

Geophysics and Our Aging Aviation Infrastructure

The 9th Geotechnical, Geophysical, and
Geoenvironmental Engineering Technology
Transfer Conference & Expo (Geo³T²)

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ASCE REPORT CARD HISTORY



- Originated in 1988 with the congressionally chartered National Council on Public Works Improvement report, *Fragile Foundations: A Report on America's Public Works*.
- A decade later, when the federal government indicated they would not be updating the report, ASCE used the approach and methodology to publish its first *Report Card on America's Infrastructure* in 1998.
- With each new report in 2001, 2005, 2009, 2013, and now 2017, the methodology of the Report Card has been rigorously assessed so as to take into consideration all of the changing elements that affect America's infrastructure.



2017 ASCE REPORT CARD CONCLUSIONS



- The aviation industry is marked by technologically advanced and economically efficient aircraft, however, the associated infrastructure of airports and air traffic control systems is not keeping up.
- The U.S. aviation network includes 3,345 airports as part of the National Plan of Integrated Airport Systems (NPIAS) with 3,331 existing and 14 proposed. Of these, 514 airports offer commercial service.
- In 2013 97.5% of NPIAS runways were rated excellent, good, or fair. The condition of existing runways is not an issue, rather the overall capacity of the busiest airports, as well as other airport facilities for handling passengers, cargo, security, and related functions. Maintaining and updating runways, including changes to meet new standards, is an ongoing airport operation.



So.....

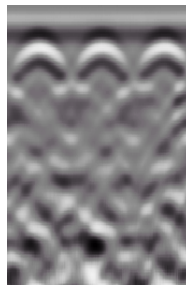
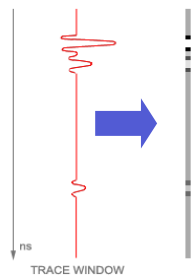
Example “Common” Maintenance Case Studies:

- Pavement Evaluations
- Storm Drains

GROUND PENETRATING RADAR



GPR is an electromagnetic method that detects interfaces between subsurface materials with differing dielectric constants.



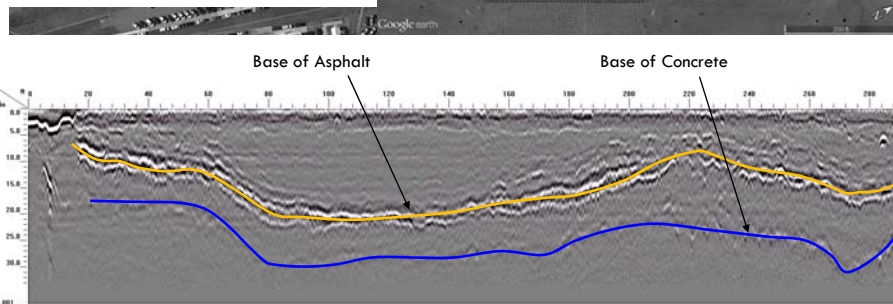
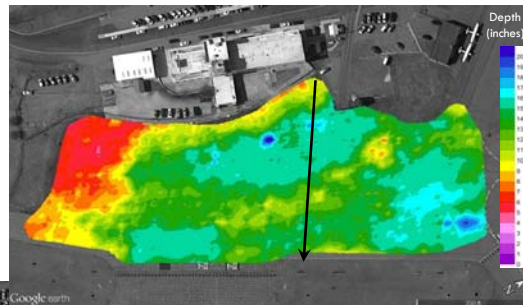
← Steel Reinforcement

Material	Dielectric Permittivity (ϵ)
Air	1
Fresh Water	80
Sand	6-12
Saturated Sand	20-30
Concrete	8-10
Asphalt	4-6
Crushed Stone	6-8
Cement Bound Base	8-10
Gravel Road Wearing Course	12-14

PAVEMENT EVALUATIONS



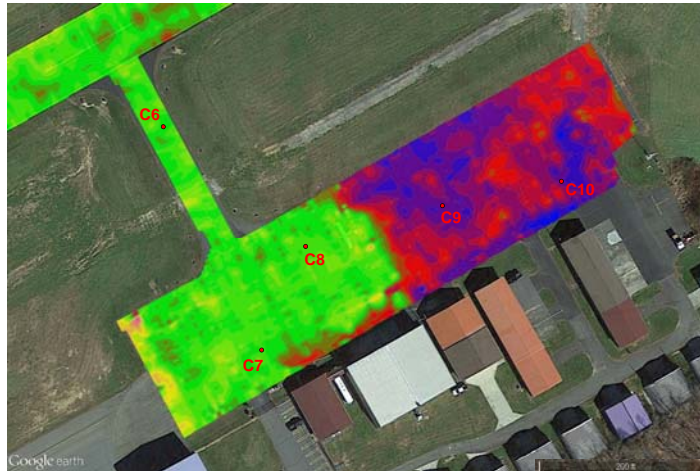
**Smith Reynolds
Airport**
(Winston-Salem, NC)



PAVEMENT EVALUATIONS



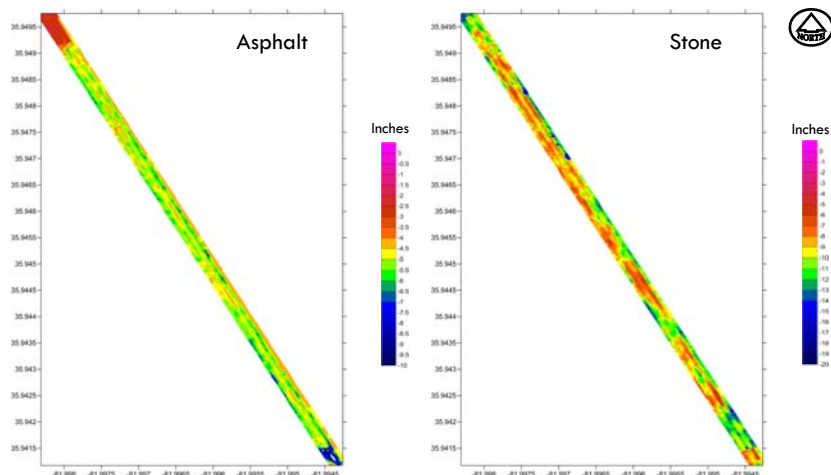
Ashe County Airport (Jefferson, NC)



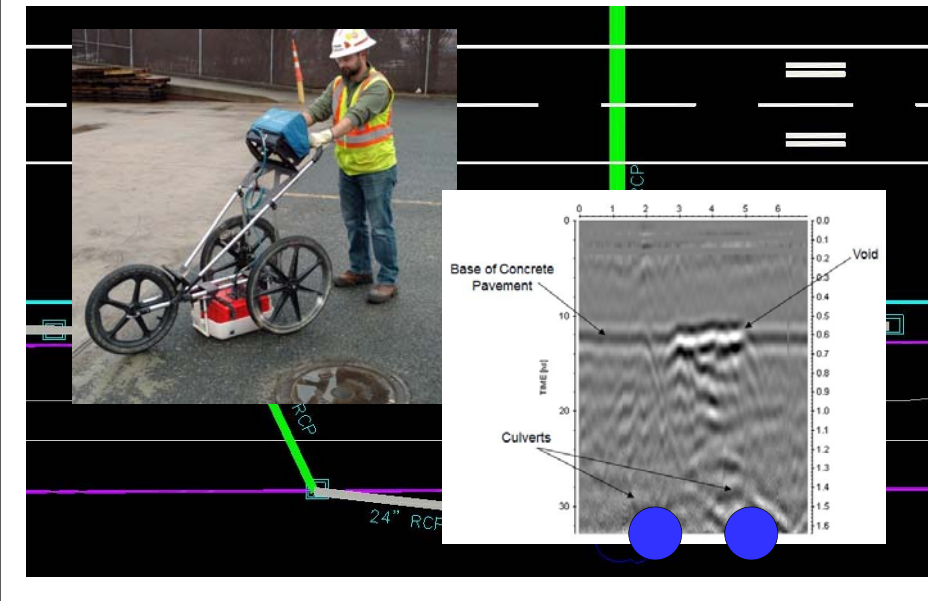
PAVEMENT EVALUATIONS



Avery County Airport (Spruce Pine, NC)



STORM DRAIN SYSTEMS



So.....

Example “Uncommon” Case Studies:

- Buried Material/Debris
- Karst/Sinkhole



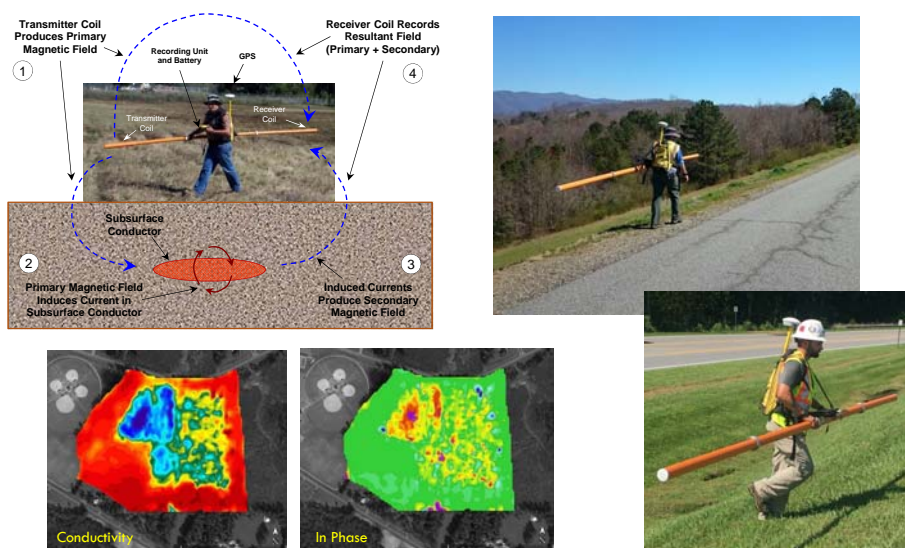
Buried Material/Debris

- Ground Penetrating Radar (GPR)
- Frequency Domain Electromagnetics (FDEM)

FREQUENCY DOMAIN ELECTROMAGNETICS



FDEM is used to measure the electrical conductivity of the subsurface



BURIED MATERIAL

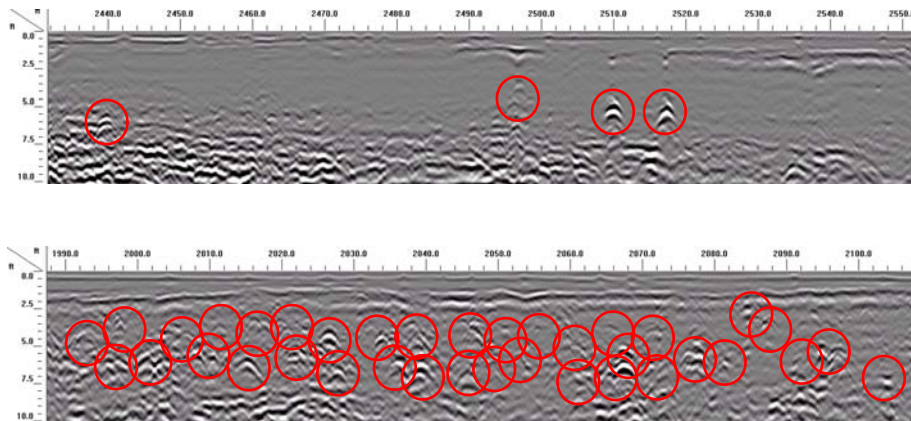


NC
Airport

BURIED MATERIAL



Anomalous Targets

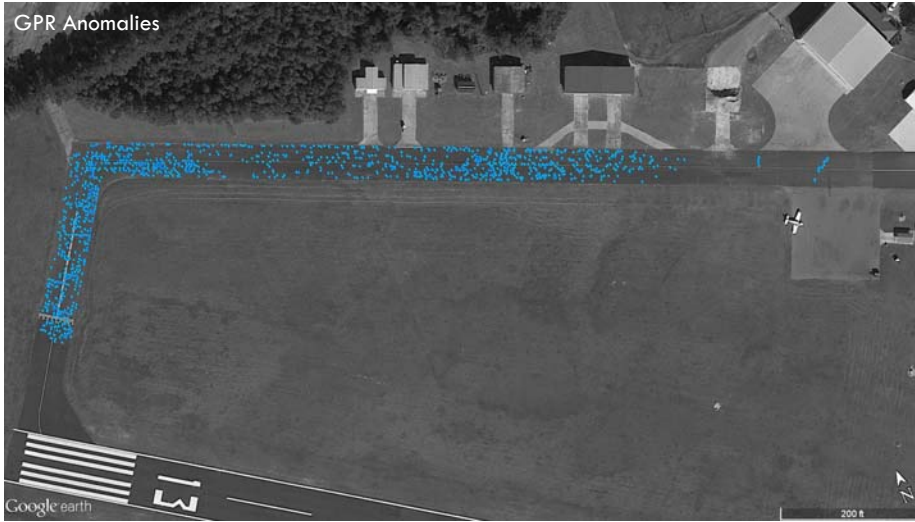


Example GPR Data

BURIED MATERIAL



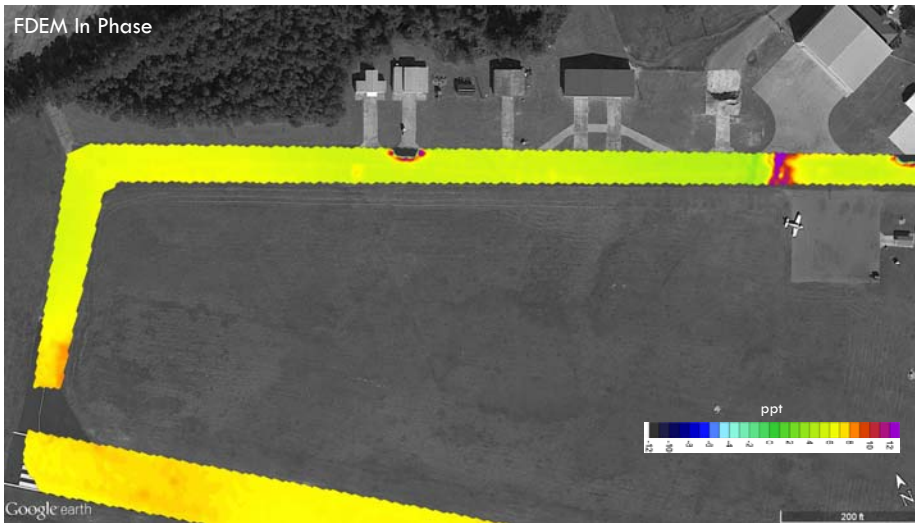
GPR Anomalies



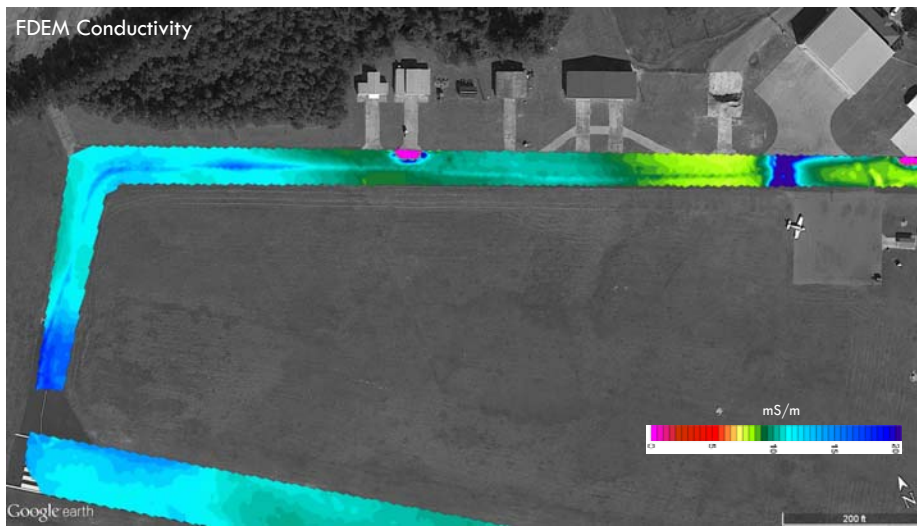
BURIED MATERIAL



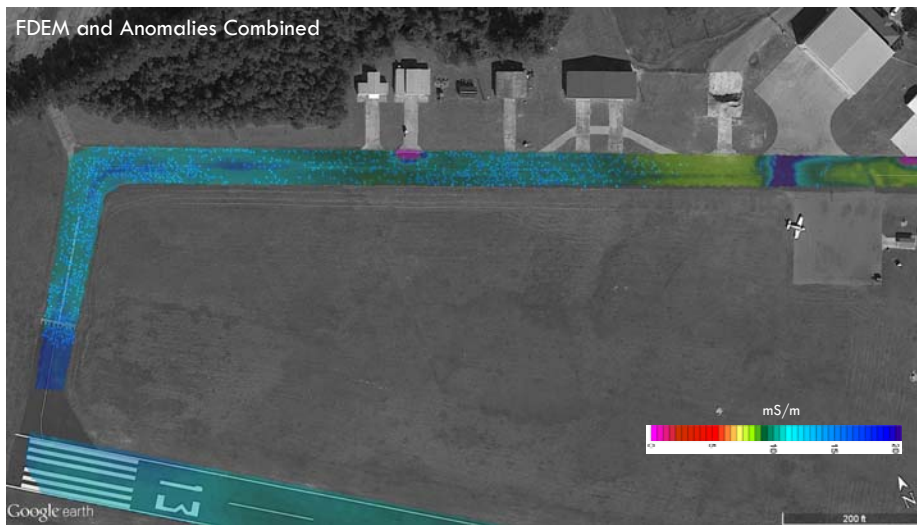
FDEM In Phase



BURIED MATERIAL



BURIED MATERIAL





Karst/Sinkhole

- Ground Penetrating Radar (GPR)
- Electrical Resistivity Tomography (ERT)
- Spontaneous Potential (SP)

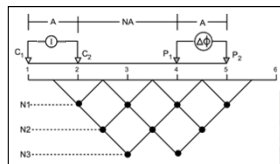
ELECTRICAL RESISTIVITY TOMOGRAPHY



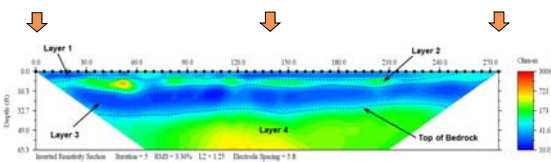
ERT is a measure of how strongly a material opposes the flow of an electric current (DC)



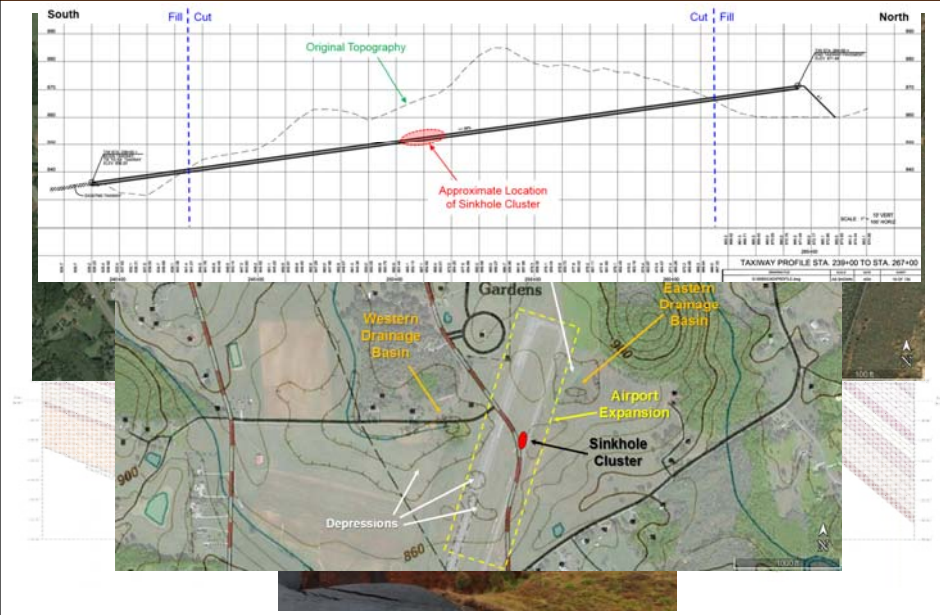
Advanced Geosciences, Inc. (AGI) SuperSting™
R8/IP configured with up to 84 electrodes



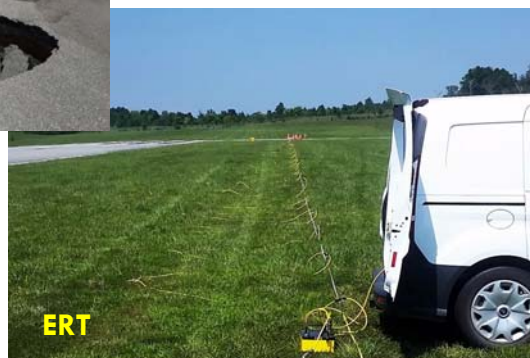
Apparent resistivity values for each point are plotted, inverted through modeling and contoured to create a 2D pseudosection



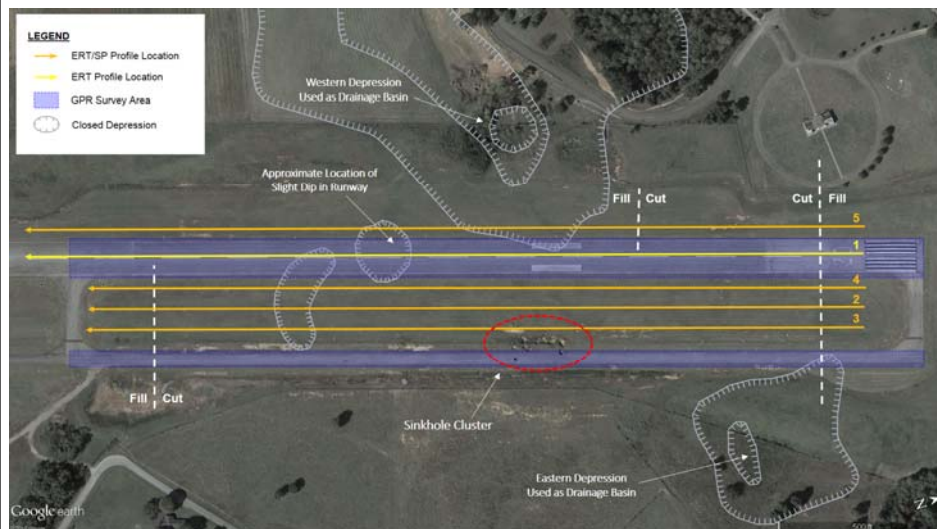
KARST/SINKHOLE EXAMPLE



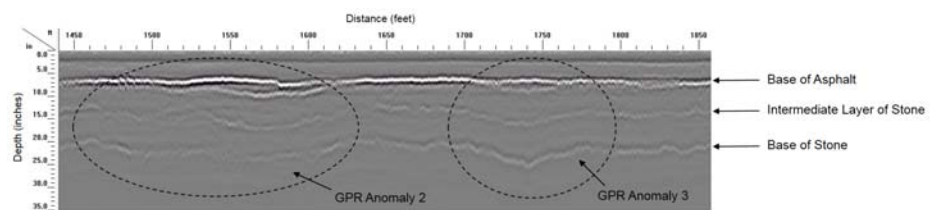
KARST/SINKHOLE EXAMPLE



KARST/SINKHOLE EXAMPLE



KARST/SINKHOLE EXAMPLE

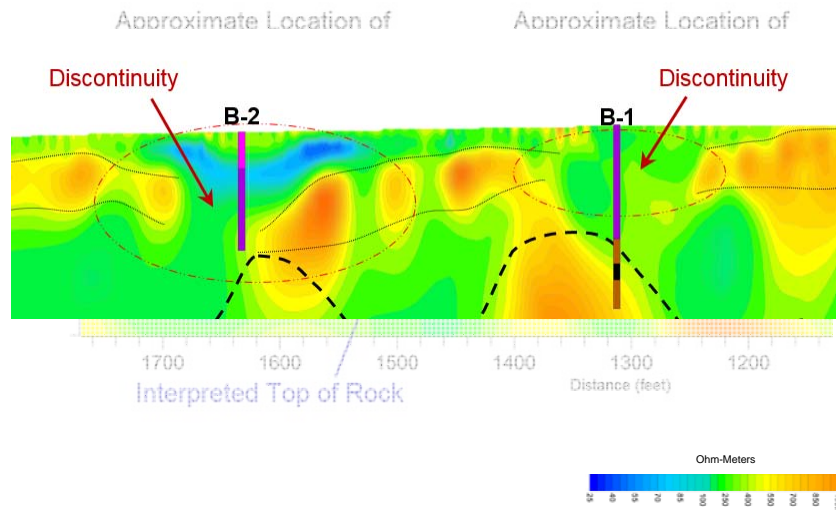


Example GPR Data

PROJECT EXAMPLE #1



Example ERT Data



PRESENTATION OUTLINE



ACKNOWLEDGEMENTS



The End.....Questions?

Acknowledgements

- AVCON
- GeoTechnologies, Inc.
- PDC Consultants
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