

# WISCONSIN COUNTY SURVEYORS ASSOCIATION NEWSLETTER

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## **Successful Survey Despite Steep Challenges**

By Wade Pettit, Clark County Surveyor

A call from the Forest and Parks Office usually meant that we would be bound for some



hell hole to survey a County Forest boundary where no Forester had ever walked before. I was somewhat surprised and intrigued when the topic of surveying for a new chairlift at the Bruce Mound Winter Sports Area was discussed. An air photo was provided that showed the corridor where a new chairlift was being proposed. It didn't look like too bad of a job other than going through a wooded area.

This would be a project that would span several years beginning with a topographic survey in the winter of 2006, and ending with the construction and an as-built survey in the fall of 2008.

It all began with that phone call in January of 2006. My assistant Rod Mayer and I met the next week with the Forest and Parks Administrator, Mark Heil, to define the beginning and end points for the location of the proposed chairlift. There was a few feet of man made snow on the ground, so a lathe was driven to mark the beginning point. Mr. Heil then pointed in a southwesterly direction and

said “It is going to go up through there.” I was in disbelief at where he was pointing and repositioned myself directly behind him to sight over his hand. The alignment was up a very steep hill and then over a rock shelf. This project was starting to look a little more like what we usually get involved in.

Mr. Heil and I jumped on the snowmobile and proceeded up a ski slope to the top of the hill where the end of the alignment was staked. The alignment did not look nearly as bad from the top looking down, as it did from the bottom. The terrain didn't look quite as steep and it was a little more open with a ski slope adjacent. We went back down the ski slope a little faster than we came up, as I held tight to a bar on the back of the snowmobile. In the bright sun and white snow it was hard to see that we were approaching a snow mogul. I was not really watching where we were going, but just enjoying the beautiful scenery and crisp winter air.

The next thing I knew, I was doing a summersault and then flying through the air, having been thrown from the snowmobile. I remember flying face first with my hands extended forward to try and brace for the landing. The initial contact was relatively smooth and I continued sliding down the hill with a face full of snow. We were lucky that this was the intermediate hill, so the slide was only about 25'. Neither of us was hurt, as we were not really going all that fast.

I got to my feet and cleared the snow from my face to see the snowmobile on its side and Mr. Heil asking if I was ok. After much apologizing and examining the snowmobile for damage, we proceeded down the hill at a much slower speed. It didn't seem funny at the time, but as I look back, I have to chuckle at what happened. The snowmobile really had no damage other than a broken choke lever.

Our immediate task at hand was to create a contour map and cross sections for the chairlift alignment. The good thing was that we only had to go 30 feet each side of the centerline. Additional requirements included that we locate the existing lifts, structures, electrical, water main and hydrants near the beginning and end of the alignment. It was obvious this project would have to be completed using the total station due to the extensive tree cover and steep terrain.

Rod and I returned the next week setting control points with our Leica 500 real-time GPS system. We set a couple of points on the top and bottom, and were fortunate to get one point near the midpoint of the alignment that could be used as a check in our traverse up and/or down the hill. We began our survey at the top as the alignment closely paralleled a ski run that provided easy access to the majority of the top portion of it.

The majority of the survey went very well. I have found that my fear of heights has increased as I've gotten older. I can remember standing in the back of a truck when I was 20 years old; bow in hand, as we rode up and down the switchback of mountain logging roads trying to get a mule deer. Things sure have changed. As I stand by the instrument on the very top of the hill, I could see the bottom some 300 feet below, and on occasion would crouch to the ground after looking through the scope at what seemed to be a sheer drop. My nerves took a beating for a while, but I seemed to survive each day.

We continued our way surveying down the hill until we began to approach the rock shelf that was visible from below. The centerline alignment was on relatively flat ground that began to drop steeply off the edges about 75 feet to each side. The flat narrowed and steepened off the edges, to where it became a straight drop on the right side. The end of the day came as we assessed what was in store for tomorrow. The top was no longer so flat and was getting much narrower. As I walked further out, I kept getting that drop to the ground feeling and was no longer walking totally upright. It was decided that I needed a replacement and that we should get some rope for someone other than me to hang on to when we got by the edge. There was also about 8" of snow on the ground that made the footing a little treacherous.

With me sitting in the office, the project was finished the next day by my assistant and a volunteer from the Forestry Office. I felt kind of bad that I wasn't there, but not really.

The maps, profile and cross sections were prepared and forwarded to an Engineer in the state of Washington for the chairlift design. Apparently the location was an acceptable alignment as preliminary plans showed up about a year later. The project was approved and funding allocated for construction in 2008.

Now came the time for construction and stakeout of the proposed tower locations. In July, we returned to Bruce Mound, which I have come to call Bruce Mountain. We were pleasantly surprised to find that the alignment had been cleared of trees and brush for 30' on either side of the centerline. We were now equipped with a new Leica 1200 real-time GPS with the addition of the GLONASS functionality. We have had the system for a couple of months and have been impressed by the ability to reliably initialize in tree cover. We were unsure if the system could be utilized due to the remaining trees and terrain.

Eleven tower locations were to be temporarily staked to see if their positions would be acceptable for construction and access. We checked into our existing control and set out with some hubs and lath, beginning again at the top. The Leica GPS was incredible as we were able to stake all but one of the tower locations, which was positioned on a steep wooded slope with only a narrow window to the northeast. We were able to easily stake that lone tower position from the bottom utilizing the total station.

After examination by Mark Heil and consultation with the engineer, some adjustments were made and an additional tower was added. We adjusted a few tower locations and were ready for construction.

Construction time arrived; an engineer with extensive chairlift construction experience had been hired to supervise the chairlift project. Much of the funding for this project, as well as manpower and equipment was being donated by area businesses and construction companies. Everyone knew that we had to excavate holes in the sand and rock to insert the tubes that would be filled and surrounded by concrete to serve as the tower bases. One of the contractors said that "once a year they have a project from hell and that this was going to be it."



There were concerns about getting equipment and concrete to each of the tower locations. There was even discussion of using a helicopter. It was time to begin this project with a thought provoking plan of attack and several pieces of equipment. Bruce Mound has underlying sand and tight sandstone that was visible at the surface of several tower locations. Two medium sized tracked backhoes worked their way up the 340' vertical climb. One was equipped with a jackhammer and the other would use its bucket to remove the sand and rock.

Each hole was to be about 3 feet in diameter and 9 feet deep. The towers also had to be tipped so that they would be perpendicular to the chair cables at each location. This resulted in some towers being tipped as much as 29 degrees off vertical. Todd Lechliter was the engineer on site and knew the steps involved for construction of the tower bases. The process was much easier having his expertise on every aspect of what was being done. I was unsure how to determine the angle that each tower was to be tipped. Mr. Lechliter got out a clinometer and placed it on the pipe to set the angle. The first two towers were dug into sand, but soil and bedrock conditions changed drastically as we proceeded down the hill. The next six towers were located in solid sandstone. It took 5 hours to excavate each hole, and about the same to prepare each one for the pour.

The next morning, the construction crew was ready to pour one of the bases. The concrete truck was assisted up the hill by a D6 dozer. The trucks could only haul half loads due to the weight and the fact that concrete would spill out the front chute when they began to go down to the lower towers. The top pour went well, and it was time to pour the next towers down. Two dozers at the top of the hill were hooked onto the concrete truck to take it down to the next pour. The driver was very nervous about going down the steep slope - this was an expert hill called "Death Valley." It is initially steep to start and then flattens to a small bench followed by a very steep slope. They had to go to the bench and then navigate out on the rock finger where many towers were located. It went smoothly and the next driver said that he didn't need a dozer and went down on his own, brakes locked up and sliding on occasions. If that truck got past the bench, it would be history, either continuing to the bottom or crashing into the trees..



Most of the truck drivers and machinery operators seemed unfazed by the danger. The hoe operators would be digging a tower at the rock shelf and start sliding down the hill as they were digging. This is what they told me as I would not go out there even to watch. I'm lucky that I have a good assistant that doesn't mind heights. Once the tubes were set to be poured, we would check the height and position. We had set offset stakes, but with such uneven terrain, it was difficult to stretch tapes to check alignment and position on something that was sticking above ground. We had been using our GPS and

occasionally verifying things with the total station, finding that the positions and elevations provided by the GPS were as accurate as what could be obtained with a prism and the total station. The total station was set up atop the hill and the tower centerline was sighted while standing on top of the tower base tubes with the GPS. Tube elevations were set using the GPS and later confirmed by Total Station to be within 0.05 feet or less of plan elevation. Elevations weren't extremely critical, as long as they were within a couple of inches.

One tower remained on the steepest hill and it was determined to be inaccessible by any equipment. It was decided it would be dug by hand, possibly using a jackhammer, picks, shovels, pry



bars and prison inmates. Yes, prison inmates! They made a 3-foot diameter hole, 9 feet deep and at a 29 degree angle into the ground. It actually didn't take too long to get this done. Inmates carried the steel pipe tube up the hill to be set and when the time arrived to pour concrete, they also dragged the hose 140 feet up the hill. Better them than me!

Cold weather has caught up to us and the project has been put on hold until next spring. I hope that I can be down there to see the towers put into place, as the last one mentioned will have to be set by a helicopter.

I was asked if I wanted to be one of the first ones to ride the chairlift up, and I graciously declined. These feet belong on flat ground! The pictures don't do this project justice. It is a beautiful place to be and I enjoyed the unbelievable views as long as I was nowhere near the edge.