

CONTRACTING OUT SURVEYS IN COLORADO

Contracting out for surveying services is nothing new at the Colorado Department of Transportation (CDOT). It is used on projects to build, control, find ownership and right-of-way information and for topographic surveying. It is not always popular and not always successful for a number of reasons, but it is a way of life as it should be. In dealing with contracting out for horizontal control, the state and the National Geodetic Survey (NGS) established the state-wide High Accuracy Reference Network (HARN) in 1991 to provide control for the contractors and CDOT surveyors. This has been densified at three to six mile spacing by contractors and CDOT surveyors. This has been broken down even more to the project level. By offering training to the contractors as well as CDOT surveyors and making them tie into a network that is accurate and available, there is little room to make errors. To show that this system works, we need to only look at the contractors and other private surveyors in Colorado using the HARN and densification stations when they do non-CDOT work.

Vertical control is another problem. Colorado has a lot of elevation change and the least amount of classical bench marks per square mile than any other state in the country. It is not that the state does not need bench marks, it just never got them put in by the federal government. The surveyor goes out and finds anything that has an elevation on it and ties the world to it, never knowing if it has been reset, re-buried in the ground or last leveled to in 1908. An elevation is an elevation. From this point, how can the state get to have a vertical network that can support GPS heights and have the bench marks that are available to all users and nearby? First, you have to start someplace. Second, you use what you have. Third, you have to know what you want. The CDOT does have first order vertical equipment and has used it a few times. One of our small surveying contractors has first order levels and hoping they had the work, bought invar rods. Training is available from dealers and the National Geodetic Survey that CDOT could fund. Could surveying contractors do the work? Could they find enough work to justify the purchase of equipment and get a level crew going?

A CDOT region proposed that a section of Interstate 70, from Denver to Empire, get first order leveling because of the complete lack of bench marks in the area that is going to be widened and get some sort of rail system to support the ski industry. It will go from Denver International Airport to Eagle Airport in time. The idea was proposed, accepted and funded. The contractor purchased the equipment and also found a county wanting levels as well. The FAA called to ask about a leveling contractor, more work. Other CDOT regions said they might have leveling run up their light rail corridors. Another contractor says they would like to offer leveling services. The Air Force Academy wants some first order leveling. The NGS state advisor requests that all 1980's bench marks that are going to be destroyed by highway construction be funded to reset to first order standards. The second contractor gets a small leveling job. Maybe there is some leveling to be done in New Mexico. It builds, the Metro State College surveying program wants to run levels from Downtown Denver to Denver International Airport and will do the recon and help with the mark setting. Colorado now has a few contractors doing first order leveling and a small program to keep things going. Colorado is further down the road than before.

Getting first order equipment is the first step in running first order levels. The next step is getting the rest of the equipment that is needed, but not sold by an equipment dealer. The “Turtles”, the driving pins, the sunshades, the 20 mm plugs, the processing program and other little doodads that make life more interesting. NGS has the plans for making these items and Colorado was lucky to have Hixon Manufacturing and Supply Company of Fort Collins willing to make these items for a reasonable price. NGS has the standards and specifications for bar code levels and a new draft of the “Digital Leveling User’s Guide”. For first order leveling, the rods must be one piece, invar and calibrated with paperwork. A 50 or 60 cm invar strip is useful for doing vertically set marks, but needs a zero marker made for it. Also there is the protective tubes to be made for the invar strip and the three meter rods need to be mounted on the truck in PVC pipe.

Leveling can now begin. At this point, training is helpful and in Colorado we almost had it, but Mr. Audie Murray of NGS had heart problems at the airport and could not make it. The contractor started with a tie section that had stainless steel deep rods at both ends. They read the specifications 100 times. They called about what they did not understand and got the C-shot to work. Down the road they went, it only takes one mistake to blow the section. Start again, it only takes one mistake to blow the section. Finally it started to work and with a little help continues to work. Leveling is not a mindless wondering down the road, but an exact science of chasing a millimeter from one point to another. Geodetically, one of the last direct measurements made by surveyors.

Is there a difference between the private sector and the public sector in relation to the quality of work? It depends on what is put into the contract and who the contractor is. It depends if the time and the money is put into the contract to do the job well. The government has the time to do the work until it is as perfect as they want it, the contractor must be paid for their time, but must also be able to deliver quality through pride in the work, training and getting it right the first time. In Colorado, we try to get quality through teamwork between the federal, state and private sector. Our contractors are small surveying companies that may not have the time or money to fail a state contract. The CDOT surveyors would tell you that CDOT engineers think surveying breaks the multi-million dollar highway project. Anytime a contract fails the surveyors get complaints. The National Geodetic Survey no longer has a field party or a program for first order leveling, no funds for other people to do the work and now can only offer advice and assistance over the phone, except for the state advisor program. As surveyors at any level, each contract must be fully successful.

What can we do to improve the private sector quality? Hands on training is a great help and must be offered by the government to their surveyors and their contractors. Even charging the contractors for training is worth while or have them bring the donuts. NGS must continue to have people that can offer training in first order leveling. The contracts for first order leveling should bring the contractor along in stages, first running the levels and processing. The next contract will do recon, levels, descriptions and computations. The next contract will be for recon, mark setting, levels, descriptions and computations. More time must be spent with the contractor in the field until they get careful and gain control of the entire process. There must also be a business here for the contractor. One project is not enough to get good at leveling or to make business of it, by developing an ability to do the work, we must also create the need for the product.

The long term goal for leveling is to not level anymore. The GPS Height Modernization process must be used in time to replace leveling. Maintenance of the existing vertical network must continue into the future. In Colorado, after the leveling is complete from Denver to Vail, our hope is to start doing GPS along the line to see what accuracies we can get with GPS as the change in elevation is about 5500 feet. One of the problems with GPS elevations is who is going to set the bench marks now that the federal government is not going to? Will the state support a bench mark every 0.5 mile? To help the contractor and to keep setups per section down, bench marks were set every 0.3 to 0.6 miles. It is cheaper to do this since the road widening will get some of these marks in the future. GPS Height Modernization must include quality monumentation that will remain for the future.

The need for bench marks in Colorado is great, but by itself will not get many more precision elevations in. The contractor, the instrument dealer, the small manufacturer of survey equipment, the survey marker manufacturer, the lumber yard, the new truck dealer, the colleges and universities that train new surveyors, the state and federal governments are all part of the business and should be looking for funds to get consistent elevations in place and prepare for the future of GPS Height Modernization based on getting bench marks where they are needed for all surveyors.