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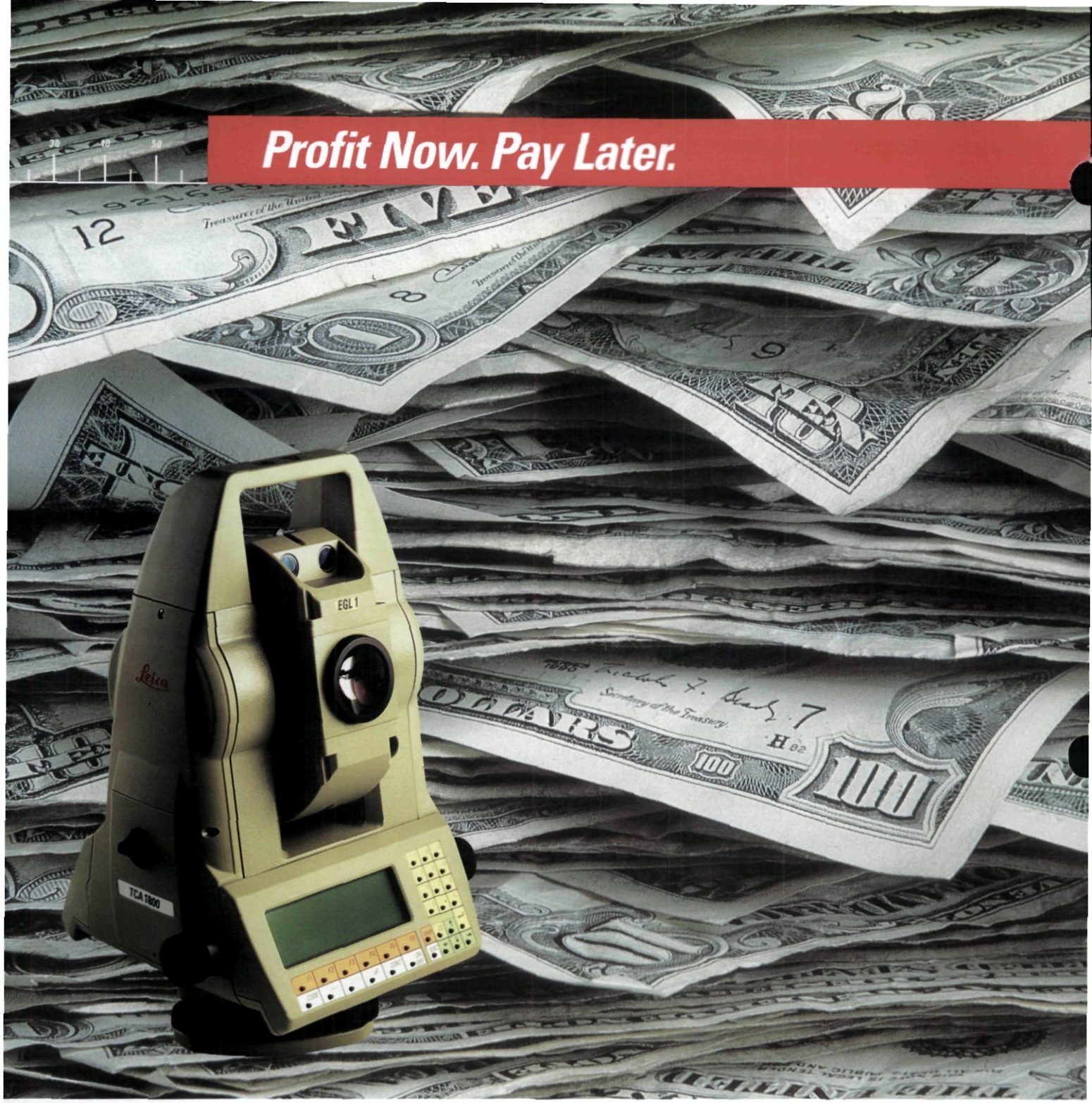
The California Surveyor

Spring 1999 The Voice of the Land Surveyors of California NO.122



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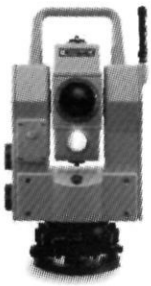

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The California Surveyor

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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."

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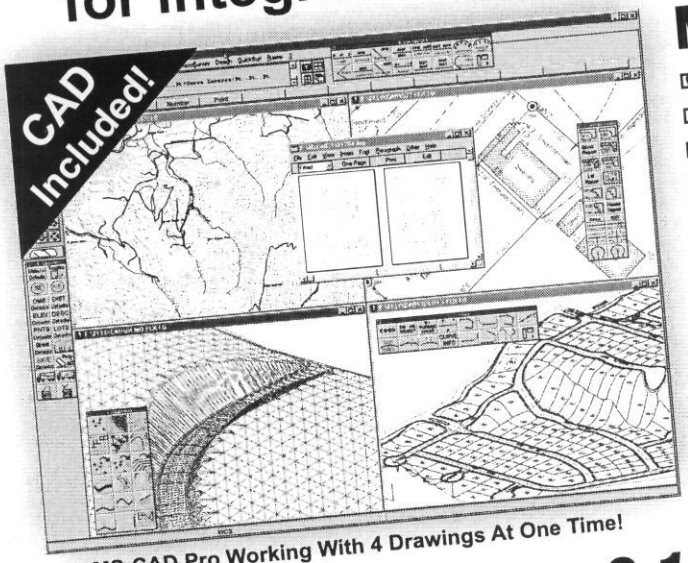

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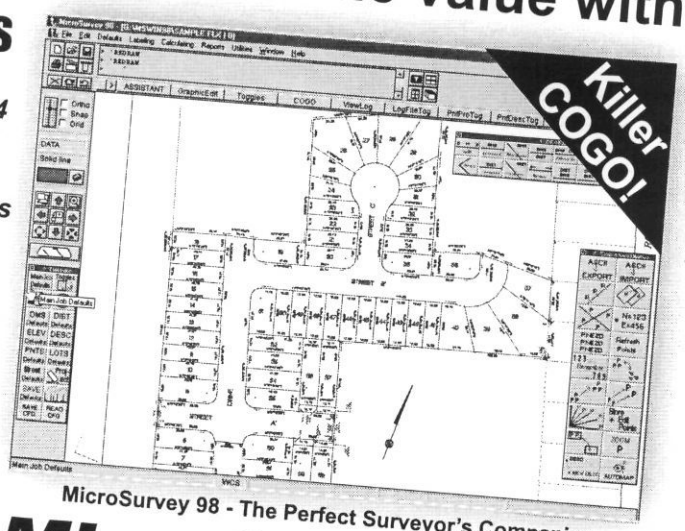

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Isn't It Time You Started Using MicroSurvey?

From the Editor

PROFESSIONAL SOCIETIES

By: Phil Danskin, PLS

Good morning California Surveyors! Are you reading our CLSA publications cover to cover in your ez-chair, or are you like me - logging "library-time"? (Be sure to thoroughly wash your hands before returning to work.) Cousins, it's soap box time! (In order to make an impression, I have taken the liberty to shower, shave, and wear a tie with my bib overalls! Now, that's a picture!)

Has your enthusiasm for your profession waned to - "it's a job"? Is your idea of Professional Development like the above - loggin' "library time"? I hope not! However, statistically, it appears most in our profession do not belong to professional societies, let alone be *involved* with their profession! How many ***belong*** to **ACSM**? Less than one-third of the licensed Surveyors are members of the **California Land Surveyors Association!** Sadly, statistics indicate that these are good numbers. What is not good, is how few participate in, and/or are involved with, their professional society.

"Ask not what CLSA can do for you, but what can you do for CLSA!"

So, here are some words for thought regarding membership in our professional society . . .

Do ***you*** belong? The CLSA **Belong Category** is the easiest. However, I can't believe the lack of interest in this one. It's a NO-BRAINER! Just fill out the form and pay the dues. Now you're a ***Belong*** member! Unfortunately there are only about 1,000 of *these* members that reside in our great state. And thank goodness for them! All viable organizations require funding, of which the Belong Members bring to our Association.

Do You Just Belong?

Are you an active member
The kind that would be missed?
Or are you just content
That your name is on the list?
Do you attend the meetings
And mingle with the flock?
Or do you stay home
To criticize and knock?
Do you take an active part
To help the work along
Or are you satisfied
to only just belong?
Do you work on the committees
and get right in and mix?
Or leave the work to just a few
and talk about the "Cliques"?
Think this over, member -
You know right from wrong.
Are an active member
or do you just belong?

The more difficult is the **Participate Category**. One should have **Belong** status, attend "some" meetings, (the ones that coincide with your disrupted cable service), share some interesting war stories at local meetings, voice some opinions and vote on issues. Some whom do not have the funds to belong, certainly are an asset to local organizations *by at least participating*. (Though contrary to Association By-Laws). By participating, one is exposed to professional issues, as well as absorbing knowledge shared at the chapter meetings.

Do you recall the fiscal difficulties of paying for tuition and expensive text books in disdaining subjects? Or the time you came home from college, wolfed-down a quick dinner, jumped in the hundred-dollar vee-double-u, only to have the rear wheel come off on the way to work? It is understandable for those that may be starting a family - time and dues are hard to come by. We are all aware that fiscal difficulties are indisputable. So, participate when you can, and belong when the wolf's no longer at the door. I guarantee you'll get more out of belonging ***and*** participating, than you could ever put into such!

". . . to promote and maintain the highest possible standards of professional ethics and practice . . ."

Last, and far from least, is the **Involved Category**.

This requires Belong and Participate status, along with a propensity for troglodytism. One should attend chapter meetings more often than not, (even if the cable channels are working), be involved with local issues and

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knowledgeable of state and national issues. Your thoughts and ideas would benefit the profession. Also, CLSA could use a few mavericks. (As General Patton would bark, *"if everybody is thinking alike - then nobody is thinking!"*)

The benefits of ***belonging and participating*** in an organization such as **CLSA** are tremendous.

Some of the non-fiscal benefits are:

Networking.

Sharing knowledge of software/surveying/ business tips and techniques.

Bridging the understanding of our profession with other disciplines.

Being the watchdog of governmental practices.

Assisting governmental agencies in profession - related matters.

Instantaneous information via the CLSA Website.

Some financial benefits are:

Group insurance discounts. (The last dividend received from my professional liability insurance paid for my ACSM dues and a portion of my CLSA dues!) Group discounts with United Parcel Service. (e-mails affect on the snail mails?) Referrals from Association members, due to your wisdom in a particular area of practice.

Discounts for CLSA reference materials.

Discounts at CLSA sponsored seminars.

Learning from another member's horror-story, that may save you from a lawsuit. Or hearing of another's plight trying to collect from a brummagem client.

So, pick up a pen and fill out an application . . . write a check . . . write the editor . . . write an article . . . and lend us a cool surveying photograph or slide! Get involved!! ❖

Letters to the Editor

Dear Editor:

Cindi Christenson speaking on behalf of the Board of Registration for Professional Engineers and Land Surveyors in the interview in the Winter 1998-99 issue stated that "the Board reviewed the national examination last year and determined that the quality and level tested does not adequately protect the public in California". Well, golly gee, then it's our moral obligation to export our elite California L.S.'s to protect our fellow Americans from the dangerously low standards of those ("shudder") eastern surveyors. I am always amazed by the arrogance of the Board. The national exam is just fine for us and any special aspects about California could be addressed in a state-specific portion, just as it is done in Nevada and many other states.

The poor pass rate is nothing new, a 98 percent failure is a new record, but not far from the poor showings in 1985 when I took the exam. The solution we thought was team grading. I was a grader 3 times in the early 90's. It was obvious that more than 60% were unqualified, but the grading itself could be very subjective and painstakingly slow on boundary problems and legal descriptions. When you have 4-6 people grading a legal, you discover many solutions that the writer and reviewers overlooked.

We would have saved so much, approximately $430,000 according to Ms. Christenson, by administering the national exam. For those who think this would result in a 100% pass rate, fear not, considering the tests I graded.

Aleksi Rapkin, L.S.

Newport Beach

Dear Editor:

I have read, with interest, all the articles and listened to all the discussion regarding the results of the last Professional Land Surveyor examination. I am concerned that we are losing sight of the purpose of the exam by becoming lost in a sea of percentages and statistical numbers. The purpose of the exam is to insure that those who become licensed are qualified to practice land surveying in this state. It is not to insure that a certain percentage of the candidates pass the exam. Since we seem to have declared to the public at large that, once we are licensed, we do not need any additional education or remedial training, the burden of the exam becomes even greater.

The first question to be asked should be: Was this an anomaly or was there truly something wrong with the exam? The articles seem to indicate that CLSA concludes from the results of their survey that the exam is at fault. While, undoubtedly making for some interesting reading, asking someone for comments or suggestions on how to improve an exam that they have failed is at the very least taking a back door approach to a very real problem. In my estimation those comments are useless. However, there are some interesting facts to be gained from the questionnaire: 31% of those responding were taking the exam for at least the fifth time. This would indicate a candidate pool made up of too many unqualified people. 74% of the respondents indicated that they were properly prepared for the exam yet only 2.4% passed???? This indicates a candidate pool that has somehow come up with what the proper preparation for the exam should be even though they did not pass the exam, this is ludicrous. Most indicated that they had taken a review course of some kind, which indicates that is not enough! The candidates must prepare for this exam - a few hours spent one day a week for 10 weeks is not nearly enough preparation. It should take a few hours every day for six months or a year. The above comments would also apply to the 60% or so that claimed they were prepared for

the breadth of the exam but still failed. Remember nine did pass!!!

To those who blame the exam, did you know that over the last ten LSIT examinations California has failed to match the national passing average? Remember that the LSIT is administered by NCEES. The national average for that period was 52.4% passing while California's was 34.3%. What does this say? To me it says that the overall pool of candidates in California is under-qualified and this may be a large part of the answer to the low PLS exam pass rate. There are undoubtedly many other possible reasons but the qualifications, education and experience of the candidate pool is a prime suspect. It can be seen from the information gathered that there is a revolving 30% to 50% of candidates that take the exam that have taken it numerous times and probably will never pass it. These people not only waste the examiners time but also they infect the pool of qualified candidates and drag their perceived performance level down.

Part of the answer to this problem is to increase the standards to be met to take the exam and a more diligent screening of potential candidates and their references. Another would be to increase the amount of educational opportunities available to the candidate, not only formal, but through the work place. Those of us that are licensed need to be willing to put more time and energy into educating these candidates. Another approach would be to limit the number of times that the exam can be taken without retaking and passing the LSIT, providing additional work experience, and providing new references. I would suggest three times as the limit. The answer is **DEFINITELY NOT** to "dumb" down the standards, as some seem to be advocating.

This should stir the pot a bit. I hope that others may have some suggestions on how to better prepare the candidates so that a larger percentage of them will be successful.

Respectfully submitted,

James M. Herrick PLS ❖

The Geomagicians

by Joddie C. Heavener

A "Geomagician" is coming to town
it's sure to make a surveyor frown.

Be it "Geomatrician" or "Geomagician"
it is sure to raise a lot of suspicion.

Surveyors take warning and please comprehend
the title "surveyor" is near to the end.

If "Geomatracian" will soon be the name,
surveyors will say, "it won't be the same."

Some older surveyors, I am sure will say
"How in the Hell did it get this way?"

A few will wonder if this name will last
What's wrong with a title that comes from the past?

A new image is needed, you've heard it said
without this title, you can't get ahead.

"Geomatics" will make the profession the best
did somebody drool on their surveyor's vest?

How did it happen that GIS and Digital Mapping
found a large number of surveyors napping?

"Geomatics" is strange and rings odd to the ear,
but for most surveyors there's nothing to fear.

When the end comes and the "geomatricians" all die
they'll meet the old surveyor who lives in the sky.

Was the LS Exam Unfair?

By: Shasta Greene, PLS

No, I don't think it was, not more so than any other difficult exam. It was, as usual, too long to allow most of us to complete it. After the exam I heard several people say they didn't expect so many detailed questions on law. The emphasis of the test was primarily law and boundary; law and boundary are vital parts of land surveying. This is material that should be on the test.

If we assume for the sake of argument that the problem was not the content of the test, what was it? One of the main reasons that I think so few people passed is that there is no real mechanism in place to get people ready to pass this exam. Examinees need a consistent, organized way to study the required material. They need to absorb massive amounts of material and discuss it with others. Examinees need to work many problems and have their answers and problem solving mechanics evaluated. A surveyor can move to Fresno or Pomona and get this structured education. Anyone who is going to sit for the exam would benefit immensely from attending a four year surveying program, but many people cannot afford to stop working for four years to achieve this goal. Our profession is full of people who came to surveying after another career and are already supporting families. These are very competent people with full lives. This limits the amount they can rewrite their lives in order to get licensed. If we look at David or Denise, a ten year party chief with a family who only has Surveying 1A (the only class available in many areas of the state) and wants to take the exam, how do we make the required knowledge and its applications available so he or she can become ready to pass the test and become a "minimally qualified" surveyor? And what can we do about our dismal and erratic passing rate? We can ask the board to change the exam in some substantive way. Perhaps the grading process needs discussion. We can ask to be an NCEES state. We can require a degree to sit for the exam; we can screen examinees out in some other way. Or we can make some changes that I think will improve the passing rate and benefit the profession as a whole without excluding people from the exam: we can make adequate exam preparation available to all examinees.

NCEES exams, whatever their shortcomings, are widely used and have a large body of test preparation material available. The California exam preparation guides that I found were all either too old to be useful, or useful but nearly impossible to get and based on ten year old tests. Even the five year old exams that the board releases

are not written in the current style. There were very few review courses available, and though I was very happy with the Pacific Land Seminars course I attended, it was only five days of instruction and occurred about three months before the exam. We need updated study guides and we need review classes that begin in September, not February, to turn things around. We need on-line and video based curriculums; we need ongoing review sessions.

If you were to go on the internet today and look for land surveying workshops, you would find many more in the states that have a continuing education requirement. I know, because I was sure looking last year. If surveyors in this state get behind continuing education we will see many more workshops and classes offered because the number of attendees will make it profitable to give these workshops. The continuing education requirement is a very reasonable number of hours, 15 per year in most of the approximately 20 states that now have continuing education requirements. We should lay the requirement on the LSIT's, too. Heck, isn't that what the IT stands for? Add a waiver after 20 years of experience, or whatever seems to make this more palatable. In a small profession like ours, we need to make it profitable for the experts to share their information. A continuing education requirement will make these classes happen.

Exam challengers should get the reference citations for any problem challenged unsuccessfully. A person needs to know where to start in correcting either their studying or their interpretation. I know several people who say they were within 10 points of passing this exam and the previous one and I know of no successful challenges. Do we have a valid challenge process in place?

It appears we have a very long and difficult exam without much of a possibility of challenge, no real opportunity to learn from errors on previous exams and a woefully inadequate preparation process. From my point of view the best thing to work on is the availability of comprehensive preparation classes. David and Denise need access to these classes, otherwise they may end up taking the test 6 times and coming to resent a profession that will never let them in. Let's put continuing education in the LS Act and I'll see you in class.

Thanks to the administrators of the California, Washington and Nevada Boards of Registration for graciously sharing this information:

California PLS passing rate - 1997 - 23.2% , 1998 - 2%

Washington PLS (non-NCEES) passing rate - 1997 - 30.9%, 1998 - 26.9%

Nevada PLS (must pass both) - 10/97 - 30.9%, 1998 - 26.9%

PLS/Nevada Specific; 4/98 - 77% NCEES/PLS, 50% PLS/Nevada Specific)

Below are current pass rates with some other California professional exams the last few years:

California Bar passing rate - 2/97 - 48.8 %, 7/97 - 62.9%, 2/98 - 40%

California RCE passing rate - 1996 - 42.7%, 1997 - 55.2%

The other professions apply more strict educational requirements for licensing than we do, but they also have many more study guides, seminars and ongoing training programs available.

This is not complete research on the subject, but for illustrative purposes only.

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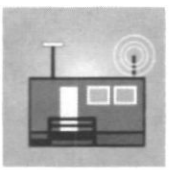

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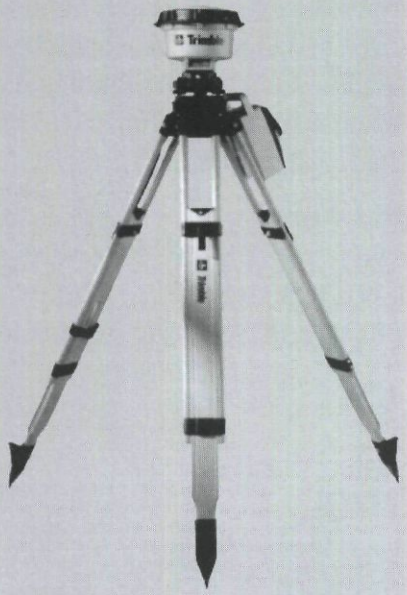

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Shasta Dam Temperature Control Device (T.C.D.)

By: Stephen W. Dean, PLS

Since 1989 Reclamation Engineers have been researching a means to control the water temperature at Shasta Dam. After assessing several alternatives it was decided that a shutter-type device was the best solution. The shutter design is an adaptation of a concept used at the Glen Canyon Dam to control water quality. However, the shutter at Glen Canyon is only a tenth of the size of the proposed T.C.D. at Shasta. The Shasta T.C.D. is comparable to building a 30 story steel building underwater weighing over 8,500 tons. Another frame of reference would be that the T.C.D. is equivalent to the Statue of Liberty in height.

The T.C.D. will allow the selective withdrawal of the water from the reservoir's surface during winter months when the water is suitably cold, or from the bottom in the summer when the surface is warm. The coolest depth of the reservoir is 600 feet above sea level. Currently, water can only be drawn from 815 feet.

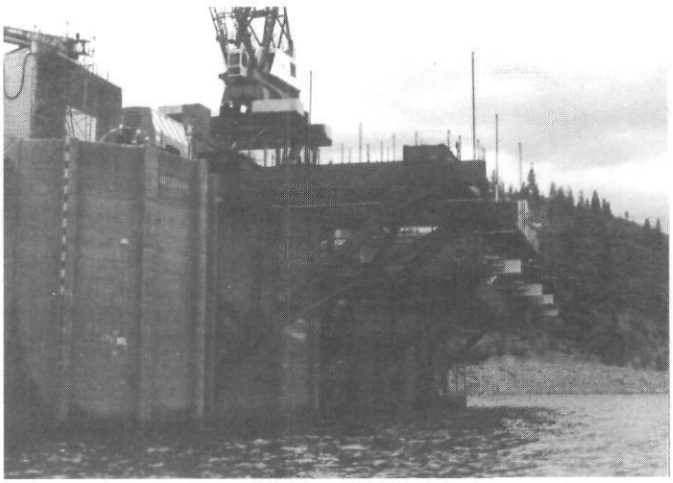
The five existing concrete intake structures will be surrounded by five steel frames which are three sided rectangles about 50 feet on a side and 300 feet long which are constructed above the water and lowered down some 300 feet by hydraulic jacks and then secured to the dam by fittings or "dam connectors" (DC'S). Dam connectors were set in the top of the dam and connected to the dam connectors in the face of the dam by 1 3/4" bolts at 35 degrees to each other. Those dam connectors on top of the dam weighed as much as 20 tons. The alignment elevation and angle of all holes had to be exactly precise so they would not interfere with existing structures within the dam and also meet their pre-designated destinations at the face of the dam. After the holes were drilled, pockets were excavated and the dam connectors were set in place. Long 1 3/4" bolts were then used to connect these dams connectors and grouted in place with high strength grout.

Start

Some time in February 1995 I received a telephone call from Fletcher General Corp. The request was to lay out a few holes on the top of Shasta Dam. The following day I met their representative at the dam crest and looked over the project. It didn't seem too complicated to me so I said, "Sure, when do we start?" Two years and some 600 holes later this project was complete. Every hole that was drilled into this dam had to be laid out within 0.02' horizontal and vertical and checked after drilling. Almost every piece of steel , temporary or final, which was attached to the dam was located with the same precision. The dam itself is on a 2500 foot radius and none of the holes were on a tangent. The work schedule was 6 days a week rain or shine, although one day it snowed on the dam and workers were unable to reach the site because of bad road conditions.

Temporary Rigid Frame

The temporary rigid frame is the structure which was constructed and bolted to the dam face to allow the construction of the final rigid frame and the structures



The temporary rigid frames in place and connected to the dam.

which were lowered into the water and secured to the dam face. The temporary rigid frame was removed after the final rigid frame secured to the dam face. This was like building a box inside of a box. (The outside box supporting the inner box during construction). This temporary rigid frame had to support all of its own weight and the weight of the final rigid frame until completion.

Control

Most of these holes were drilled on an angle of 35 degrees from the horizon and some of these holes were 70 feet lower than the top of the dam on the upstream side. The first problem was to establish control that would not get knocked out and would be available after the hundreds of pieces of equipment that were used in the construction and scattered all over the dam. I decided to establish an offset line on the 2498' radius which is 2 foot down stream of the face the dam. I drilled holes and epoxied brass pins into this offset line where they intersected the center line and critical points of the T.C.D. structures, then later measured them with a low-var tape and Wild T2. This established a good control line across these points which stretched about 400 feet across the dam. This measurement was made in the winter with the dam at total capacity. In the summer I remeasured these points and found the dam had expanded upstream from lack of water pressure. Some points measured as much as 0.04' more than my original measurement, this movement was also clearly visible in the opening of the construction joints. I then established the center line of every dam connector on the face of the dam and drilled holes and epoxied stainless-steel pins into these holes on the precise centerlines to assist Oceaneering in referencing their trolley which was lowered down into the water to drill holes that were submerged. I checked the cable which supported this trolley to assure its plumb of the portion which I could see above the water line.

Pockets

The tricky part was getting control points 70 feet below the dam crest on the upstream side and then into pockets which were excavated. These pockets are about 7 foot tall, 8 feet into the dam and 20 feet wide. I would bring my control down from the top of the dam and set jig plates for drilling. This meant I had to be exactly 20 feet and 70 feet below and on line with the control on top of the dam and pointing in the proper azimuth. When the 50 foot temporary rigid frame and final rigid frame braces were secured to the upper dam connector they had to fit the lower dam connector precisely.

This control was accomplished by securing two steel plates to the face of the dam on either side of the pockets. Because these plates became handy to tie off barges, support catwalks, (and some disappeared entirely), it was necessary to epoxy a brass pin behind these plates so that, in the event of loss or disturbance, new plates could be added and the survey marks could be transferred from the brass plugs back to the steel plates. These plates were set on the outside of these pockets to culminate the transferring of the control thus producing a miniature baseline. Plumb bobs were useless because of the constant wind at the dam face. I tried 80 oz.

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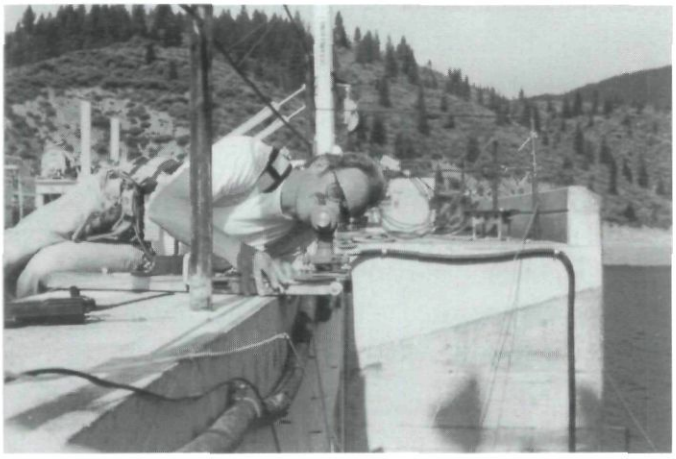
bobs on fine stainless steel wire but movement was a problem. There are still three of these $100 bobs at the bottom of dam. My final solution was to design a cantilever bipod which was secured to the dam top and located from control. Then setting a Wild precise Nadir level on this bipod which projected out over the dam face about 2 feet. I transferred that position down to



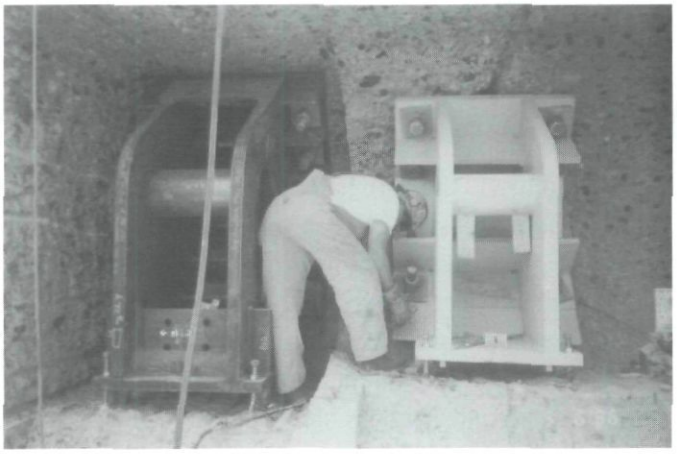
The author using a Wild vertical level.

Iron worker Bud, and foreman Ray, of Fletcher General Construction, on a barge, setting control plates 70 feet below the top of the dam.

the steel plates while I was hanging over the dam face with a safety harness and line while the rodman marked the plate below. Next an elevation was established on the bipod and a 100 foot tape was lowered over with a 10 weight on the end and a vertical measurement was established for reference elevation on the steel plates. These two steel plates on each side of the pocket gave a small base line and elevations to start my surveying to lay out the pockets for excavation and control points for drilling. The excavation of the pocket was monitored by a sliding frame on rails above and below the pocket which were set perpendicular to the dam connector at a set elevation to insure right pocket size and alignment and minimum excavation. The excavation was done by predrilling and a jackhammer. The pocket was then checked for size and shape. The next step was to set another cantilever bipod on the dam face at the edge of the pocket where I could set up a transit, and by two point resection establish a position for control. Everything was too close for edm's so the points inside of the pockets were set by tape and bobs and a miniature rod. Our working platform was a floating barge or a small cat walk secured to the dam face. There were twenty of these pockets along the dam face.

Structures

After the dam connectors where set in place, the large steel frames (which look like an angle brace) being 50 feet vertical and horizontal and weighing almost a hundred



John, an iron worker, putting the final touches on a temporary and final dam connector (about 20 feet below the top of the dam).

tons, were hooked to the dam connectors on the face of the dam, then positioned to match the dam connectors 50 feet below. This alignment was extremely critical and had to be exact to build a temporary platform upon which the permanent structure was constructed. Next I had to establish control marks on the temporary rigid frame at precise points, punched and painted. When it came time to place one brace of this temporary rigid frame, I established an exact point on my cantilevered bipod and inserted the T16 into the tribach. Through the optical plummet I could guide the temp-orary rigid frame into a

A temporary rigid frame and dam connector being craned into position.

position below me on the predetermined mark. Then, off a reference line, turn an angle and sight the end of the temporary rigid frame for alignment, while the rodman leveled the temporary rigid frame with two scales mounted vertically by magnets on top of the temporary rigid frame. All of this while it was suspended from the crane. The top of the existing intake structures was at an ideal elevation to set up a level and monitor the temporary rigid frame. Next operation was to assure the vertical plumb of the temporary rigid frame by bobbing or a Nadir Level. The crane could only support this temporary rigid frame and the moving of it was accomplished by small hydraulic jacks. This alignment took about 4 hours per frame to complete.

When all positions were on target, the bottom of the dam connector was secured to the pocket and grouted in. There was a 3" gap behind the dam connector which had to be grouted but the grout could not fill the holes until these bolts could be tensioned. To accomplish this, spring loaded cans were epoxied to the dam pockets to seal the gap between the pocket and the back of the dam connector. When the dam connector was in place, little hooks would release these spring loaded cans and would compress on the back of the dam connector to seal and prevent the grout from entering the holes and bolts. Because of the bolts being at a 35 degree slope, and the dam connector could only be set horizontally, this meant that the bottom bolts had to be lowered into the over-drilled holes and, when the dam connector was in place, these bolts were retracted up and secured. Later the holes were filled 1/3 of the way with grout and then tensioned for final grouting. These spring loaded cans

Ricky, an iron worker, admiring the placement of a drilling jig which is 70 feet below the top of the dam.

had to be surveyed and set prior to the above operation. Every hole that was drilled had to be checked prior to setting any bolts, dam connectors, temporary rigid frames or the final rigid frames, to insure all the pieces of the giant puzzle would fit when assembled. Some of the holes had to be redrilled because of bit wander or improper drill alignment. In many cases it was necessary to align these drills by survey practices for position, alignment and grade.

Final

When the final steel was assembled, which were three side boxes stacked upon each other and bolted together, they had to be measured and aligned before it could be lowered down into the water so as to proceed with the next section. The top of this structure was 50 feet above the top of the dam. The lowering of one 50 foot section took about 8 hours. All four corners of the structure were marked from the very bottom and carried up to the last section, 300 feet, in order assure the frames below the water line were level. The diagonals and location of the corners were carefully measured and checked for alignment prior to any lowering. This platform was then lowered into the water by 8 hydraulic jacks down 300 feet and attached and aligned with the dam connectors that were already set below the water. These temporary frames were later removed and discarded after the final frames were set. Underwater divers monitored the lowering and the attaching of the final steel frames to their respective dam connectors.

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Extra

It was not all work and no play. I can remember one sunny spring day when two very good looking girls cruised by in a nice boat. I don't know what one of the workers hollered, but the girls proceeded to take their tops off and cruise by again. All I can say is I was offered a lot of money for just a peek through my transit which just happened to be set up at a great observation point.

In the early spring of '96 I was helping the drill crew set up their drill when the dam started to shake and vibrate. We all looked at each other and couldn't figure out what was going on. I went to the downstream side of the dam and looked over as the rumbling got worse. I ran. When I got halfway to the west bank a large stream of water shot out downstream for 100 feet or more. From that vantage point I could see that the water was coming out of a pipe at the top of the dam. By this time, the rest of the drilling crew was hot on my trail. We found out later that someone (United States Bureau of Reclamation) had shot off the wrong turbine and produced a water hammer. In my haste the only thing I grabbed was a life vest. Later one of the drill crew asked me "Why the vest?" I answered "I wanted my children to at least find my body".

Some time that summer one of the construction workers was told to fix a leak in one of the barges. Those barges were hollow steel boxes which measured 20 feet by 10 feet and 5 feet high. He decided to just blow the water out with the air hose. So he hooked it up to a 200 hp compressor, and let it "rip." And it did. It blew that barge into five segments, leaving a hole you could drive a Volkswagen through.

This project offered me the greatest challenge of my career to date. This was nuts and bolts surveying, no GPS and very little EDM were used. Traces of my 2600 survey points on top of the dam can still be seen. All of the special bipods, fixtures and adapters were designed and engineered by me in order to accomplish the surveying for that project. This was like building a watch the size of a locomotive.

Stephen W. Dean PLS has owned and operated Astro Survey Co. in northern California since 1972, specializing in Hydroelectric Projects, GPS control, Expert Witness, Cellular Communication towers and special surveying projects. Mr. Dean is also licensed in Montana and Nevada as a Professional Land Surveyor. Please visit www.astro-survey.com for complete details. ❖

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Compass and chain survey work from "The Penny Magazine" August 1840

From: Ames Instrument Company

Very little is known about how the surveyor worked in the field, The following article is from "The Penny Magazine" (Society for the Diffusion of Useful Knowledge), published in England on August 1, 1840. It was written by an English surveyor after his trip to the New World. While this survey was in lower Canada, conditions must have been similar in the United States. It offers interesting insight into how the field work was performed in times gone by.

Having spent a second day in making some further exploration and getting our camp a little into order, on the third day I prepared to run our first line of the township that had been previously surveyed, which was the front line of our survey; and employing a two-rod chain (four-rod ones do not answer for the rough woods), I found that in chaining 960 chains (six miles) we varied from one old measurement only four yards, or eight-elevenths of a rod. This was very satisfactory; for as it was desirable that the corners or angles of the lots I was about to survey should correspond with the corners of the lots in the old survey on the opposite side of the division line, I now found there would be no difficulty on this head.

I next chained one side of my own block, staking, as I went along the points from which the cross-lines were to be taken, then the cross, or end-line, (if I may so call one side of a square); and have returned to the old township line, I then ran the other side-line, meeting the end of the last line where I left it, uniting the two lines without either of them varying from the correct length above one-third part of a rod, which I considered good work with a plain seven-inch compass.

. . . until some stout tree appears to stand upon the exact line that has to be run, and interrupts the view.

But the method of chaining in the woods remains to be explained: the surveyor (in the instance alluded to it was myself) carries the compass slung under his left arm, and covered with a brass cover or case, except when in use, the sights projecting inwards, one in front, and the other in rear of his person, in order to prevent accidents happening to them where there is difficulty in creeping through the thick underwood. The compass stand has not three legs, as is usual with mathematical instruments of sort in open countries, but consists of a single stout staff, well shod with iron pointed with steel, which is stuck firmly in the ground when the surveyor has a sight to take, the head of which is supplied with the ordinary ball and socket on which such instruments traverse.

Having planted his compass at the commencement of the line he intends to run, and having arranged the sights to the proposed course or particular degree, when the underwood is not thick, it frequently happens that a tolerably clear way may be seen among the trees to a distance of ten or twenty chains, until some stout tree appears to stand upon the exact line that has to be run, and interrupts the view. This tree the surveyor particularly notices, for he calls it a sight-tree; and having slung his compass under his arm, pulled up his compass staff, and called out "chain" (as a signal for the chain-men to commence measuring), he sets off ahead of the chain-men, taking the axe-man along with him, who here and there cuts down small saplings that seem in the way of the chain-men, which serves also to mark the line; and having reached the sight-tree, on which he has kept his eye on the whole way, he goes to the front side of it, and there resets his compass, during which the axe-man is engaged in marking the tree in a particular manner (three, four, or five notches both in front and rear); while the surrounding trees, particularly the young ones, are scored with a similar number of notches on the side of each, looking inwards, or towards the sight-tree. The trees thus marked are called witnesses, and the object in marking them in this manner is, that in case of the sight-tree being cut or blown down

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hereafter, its place may be nearly ascertained by the position of the witnesses.

When the chain-men have measured up to the tree in question, the distance, as well as the sort of tree, is noted in the surveyor's field-book. By this time a new object has been taken, and forward goes the surveyor and the axe-man again. He never, however, heads the chain-men so far as to be out of hearing of anything either party may have to communicate; for in order to prevent mistakes of ten chains, he carries a tally-strap round his waist, with sliding rings or pieces of horn upon it; so that when the leading chain man has got to the end of ten chains, and consequently used his whole number (10) of pins or arrows, he calls out to the hind chain-man "tally." The reply to which from the hind chain-man is "tally one," or "tally fifteen," or any other number, as the case may be; upon hearing which, the surveyor counts the tallies he has passed from one side of his belt to the other, to ascertain if the chain-man is correct in his number of tallies, he, as well as the surveyor, carrying a strap round his waist with the number of tallies upon it. If there be no error in counting the number, no remark is made; but if the tallies do not correspond, the matter has to be examined into. It sometimes happens that the underwood is so thick, that it is impossible to see four rods ahead, in which case the chain-men have to assist the axe-man in opening a track sufficiently wide for the surveyor to get a sight through; this, however, makes the work progress very slowly.

In the survey alluded to, we found three or four cedar swamps, marshy pieces of ground where those trees grow in such close contact, that it is next to impossible to squeeze through among them. Besides, the trees being so close to each other, the ground is generally so boggy that a person will sink knee-deep; and what renders these places still more dreary and dismal the branches of the trees are so intermingled with each other, that the brightest sun that ever shone cannot penetrate the dark foliage one-third of the distance from the top to the ground; so that when fairly within a tolerable-sized cedar-swamp, though at noon on a cloudless summer day, you find yourself in a pichy darkness. It is impossible, therefor, to run a line with any degree of accuracy through such places until the axe-man, perhaps up to his knees in mud, has exercised his calling, which renders the surveying of a cedar-swamp a slow and disagreeable business; and, when the work is performed, such tracts are absolutely worthless, as no settler, while there is another acre of land to be had, would think of attempting the cultivation of the cedar-swamp."

. . . at noon on a cloudless summer day, you find yourself in a pichy darkness.

Sent in by Joddie C. Heavener ❖

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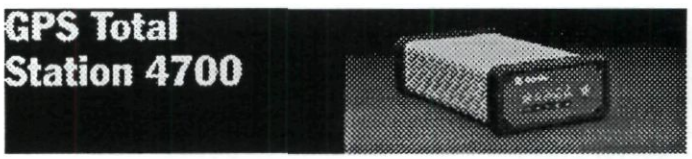

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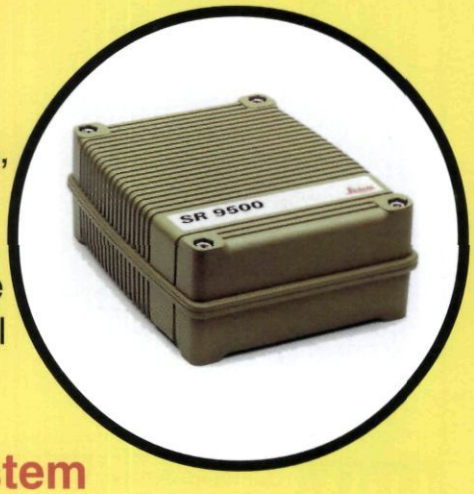

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