes have been set is not recorded on the plot. One who is acquainted with the practice of surveyors in a given district knows at what points to look for such stakes, and if they have been set and not pulled out to make room for a fence post or building, he may succeed in finding them. Some surveyors are accustomed to set stakes a certain distance away from the point the stake is supposed to mark, but no mention of this fact appears on the map. In fact, the map is so drawn that no one but the surveyor who made it can write a description of any one of the parcels of land shown, or correctly locate it on the ground. Furthermore, the surveyor himself finds it impossible, after the lapse of a few years and the destruction of his "private marks," to rerun any one of the lines exactly as originally laid out.

It is easy to see to what this leads — impossible descriptions of property, giving opportunity for differences in judgment as to interpretation of what was intended; disputes as to position of party lines; costly litigation and expensive movement of structures begun or completed; and the actual shifting of lines back and forth by different surveyors, or even by the same surveyor, honestly trying to locate the lines properly.

The writer has seen enough trouble of this sort to indicate to him that a radical change is needed in the field work and mapping of cities, towns, and additions, not to mention farms and other tracts of land that it may be necessary to lay out and describe. So long as fallible man is responsible for the accuracy of surveys, maps, and descriptions of properties, so long will there be errors; but that it is possible greatly to reduce their number by proper regulation the writer is fully persuaded. What we have been describing are not maps at all, or at most they are very imperfect maps, and "what constitutes a map?" thus seems to be a very pertinent question.

A map of a city, town, or addition, or other tract of land, serving as a basis for the description of property, should furnish all the information necessary for the proper description and location of the various parcels shown, and also of the whole piece. It should further show the exact location of the whole tract relatively to the lands immediately adjoining; particularly should this be done when an offset or angle in a street line occurs. To accomplish these things, there should appear on the map the following items:

(1) The lengths of all lines shown.

(2) The exact angle made by all intersecting lines.

(3) The exact position and character of all monuments set, with notes of reference points.

(4) The number of each block and lot.

(5) The names of all streets, streams or bodies of water, and recognized land marks.

(6) The scale.
(7) The direction of the meridian and a note as to whether the true or magnetic meridian is shown. (It should be the true meridian.)
(8) The angles of intersection made by the lines of adjoining property with the boundaries of the tract mapped.
(9) The exact amount of offset in lines that may extend from the outside through the tract mapped.
(10) A simple, complete, and explicit title, including the date and the name of the surveyor.

All this is necessary to make the map valuable for *description and location* of the property it represents.

Of course monuments will not be shown if none have been set, and very frequently none are set, either from carelessness on the part of the surveyor, or an unwillingness on the part of the owner to pay their cost. Monuments of a permanent character should be set at each corner of a tract surveyed, and at least two, visible the one from the other, should be on the line of each street. If these monuments are not placed on the center lines of the streets, they should be at uniform distances from the center or property lines. If placed with reference to the center line they should all be on the same side of the center. In streets extending east and west the monuments should all be on the north of the center, or they should all be on the south, and at *uniform* distances. In streets extending north and south the monuments should all be on the east of the center or all on the west. Uniformity in such practice saves a vast amount of time.

Monuments may be set at uniform distances from the block lines, in the sidewalk area, and this is an excellent practice. The stakes or monuments set at the corners of the blocks in additions, or town sites, should never be the only stakes or monuments set in the tract.

That the map may be reliable there should appear on it the following:

(1) The certificate of the surveyor that he has carefully surveyed the land, that the map is a correct representation of the tract, and that he has set monuments (to be described) at the points indicated on the map.
(2) The acknowledged signature of all persons possessing title to any of the land shown in the tract, and, if possible, signatures of adjoining owners.
(3) If of an addition, the acknowledged dedication to public use forever of all areas shown as streets or roads.
(4) If a street of full width, whose center line is a boundary of the tract is shown, the acknowledged signature of the owner of the adjoining property, unless his half of the street has been previously dedicated.

It has been already stated that, in some states, a map may be filed at the request of any person, and without signature. This practice frequently leads to trouble. The writer knows of cases in which owners of large tracts of land have had those tracts subdivided and have taken land of adjoining non-resident owners for street purposes without the consent or knowledge of those owners. When, at a later day, the owners of the land so taken have objected and attempted to close half of the street, trouble of a serious character has arisen. The same trouble has occurred where streets have been run through narrow gores of land and have subsequently been completely closed, leaving houses built on the mapped property without outlet. Time and again have cases of this sort come to the knowledge of the writer.

Having pointed out certain evils, it remains to suggest a remedy. It lies in the enactment of laws governing these matters. There should be included in the statues of every state a law explicitly defining what shall appear on every map filed for reference, and making it a misdemeanor to file a map that does not strictly conform to the requirements. In the absence of such laws it is believed that the young surveyor can assist greatly in a much-needed reform, by following the principles suggested in this paper as the correct ones, and avoiding the errors here indicated.

It is hoped that those graduates of our engineering schools who drift into this class of work will be guided by a higher principle than that which actuates the surveyor who covers up his tracks, at the expense of his employer, in order to secure a monopoly of the business of the locality. The young surveyor can spend his energies to greater advantage in devising new and better methods of work, than in inventing ways for hiding information that belongs to his employer. Certainly a thorough education should so broaden the young man's views as to make it impossible for him to be controlled by those meaner instincts which, if indulged, lead ever to narrow the vision and prevent one from perceiving the greater problems that continually present themselves for solution. ⊕

PRORATION AND THE THEORY OF BLUNDERS

By George R. Dunbar, P.L.S.

A SELDOM MENTIONED FACT of Land Surveying is the employment of the "Theory of Blunders." Briefly this theory can be stated as, "almost always a blunder shall be placed where the blunder occurred." In the immortal words of William C. Wattles, however, "the contrary may be shown."

As to proration, I would like to caution all surveyors to use this particular theory infrequently and with extreme caution. This theory should NEVER be used as a cure-all. If you do you will invariably end up behind the eight ball and on the losing end of a court battle, somewhere, sometime, with a disgruntled client and a rabid attorney shouting your deficiencies to anyone who will listen.

Hypothetical Survey

Mr. Exact, employing his $100,000 GPS system discovers and measures between the found original Section corners of Section 9 he measures 5,215.10 feet between corners. His job is to set the north ¼ corner of section 9. Mr. Exact being fairly proficient, then goes to the center of the line and makes a diligent search for the ¼ corner. He notes the original notes state that "falls in a meadow, no timber or stone being near, I set a 5" x 5" post and witness it with mounds and pits per G.I." Mr. Exact noting signs that the meadow has been cultivated and planted in the past, which accounts for the missing post and pits, say, "Ah ha! This is obviously a 'lost corner'." Using his handbook on the "Restoration of Lost and Obliterated Corners and employing his state of the art GPS system he sets his ¼ corner quite precisely mid way between the section corners at 2,607.55 feet equidistant from each corner and proceeds back to his office where he prepares and files a Record of Survey on behalf of his client Mr. Able. Sounds like a good survey, uh? VERY PRECISE, follows the Manual of Instructions to a "T."

Almost immediately Mr. Able's neighbor, Mr. Baker goes to see a local Land Surveyor, Joe Cagey. Mr. Baker states that he always thought the corner was someplace else and would Mr. Cagey look into it for him? Mr. Cagey acquires copies of the original notes, which describe the survey of the north line of Section 9, as follows.

"Commencing at the corner to sections 9, 10, 3, and 4 previously set by me, I run west, at 14 ch, cross a narrow ridge 1 ch wide, descending at 27.5 ch, cross small stream, cse S, at 35 ch, enter lg meadow, at 40 ch the ¼ corner falls in meadow, no timber or stone being near, I set a 5" x 5" post and witness it with mounds and pits per G.I. I thence continue to run west and at 4 ch leave meadow and enter timber (mostly Oak and Mountain Mahogany, descending, at 12 ch cross small stream, cse SW, ascending, at 27 ch cross razorback ridge and at 40 ch set a 5" x 5" post from which a 40" rwd bears North 20° West, 42 lks, and a 12" rwd bears South 47° West 21 lks distant.

Mr. Cagey visits the site and assures himself that both Section corners are original. He then goes to the common corner of Sections 9, 10, 3, and 4, and employing solar observations for bearing proceeds to run west with his EDM (which he views with a jaundiced eye because he doesn't really trust these new fangled machines) he finds that the terrain calls fit exactly to and through the meadow. He sets a temporary stake at 40 chains (2,640 feet) noting Mr. Exact's pipe Easterly 32½ feet more or less and proceeds west.

At this point I'd like to interject the comment that Mr. Cagey realizes that Mr. Exact's measurement of the section line is 64.9 feet short from record which is almost exactly ONE CHAIN short. The 1.1 feet is easily explainable as the difference in measurement between 1855 (the date of the original survey) and the present date. Mr. Cagey is looking for a blunder. Having re-traced other work by the original surveyor and knowing him to have been a conscientious practioner, Mr. Cagey suspects that the chainmen have made a 1 chain "boot" in their tally.

Proceeding west Mr. Cagey notes that he enters the timber at 4 chains, as described. Descending Mr. Cagey finds a small well defined stream course southwest at *11 chains*, rather than the 12 chains noted in the notes, feeling confident he has discovered the blunder but deciding to proceed with caution, he continues west and at 15 chains from the creek crosses a razorback ridge and from the ridge 13 chains finds the original corner and both witnesses previously observed.

Mr. Cagey goes at once to consult with Mr. Exact and to explain his findings and his belief that the ¼ corner is not "lost" but simply obliterated since it can be placed with reasonable certainty by employing "the theory of blunders." Mr. Exact is adamant in his conclusion that the corner is truly lost since no *immediate* evidence of it's location is to be found. Since the two surveyors cannot agree, Mr. Cagey proceeds to *prorate* the 1.1 feet and sets his ¼ corner at 2,639.44 feet from the corner of sections 9, 10, 3, and 4 and also files a Record of Survey showing his disagreement with Mr. Exact (31.89 feet) the difference between these two surveys is about 1.9 acres and at today's price of $30,000 per acre Mr. Baker proceeds to file a hotly contested Quiet Title action.

Accuracy Versus Precision

Accuracy versus precision. Both of the above surveyors agree to the distance between section corners within .03 of each other (about 1:17,400). It is my contention that both surveyors were equally precise since there is no economical method of determining how much of the .03 is attributable to which surveyor, and besides the difference is minuscule and of no consequence. However it is my contention that Mr. Cagey is *AT LEAST* 98% accurate in his location, whereas Mr. Exact is entirely inaccurate as to his location of the corner. Had Mr. Cagey uncovered physical evidence of the corner post, he would be 100% accurate, even if he had measured all of his distances with a cloth tape, which I'm sure we all agree is a highly imprecise method of measurement.

I would like to take this opportunity to digress a little:

> We must *ALWAYS* remember that in the case of a re-tracement it is our duty and obligation to walk in the

footsteps of the original surveyor whenever possible, and at all times to employ common sense when making a land survey. When re-tracing a survey reported in chains, the first thing I examine is any mis-closure of .66 feet, 6.6 feet, 33 feet (in case the practioner was complying with the Oregon Manual of Instructions, and was using a two pole chain), and 66 feet. Most of the old surveyors did pretty darn good work, using the tools available at the time. However, it is the "nature of the beast," that makes blunders, when employing a Gunter's Chain, easily committed. The mis-count of one link, the mis-reading of the notched tabs at 10 link intervals (how many chains have you observed with one or more of the tabs missing?), the mis-tallying of the taping pins, resulting in a blunder of either 33 feet or 66 feet depending on the chain in use at the time. But before we rush to judgement and blame the surveyor for the acts of his chainmen, how many of *YOU* have transposed a figure in your notes at one time or another?

None, you say? Then you haven't been working very long or very hard. Just remember that the last man that was perfect was crucified.

Now, let us return to the NW ¼ of Section 9. Mr. Able's description reads, "The east half of the NW ¼ of Section 9... etc." Now worried that the one chain blunder occurred within his boundaries and being disenchanted with Mr. Exact, he employs Joe Cagey to determine his corners. Mr. Cagey being the careful practioner first checks to see about any prior surveys and finds that on April 4, 1872, a Mr. Quick ran from the still existing north ¼ corner; West 20 chains, set a stake and then ran South to the east-west centerline of the section, setting line stakes and blazing trees. Mr. Cagey reviews his prior work and notes he did not find any stakes, however he did cross an old Spanish style picket fence at about 1,319.5 feet more or less from his corner location. He notes that the first deed out in the quarter section is for Mr. Able's property, dated April 5, 1872, and recorded April 21, 1872. The description has remained unchanged to date, with no evidence of litigation on the property. Even though the one chain blunder occurred in Mr. Able's North Boundary, Mr. Cagey sets a pipe at 1,320 feet, files a Record of Survey and suggests to Mr. Able that he instigate a quiet title action, and that he is positive that if the action is protested that they will prevail in Court. *WHY*?

What Is The Answer

I would appreciate hearing answers to:

a. Why Mr. Cagey did not place the blunder where it occurred, in this instance?

b. Why, if ignoring the blunder, did he not prorate the shortage between the East and West halves of the NW quarter?

I will leave my reasoning for some future date, if enough interest is generated. Anyone interested in replying can send their reply to the *California Surveyor* or send it to George Dunbar; 2839 Estates Drive; Aptos, CA 95003. ⊕

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.

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Product News

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For more information, contact:

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Starplus Software, Inc.
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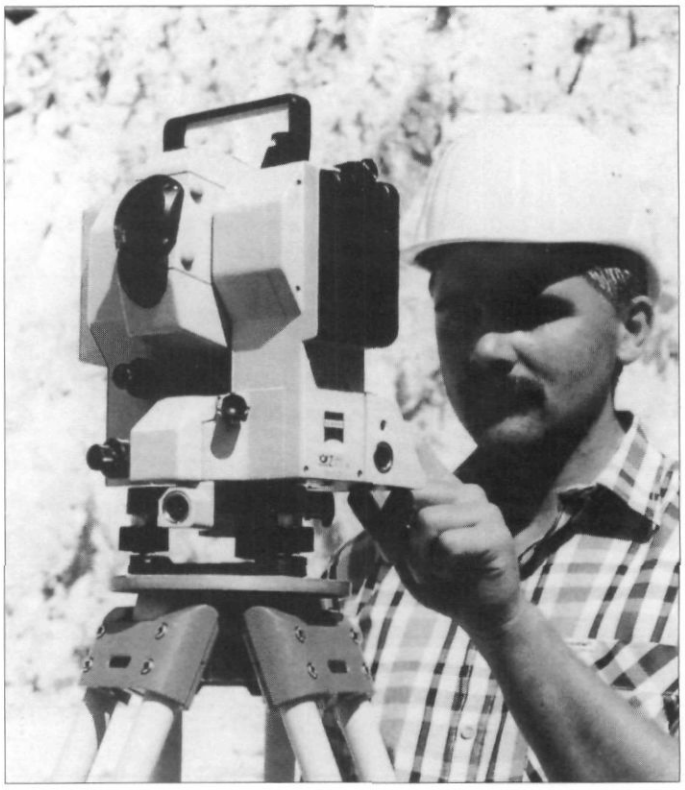

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Belmont, CA — Professional Publications, Inc., (800) 426-1178, announced today the January 1994 publication of *Land Surveyor-In-Training Sample Examination by* George M. Cole, PE, PLS. Designed as a study supplement for the Fundamentals of Land Surveying (FLS/LSIT) licensing exam, the book, which is $19.95 plus $3.75 shipping and handling, contains one complete eight-hour sample exam in the same format as, and with problems similar to, those on the actual exam.

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ON "GOING METRIC" *(continued from page 13)*

Converting the U.S. Public Land Survey System

From its inception in the early years of this country, the United States Public Land Survey System (USPLSS) has been designed and laid out using the Gunter's Chain as the basic dimension. Even today the surveyors of the Bureau of Land Management (BLM) are supposed to be using units of chains in their work, and it is within reason to imagine this will be a requirement forever. One can also envision the whole world designed and operating in metric units, and yet the BLM manuals of instructions will specify units of chains. There is merit in retaining some connection with our surveying roots, but hanging on to units of chains is like insisting modern day football be played while wearing leather helmets!

What would an all metric USPLSS be like? What would it be like to do retracement surveys using metric units? It would be very similar to the present structure, with the added requirement that surveyors answer the same basic questions as discussed above:

(1) Should the conversion be soft or hard?

(2) Is the situation a Type 1, Type 2, or Type 3 problem?

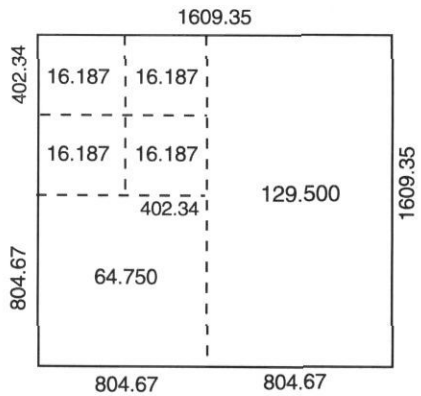
For soft conversions, there will have to be agreement on a few numbers:

1 Gunter's chain	=	66 feet (12 metre/39.37 feet)
	=	20.116,840,23 metre
1 Gunter's chain link	=	0.201,168,402,3 metre
1 acre	=	43,560 ft^2 (12 m/39.37 ft)^2 = 4 046.872 609 m^2
1 acre	=	4,046.872,609 m^2 (1 hectare/10,000 m^2)
	=	0.404,687,261 hectare
1 hectare	=	2.471,043,931 acre
1 Section	=	640 acre (0.404,687,261 hectare per acre)
	=	258.999,847 hectare

Using the above relationships, the dimensions and areas of a typical regular Public Lands section can be soft converted and will look like Figure 1. The dimensions shown are correct to two decimal places and the areas shown are correct to three decimal places.

There is no need to memorize the exact values shown in Figure 1 because a surveyor retracing an old USPLSS survey must accept original undisturbed monuments where they are found or where they are properly re-established. The "correct" dimensions of any section can be determined only by field measurements between monuments. Re-establishing missing monuments and breaking down the section into aliquot parts will be done exactly the way it is at present, but using metric units instead of English units.

FIGURE 1.
A Soft Conversion
Regular Section In Metric Units



Lengths in metres.
Areas in hectares.

Communicating information about metric sizes to the public is a duty that surveyors must accept, especially when it concerns dimensions of land area. We must develop analogies

which enable the public to easily relate old land dimensions to the new metric dimensions. Several useful analogies are:

(1) The area of a typical small house lot is about 600 m^2.

(2) The area of afootball field is about 4,000 m^2.

(3) A 2.5 acre "ranchette" is 1.0 hectare.

(4) A 10 acre parcel is 4.0 hectare.

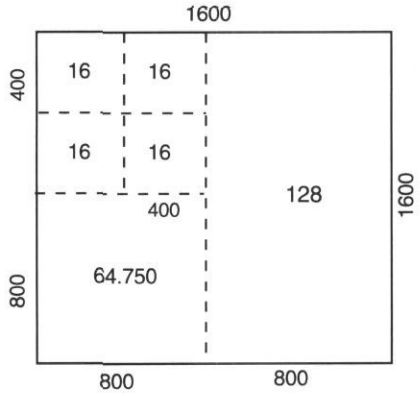
(5) One metre is a little longer than one yard.

(6) The width of a football field is about 50 metre.

Larger dimensions can be related to a USPLSS section as shown in Figure 2, on which a hard conversion has been made to get clean, rounded off metric length dimensions between monuments.

The dimensions in Figure 2 are quite likely to be found in any retracement survey because of the limits of closure permitted in original USPLSS surveys prior to 1973. The first USPLSS Manual of Instructions, dated 1855, permitted section lines running east and west to deviate from 80 chains by as much as 100 links (1 chain, or 20.1m). Section lines running north and south needed only to be within 100 links of equal length. The exterior lengths of the section shown in Figure 2 easily meet these criteria since they deviate from 80 chains by only 9.35m. (*McEntyre, 1978*)

FIGURE 2.
A Suggested Hard Conversion
Regular Section In Metric Units



Lengths in metres.
Areas in hectares.

The dimensions of Figure 2 meet the limits of closure of all Manuals of Instructions up through 1947. Only the last Manual, dated 1973, has limits of closure (slightly more than 5 m) that are stringent enough to make the dimensions of Figure 2 fail. (*Manual, 1973*)

The BLM should make a hard conversion to metric in their next Manual of Instructions. The dimensions of the section shown in Figure 2 can serve as the module for building the whole structure of townships, ranges, standard parallels, and guide meridians. For example, township lines would be 6 (1,600 m) = 9,600 m apart, compared to the present dimension of 9,656.08 m. Standard parallels would be 4 (9,600 m) = 38400 m apart, compared to the present 38624.33 m. The overall cadastral grid would be smaller, but the shrinkage would not be apparent to anyone on the ground except surveyors.

RECOMMENDATIONS AND CONCLUSIONS

Surveyors cannot just sit back with calculator in hand and multiply by (12m/39.37 ft) as the United States converts to the metric system. There are some complex decisions that must be made, not the least of which is should the International Foot be used in any surveying conversions? Unit conversions are not as straightforward as multiplying two numbers together; what two numbers? how many significant figures? soft or hard conversions? modules and roundoffs? There is strong need for surveyors to use uniform methods in all these changes.

Surveyors should become assertive in this metric changeover rather than wait for other professionals or government agencies to take the lead. Both ACSM and NSPS should have active metric conversion committees which will make recommendations to the membership and to any group which wants the opinion of "the surveying community." Surveying journals must set a date beyond which only metric units will be used in published articles, unless dealing with an historical survey or a discussion such as this paper.

State and local chapters of NSPS member groups should take the lead in finding English dimensions that are part of the government Codes they work with, and make recommendations to their state Professional Surveyors Association (PSA) of what suitable conversions would be. Each state PSA could then get consensus from all members and periodically have legislative advocates modify the Codes to metric units. This type of assertive action by surveyors may require that they initiate cooperative discussions with other professionals, politicians, and the public. It is time for surveyors to abandon their passive role in the change to the metric system!

ACSM and NSPS should immediately start discussions with BLM about converting the USPLSS to a metric based system. The pros and cons of various formats, such as the one presented in this paper, should be reviewed by government and private surveyors, and then a hard conversion must be made.

Finally, each surveying company, college, or organization should have a designated metric coordinator — someone who is kept up-to-date on all the latest metric information and who can rapidly transmit that information to co-workers and the public. The coordinator should also have the duty to use this time of change and upheaval to reflect on how the company or organization is doing its work. "Going metric" may be an opportune time to modify and improve many other operations.

Reprinted with permission from ACSM – This article also appeared in their May/June *Bulletin*.

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