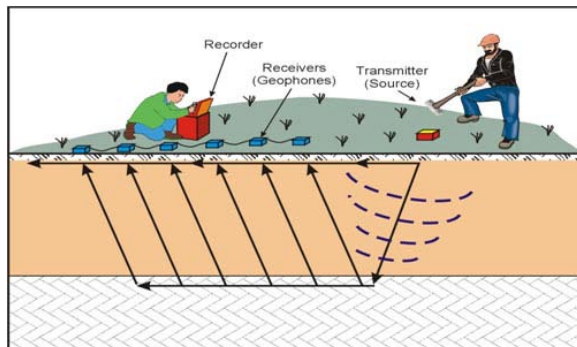


Detection of Structural Components and Seepage Zones Using Geophysics

Justin Rittgers, managing geophysicist, Zonge Geosciences, Lakewood, CO. Kansas Dam Safety Conference, 15 February, 2011, Topeka, KS

Geophysics, the study of earth materials and processes using physics methods, uses a number of tools, including [seismic refraction](#), [seismic reflection](#), [electromagnetics for metal detection](#), [gravity](#), [cross hole seismic](#), [s-wave refraction](#), [surface wave analysis](#), [self potential](#), [magnetics](#), [utility locator](#), [borehole methods](#), [thermal gradients](#), [induced polarization](#), and [long-term seismic recording](#), to find the best solution to complex engineering, environmental, and exploration problems. For example, if a reservoir or dam has a leak, a geophysicist might use [electromagnetics for geologic structures](#), [DC resistivity](#), or [self potential](#) to learn more about leaking.

With the Eagle Mountain Dam and its spillway levee north of Lake Worth, Texas, Zonge used magnetic mapping to verify the presence



and location of sheet-piling and an abandoned “morning glory” spillway structure. In mapping, engineers selected data for a line-oriented perpendicular to the main dam; built a 2D cross-sectional model of the dam using realistic dimensions and values of magnet susceptibility for sand/clay/steel sheet-piling; input the local magnetic field (magnitude, declination, inclination); and adjusted sheet-piling position and depth in the model until calculated measurements best fit the selected data. By doing so, they confirmed the estimated 80-foot depth below dam crest and refined the actual position of a sheet-piling wall upstream of the crest roadway which will guide future borings.



They also performed self potential surveys to detect possible seepage paths at each structure, which showed one broad anomaly perpendicular to the main dam and one lesser anomaly near the right abutment. A 2D follow-up with DC resistivity tomography profiling and 2D seismic refraction tomography verified the presence of concrete cutoff-wall at the levee.

Justin Rittgers, a graduate student at the Colorado School of Mines, is a geophysicist, which can be defined, according to Zonge, as a slightly below average classical physicist, a slightly below average mathematician, a slightly below average geologist, a slightly below average electrical engineer, a slightly below average seismologist, a slightly below average computer programmer, a below average geochemist, a below average lawyer, a below average geotechnical engineer, and a below average grammarian.