SPRING BREAK LWA SITE WORK -- ***goes with the photos***

Site Work Spring Break 2009

Monday March 16

1. Walk site with students
2. Clean up ground screens, etc.
3. Secure RV
4. Reposition Weather Station
5. Run conduit and glue for WS
6. Test LWDA baluns?
7. Setup survey equipment
8. Verify station layout orientation
9. Start surveying

Monday Analysis/Report

We walked site with students, pointed out what antennas and cables were operational. We walked the area in SW corner, discussed conduit plan, secured RV at 4 points with tie-downs. The result is a much more stable RV. This will be needed at any site where the mobile workstation is parked.

Weather Station - we removed the 3 fence posts (which were dug ~ 6 ft underground) with a large jack that Adam brought. We wrapped a chain around the posts and pulled them out. This effort required 3 people and took about 1 hr. This is similar to what is needed to pull LWDA antennas up. The weather station was moved to the SW fence and realigned N/S. Adam and students drove the 3 fence stakes back into the ground and secured the weather station, as before. It was decided that running the weather station cable in small black flex conduit, along the fence would be minimal, and should provide a good test of the animals' ability to mess with cables along barbed-wire. Two splices were soldered into the cable. The weather station cable was run from the fence to the LWDA shelter, under the door to the hole behind the rack (NOTE: this proved to be very problematic. It seems the rodents like to hang out there and have chewed the weather station cable twice). Weather station was brought back online.

Surveying - true North was found by standing at the station center (already marked) and recording the NS & EW. (note, only EW is actually needed). About 300 meters to the north of the center of the station, a stake was place with the same EW value. The total station was set in the center of the site, the reflector was set at the north mark, total station was calibrated.

Surveying began. Radios were used to communicated between Adam (at the total station) and the students (with the survey stakes). Adam used the antenna location table, in vector format to find each antenna location. Students drove a long wooden stake in with the antenna number labeled on it and painted it orange. About 5 locations were surveyed before the days end.

Item 6 was deemed unnecessary (J. Craig, P. Ray),
Item 5 was OBE,
Item 2 was not started due to lack of time,
Item 8 should probably get additional attention in the form of an accuracy measurement.
Every other item completed. Daily efficiency was ~ 85%.

Tuesday March 17

1. Survey
2. Start junction box mods

Tuesday Analysis/Report

The morning was spent ***surveying***. Although Adam and students found a quick method, it still took 5-10 minutes per location. One quadrant (~65 antenna locations) was surveyed. It should be noted that out of all the antenna locations surveyed, none appeared to be in burrowed soil. The rest of the day was spent completing item 2 (cleanup) from Monday.

Tooling was detailed for ***junction boxes***.

Both items planned were completed. Daily efficiency, 100%.

Wednesday March 18

1. Trench and conduit
2. First trench with straight conduit, continue if ok
3. If straight conduit is difficult, use flex conduit
4. Goal:
   Two fully connected junction boxes with 3" conduit and 1" conduits. Gooseneck above ground for ~ 9 antennas. Pull a test cable from junction box 1 to junction box 2 and then to each of the goose necks. Remove cable when done.

Wednesday Analysis/Report

Trenching – Greg arrived with the smaller home-depot trencher and work began. Adam painted the area to be trenched with surveyor spray paint - according to CAD drawing (last leg of SW corner antennas). Adam and crew modified junction boxes, dug holes for both junction boxes, and trenched. The 3" straight conduit (sold in sticks) proved to be very difficult to glue and align in the trench.

The ***decision*** to use the ***flexible hard conduit*** (sold in rolls) would be necessary for the 1" trenches. It is recommended the 3" conduit also be changed to the hard flexible conduit. This will save enough man-hours to warrant the higher materials cost. Since the trenching can not be accomplished perfectly straight, many small pieces (glued) would be required to make small bends. The 1" hard flexible conduit worked well since one continuous piece is all that is needed between junction boxes and out to antennas.

After the 3" straight conduit was glued and installed, the 1" conduit out to antennas was run. The termination of the 1" conduit proved to work well and the design was validated. On the antenna end, water-tight flex conduit was used to stem up from the orange conduit (underground) to the antenna mast location (above ground). Approximately 3 ft was left on the end of the conduit to connect to the antenna mast. The trench and conduit stopped 1 ft from the antenna location. The end was sawed off for a future TBD connection. The trenching and conduit was completed by the days end.

Most of the time spent was fooling with the 3" straight conduit between junction boxes. This is why we are recommending the more expensive flexible hard conduit be used. (note from J. Craig: to save cost of material, some hybrid of flexible hard conduit and straight hard conduit may be used). The end of day arrived before any filling in of the dirt could begin.

All items complete except a portion of item 4. Daily efficiency, ~90%

Thursday March 19

1) Install Oz-Post using post leveler (record deviation from vertical at top of mast) and sledgehammer. We may have to install a mast and use the post hammer to drive it down. I would like to install 4 Oz- Posts in different soil conditions, varying from solid (virgin) soil to heavily burrowed soil.

2) Install 5' masts and secure the collars. Record time, manpower, level of effort required to install.

3) Attach a rope to the top of the mast and use a spring tool to measure force applied. Record forces required to deviate the posts by some angle. (This is the step I am unsure about, maybe Walter can chime in here)

4) Install 8' pipe (5' above ground, 3' below ground) using post leveler and post driver in the same soil conditions as step (1).

5) Do measurement in step (3) on 3' buried posts.

6) Bury posts in heavily burrowed soil until they stabilize (might be 3', might be more). Record the depth at which the post seems to be stable, repeat test (3).

7) As time permits, secure a road sign size piece of plywood onto the posts and leave it for durability test. (Record angle and any movement, etc so we can compare the results over long time scales)

Thursday Analysis/Report

Morning and early afternoon was spent filling in the trenches with shovels.
We note that this work must be minimized by using machinery; many trenchers have a shovel that scrapes the dirt back into the trench.
Strings were pulled out to every antenna location for cable pulling.
The "fish-tape" worked extremely well for feeding strings and cables into the conduits. A better spool should be procured as the current one tends to bind up.
A single cable was pulled by fish- tape through junction box 1 to 2, in 3" conduit. The string was used to pull the cable from box 2 to an antenna location. It was extremely ***easy*** to pull cables through the junction box system.
The ***only real concern*** left in the conduit design is if 28 cables can be pulled easily in the 3" conduit.

Oz-Post testing began. We took our time to maximize our confidence in the results.
Item 1 - No deviation from vertical (at least measurable with a level along multiple points in the mast). We did spend a lot of time checking the level during the pounding process. We used a mast/pipe and post driver. One person would hammer a few times, one person would check the level and readjust. This process repeated for about 15 minutes to get the Oz-Post completely driven into the ground.
The Oz-Post in heavily burrowed soil provided no stability (can pull out by hand).
Item 2 - This was OBE since OzPost was out of stock on the correct collar driver tool. We pounded the collar down with hammers and it took a while.
Item 3 - upon inspection, the OzPost seemed to be very solid in all the soil points (except heavily burrowed) tested. We attached masts and pulled 50 lbs of force, measuring the movement. 48" from the ground, the post moved 1/4" in the direction of 50 lbs of tension. This is not significant enough to cause any concern. The Oz-Post performed so well that one was installed in an actual antenna location to see if there were any issues. After the collar was installed, torsional testing was conducted and determined to be no threat. The mast did not budge, even with a pipe-wrench torqued on it.
Items 4 & 5 were deemed unnecessary (J. Craig)

Item 6 - in the most heavily burrowed area at the site, the 8 ft mast required us to drive it down 4 ft minimum before it stabilized. Even at 4 ft, it was slightly less stable than the Oz-Post installations. There was no resistance to torsion, the pipe rotated freely in the ground. Same tension tests were done and this and resulted in 1/2" of movement at 48" above the ground, 50 lbs of tension.
Item 7 was not completed and probably not needed since the Oz-Posts performed so well.

Daily efficiency, ~85%

Participants in this LWA Work Week include the following:

Joe Craig - LWA Programs Operations Director
Adam Matrinez - Assistant, graduate student in Civil Engineering (working under Prof. Walter Gerstle)
Su Zhang - graduate student in Civil Engineering
Francisco Foms – graduate student in Civil Engineering