



Electrical Resistivity Tomography for the Detection of Subsurface Cavities in the Hofuf area of Eastern Saudi Arabia

H. R. Ahmed (1), S. I. Kaka (2), and A. Al-Mulhim (3)

(1) Riyadh Geotechnique and Foundations (RGF), Al-Khobar, Saudi Arabia (rgf-ep@rgf.com.sa), (2) King Fahd University of Petroleum & Minerals, Saudi Arabia (skaka@kfupm.edu.sa), (3) Deputy Mayor, Al-Hassa Secretariat, Hofuf, Saudi Arabia

The Hofuf area in Eastern Saudi Arabia is marked by numerous karstic features including sinkholes, solution cavities and caves. These features have always been a hazard to the stability of the flyover bridges being built in the area. Recent development projects in the area included the construction of two flyover bridges at most heavily trafficked intersections in Hofuf city. Several investigations were attempted including conventional geotechnical investigations using boreholes, however, these did not furnish necessary information to visualize the subsurface cavities. Consequently, an electrical resistivity tomography (ERT) survey was carried out to map the shallow subsurface strata at two proposed sites for future flyover bridges with the aims to detect and map the subsurface cavities. ABEM LUND Imaging System (<http://abem.se/products/sas4000/sas4000.php>) consisting of Terrameter with an automatic electrode selector was used to acquire apparent resistivity data during the survey. Cables with 2 to 5m electrode take-out spacing were adopted with a total of 160 to 400 m layout using Wenner-Schlumberger configuration. During the data acquisition process, connectivity and grounding at all electrodes were verified. Due to extreme dry surface condition, bentonite slurry was used for proper grounding of the electrodes. Windows based software, RES2DINV and RES3DINV developed by Geotomo Software (<http://www.geoelectrical.com/index.php>) were used for the inverse modeling of the acquired apparent resistivity data resulting in 2-D and 3-D absolute / true resistivity models of the subsurface conditions. The results show the presence of small to large isolated cavities at various depths which were subsequently verified by drilling boreholes. This study enables us to make a number of recommendations for the design and construction of safe foundation systems for the proposed flyover bridges.