Electrical Resistivity Tomography Survey Preparation—Additional Supplies, Planning, Safety, and Field Note Recommendations

*This document is intended to augment other guides specifically about the data collection and analysis and help people newer to electrical resistivity tomography be ready for the field.*

# Additional supplies

EarthScope Primary Instrument Center (EPIC) does not typically provide all the supporting supplies that are needed or recommended for an electrical resistivity tomography (ERT) survey because needs vary and because some are prohibitively heavy to ship repeatedly. However, EarthScope may be able to help low-resource institutions purchase the supplies the first time. Contact [education@earthscope.org](mailto:education@earthscope.org) if this would reduce use barriers for your course.

* 1-2 100-meter measuring tapes
* A tarp on which to place the SuperSting, switch box, and batteries if you are working in a dusty or damp setting. This will make it easier to keep the connectors clean. Suggestion: lay out the tarp and put the equipment on the downwind side. That way if wind comes up or it starts to rain you can quickly fold the upwind half of the tarp over the equipment. (Even more luxurious is a camp chair and even a folding table. Even if you do not put it underneath, have a tarp available in case of rain.
* Extra mallets or hammers: At least one should be included with the ERT equipment, but to make deployment faster, you can bring extra so more than one person can be setting stakes at the same time.
* 5–6 camping stakes per 100 m tape to hold the survey tapes in the ground. Use stakes to hold both ends, and if there is topography, you may want to hold intermediate points to the ground as well. Be careful about the stake at the far end of the line—you don’t want to pull the survey tape off the spool. You can put a couple of wraps of the survey tape around a stake at the far end of the line, if you don’t leave the tape in that position for too long. Any folding from the wraps should come out as you rewind the tape. Rewind the survey tapes carefully before you move any tape to a new location, a tangled tape or one that does a 180-degree twist can cost a lot of time to fix.
* One or two 12-V deep cycle marine batteries and 12-V battery charger OR a generator with a floating ground and fuel for it.
* An umbrella for sun, if it is sunny and not too windy. It can be hard to see the tablet and computer screens in full sun.
* Work gloves are recommended for anyone deploying and setting up equipment.
* High visibility vests are recommended, especially in urban or busy areas.
* Flags, caution tape, or signs: Since there is a rick of electrocution if someone touches the system while it is one, it is recommended that if you are in an area where people uninvolved in the survey may come across it that you mark out or block off the line and spread students out along the line to look out for people or even animals.
* Water or salt water, clay, aluminum foil: to increase soil conductivity, you can either spray the surrounding soil around the stakes with water or salt water, put clay inside the holes with the stakes, or wrap the stakes in aluminum foil before placing them in the ground. (don’t spray salt water unless it is permissible in your field site; i.e. probably not on a campus quad)
* Optional: If you are doing a long survey you may want walkie-talkie radios so that students all along the line can be alerted when the equipment is on and so they can quickly alert the person running the survey if there is an issue.

# Site Selection

* Choose a site where there is room to lay out a line with length ~5 times the depth you want to image. See below “electrode spacing” instructions to compute exact length.
* Gently undulating surface topography or topography with a uniform dip will be more straightforward to interpret.
* You need a surface with some soil to push the electrodes into. Solid rock is impossible and loose sand will give very noisy data. A grassy field is great.
* The line location can be close to development but consider if any infrastructure will cause interference. Is the site near power lines, underground utilities, metal fences, etc.?
  + Ideally run your line perpendicular to these obstructions and place your first electrode at least one electrode spacing away.
  + If you need to run parallel, set up at least 15% of the line distance away.
  + With power lines, for safety remain at least 50 meters away.
* You will want a space halfway down the line with room to set out the equipment and battery.

# Before data acquisition

* Research what you might expect in the subsurface at your site. What types of rocks or soils and their possible depths, the location of the water table, any possible underground infrastructure. If the expected depth of a feature you want to find is fairlydeep, then plan a longer survey line. Decide which type of array geometry might work best based on what you know of the structure and the particulars of each array geometry.
* Look through Unit 3 of the ERT module to help you plan the survey.
  + The introduction to electrical imaging video/power point goes over how ERT surveys are done and discusses the different types of arrays.
  + The [Scenario Evaluator for Electrical Resistivity](https://code.usgs.gov/water/espd/hgb/seer/-/tree/master?ref_type=heads) (SEER) Excel tool can help you test out possible designs but letting you input your initial predictions of the subsurface model and see how different arrays and spacing affect the resulting model.
* Choose an electrode spacing. Assume that the survey will “see” to a depth around ¼ to 1/5 of the total line length. SuperSting R8, it will come with 56 electrodes – so choose a simple spacing between electrodes, such as 1, 2, 3, 4, or 5 meters. For example, to image to 20 m depth, your line should be 100 m long. An electrode spacing of 2 m will give you a line length = (55 intervals \* 2m interval) = 110 m. Note the SuperSting R8 resistivity cables come with spacings of 2 m or 5 m, you can’t collect with spacings larger than the cable spacing. If 2 m spacing is sufficient, request the 2m cables as they are lighter to ship and easier to manage.
* Print out the resistivity electrode positions table to help students properly place and locate individual electrodes. It’s very useful for looking for electrodes with high contact resistances.
* Make a checklist of things you will take to the field and bring home from the field. (Sample checklist supplied.)
* The night before the survey, charge the batteries and the tablet and laptop. Make sure you have enough fuel for the generator if you’re using one.
* The day of the survey, check with a voltmeter that the battery is charged (>12.7 V).

# During data acquisition

* Make sure every student is behaving safely, staying away from the electrodes and cables while the system is on.
* Students should make a sketch of the experiment in their field notebooks, carefully noting the locations of all electrodes. If you can, get GPS positions for all electrodes or at least the first and last electrodes of every line you do.
* Make sure students note the direction of any survey. For example, on a line that runs NW–SE, is the first electrode at the NW end or the SE end?
* Make sure students record the specifics of the survey: how many electrodes and their spacing and what array type are you using (Wenner, Dipole-Dipole, etc.), as well as any other pertinent information (like the max n and max dipole if doing dipole-dipole).
* Students should record the names of the data files and what lines, locations, or groups they correspond to.
* After you are finished, if the pounded-in stakes don’t come out easily, hit them on the side to create a bigger hole to pull them out.
* Pull up stakes before you pull up the survey tape. (If working in tall grass, stakes alone may be hard to find.)
* Use the checklist again at the end of the day to make sure no equipment is left in the field.